AGRICULTURAL PERFORMANCE IN NORTHERN GHANA: A GENDER DECOMPOSITION

by

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Abstract

Women represent approximately 50 percent of the active labor force in Sub-Saharan Africa. Even though women are involved in a variety of agricultural activities, they have limited access to resources and have restricted decision-making power compared to their male counterparts (FAO, 2011). These limitations and restrictions are likely to have a significant effect on women's performance levels compared to men. The present research measures the gender-based performance differences, identifies factors that influence the financial performance levels, and factors contributing to generate disparities between male and female smallholders performance in northern Ghana. Data used in this study are from the Agriculture Production Survey (APS) focusing on the 2013-2014 cropping season. The study uses the Oaxaca-Blinder decomposition method to measure and decompose the gender performance gap in two parts: endowment effect and structural effect. Gross margin is used to measure farmer's financial performance. The endowment effect is attributed to differences in the explanatory variables, and the structural effect is associated with differences in returns of the explanatory variables. Results from the study indicate there is a gender gap between male and female smallholder farmers with male farmers outperforming females by 46 percent. Land area had the largest significant impact on the explained part of the gender gap, followed by tractor service. The endowment effect portion of the decomposition models is accounted for 35 percent of the gender gap, and the remaining 65 percent is associated with the structural effect. The larger structural effect part suggests that developing programs to establish equality among male and female smallholder producers in terms of access to resources will not close the gender gap. Additionally, factors contributing positively overall to gross margin of smallholder farmers were land area, and tractor services and crops produced. Based on the results of this research, policymakers and agribusiness stakeholders may look to reduce the gender gap existing between smallholder farmers in northern Ghana

by empowering women by providing them access to land area and tractor services. Further research into factors affecting the gender gap in financial performance in agricultural activities is warranted.

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Dedication

This thesis is dedicated to my parents.

For providing me with unfailing support and continuous encouragement throughout my years of study.

To Victoria and Rafael

Chapter 1

Introduction

In recent years, the importance of women's role in agriculture has been widely discussed by the development community, international organizations, and government. Although women contribute a significant proportion to the labor force in the agricultural sector they have unequal access to resources and inputs compared to men. These gender differentials are thought to be attributed to limited access to resources, such as land, livestock, technology, financial services, lack of training and education (FAO, 2011). This has not gone unnoticed and governments, policy makers, development practitioners, and agribusiness practitioner have guided activities to promote womens empowerment that bring in turn alleviation of major problems as poverty, malnutrition, and food insecurity.

1.1 Reality of female farmers in Sub-Saharan Africa

Sub-Saharan Africa has one of the highest female labor-force participation rates worldwide. In this region, women represent, on average, 50 percent of the labor force in the agricultural sector (FAO, 2011). Countries, whose economies depend heavily on agriculture, have high female labor force rates. Niger, Lesotho, Mozambique, and Sierra Leone have some of the highest female labor force participation rates, as a matter of fact, women provide over 60 percent of the labor force in those countries (FAO, 2011). Given their high participation in the labor force, it is not surprising that women get involved in several activities along the value chain of food production. In a study conducted by Herz & WorldBank (1989), women performed 90 percent of the activities related to processing food crops, 80 percent of food storage activities and transporting marketable products from farm to village, 90 percent of hoeing and weeding, and 60 percent of harvesting and marketing. Additionally to these occupations, women farmers perform activities beyond their own managed fields. Quisumbing (1993) revealed that women must make decisions outside of their households e.g. when their skills are desirable or when the head of the household is working on urban area, which repesents an additional burden for them.

Sub-Saharan women play a central role not just in agricultural activities but in domestic activities. In their households, women are the primary caregivers and are concerned with providing the necessities for their childrens' health and well-being (Duflo, 2003). Although these activities are vital to the development of the future generation, many of these domestic activities are unpaid activities (Doss, 2011). In Kenya, women perform more activities than men not only in their home but also in field. In the household, women are responsible for preparing food, caring for their children and gathering firewood and water, and in the field women perform most of the cropping activities and help in raising the livestock (Saito et al., 1994).

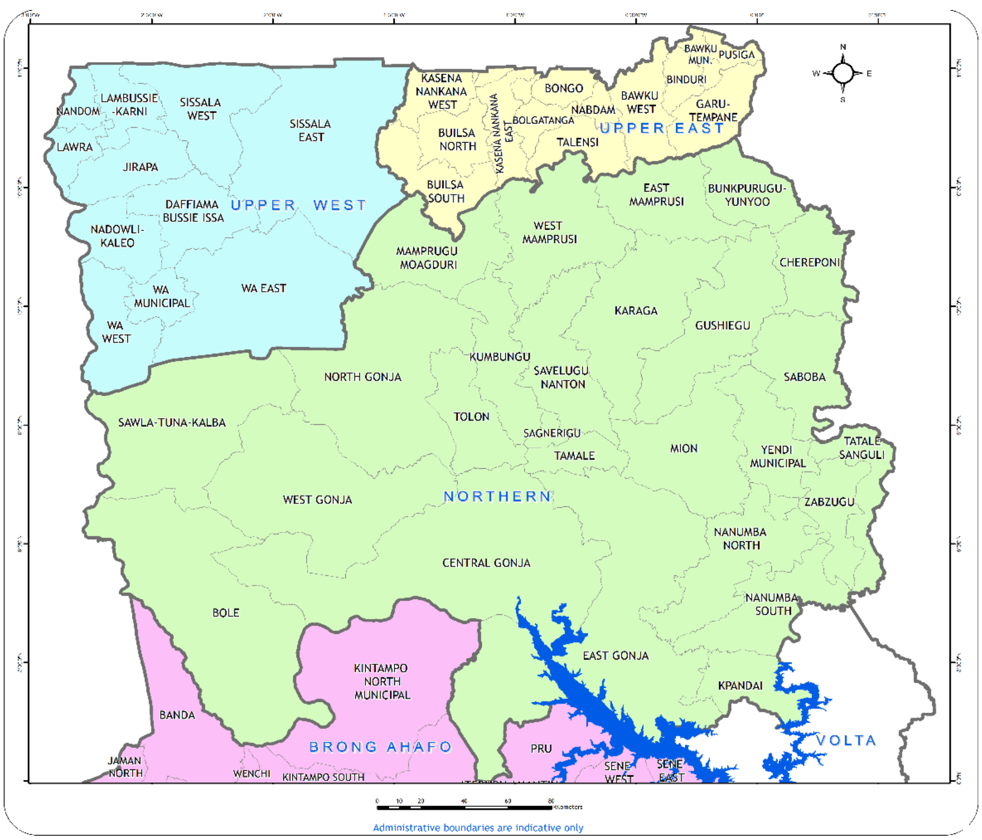
Although women may lack of resources such as land and inputs of agricultural production in Sub-Saharan Africa which can result in low productivity, there is empirical evidence that suggest women are, or are almost as, technically efficient as men (Adesina & Djato, 1997; Kinkingninhoun-Mêdagbé et al., 2010; Oladeebo & Fajuyigbe, 2007; Quisumbing, 1996). This result suggests that the gender differential in agricultural productivity is not due to lack of knowledge or mismanagement of inputs in crop production. In fact, women are producing the best they can with whatever resources they have.

Several studies have been developed to understand gender disparities in agriculture. The present study chose to analyze gender differences in northern Ghana; the reasons that efforts to close disparities should be focus in this part of this country are contained below.

1.2 Motivation to Study Northern Ghana

Ghana has experienced economic growth over the last 15 years, however, some regions have improved more than others. Northern Ghana, which is comprised of Upper West, Upper East, Northern region, and northern parts of Brong-Ahafo, represents more than half of the total land surface of Ghana (Shepherd et al., 2006); however, its economic growth have been left behind in comparison with Southern Ghana (World Bank, 2014). In fact, poverty is more prevalent in northern Ghana than southern Ghana. The World Bank (2012) revealed that the number of the poor increased by nearly 1 million in northern Ghana, while in southern Ghana the number was reduced by 2.5 million. Northern Ghana also experiences more food insecurity; according to USAID|Ghana, northern Ghana experiences seven times more food insecurity than the national average.

Figure 1.1: Map of northern regions of Ghana



Source: Monitoring, Evaluation and Technical Support Services, Ghana (2012)

Differences between these regions can be attributed to several factors. Northern Ghana possesses low population in extensive land; while population density in northern Ghana is approximately 43 people per square kilometer, southern Ghana experience 145 people per square kilometer (Ghana Statistical Services, 2012). Adding to these factors an inferior infrastructure, the result is isolation of households and communities which make it difficult to have access to markets, and increases risk of food insecurity and poverty (Zereyesus et al., 2014). Additionally, northern Ghana represents a challenging region with adverse conditions of poor soils, and unpredictable rains (Dickson, 1968). While southern Ghana faces a prolonged rainy season that provides favorable conditions to generally support two cropping seasons, northern Ghana faces a shorter rainy season which results in only one cropping season (CARE and UNU, 2012).

In Ghana, agriculture plays an important role as source of employment and contributor of its GDP. The agricultural sector accounts over 50 percent of the Ghanaians work force, and contributes a quarter of its GDP (Wood, 2013). One of the major crops in Ghana is cocoa, which accounts for over 30 percent of the exports and its cultivation lies mainly in the southern part of the country by smallholder farmers with less than 3 hectares (Nations Encyclopedia, 2016). Moving to the northern part of this country, the northern region is considered the breadbasket of this country for providing the majority of the staples; however, it is a challenging region for agricultural production and general living conditions (Ministry of Food and Agriculture, 2011). Northern Ghana's population relies heavily on agriculture for their livelihoods, and it mainly consists of smallholder farmers who cultivate less than two hectares (Chamberlin, 2007). Northern Ghanaian farmers mostly cultivate cereal crops and staples, including maize, rice, sorghum, pearl millet, cassava, groundnuts, cowpeas, and soybeans (Ministry of Food and Agriculture, 2011). The majority of the farmers are subsistence farmers and produce the crops for household consumption. According to the 1998 Ghana Standards Living Survey, only 27 percent of the households in the Northern region that produced maize intended to sale their maize; in Upper East and Upper West only 8 percent of the households that produced sorghum or millet sold their production (Al-Hassan & Poulton, 2009).

The situation does not change for female smallholder farmers in the northern part of Ghana, on the contrary, it becomes more critical facing additional challenges ranging from cultural factors to lack of access to productive factors. A typical woman farmer in northern Ghana works in the joint family farm and is a self-subsistence food producer of small plots in contrast to men that produce mainly for the market with bigger size of land (Baden et al., 1994). Additionally, cultural barriers such as patriarchal family structures inhibit their decision-making, and demographic phenomenas such as men outmigration has left women with heavier labour burden in the household and in the field with no improvements to their income that limit their options to access to education and modern sector employments (Baden et al., 1994).

Ghana's large agricultural sector, regional heterogeneity, and the significant amount of attention received from the development community make it an interesting and relevant country to examine in regards to improving agricultural productivity to reduce poverty and food insecurity. In recent years, initiatives have been focused on improving the livelihoods of smallholder farmers by increasing their performance, especially poor female smallholder farmers. A key objective of the United States Agency of International Development's (USAID) Feed the Future Initiative in northern Ghana is to promote inclusive agriculture sector growth by increasing agriculture production and the incomes of both men and women who rely on agriculture for their livelihoods (USAID, 2011). Also, the International Food Policy Research Institute (IFPRI) launched a irrigation project in Ghana to ensure efficient and effective use of water as a way to improve agricultural productivity and save time in gathering water, which, in turn, could have positive effects in women's time allocation (IFPRI, 2016). Additionally, the Northern Rural Growth Programme implemented in 2009 by the Ministry of Food and Agriculture of Ghana seeks to improve rural livelihoods and food security of vulnerable groups, including women, through development of agricultural value chains, agricultural productivity growth, and market linkages (IFAD, 2015; Ministry of Food and Agriculture of Ghana, 2012).

Given the importance of women in agriculture, the gender-specific constraints that poor female smallholder farmers encounter has garnered a lot of attention in recent years from development practitioners, activists and agribusiness practitioner. The women's situation in the agricultural sector varies even within the borders of a country, so activities that can be successful in one area may not be the best alternative in others. For this reason it is necessary to conduct researches and analyze performance of farmers and identify which factors and to what extent to provide greater access to inputs for women farmers could benefit them and improve their living conditions.

1.3 Research Question and Objectives

The aim of this study is to examine gender-based performance differences within the agriculture sector in northern Ghana. The specific objectives include:

i Identify the factors that influence performance levels of smallholder farmers;

ii Estimate the gender-based performance differences of smallholder farmers of the three focus crops in northern Ghana;

iii Identify the factors that contribute to widening or closing the gap between female and male smallholder farmers in northern Ghana; and

iv Provide empirical evidence to policy makers and other decision makers to help them develop initiatives that will reduce the gender gap in smallholder farmer performance in northern Ghana.

The present study uses household level data from the USAID funded Agriculture Production Survey conducted in the three regions in northern Ghana (Upper West, Upper East, and Northern) and parts of Brong-Ahafo during the entire 2013 cropping season, from later June to mid-November. The information collected is in regards to the three focus crops in northern Ghana, which are maize, rice, and soybean. For the purpose of this study, the Oaxaca-Blinder (O-B) decomposition method is used and farmer performance is measured by gross margins of these three crops, which provides a good estimate of how profitable a farmer is.

Results from this study will lead to a better understanding of the situation in northern Ghana for women participating in the agriculture sector and will help guide the development of informed policy interventions aimed at closing the gender gap. Actions to mitigate the gender gap such as increasing womens human capital and resources could promote agricultural growth, generate higher income for women, and lead to better food security for all (Quisumbing, 1993). Results from this analysis may also be applied to similar countries experiencing similar situations in their agricultural sector and have a high prevalence of poverty and food insecurity.

The remainder of this thesis is organized into six chapters. Chapter 2 provides a brief explanation of the O-B decomposition method used in this research and a review of four recent studies focusing on gender differences in agricultural productivity in Sub-Saharan Africa. Chapter 3 describes the data source, performance model and the Oaxaca-Blinder model specification. The results from the O-B decomposition and their implications are discussed in chapter 4. Chapter 5 provides a discussion of this study and conclusions and limitations of this research are presented in chapter 6.

Chapter 2

Literature Review

The main purpose of this chapter is to review findings from recent studies focused on examining gender differences in agricultural productivity among different countries in Sub-Saharan Africa. In recent years, a number of studies have used the Oaxaca-Blinder (O-B) decomposition to examine gender differences in agricultural productivity. This chapter includes an overview and brief history of the O-B decomposition method and reviews four studies that have applied this decomposition method within the context of agricultural productivity. These studies are part of the World Bank Policy Research Working Papers Series and they analyze gender differences in Malawi, Nigeria, Ethiopia and Uganda.

2.1 An Overview: The Oaxaca-Blinder Decomposition

The (O-B) decomposition was developed by Oaxaca (1973) and Blinder (1973), and it gained importance and popularity through the decomposition of wage earning gaps and the estimation of discrimination in gender earning differentials. Oaxaca (1973) and Blinder (1973) developed the method to examine wages differences between white males and white females, as well as white males and black males. The O-B decomposition method calculates the gap between means of an outcome variable of two groups and identifies the contribution of each variable to the differences between the groups of interest. This decomposition method divides the gap or the result of the mean differences of the two groups, between the explained component, i.e., endowment effect, and unexplained component, i.e., structural effect. The explained component is the part of the differential in group outcomes due to group differences in the explanatory variables while the unexplained component is due to discrimination or omitted predictors (Oaxaca, 1973).

Since its development, the decomposition method has been used widely in the field of labor economics. Darity et al. (1996) studied differences in performance among racial and ethnic groups. O'Donnell et al. (2008) analyzed health inequality between poor and non poor in child malnutrition using Household Survey Data level. Bustamante et al. (2009) studied differences in health insurance coverage of U.S. Latino adults and U.S. Latino adults of Mexican ancestry. The use of this method has gone beyond the field of labor economics and has been applied to other fields, such as sociology for the analysis of social issues including education (Barrera-Osorio et al., 2011; Sandy & Duncan, 2010).

More recently, the decomposition method has been used to analyze gender differentials in agricultural productivity. Kilic et al. (2013) were the first authors to introduce the use of O-B decomposition to measure gender differences in agricultural productivity. Several studies have since followed and have use this method to measure agricultural productivity in Sub-Saharan Africa such as Ethiopia (Aguilar et al., 2015); Nigeria (Oseni et al., 2015); Uganda (Ali et al., 2015); and Niger (Backiny-Yetna & McGee, 2015).

2.2 World Bank Policy Research Working Papers

The World Bank Policy Research Working Papers is a collection of studies in progress which present recent discoveries in development topics. These working papers have been peer reviewed internally, but not externally and are publicly available on the World Bank website with the intention of generate discussion. The four above mentioned studies on agricultural productivity in Sub-Saharan Africa are a part of this series. The remainder of the chapter is focused on reviewing these studies.

2.2.1 Caught in a Productivity Trap: A Distributional Perspective on Gender Differences in Malawian Agriculture

The O-B decomposition method was used by Kilic et al. (2015) to find mean differences between male manager and female manager in the agricultural sector in Malawi.

Malawi is a small country located in Southern Africa with 14.5 million people. Since 85 percent of its population lives in rural areas and 84 percent of its households own and/or cultivate land, agriculture has become a main economic activity for its population livelihood. The agricultural sector accounts by 30 percent of the country's GDP and it is considered the main pillar of Malawi's economy. Farming practices in this country rely heavily rainfall since irrigation systems are limited. In general, Malawian farmers practice subsistence agriculture and maize is the main cultivated crop. Farmers in Malawi face production challenges such as unpredictable weather, low soil fertility, lack of infrastructure, aversion to adopt new technologies and land farming practices. Under these circumstances, female headed households poverty rate is 57 percent in contrast with male headed household who faces poverty rates of 49 percent. To support farmers, the Malawian government has undertaken initiatives such as fertilizer and seed subsidy programs to help improve productivity; however, only half of the households have utilized these programs (Kilic et al., 2015)

Kilic et al. (2015) conducted a gender analysis using data from the Third Integrated Household Survey collected by Malawi National Statistical Office in collaboration with World Bank Living Standards Measurement Study (LSMS) 2010-2011. The data questionnaire covered 12,271 households including a total of 16,372 agricultural farm plots, 26 percent managed by female farmers. In contrast with other data sets, these data sets identifies the manager at plot level, and also provides information about the manager's household.

The O-B decomposition method has used to measure the gender gap in agriculture and to find the factors driving disparities between male and female managers in Malawi. Kilic et al. (2015) found a statistically significant gender gap in productivity where male managers overcome female managers by 25 percent of which 80 percent of the gap is due to average differences in levels of observable attributes such as limited use of inputs. In fact, female managers from Malawi are constrained by i) lower use of inorganic fertilizer; ii) lower production of high-value export crops; iii) lower use of household adult male labor and iv) restricted access to agricultural tools. Female farmers try to compensate for their low male labor through more female labor, child and exchange labor; however, these labour types do not eliminate differences in productivity.

The remaining 18 percent of the gap is attributed to the part explained by deviations from the mean of the observable attributes. In point of fact, factors attributed to these deviations were i) household adult male labor; ii) application of inorganic fertilizer. Kilic et al. (2015) point out that female managers have other responsibilities such as household core activities which overburden them and decrease their time to supervise their plots and in turn diminish their productive levels, in contrast, the main activity of male managers is to expend their time at field, which results in better outcomes. Regarding to the use of fertilizer, female managers have lower rates of application which may be attributed to lack of knowledge of proper application rates and techniques.

Kilic et al. (2015) discovered that the factors needed to improve female agricultural productivity are level of inputs. Policies promoting the adoption of export crops, effective access and use of fertilizer, and labor-saving tools by female managers could have positive impacts on their productivity and their welfare as well.

2.2.2 Nigeria: Explaining Gender Differentials in Agricultural Production

Nigeria is considered the most populous country in Africa with 160 million people. With 30.8 million hectares of arable land, one of the challenges this country faces is food security. Agriculture in Nigeria is a high productive sector in the country, accounting for 40 percent of the country's GDP and providing a livelihood for approximately 60 percent of its population. In general, Nigerian farmers are smallholder subsistence farmers with only a small portion of the farmers producing commercially. Traditionally, men have exercised control over the agriculture sector in Nigeria; however, in recent years women have joined the agriculture sector work force. Almost half of all female headed households are involved in agricultural activities, and 70 percent of rural female headed households rely on agriculture for their livelihood. Despite women's involvement in the Nigerian agriculture sector, they are faced with production constraints including access to resources such as land, inputs and extension services.

Oseni et al. (2015) examined gender differentials in agriculutural productivity across two regions in Nigeria: North and South. These regions were selected because of the variations in agro-ecological, and socioeconomic conditions between these two regions. The study used data from the General Household Survey collected by Nigeria National Bureau of Statistics in collaboration with World Bank LSMS 2010-2011. The dataset included information from 2,431 households including a total 4,240 agricultural farm plots, with 15 percent of the plots belonging to female managers.

The study analysis used the O-B decomposition method to measure the gender gap and to again insights into the factors driving differences in productivity between female and male plot managers. After controlling for the main factors of production, Oseni et al. (2015) found a statistical significant gender gap of 27 percent on Northern region. Furthermore, factors widening the gender gap were i) adult labor pool; ii)lack of use of fertilizer; and iii) hired labor. Land area, on the other hand, was found to be the only factor that could reduce the gender gap.

In the southern region, the difference in productivity between male and female managers was also found to be statistically significant, and the gender gap was of 24 percent. The results found that having more female adults living in the household mitigates the gender gap but having more male labor days and the lack of herbicides used widen the gap. Land area helped reduce the gap, which is a similar result to the northern region. Unsurprisingly, female managers face disadvantages in their productivity age and get older (Oseni et al., 2015).

Results also indicate policy implications for Nigeria should be considered separately by regions. Nigerian female farmers in the Northern region would benefit for having greater access to inputs; however, more research about the returns in productivity for using these inputs is needed. The gender gap in the Southern region can be reduced if female managers had access to larger farm plots.

2.2.3 Ethiopia: Gender Differentials in Agricultural Productivity

In this study, Aguilar et al. (2015) explained the differences in agricultural productivity between male and female smallholder farmers in Ethiopia using the O-B decomposition method.

Ethiopia is considered the second most populated country in Africa. A large part of its economies relies on agriculture, which represents 46 percent of its GDP, and the majority of its population (83 percent) lives in rural areas. Although Ethiopian women participate in the agriculture sector, their activities are limited by cultural norms. Typically, women are responsible for weeding and vegetable production in parcels of land located close to their household, but they have no input into the marketing and sales decisions for their agricultural output. In fact, cultural norms and limited field activities inhibits women's ability to make decisions that could improve their productivity and have a positive impact on their livelihoods and the agricultural sector, in general (Aguilar et al., 2015).

The study used data from the first wave of the Ethiopian Rural Socioeconomic Survey, which was modeled after World Bank LSMS. Information was collected during 2010-2011 from 3,969 interviewed households in the four largest regions in Ethiopia: Amhara, Oromiya, SNNP, and Tigray. Of the total of 1518 agricultural managers interviewed, 84 percent are male and 16 are female.

Through the use of the O-B decomposition method, Aguilar et al. (2015) found a gender gap of 23 percent in favor of male smallholder farmers, with 10.1 points linked to the differences in characteristics by gender and 13.4 points linked to unequal returns on characteristics. The main contributors to these gender differnces were land area and child dependency ratio. Both of these factors have a negative sign which indicates these factors could help to mitigate the gender gap through access to larger extensions of land and by having lower children dependency ratio. Factors widening the gap were household size, food consumption, and rented land.

Factors linked to unequal returns of the covariates were found to be i) access to extension services; ii) manager hours per week in agricultural activities; iii) number of fields managed; iii) field certification; iv) land size; v) distance to the household; vi) use of fertilizer; and vii) oxen availability.

The results indicated by Aguilar et al. (2015) point out that the portion of the gap due to unequal returns on characteristics is greater than the portion related to differences in characteristics by gender. Thus the gender gap cannot be closed completely by giving female managers equal access to inputs and other productive factors as their male counterparts. However, female managers could benefit from having access to certain productive factors which could reduce the gap, and certain demographics also play a role in reducing the gap, e.g., child dependency ratio.

From a policy perspective, the main factors that constraint the ability to improve female productivity are level of inputs. Aguilar et al. (2015) suggest that policies that focus to improving access to larger extensions of land and promoting effective use of limited inputs could help to mitigate differences in productivity between male and female smallholder farmers in Ethiopia.

2.2.4 Uganda: Investigating the Gender Gap in Agricultural Productivity

Uganda is a country located in East Africa and has one of the highest growth population rate in the world (3 percent). As with other Sub-Saharan countries, Uganda faces challenges of how to feed its growing population. The Ugandan agricultural sector accounts for a quarter of its GDP and employs 66 percent of its population. In recent years agricultural productivity has stalled progress, and as a result Uganda government has stimulated initiatives to increase agricultural productivity implementing programs such as Agricultural Sector Development Strategy and Investment Plan (DSIP). In Uganda, women represent 53 percent of the agricultural labor force, and more women are employed in this sector than men (76 percent compared to 62 percent). This labor force composition is one of the main reasons that promoting empowerment in agriculture can have positive impacts on food security and economic status of rural households.

The study conducted by Ali et al. (2015) measured the gender gap across smallholder managers in Uganda and determine aspects contributing to gender disparities. The study used data from the first two rounds of the Uganda National Panel Survey (UNPS) sponsored by the Uganda Bureau of Statistics (UBOS) and conducted in collaboration with the World Bank LSMS Integrated Surveys on Agriculture during 2005-2006. The analysis used a restricted sample of 6,999 plots produced by 630 couples with half of the plots managed by females and the other half managed by males.

The study used two approaches panel data and the O-B decomposition method. Through the O-B decomposition method, Ali et al. (2015) found a gender gap of 18 percent. Results indicate that 12 points are attributed to differences in characteristics are stastistically significant and 29.6 points are attributed to differences in returns, which was also statistically significant. The portion due to differences in characteristics showed negative signs for land area and family labor days, indicating that these factors contribute to reducing the gap. Overall, female smallholder farmers managed smaller plots. Therefore, providing them with larger extensions of land could decrease the gender gap. Also, hours invested by the household into the field's production could decrease the gender gap. Factors widening the gap were found to be improved seed, pesticide, manure, and hired labor, and these factors were found to be statistically significant. These factors are not surprising since female managers have lower rates of use of improved seed, manure, fertilizer, and hired labor.

In regards to the portion of the gap explained by differences in returns, female managers were at a disadvantage by their decision to cultivate less export crops. Women could reduce the gender gap by diversifying their production mix using export crops. This is specifically true for female managers who cultivate roots, bananas, pulses and oilseeds, because farmers experience higher returns for these crops, and as a result, could reduce the gap (Ali et al., 2015)

In fact, female managers lack in access to level inputs, then, the center of attention of policies in Uganda should be focus on providing access to land to increase their levels of productivity. Additionally, encouraging female farmers to cultivate export crops could have positive impacts on their productivity levels (Ali et al., 2015).

2.3 Conclusions of the four studies

Among these four studies in Sub-Saharan countries, one can find similarities in contributions and women's role in this sector. Malawi, Nigeria, Ethiopia, and Uganda are countries with high rates of population growth, food insecurity, and poverty. Agricultural activities are the large source of employment in these countries and a significant contributor to their economies. However, agriculture sector has slowly evolved; technology adoption prevail low, and farmers practice subsistence agriculture.

The situation of female farmers is not as favorable as for men. Despite their significant contributions to this sector, women in agriculture continue to have limited access to resources, little to no authority in decision making, limited involvement in certain activities and skills in the field because of cultural norms, and additional responsabilities related to the household and care of dependents.

Given these conditions, it is not surprising, that female smallholder farmers present lower productivity than their counterpart male farmers. The average gender gap in productivity among these countries was 23 percent. Factors contributing to female farmers' lower productivity rates are limited access to land, lower returns on inputs such as fertilizer; cultivation of staples crops instead of cash-crops, and hired labor.

Policies focused on improving productivity level and empowering women can have positive impacts on female welfare and food security. Key factors in these policies could be improving land access for female farmers and training sessions on effective use of inputs such as fertilizer. Female farmer face challenges that could be overcome providing access to certain resources such as the aforementioned; however, to any policy implemented must be sensitive to cultural beliefs and traditions. Analysis of these four studies has provided insights into agricultural situation, challenges and opportunities faced by female smallholder farmers in Sub-Saharan

Africa. These four studies have helped to identify factors driving disparities between male and female farmers were studied and suggested policies that may reduce the gender gap. Results from these previous studies can help guide the analysis of the gender gap in farmers in northern Ghana and provide source of comparison.

Chapter 3

Methodology

This chapter presents the empirical models used to examine farmer's performance and decompose gender differential in performance in northern Ghana. Section 3.1 provides detailed information about the data source for the study - Agriculture Production Survey (APS). Section 3.2 discusses the farmer's performance model, variables used to model performance and expected sign of each factor. Finally, section 3.3 describes the Oaxaca-Blinder Model.

3.1 Data

The present study used data from the USAID funded APS conducted during the entire 2013 cropping season. The survey was conducted in the three northern regions of Ghana (Upper West, Upper East, and Northern) and parts of Brong-Ahafo region. The total survey sample was based on the households surveyed in the Population Baseline Survey (PBS), which was conducted in 2012. The sample for the APS included 527 smallholder farmers of which 474 were male respondents and 53 were female respondents.

The survey was a part of the USAID|Ghana Feed the Future Initiative, which is aimed at helping northern Ghana address the root causes of hunger and poverty specific to their individual and unique circumstances through the transformation of agricultural production and improvement in health and nutrition (USAID, 2016). The purpose of the APS was to collect reliable data on crops production for the three target crops in Ghana - maize, rice, and soybean - and to analyze and measure the impact of activities aimed to help to improve agricultural production.

The survey consisted of multiple scheduled visits to smallholder farmers over the cropping season 2013-2014. The first visit was held in late June and household social demographic information was collected during the visit. The second visit occurred in July and enumerators gathered information related to the value chain and cost data on maize, rice and soybeans. During late July, information on agricultural related assets and agricultural extension services was collected in the third visit. In August, data on labor farm activities was collected during the fourth visit, and the fifth visit in September, involved the collection of geographical data and yield plot establishment data. The sixth and seventh visit occurred in November and December, where enumerators collected harvest and crop storage data from respondents, respectively. The final visit happened sometime between January and March to collect marketing and sales data.

For the purpose of this study, data incorporated into the models included labor and non-labor inputs, field characteristics, and smallholder farmer social demographic characteristics. Market and sales data were not incorporated into the models.

3.2 Performance Model

The conceptual model used in this study is based on a performance function, where gross margin is used as a proxy variable to measure smallholder farmer's performance in northern Ghana. There are two approaches to measure performance differences between male and female smallholder farmers. The first one is measuring performance per unit of land area (GHS/acre). However, for purposes of this study, a different approach is used; land area is treated as an independent variable to measure how land area impacts farmer's gross margin. Therefore, farmer's performance is thought to be a function of demographic, production and input factors. Gross margin captures the difference between revenue and variable cost of production, it is measured in Ghanaian cedis (GHS) and measured at household level. Gross margin is considered to be a good indicator of performance because i) it captures the efficient management of production factors; and ii) fixed costs are minimal in northern Ghana. Performance is represented by the following regression:

$$GrossMargin_j = \beta_0 + \beta_1 Gender_j + \beta_2 X_j + \beta_3 Y_j + \beta_4 Z_j + \varepsilon \tag{3.1}$$

where X represents farmer j's demographic variables, Y represents production variables, and Z represents input variables. Demographic variables included in the model are gender (GEN), gender is its own independent variable and is not captured in the vector X. The remaining demographic variables are education (EDU), and child dependency ratio (CHILD). Intercropping (INT) and crops produced (CROPS) are production variables. Input variables include hired labor (HLAB), land area (LAND), tractor services (TRAC), agrochemical (AGRO), and fertilizer (FERT). The variables included in the performance regression are defined below, and sign expectations are established for each variable. It is assumed greater yields reflect higher gross margin.

GEN represents the gender of the farmers where female farmers are coded as 0 and males are 1. This is also the group defining variable and its is expected to be negative. Previous studies have shown that female farmers tend to have lower yields than males (Kilic et al., 2013; Oseni et al., 2015; Quisumbing, 1993).

The vector X contains demographic variables. EDU is a binary variable where 1 indicates that the farmer has some level of formal education (primary, secondary or tertiary level) and 0 if otherwise. The variable EDU is expected to be positive. The more education that a farmer has, the more skilled and knowledgeable they become; making them a better producer or more profitable producer (Huffman, 2001). CHILD represents the ratio of children to adults, both male and female, in the household. The expected sign on CHILD is ambiguous. As the number of dependents a farmer has to support increases, the farmer gross margin decreases (Kilic et al., 2015). However, a high number of dependents could mean more family labor, which can have a cost-savings effect and have a positive impact on gross margin (Admassie, 2002).

The Y vector of production variables provides information on agricultural practices used in the crop production. INT is a binary variable representing the decision to concurrently grow two or more crops in the same field plot where 1 indicates the decision to intercrop and 0 for monocropping. The variable INT is expected to be positive. The decision to intercrop is expected to increase yield per acre of land and thus to increase gross margin (Reddy et al., 1980; Wang et al., 2014). The variable CROPS represents the number of crops produced per household. The expected sign on CROPS is positive. As a farmer diversifies their crops, the risk of economic losses is lower (Kahan, 2008).

The input variables in the Z vector capture the inputs and resources used by smallholder farmers. HLAB is the sum number of hired labor hours worked during the season at household level. Emran & Shilpi (2014) discovered that high agricultural productivity could result in reduced hired labor hours; thus, conversely a field with low productivity implies more hired labor is needed, which is a added cost. Thus, the variable HLAB is expected to be negative.

LAND is the area in acres used for cultivation purposes. This variable is transformed into logarithmic form to normalize it in order to align the values to a normal distribution. LAND variable is expected to be positive. An increase in field size or land generally, results in an increase in gross margin (Schneider & Gugerty, 2011). TRAC is another binary variable, in which 1 denotes the use of a tractor in the agricultural related activities. The variable TRACT is expected to have a positive sign. The use of mechanical tractors and other equipment has been found to improve soil properties and yield which can have a positive impact on farmer's financial performance (Takeshima et al., 2013). AGRO represents the total agrochemical in kilograms used by the household. The variable AGRO is expected to be positive. Agrochemical use has a positive impact on gross margins since application of agrochemicals protects crops from pest damage and prevents overall yield losses (Alabi et al., 2014). FERT represents the intensity of fertilizer application measure as kilograms per acre. Fertilizer is the ratio of the total kilograms of fertilizer to the number of plots per household that apply some level of fertilizer. The expected sign of FERT is positive. Fertilizer use promotes increased yield, which has a positive impact on gross margin (Strasberg et al., 1999).

3.3 Oaxaca-Blinder (O-B) Model Specification

Differences in performance are examined through the Oaxaca (1973) and Blinder (1973) decomposition method. As was mentioned in section 2.1 has been used to examine differences in groups in several fields of study. In order to measure and analyze differences using this method, the following set of assumptions are needed to be determined:

i Decomposition method uses a partial equilibrium approach, where outcomes for one group is used to construct various counterfactual scenarios for the other group (Fortin et al., 2011).

ii In purely accounting sense, decomposition methods quantify the contribution of various factors to a difference in an outcome across groups, they are based on correlations and cannot be interpreted as estimates of underlying causal parameters (Fortin et al., 2011). Despite this fact, by indicating which factors are quantitatively important to explain the gap, decomposition methods allow to prioritize which factors need further analysis and policy interventions (Fortin et al., 2011).

The first approach of this method is to calculate the Ordinary Least Squares of farmer's gross margin, which is the proxy variable to measure performance. The equation can be represented as:

$$GrossMargin_j = \beta_0 + \beta_1 Gender_j + \beta_2 X_j + \beta_3 Y_j + \beta_4 Z_j + \varepsilon \tag{3.2}$$

As was mentioned before, X, Y, and Z are vectors of demographic, production, and input variables for farmer j. This is called the pooled model, since this approach provides an overview of the variables affecting gross margin. The study wants to investigate the differences between male and female smallholder farmer, then, equations are calculated for these groups separately:

$$GrossMargin_{\text{males}} = E(\beta_0^M + \sum_{i=1}^{I} \beta_i^M K^M + \varepsilon_i^M) \tag{3.3}$$

$$GrossMargin_{\text{females}} = E(\beta_0^F + \sum_{i=1}^{I} \beta_i^F K^F + \varepsilon_i^F) \tag{3.4}$$

where the M superscript designates male farmers and F designates female farmers, β denotes the intercept parameter and slope parameters, where i designates the predictors contained in K. Since the error term is under the assumption that $E(\varepsilon^M) = E(\varepsilon^F) = 0$, the equations can be rewritten as:

$$GrossMargin_{\text{males}} = \beta_0^M + \sum_{i=1}^{I} E(K^M)\beta_i^M \tag{3.5}$$

$$GrossMargin_{\text{females}} = \beta_0^F + \sum_{i=1}^{I} E(K^F)\beta_i^F \tag{3.6}$$

Difference in financial performance, measured by gross margin, between male and female smallholder farmers is represented as:

$$\Delta GrossMargin(GM) = GrossMargin_{\text{males}} - GrossMargin_{\text{females}} \tag{3.7}$$

The difference in performance can be further broken down as:

$$\Delta GM = \beta_0^M + \sum_{i=1}^{I} E(K^M)\beta_i^M - \beta_0^F - \sum_{i=1}^{I} E(K^F)\beta_i^F \tag{3.8}$$

Additionally, a vector of coefficients from the pooled model is used to determine contributions of the difference in the predictors including the dummy variable that identifies the groups of interest , i.e., male and female smallholder farmers. This vector is denoted by β^* an it is used to prevent distortions in decompositions results (Jann et al., 2008). The next step is to rearrange equation 3.8, the result is known as the aggregate decomposition:

$$\Delta GM = \underbrace{\sum_{i=1}^{I}[E(K^M) - E(K^F)]\beta^* +}_{\text{Endowment Effect}} \tag{3.9}$$
$$\underbrace{(\beta_0^M - \beta^*) + \sum_{i=1}^{I}[E(K^M)(\beta^M - \beta^*) + (\beta^* - \beta_0^F) + \sum_{i=1}^{I}[E(K^F)(\beta^F - \beta^*)}_{\text{Structural Effect}}$$

Furthermore, this equation 3.9 can be separated in three components. The first component is:

$$E = \sum_{i=1}^{I}[E(K^M) - E(K^F)]\beta^* \tag{3.10}$$

which represents the explained part or endowment effect. This portion of the gender gap is the portion explained by differences in the level predictors between male farmers and female farmers.

The next component belongs to the structural effect which is the result of differences in returns of characteristics. This component is broken down into two smaller components; one representing the male structural advantage (equation 3.11) and the other representing the female structural structural disadvantage (equation 3.12).

$$C = (\beta_0^M - \beta^*) + \sum_{i=1}^{I}[E(K^M)(\beta^M - \beta^*) \tag{3.11}$$

The male structural advantage (equation 3.11) measures the deviation of coefficients of the male model from the pooled model.

$$D = (\beta^* - \beta_0^F) + \sum_{i=1}^{I}[E(K^F)(\beta^F - \beta^*) \tag{3.12}$$

The female structural disadvantage (equation 3.12) measures the deviation of coefficients of the female model from the pooled model.

According to Fortin et al. (2011), it is important to recall that additional assumptions that were made for the validation of aggregate decomposition. These assumptions are as follows:

i *Overlapping support* establish that there is not a single value of K=k or ε =e to identify female farmers.

ii *Ignorability* makes references to the random assignment of female farmers conditional on observable attributes.

For validation of detailed decomposition of the performance gap this study uses a set of assumptions established by Fortin et al. (2011). These assumptions included *additive linearity* and *zero conditional mean*, where zero conditional mean implies that term of error (ε) is independent from the predictors (K). This study also uses the method developed by Jann et al. (2008) for the STATA [1] software package.

[1]This study uses the STATA 14.1 for analyzing gender differentials in performance

Chapter 4

Results

The chapter presents the results of the estimated models. First, summary statistics are presented in section 4.1 followed by the results from pooled model, and by gender groups in Section 4.2. Outputs from the O-B decomposition method are provided in Section 4.3 and Section 4.4 exhibits results from the detailed decomposition.

4.1 Summary Statistics

Table 4.1 provides summary statistics of the variables used in the model; mean differences are divided by gender group. From the APS data, this study captures data from 349 respondents of which 309 observations are male respondents and 40 observation are female respondents. Differences between the predictors for male and female smallholder farmers were tested. The differences between male and female farmers in gross margin, decision to intercrop, and use of tractor services are statistically significant at the the 5 percent level. Differences in child dependency ratio and land area were found to be statistically significant at 1 percent level.

Table 4.1: Summary Statistics of respondents growing maize, rice and soybean

		Overall		**Female**		**Male**			
Variables	**Description**	Mean	S.D	Mean	S. D	Mean	S. D	**Differences**	
Gross Margin	Revenue - Variable Cost of production in Ghanaian Cedis	887.88	1104.23	515.92	677.83	962.26	1103.31	-446.34	**
Vector X	***Demographic variables***								
Level of Education	Binary variable (some level of education=1)	0.12		0.10		0.14		-0.04	
Child Dependency Ratio	Ratio of children to adults in the household	1.37	1.07	2.18	2.31	1.33	0.84	0.85	***
Vector Y	***Production variables***								
Crops Produced	Number of crops produced per household	1.96	0.78	2.05	0.81	2.06	0.80	-0.01	
Intercropping Decision	Decision to grow two or more crops in same field plot = 1	0.15		0.23		0.11		0.12	**
Vector Z	***Input variables***								
Hired Labor	Number of hired labor hours worked	188.57	485.43	220.80	436.20	229.41	585.03	-8.61	
Log Land Area	Natural logarithm of the growing area in acres	1.02	0.88	2.14	1.57	4.23	3.42	-2.09	***
Tractor service	Binary variable (use of a tractor =1)	0.52		0.33		0.53		-0.20	**
Agrochemical	Total kilograms used in the production by the household	8.40	57.17	1.34	2.53	9.12	66.08	-7.78	
Fertilizer	Ratio of total kilograms applied to area in acres of plots	85.88	158.77	119.84	143.23	80.91	161.21	38.93	

***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively

A mean gender difference in gross margin, the proxy variable of performance, of 446.34 GHS, was found. On average, male smallholder farmers earned a gross margin that was 46 percent higher than female smallholder farmers. Although the differences in level of education were not found statistically significant, the results showed that the majority of men and women have little to no education. The child dependency ratio for female farmers is 39 percent higher for female farmers than males, meaning that female farmers have more younger dependents than male farmers. This could mean that female farmers have more domestic responsibilities including childcare than male farmers.

For the production variables (Vector Y), the decision to intercrop was found to be statistically significant at the 5 percent level. This result revealed that female farmers are more willing to intercrop than male farmers by 52 percent. Furthermore, summary statistics show that both female and male farmers choose to produce more than one crop.

In Vector Z, input variables, land area indicates that, on average, female farmers possess land that is 49 percent smaller in acreage than male farmers. Furthermore, the percentage of female farmers using tractors in their agricultural activities is 38 percentage lower than the percentage for male farmers.

4.2 Gender Differentials in Performance

Estimates from the Ordinary Least Squares[1] from the pooled sample and by gender are presented in Table 4.2.

Column 2 displays results from the pooled regression model. The number of crops the farmer decide to grow, and land area were found to be statistically significant at 5 percent level. Tractor service was found to be statistically significant at 10 percent level. The decision to produce more than one crop, to increase land area for the crop production, and to use tractors for performing agricultural activities could increase farmers' gross margin.

Column 3 and 4 in Table 4.2 present the estimated results for the male and female farmer

[1] Regression diagnostic test were performed and issues of heteroskedasticity were detected. These issues were corrected using robust estimators. There were no multicollinearity problems detected.

Table 4.2: Gross Margin Regression Outputs: Pooled Model and by Groups

Variables	Pooled Model (N=349)		Males Model (N=309)		Females Model (N=40)	
Gender	290.09					
	(186.48)					
Level of education	119.71		158.67		-235.56	
	(162.82)		(176.92)		(391.17)	
Crops Produced	168.96	**	126.51		569.53	***
	(83.02)		(90.65)		(197.74)	
Intercropping	175.59		169.52		416.34	
	(180.72)		(204.53)		(332.88)	
Child Dependency Ratio	0.27		0.53		0.19	
	(.51)		(0.74)		(0.52)	
Hired Labor	-0.06		-0.03		-0.32	
	(0.10)		(0.11)		(0.28)	
Log Land Area	230.71	**	272.80	***	-4.04	
	(91.68)		(102.33)		(188.55)	
Tractor service	274.32	*	255.81	*	587.81	*
	(126.99)		(139.97)		(288.06)	
Agrochemical	-0.12		-0.07		-1.86	
	(0.90)		(0.93)		(49.61)	
Fertilizer	0.36		0.33		.52	
	(0.38)		(0.41)		(.92)	

***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.
Standard errors are presented in the parentheses.

models, respectively. In the male farmer model, land area and the use of tractor services are statistically significant as they do in the pooled model and have similar effects on male farmers' performance. In the female farmers model, crops produced and tractor service have a positive and significant impact to female's performance.

Overall, the results suggest that male farmers can increase their gross margin if they have access to more land and decide to use tractors services. Female farmers can improve their performance by producing more than one crop, and using tractors services. Both women and men have benefits in gross margin for tractor use; however, the coefficient for this variable is larger for female farmers than male farmers, indicating that the decision to use tractor service has a higher impact on female farmers than male farmers.

4.3 Aggregate Decomposition

Table 4.3 provide aggregate results from the O-B decomposition and it is structured into two sections. In the first section, the Mean Gender Differential provides the estimates of gross margin for the two groups of this study. Male farmers' mean gross margin is 962 GHS, and female farmers gross margin is 516 GHS; both estimations were found to be statistically significant at 1 percent level. The difference in gross margin is the result of subtracting the Female Gross Margin amount from the Male Gross Margin amount, this outcome is called the gender gap in performance. In fact, the gender gap in performance in northern Ghana is 446 GHS, meaning that male farmers out perform female farmers by 46 percent.

The second section of the table splits the mean gender gap into the endowment effect (second column) and structural effect (third and fourth column). The structural effect is divided into male structural advantage and female structural disadvantage. The endowment effect, or explained part, and the male advantage were found to be statistically significant at the 5 percent level. The explained part accounts for 35 percent of the gap and the remaining 65 percent is associated with the male advantage. Translating the percentage of the explained part into a monetary amount indicates that 156 GHS of the 446 GHS gross margin gap is due to the differences in the average characteristics of male and females smallholder farmers.

The remaining 290 GHS represents the unexplained part and can be attributed to difference in the returns associated with the characteristics. Given that the explained part was found to be smaller than the unexplained part, this result suggests that even if female and males smallholder farmers have access to the same resources, significant differences in their gross margin earnings will continue to exist.

Table 4.3: Oaxaca-Blinder: Aggregate Decomposition

Mean Gender Differential					
Male Gross Margin	962.26	***			
	(62.75)				
Female Gross Margin	515.92	***			
	(106.33)				
Difference Gross Margin	446.34	***			
	(123.47)				
	46.38%				
Aggregate Decomposition	**Endowment Effect**		**Male Struct. Advantage**		**Female Struct. Disadvantage**
	156.26	*	290.09	**	0.00
Total	(81.30)		(129.33)		(69.75)
	35.01%		64.99%		

***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Standard errors are presented in the parentheses.

4.4 Detailed decomposition

Table 4.4 provides the results of the detailed decomposition analysis. For the interpretation of the results, it is important to note that factors with positive coefficients expand the gender gap, while negative coefficients reduced the gap. Additionally, importance of the factors were calculated by the ratio of the coefficient parameter over the endowment effect (156.26) and over the gender difference in performance (446.34).

The second column of the table belong to the detailed decomposition of the endowment effect. Recall from the summary statistics in Table 4.1, male smallholder farmers had higher levels than female smallholder farmers in land area and tractor services; these factors were

Table 4.4: O-B Detailed Decomposition

Variables	**Endowment Effect**		**Male Struct. Advantage**		**Female Struct. Disadvantage**	
Level of education	4.69		5.42		35.53	
	(8.98)		(4.06)		(30.97)	
Crops Produced	1.39		-87.38	*	-821.16	**
	(23.10)		(44.63)		(409.54)	
Intercropping	-20.76		-0.65		-54.17	
	(27.48)		(5.97)		(66.44)	
Child Dependency Ratio	-23.43		34.55		19.16	
	(35.25)		(50.80)		(99.20)	
Hired Labor	-0.50		5.75		57.98	
	(4.49)		(3.93)		(39.41)	
Log Land Area	154.33	**	49.27	*	117.81	
	(70.10)		(28.54)		(82.69)	
Tractor service	55.55	*	-9.76		-101.88	
	(30.72)		(13.76)		(90.57)	
Agrochemical	-0.91		0.40		2.33	
	(1.93)		(0.50)		(60.08)	
Fertilizer	-14.12		-2.65		-18.48	
	(25.99)		(5.30)		(114.88)	

***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Standard errors are presented in the parentheses found to have a positive impact toward gross margin (Table 4.2). Thus, it is not surprising, these variables had a positive and significant impact on the endowment effect. Land area and tractors service contribute to widening the gender performance gap in northern Ghana. Land area explains 99 percent of the endowment effect and 35 percent of the overall gender gap. Tractor service explains 36 percent of the endowment effect and 12 percent of the gender gap. These percentage contributions were calculated dividing the coefficient of the predictor by the coefficient of the endowment effect and performance gap.

The male structural disadvantage is presented in column 3 of Table 4.4 and it indicates that crops produced were found to be negative and statistically significant; thus, closing the gap. Land area was the factor with a positive sign and statistically significant. This result indicates that land area is widening the gap. In the female structural disadvantage result, column 4 of Table 4.4, the only factor that was found to be statistically significant was crops produced. The sign on crops produced is negative, which indicates that this factor can close the gap.

Land area and tractor services were found to be contributors to the endowment effect, and they also had an impact on overall farmers's performance. For male smallholder farmers, they had a higher return for land area compared to female smallholder farmers. Tractors services presented a higher return for female smallholder farmers than male farmers. Furthermore, for female farmers, growing more than one crop can have a negative impact on the gender gap, which implies that it can help to reduce the gender gap in northern Ghana.

Chapter 5

Discussion

One of the specific objectives of this study was to determine which factors were contributing to the smallholder farmers performance in northern Ghana whereby performance is measured by gross margins. Those contributing factors to gross margin were land area, crops produced, and tractor services. All these factors have a positive effect towards gross margin. Overall, smallholder farmers in northern Ghana could improve their gross margins by increasing the land area for production purposes, growing more than one crop, and using tractor services to till the soil.

For male smallholder farmers, land area and tractor service have a positive impact on their gross margin. For female smallholder farmers, the factors that have a beneficial impact on their financial performance are the number of crops produced and using a tractor for agricultural activities. The impact of these factors on gross margin is consistent with the expectations stated in Section 3.2.

Through the use of the O-B decomposition method, it was possible to estimate the gender gap in smallholder farmers' financial performance in northern Ghana. Results indicate a gender gap of 446 GHS, where male smallholder farmer outperform female smallholder farmers by 46 percent. The O-B decomposition breaks down the gender gap in two components and identifies factors that contribute to the gender gap. The structural part of the gap was found to be larger than the endowment portion. This relationship suggests that even if female smallholder farmers in northern Ghana had access to the same inputs and resources as their male counterparts, significant differences in performance would still remain. However, additional inputs and resources given to female farmers would be of some benefit to them and would improve their performance. More research into what factors are influencing the structural differences between male and female farmers such as cultural factors is needed.

Another specific objective of this research was to determine the factors contributing to the performance gap. Through the use of the O-B decomposition method, it is possible to identify which factors are important to mitigate outcome differences between male and female smallholder farmers in northern Ghana. Land area and tractor service were the two variables found to have a significant impact on the gender differences. Land area accounts for 35 percent of the performance gap while tractor service accounts for 13 percent. Additionally, these two factor were found to be statistically significant and positevely contribute to the farmer's gross margin. This evidence suggests that providing more access to land and tractor services, will lead to improved financial performance for both female and male farmers. These factors could also help to close the gender gap.

One way to manage these factors to help female farmers improve their financial performance is through education and training. Female farmers could benefit from training on efficient and effective use of tractor services for improving soil quality, thus, training can increase their productivity and in turn increase their gross margin. Some tractor training initiatives have already been launched in northern Ghana. For example, Savanna Accelerated Development Authority (SADA) in 2012 started the Agriculture Input Support Programme that benefit smallholder farmers from the Upper East Region by providing tractors, other inputs, and technical assistance to enhance mechanized agriculture (Vibe Ghana, 2012). USAID |Ghana's Agricultural Development and Value Chain Enhancement (ADVANCE) project also developed a program in Chereponi District in the Northern Region that provided support from smallholder farmers, especially female farmers to improve their productivity through mechanization and training (ACDIVOCA, 2012). This initiative allows smallholder farmers to enhance their crop production and improve their livelihood as well as enable policy makers and the agribusiness community to promote and track the use of these technologies to raise technology adoption rates.

This study also confirms that access to land could help to mitigate gender differences in performance. Although land tenure is one of the most debatable topics in Ghana, partially, because of the cultural norms associated with land ownership, providing access to more land can have significant positive impact on a smallholder farmer's livelihood and their family's well-being. Attention from international organizations has been paid to promote activities to address this land issues. For instance, the government of Canada recognized the importance of land tenure to strengthen economic growth in the three northern regions of Ghana and implemented the Land Administration Project - Phase II to consolidate and increase Ghanas land administration (Global Affairs Canada, 2012). However, additional programs are needed to make smallholder farmers, especially males, aware of the benefits that female smallholder farmers can achieve if they have access to more land (Bonye, 2012).

Comparing the results from this study with the similar studies from Malawi, Ethiopia, Nigeria, and Uganda, it is evident that a number of similar characteristics exist across these gender studies. All of these countries, including Ghana, have a high dependency of agriculture for their livelihoods; agriculture represents a significant portion of their GDP, and there are high female participation rates in the agricultural sector. However, female farmers still face disadvantages in access to inputs that constrain their productivity or performance at the agricultural production level. One factor that all four studies and the present study have in common is that access to land can lead to closing the gender gap. Besides land, while in Malawi and Uganda the adoption of export crops could close the gap, in Ethiopia and Nigeria, the use fertilizer and herbicides could reduce the gap, which was not a result found in northern Ghana. However, the use of tractor services was found to have a positive impact on women farmer's gross margin on northern Ghana. These results provide valid information suggesting that policy interventions may vary by country. Thus, it is necessary develop and analyze a country's agricultural sector and women's conditions within this sector to provide country-specific and sector-specific effective policies initiatives.

Chapter 6

Conclusions

This research studied the gender differences in agricultural performance in northern Ghana using a data set from the USAID funded APS 2013-2014. The aim of this study was to determine the gender-based performance differences in agricultural activities and identify factors driving these disparities. Overall factors influencing performance levels of smallholders in northern Ghana were analyzed as well. Performance was measured by gross margins.

Results from this study confirmed the existence of gender gap in financial performance by smallholder farmers. This gap suggested that female farmers' gross margin differs from males' gross margin by 446 GHS, in percentage terms, male farmers outperform female farmers by 46 percent. The gender performance gap was broken down into two components: the endowment effect and the structural effect. The endowment effect represented 35 percent of the gap while the structural effect represented 65 percent of the gap. Since the structural effect is larger than the endowment effect, gender differentials between male and female smallholder farmers will persist irregardless of program interventions to provide men and women with equal access to resources and production conditions.

Land area and tractor services were the two factors that contributed to the endowment effect of the gender gap. Both of these factors contributed to widening the overall gap between male and female smallholder farmers with land area having the largest impact.

In northern Ghana, factors contributing positively overall to gross margin of smallholder farmers were land area, tractor services and crops produced. Based on the results of this research, policymakers and agribusiness stakeholders may look to close the gender gap existing between smallholder farmers in northern Ghana by empowering women by providing them access to land area and tractor services.

6.1 Limitations and Future Research

Studies focusing in women in agriculture have been increasing in recent years due to the importance of women's role in agriculture and their contributions to overcoming problems of food insecurity and poverty. However, analysis to determine differences achieved by female and male smallholder farmers using decomposition methods are limited. Decomposition methods are used to identify, in an accounting sense, the importance of factors that contribute to differences between two groups. By knowing that land area and tractor services are quantitatively important in explaining the gender gap in northern Ghana, this information can be used to prioritize further analysis for these factors and, ultimately, development of policy interventions.

The present study used the primary of the respondent as a proxy variable to identify the manager of the field. Therefore, the gender of the primary respondent determined the gender of the farm manager. This approach allowed the researcher to separate the farmers by gender at the household level; however, the manager at the field level was not captured. Having more information at the field level in terms of demographics and managerial characteristics would have added to the richness of the dataset.

Additionally, the dataset used in this research, is a sub-sample from the Population Based Line collected in 2012. It is likely that important factors contributing to the gender gap were not included in this research due to these two surveys have a different key objectives. Further research into other key factors contributing to this gender differential is needed to fully understand what programs can be developed for smallholder farmers, both male and female, in northern Ghana to effectively close the gender gap.

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