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Effects of Contract Farming on Small-Holder Soybean Farmers' Income in the Eastern Corridor of the Northern Region, Ghana

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Abstract
Contract farming is a form of vertical coordination largely aimed at correcting the market failure associated with spot markets that arise due to imperfect information. While some studies have argued that contract farming improves access to ready markets by smallholder farmers, other studies have suggested that contract farming lowers the incomes of smallholder farmers because the contractors wield greater market power over the farmers. In Ghana there has been few or no work carried out in this area to ascertain whether it is beneficial to farmers or not. This study assesses the effects of contract farming on small-holder soybean farmers' incomes in the Eastern corridor of the Northern Region, Ghana. The specific objectives were: to identify the factors influencing farmers' participation in contract farming; to identify the determinants of income of soybean farmers in the region and finally to determine whether contract farming enhances farmers' income compared to non-contract farming. The treatment effects model was used for the analysis. A sample size of 340 soybean farmers (contract and non-contract) was used in the study. Estimation of the effect of contract farming on income shows that participation in contract farming does not necessarily improve small-holder farmers' income. Factors influencing farmers' participation in contract farming, the conclusion is that; accesses to ready market, credit and extension service positively affect participation. The study recommended among others that companies or firms should permit farmers to make a percentage of sales on an extra-contractual basis when prices of soybeans rise this will enable farmers to benefit when prices are at its peak and contractual arrangements should be flexible and allow for the renegotiation of contracts when there are significant changes in market conditions.

Keywords: Contract farming, Contractual arrangement, Smallholder farmer, Income

1. Introduction

In Ghana, small scale farmers constitute the majority of the agricultural population.(IFPRI, 2007). Financing of agricultural activities is mostly done by these individual small scale farmers who are mostly poor and lack access to the necessary resources that can help increase their output. Some of these resources include extension services, credit, inputs, guaranteed markets for their produce among others (FOA, 2001). There are a number of formal and informal institutions and companies such as Savannah Farmers Marketing Company (SFMC), Mile 7 Presby Farmers Marketing Company, Advance Ghana, Masara N' Arziki, among others that support farmer organizations to acquire some of these resources to increase their output.

Quite a number of interventions and programmes such as; the Programme for the Promotion of Perennial Crops in Ghana which is implementing the strategies outlined by the Food and Agricultural Sector Development Policy (FASDEP), Root and Tuber Improvement and Marketing Programme (RTIMP), Rice Sector Support Project, the formation of the Export Development and Agricultural Investment Fund(EDAIF), Contract Farming, among others, are currently put in place by both government and non-governmental organizations to arrest some of these constraints. Contract farming is regarded as a strategy for agricultural transformation in developing countries because it has the potential to solve agricultural marketing problems (Little and Watts, 1994). It is a system where a central processing or exporting unit purchases the harvest of independent farmers and the terms of the purchase are arranged in advance through contract (Baumann, 2000). Contract farming arrangements provide farmers with access to a wide range of services that otherwise may be unattainable. It is a system for production and supply of agricultural/horticultural produce under forward contracts between producers/suppliers and buyers (Haque, 2000). It is a case of bringing the market to the farmers, which is navigated by agribusiness firms (Christensen and Scott, 1992). Access to market, credit, new technologies and risk reduction are some of the benefits for farmers from contract farming (Slangen et al., 2008 and Ton et al., 2007). The contractual agreement encompasses three areas, viz. (i) market (grower and buyer agree for future sale and purchase), (ii) resources (buyer agrees to supply inputs and technical advice), and (iii) management specifications (growers agree to follow the recommended package of practices for crop cultivation) (Wright, 1989).

There is a wide support for contract farming under the Structural Adjustment Programme (SAP) and liberalization policies by the international development agencies like World Bank, United States Agency for International Development (USAID), International Finance Corporation (IFC) and Commonwealth Development Corporation (CDC) (Little et al. 1994; White, 1997). The engagement of smallholder farmers in formal marketing will result in proper co-ordination and allocation of resources, goods and services thereby reducing poverty and improving the livelihoods of households (Jari and Fraser, 2009).

Soybean is a highly nutritious leguminous crop which is often referred to as the "miraculous" crop because of its multipurpose uses. It comes in different varieties, sometimes in black or creamy coloured small grains (Chianu *et al.*, 2009). The functions of soybean make it unique among other legumes and cereals. Plahar (2006) indicated that soybean is a bank of nutrition because it contains lager proportions of quality protein, essential minerals, vitamins and fatty acids. The crop contains forty percent protein (Greenberg and Hartung, 1998). But just about two percent of this protein is consumed by humans in the form of food products and only a marginal fraction of the rest of the 98% is fed to livestock such as pigs and poultry in the form of processed soybean meal (Goldsmith, 2008).

FAO (2013) noted that about fifty one countries in the world are engaged in soybean production. These countries utilize about 6% of the world's arable land for soybean production despite the overwhelming contributions the product brings forth. However, the rate of expansion in soybean production is faster than with other major grains or oilseeds (Goldsmith, 2008). There has been a continuous increase in global production of soybean over the years. United States of America alone in 2003 accounted for about 40% to 45% (189 million MT) of the world's total soybean production (Boerma and Specht, 2004). USDA, (2007) indicated that soybean production increased from 107 million MT in 1990 to 229 million MT in 2006. FAO (2013) estimated the world production of soybeans to 318.95 MT. About 89% of the 318.95 million MT constitute the production of soybean from Argentina, Brazil, United States and China (FAO, 2013).

Global production of soybean in recent times grows at about 54% per annum. The rate of growth is not large enough especially, when compared to global demand for soybean. For instance, between the periods 1961 to 2003, the average global per capita consumption of soybean rose from about 8kg to about 15.6kg (FAO, 2005). The demand rate for soybean grows at about 10 million MT (52%) per annum (USDA, 2007). Offsetting the rising trend in demand for soybean for food, feed, oil and fuel needs is a source of concern to stakeholders in the world and calls for the adoption of pragmatic and more efficient measures to increase production of soybean.

The introduction of soybean into Ghana dates back to 1909. It was meant to be exported to England as a cash crop and at the same time supplement farmers' food needs (Aoyagi and Shurtleff, 2007). Soybean production in Ghana is currently concentrated in the Northern Region with an average farm size of 1.4 ha and dominated by small scale farmers equipped with traditional tools and outdated methods of production (Plahar, 2006). Production levels tend to be small because smallholder farmers are unable to apply expensive fertilizers sufficiently to guarantee increased production.

Ghana's current production is about 172,345MT of soybean grain annually (MoFA, 2014), with the Northern Region producing 102,107MT. But total domestic demand for cooking oil, seasoning and animal feed cake is estimated at nearly 30,000 metric tons per year (ADF, 2004).Despite the numerous benefits of the soybean, the grain yield per unit area is low in Ghana, an average of 1.96 tons per hectare (MoFA, 2014). That of Africa is an average of 1.5 tons per hectare (IITA, 2009). Italy, Argentina, the USA and Brazil produce 3.32, 2.31, 2.30 and 2.00 tons per hectare on the average respectively (Norman et al., 1995). Reasons attributing to the low yields of soybean in Ghana include low plant population per hectare for various cultivars of the crop, pod shattering, poor germination due to rapid loss of seed viability, poor nodulation and drought stress among others (Addo-Quaye et al., 1993). The low plant population is due to lack of adequate information on specific row spacing to get optimum plant population for the various soybean varieties cultivated locally.

Like all other soybean producing nations, soybean processing in Ghana is on large and small (micro) scales. The large-scale processing is decomposed into oil extraction and animal feed (55%), soy flour and high protein foods (20%), high protein foods only (15%), soymilk and soy flour (5%) and soymilk and soy curd (5%) (Plahar, 2006). The large-scale processing also involves the use of sophisticated machinery and technologies. The micro-scale (household) processing of soybean, on the other hand, involves the use of rudimentary and unsophisticated

local machines. The processed products are in the form of *dawadawa* (local spice), *weanimix*, soy dough, soy flour and soymilk, among others.

There have been several interventions aimed at increasing the production for both domestic and industrial utilization of soybean in Ghana. These included, among others, an inter-sectoral National Committee on Soybean Production and Utilization formed during 1980s and 1990s, which constituted MoFA, MoH, CSIR Agricultural-based Institutes, Universities, Food Distribution Corporations, Farmers, and Industries (Plahar, 2006). The development of "Jenguma" and "Quarshie" non-shattering soybean varieties are also among the several interventions adopted to enhance farmer productivity of soybean by the Savanna Agricultural Research Institute (SARI) in conjunction with the Ministry of Food and Agriculture, and NGOs (Clottey, 2003). More so, over 5,000 soybean farmers in Ghana were given both forward and backward linkages to processors (Savanna Farmers Marketing Company) and marketers, and input suppliers, respectively (Clottey, 2003). Other support to soybean farmers in the form of farm inputs came from the Adventist Development and Relief Agency (ADRA) Ghana. To this effect, 4,500 soybean farmers were supported with inputs such as land preparation materials (tractor services, bullocks for plowing, boots and cutlasses), improved seeds, fertilizer and manure, storage facilities (Silos and cribs), extension services and linking farmers with industry players such as Bosbell Processing Company in Tamale (Daaku and Asante-Mensah, 2006).

2. Statement of the research problem

Agriculture is still one of the main sources of income for many people in Ghana, but there are many problems in Ghana related to agriculture, some of which include access to land, credit, inputs and ready market for produce. An efficient, integrated, and responsive market mechanism is of crucial importance for optimal allocation of resources in agriculture and for stimulating farmers to increase output. Without links of farmers to markets, increment in output, increased rural incomes and improved livelihoods cannot be sustained. Ideally, farmers should have certain well developed relationships with dynamic market agents. In this way they can access agricultural inputs easily and sell their produce for a suitable price while other stakeholders can also get benefits from their service providing or trading process. Also, this interaction can be a bridge which connects from domestic agricultural products to industrial products for supplying the world's demand (Ahmed, 2006; Berdegué et al., 2008; Estelle et al., 2004; Haggblade et al., 2007; Sorensen, 2001).

But, in many countries, especially in developing countries, the farmers harvest agricultural products only for domestic purposes. They do not get high income from their agricultural products because they do not access the markets or their access to markets is weak. There are many problems that make the farmers fail in the marketing systems. Inadequate roads, transportation, agro-processing, market actors, price control, quality control, and long distance from the city, etc. are found to be core causes leading to failure in agricultural marketing (Estelle et al., 2004; World Bank, 2007). Ghana shares several of the mentioned problems of weak marketing systems with other developing countries.

From a theoretical point of view, contractual farming is one of the ways used to solve some of such market problems. Studies have confirmed improvement in farmers' income as a result of participation in contract farming (Key and Runsten, 1999, and Warning and Key, 2002). There is also evidence that show situations where farmers received limited gains from participating in contract farming (Key and Runsten, 1999 and Simmons et al., 2005). Contract farming is taken as one of the strategies for enhancing production efficiency and enhancing marketing access for small farming business; however, not much research has been undertaken in Ghana to assess its effects on the income of small scale farmers.

Currently some organisations such SFMC, ADRA and SADA contract farmers to cultivate soybeans in the Districts, however,little rigorous work has been undertaken to quantitatively study and assess whether farmers' participation in contract soybean production is beneficial to farmers or not. Empirical evidence of the factors influencing farmers' decision to participate in contract farming and its effects on their income are important for the design and implementation of policies and strategies that aim to create sustainable markets for soybean producers, hence this study.

3. Methodology

3.1 Study Area

The study was conducted in the Yendi and Soboba districts of the Northern region of Ghana. The Northern Region has a total provisional population figure in the 2010 Population and Housing Census of 2,259,671 (over 2m) (GSS, 2010), making it the fourth most populated Region in Ghana but the largest Region in Ghana in terms of landmass of 70,383 square kilometers. The Region also has 26 political districts with the Regional capital

being Tamale, and bounded to the north by Upper West and Upper East Regions and to the south by Brong Ahafo and Volta Regions. It is bounded to the west and east by neighbouring countries like La Cote d'Ivoire and the Republic of Togo respectively. The White and Black Voltas form the major lakes in the Region and the land is relatively flat and low lying (MoFA, 2011). Agriculture dominates economic activity engaged in by the economically active population with a share of 71.2 %, followed by administrative and professional workers with a 5.7 % and finally, service sector workers (including transport and sales) with a 23.1 % (MoFA, 2011).

The Yendi Municipal Assembly is located in the Eastern corridor of the Northern Region of the Republic of Ghana. The Greenwich Meridian passes through a number of settlements in the District including Yendi, Bago, Laatam, Lumpua, Gbetobu, Gbungbaliga and Nakpachei (Ghana districts, 2010). The Municipality shares boundaries with seven districts:- To the east – Saboba/Chereponi and Zabzugu/Tatale To the south – Nanumba and East Gonja To the west – Tamale Municipality and Savelugu/Nanton To the North – Gushegu/Karaga The municipality ranks sixth (6th) in the Region in terms of surface area with a landmass of 5,350 sq km. The population of the Yendi municipality is 142,504 (2000 population and Housing census) and is varied in terms of ethnicity with the Dagomba constituting the majority. The other ethnic groups include Konkomba, Akan, Ewe, Basare, Moshie, Chokosi and Hausa.

The Saboba District Assembly used to be the Saboba/Chereponi district until 2008 when the government carved out the Chereponi district. Saboba District Assembly is one of the Eastern corridor Districts of Northern Ghana. The District Assembly was created in 1988 when the two areas together was carved out of the then Yendi District Assembly. Today the SDA is one of the 20 District Assemblies and one of the youngest districts in Northern Region with a total population of about 60,000. Saboba District Assembly is located in the North Eastern part of the Northern Region of Ghana sharing boundaries with Chereponi district to the north, Gushiegu and Karaga districts to the west, Yendi to the south-west; Zabzugu/Tatale to the south and the Oti River to the east, which serves as the international boundary between Ghana and the Republic of Togo. The district lies between Latitudes 24º N and 25º N; Longitudes 27º E and 13º E and covering a land area of approximately 1,100km².

3.2 Data and Data Analysis

Primary data was obtained from soybean farmers in the two districts. Secondary data was obtained from Savanna Farmers Marketing Company, Yendi and Saboba district Assemblies, MoFA offices in Yendi and Saboba and the UDS library.

3.3 Sampling Procedure and Size

Multi-stage random sampling will be used to select respondents. In the first stage, out of the districts where soybean contract farming takes place, Yendi and Saboba were selected on purpose because of the presence of many soybean contract farming activities. In the second stage, based on the proportion of villages that undertake contract farming, five villages from each district were selected randomly. Yendi district (Bago, Tusani, Yashiagu, Zang and Zugu), Saboba district (Bodagbam, Nakpando, Nayil, Sobiba and Wapuli).

In the final stage, soybean farmers in the villages were stratified into two strata: contracted and non-contract farmers. The non-contract farmers were selected within villages of farmers under contractual soybean production to ensure homogeneity of factors except contract farming. In total 340 respondents (200 respondents under contract farming and 140 non- contract soybean farmers) were selected using random sampling.

3.4 Method of Data Analysis

Qualitative and econometric techniques were employed to analyse the data and to achieve the objectives of the study. The econometric analysis seeks to examine the effect of contract farming on the income of contract and non-contract farmers and the determinants of participation in contract farming.A treatment effects model was used to determine the key characteristics that influence participation in contract farming as well as the effects of contract farming on income of farmers. The model involves two equations- the selection equation which estimates the factors which leads to participating in contract production and outcome equation which estimates income as a function of the socio-economic characteristics of respondents, the contract dummy variable and the inverse Mills ratio (IMR). The IMR calculated from the selection equation, adjusts the outcome equation for selection bias associated with the fact that soybean contract farmers and non-contract farmers may differ in unobservable characteristics (such as entrepreneurial skills and risk attitude).In the analysis, the maximum

likelihood estimation technique is adopted; in which case all parameters are estimated simultaneously rather than the conventional Heckman two-step procedure.
The treatment effects model estimates the effect of an endogenous binary treatment on a continuous fully observed variable, conditional on the independent variables. In our case, it is the effects on total crop or household income (*yi*) of participation in contract farming operations (*ci*). The primary regression of interest is

$yi = \beta xi + \phi ci + ei$…… 1

where, *ci* is a binary decision variable, that stems from an unobservable latent
variable that is assumed to be a linear function of the exogenous covariates and *wi*and a random component *ui* . Specifically,

$ci^* = \gamma wi + ui$…….... 2

The decision to obtain the treatment (participate in contract farming) is made
according to the rule

$ci = 1$ if $ci^* > 0$

$ci = 0$, otherwise

where *ei* and *ui* are bivariate normal with mean zero and covariate matrix

$$Cov(ei, ui) = \begin{bmatrix} \sigma & \rho \\ \rho & 1 \end{bmatrix}$$

This model has many versions and has been applied in a variety of contexts
(Barnow et al., 1981; Maddala, 1983; Angrist, 2001; and Greene, 2003). The model is estimated either by maximum likelihood (MLE) or through a two-step procedure. The MLE estimation can be time consuming with large datasets and the two-step estimation with consistent covariance estimates provides a good alternative (StataCorp, 2003). In the first stage of the two-step option (Maddala, 1983), one obtains the probit estimates of the treatment equation

$\Pr(ci = 1 \mid wi) = \Phi(\gamma wi)$……..…….3

From these estimates, the hazard, *hi* for each observation i is computed as

$hi = \varphi(\gamma wi)/\Phi(\gamma wi)$ if $ci = 1$, and…….……4

$hi = \varphi(\gamma wi)/[1-\Phi(\gamma wi)]$ if $ci = 0$……..……...5

where $hi = \varphi(\gamma wi)$ and $\Phi(\gamma wi)$ are respectively the density and distribution functions of the standard normal evaluated at *w*.
By taking the difference in the expected outcome between participants and nonparticipants in this model,
$E[yi \mid ci = 1, xi, wi] - E[yi \mid ci = 0, xi, wi] = \phi + \rho[\varphi(\gamma wi)/\Phi(\gamma wi)(1-\Phi(\gamma wi))]$, it becomes clear that if the selectivity correction is omitted from the second step equation, the OLS will overestimate the effect of the treatment (Greene, 2003).

4. Results and Discussion

4.1 Estimation of the factors influencing farmers' participation in contract farming

The results of the treatment effects model are presented in Table 1. The explanatory variables in the model are age of respondent, sex, marital status, household members engaged in soybean production, educational status of respondent, experience in soybean cultivation, access to ready market, access to credit, access to extension service and method of land ownership.
As shown in Table 1; age, marital status, experience, household size and method of land ownership are not significantly related to the probability of contracting in soybean production. The significant predictors of participation in soybean contract farming are; educational status, access to ready market, access to credit, and access to extension services.

The educational status of the farmer has a negative effect on the farmer's likelihood to participate in contract farming but was significant at the 1 percent level. The results show that an increase in years of education by 1 year will reduce the likelihood to participate in contract farming by 0.27, other things constant. This is probably due to the fact that more educated farmers are more likely to seek information on other marketing channels in the region. This is consistent with Mangisoni (1989) who concluded in his work that, educated farmers are less likelihood to participate marketing contracts.

Total acres farmed has a negatively significant effect on contract farming, which means farmers with smaller farm sizes are more likely to use marketing contracts. These are farmers considered to be in a helpless situation; and so when help comes their way in the form of contract farming, they find themselves lucky if they are selected by the agribusiness firms. These results are also consistent with the findings of Leung et al. (2009).

Access to ready market is significant and positive. This is expected because the major aim of contracting firms is to provide market for its clients. Access to extension service, measured by the number of visits by extension agents has a positive effect in participating in contract farming and significant, this implies that respondents are more likely to participate in contract farming because it provides them with technical training on how to manage their farms for better yield.

Access to credit is positive and significant, this is expected because one of the major reasons why farmers participate in contract farming. This is consistent with the findings of Simmons et al. (2005) who consider farmer access to credit as one potential motive for contract participation. Method is of land acquisition is insignificant and positive; this implies that it does not influence participation in contract farming

4.2 Main factors that contribute to the incomes of the smallholder soybean farmers and its effects on contract and non-contract soybean farmers

Table 2 represents results of the treatments effect model to explain factors influencing smallholder soybean farmers' income. The explanatory variables in the model are conpart (contract participation dummy), educational status (dummy), farm size, age, cost of ploughing, cost of pesticides, cost of seeds, cost of labour and house hold size.
The level of education of the farmer has a positive effect on the farmer's income in contract farming but was significant at the 10 percent level. Results show that an increase in years of education by 1 year will increase the income of the farmer by 0.005, other things constant.

The study shows an inverse relationship between age and income. This implies that, a one year increase in age of a respondent will lead to a 17% decrease in income. This results give credence to the fact that, because agricultural activities is labour-intensive in developing countries it requires the youth to engage more in it. This idea is supported by Musara et al. (2011) who argued that, with increase in age, farmers tend to abandon soybean contract for less demanding cropping systems with low transactional cost associated with them in order to increase income.

Farm size also conforms to our a priori expectation because it showed a positive effect on income. This means a one acre increase in area under cultivation will lead to a 10% increase in income. This is consistent with a large number of studies like Zhu and Wang (2007), Lu and Ma (2010), Arumugam et al. (2011), Wang et al. (2011), Bellemare (2012), Freguin-Gresh (2012), Hu (2012) and Wang et al (2013).

Cost of ploughing which is the amount a farmer spent in ploughing his or her total land area is positive and significant; implying that a percentage increase in the amount invested in ploughing a bigger land area will lead to a 16% increase in income. The study revealed that cost of seeds which is the amount invested in purchasing seeds has a positive coefficient but insignificant, the results is surprising and needs further examination.

Also, house hold size is positive and significant, its coefficient is 0.11, and this implies that if the household size increase by one person providing labour for the production of soybean, income will go up by 11%. This also suggest that, the larger the household size the higher the income that could be gotten from soybean production This can be attributed to more active members on the farm as it reflects reduced number of hired labour engaged by the household.

Cost of pesticides is significantly positive, this shows that, a farmer who invest in a bottle more of pesticide to control diseases and pests on his or her farm will have his income go up by 3%. Cost of labour which is the cost

of hiring labour for his farm is significantly negative, implying an increase in labour by one person will reduce income by 6%. Many people in the production process may lead to the duplication of roles especially when diminishing returns sets in, this may lead to increase in the cost of production hence leading to lower income.

Contract participation negatively and significantly affects income earned from soybean production. This implies that, contract farmers earn less from soybean cultivation as compared to their non-contract counterparts. This is contrary to our a priori expectation. The following reasons however accounts for that findings; the nature of soybean contract farming in the northern region is such that farmers are expected to sell their produce to the companies immediately after harvest at an agreed price unlike their non-contract counterparts who usually will store their produce waiting when the price is good to sell, another reason is that, these companies that contract farmers are mostly business oriented and profit is their major objective and hence tends to pay less attention to the welfare of farmers. Another possible reason is that contract farming in Ghana and for that matter Northern region is not well structured with almost
no policies regulating the operations of contracting firms. As a result, less attention is paid to the activities of these firms who sometimes short-chain farmers. This finding is consistent with a number of studies including; Eaton and Shepherd (2001), who cites monopolistic tendency, opportunistic behaviour of contracting firms, lack of transparent pricing and quality control as factors that result in a negative income effect. This is also consistent with other findings such as; contract farming of frozen vegetable with Alimentos Congelados, in Chimachoy and Patzicia, Guatemala (Glover and Kusterer, 1990).

5. Summary and Conclusions

Formal and informal institutional linkages involving agribusiness firms and smallholder farmers in Ghana should be a win-win situation as far as contract farming arrangements for soybean is concerned. However this is not the case as shown in this study. Contract farming in Ghana develops in response to the critical resource constraints faced by farmers, the need to raise the quality of the concerned commodities and address the technical difficulty associated with the production of crops, the business specialty and reputation of the contractors and the requirements of the export market, the small-scale farmers encounter severe constraints that limit their potential to increase productivity and income. Farmers lack information about production methods and market opportunities, particularly for crops that they do not normally grow. Even with sufficient information about profitable investments, small farmers have low savings and often lack the necessary equity capital. Access to credit is limited by the lack of collateral and high interest rates demanded by formal and informal lenders, this and other factors leads to the rapid expansion of contract farming in the Northern region necessitating the empirical verification of its effects on the income of smallholder farmers.

The study reveals that, participation in contract farming is influenced by educational status, access to ready market, access to credit, and access to extension services. Availability of extension services is positively correlated with adoption because these services improve participants' knowledge of the new farming techniques associated with contract production.

The research also reveals that; educational status of respondent, farm size, cost of ploughing, cost of pesticides and weedicide and the amount invested in labour are the main factors that determines the incomes of farmer. The effect of contract farming on the income of smallholder farmers' production is investigated. Indeed, the treatment effect model results show that contract farming has a negative significant effect on farm income suggesting that participation in contractual soybean production does not improve the incomes of contract farmers as compared to their non-contract counterparts.

It is recommended that companies or firms should permit farmers to make a percentage of sales on an extra-contractual basis when prices of soybeans rise. This will enable farmers to benefit when prices are at its peak, also, contractual arrangements should be flexible and allows for the renegotiation of contracts when there are significant changes in market conditions. There is evidence to proof that contract farming is beneficial in other jurisdictions where governments have shown interest in it. The same can be achieved here in Ghana if government pays more attention to it and comes out with the necessary policies to guide the operations of contract farming. Finally, farmers should be consulted in the drafting of the contractual agreement, the wording of the specifications should be in a language and terms that the farmers can comprehend. This will ensure the understanding of the responsibilities and obligations of each party leading to the acceptance of the contract.

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Table 1

Treatment Effects Model of Factors Influencing Participation in Contract

Variable	Coeff.	Std. Err.	P>|Z|
Selection equation:			
Dependent variable: conpart			
Age	0.0188	0.0175	0.280
Sex	-3.3368	0.5354	0.529
Marital status	0.0469	1.3242	0.972
Experience	-0.0317	0.0583	0.587
Education	-0.2696***	0.4087	0.009
Household size	0.0596	0.0440	0.176
Farm size	-0.3709***	0.4935	0.018
Ready market	1.2636*	0.4694	0.087
Extension service	4.7756***	0.6371	0.000
Credit	1.0243**	0.4880	0.036
Land ownership	0.2553	0.4935	0.605
Constant	-4.7954***	1.8151	0.008
Number of obs= 340	Rho	=-0.0759	
Wald Chi2(11)= 927.97			
Prob>chi2 = 0.000			
Lamda = -0.01854			

***, ** and * represent 1%, 5% and 10% level of significance, respectively

Source: Field Survey, 2014

Table 2

Treatment Effects Model of Determinants of Farm Income of Soybean Farmers

Variable	Coefficient	Std. Err	P>|z|
Outcome Equation:			
Dependent variable: Income			
Contract	-0.2136***	0.0299	0.000
Education dummy	0.0049*	0.2990	0.087
Ln_age	-0.1745*	0.1049	0.096
Ln_Farmsize	0.0494*	0.0402	0.090
Ln_cost_ploughing	0.1666*	0.1020	0.103
Ln_cost_seeds	0.1050	0.2092	0.616
Ln_hseholdsize	0.1126***	0.0437	0.010
Ln_cost_pesticides	0.0322*	0.1794	0.073
Ln_cost_labour	-0.0685	0.0464	0.140
Constant	-1.1647***	0.2270	0.000
Number of Obs= 340	Rho	=-0.0759	
Wald Chi2(11)= 927.97			
Prob>chi2 = 0.000			
Lamda = -0.01854			

***, ** and * represent 1%, 5% and 10% level of significance, respectively

Source: Field Survey, 2014