FACTORS INFLUENCING SMALLHOLDER FARMER PARTICIPATION IN COTTON PRODUCTION IN ZAMBIA

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By

Musonda Calyn

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LIST OF ABBREVIATIONS

AEZ Agro Ecological Zones

CBZ Cotton Board of Zambia

COMESA Common Market for Eastern and Southern African Countries

Ha hectares

IAPRI   Indaba for Agricultural Policy and Research Institute

LINTCO Lint Company of Zambia

SADC Southern Africa Developing Countries

SNDP Sixth National Development Plan

SPSS   Statistical Package for Social Scientists

ZMW Zambian Kwacha Rebased

ABSTRACT

FACTORS INFLUENCING SMALLHOLDER FARMER PARTICIPATION IN COTTON PRODUCTION IN ZAMBIA.

University of Zambia   **Supervisor**

Calyn Musonda   **Dr.Gelson Tembo**

Cotton production offers substantial opportunities for economic growth and poverty reduction, especially among the rural farming households in Zambia and other developing countries. However, smallholder farmers are characterized by low participation in cotton production. Understanding the determinants of smallholder farmer participation in cotton production could lead to the design of interventions that would be effective in poverty reduction. This study uses Cragg's double hurdle model and panel data collected in 2004 and 2008 to identify the factors affecting smallholder farmer participation decisions in the four major cotton producing provinces of Central, Eastern, Lusaka and Southern.

Empirical results from the regression analysis showed that demographic factors (such as age and sex of head), human capital (such as marital status, dependency ratio and adult equivalent) and institutional factors (such as access to credit and distance to nearest transport) increased the likelihood of participation while socio economic factors (such as off farm income) made it less likely for households to participate. Therefore the study recommended that, an understanding of factors that affect cotton participation and how they relate to the participation decision, should be an important part in design of interventions aimed at improving production uptake.

CHAPTER ONE: INTRODUCTION

1.1 Background

In Sub- Saharan Africa, agriculture is considered as an engine of economic growth (Kabwe 2012). Agriculture has the potential to reduce poverty through food security and increased income. Cotton is considered one of the success stories for Sub-Saharan Africa, between 1980 to 2005, Africa's share of world agricultural trade dropped by half while its share of world cotton trade more than doubled (Tschirley and Kabwe 2007). Cotton is a predominantly smallholder crop in Sub-Saharan Africa, with over two million poor rural households depending on it for cash income (Boughton and Tschirley 2003).

In Zambia, the cotton production sub-sector has grown and transformed from a parastatal monopoly into a competitive private sector enterprise (Likulunga 2005). Prior to 1994, LINTCO (Lint Company of Zambia), controlled the sector by selling inputs, buying cotton, giving credit, and facilitating access to technology, equipment and know-how (Brambilla and Pourto 2007). Cotton production had been trending downwards under LINTCO as the company accumulated debt but the sector remained functional (Boughton and Tschirley 2003).

Privatization of the Zambian economy in the 1990s led to a decline in the provision of public service and many small-scale farmers would no longer be able to engage in commercial farming activities without access to services provided by the private sector through contracting farming. This gave the incentive to Lonrho and Clark Cotton (which bought LINTCO) to develop outgrower schemes with Zambian cotton farmers in 1994.

These outgrower programs mainly involved firms providing seeds and inputs on loans, together with extension services to improve productivity. The value of the loan was deducted from the sales of seed cotton to the ginners at picking time. These schemes were based on firm employees commonly referred to as agents that acted as extension and credit officers and initially the repayment rates were high and cotton production increased. For example, cotton production rose from 20000 metric tonnes to 100000 metric tonnes in 1998 (Goeb, 2000).

However by 1999, as additional entry and competition ensued, the outgrower schemes began to fail due to side selling of cotton seeds as farmers would take loans from one firm while selling to another (Brambilla and Pourto, 2005).The outgrower schemes almost failed due to higher farmer default rates which resulted into higher input prices and lower profitability for non-defaulting farmers.

The situation began to improve again around 2001 as NWK Agriculture Services (formerly Dunavant limited) and Cargill (formerly Clark cotton) were perfecting their respective cotton farming models, raising repayment rates from 65 percent to 85 percent by 2001 (Boughton and Tschirley 2003). By the 2003/04 season, cotton production was estimated at 160.000 metric tons (Likulunga, 2005).

The main challenges facing cotton are inadequate input supply, lint quality, low productivity, conflict regarding pricing mechanism, difficulty in adding value (spinning and whining) and limited high quality research system to feed into effective extension services.

The issue of farmers' participation in a crop such as cotton is important for policy makers that want to promote rural and economic growth. Farmer participation in cotton production is an important factor for the sustainable growth and development of the cotton sector. This then entails that increasing participation of smallholder producers requires identification of the various factors that influence production as nearly 90 percent of all farmers do not produce cotton. (Tschirley and Kabwe 2009).

1.2 Problem statement

A number of studies using household data have attempted to understand the factors affecting farmer participation in crop production (for example, Randela 2008, Geremew 2013, Mwambi and Odoul 2013). Evidence based to these studies is, however, mixed. Commonly cited determinants include transaction costs (distances from nearest transport), institutional factors, demographic (size, age and gender) and socioeconomic factors (farm size, number of oxen owned). Commonly cited institutional factors include lack of access to credit and training (Barrett et al 2006). Smallholder farmers are also argued to be constrained in terms of asset ownership such as water for irrigation and land which often limit their production (Mwambi and Odoul 2013). However, participation literature specific to the cotton subsector is still quite scanty. Studies done in Zambia on cotton have mainly focused on the influence of the cotton sub-sector reforms on the performance of the sub-sector in terms of productivity (for example Tschirley and Kabwe 2007, Brambilla and Pourto 2007). None of these studies have looked at the factors influencing smallholder farmer participation in cotton production. Internationally, studies have been done on cotton but most of these studies have focused on smallholder farmer participation in cotton contract farming (for example Barett 2006, Musara and Zivenge 2012).

The Zambian government through the Sixth National Development Plan recognizes the need to address the challenges impeding participation of farmers in cotton production in order to attain national and household food security and ensure increase in income. Empirical records suggest that in many semi-arid regions cash crops such as cotton provide higher rates of return than food crops and thus present major opportunities to promote smallholder income growth, food security and national foreign exchange generation (Jayne 1994). The government continues to support cotton through the enactment of the cotton Act of 2005, the Bio safety Act and Policy of 2007, the funding of the Cotton Board of Zambia, policy support of the SADC and COMESA regional effort of harmonization of seed variety release, phyto sanitary, quarantine and certification of which cotton is one of the crops (CBZ 2012).However, the dearth of knowledge about the specific farmers' constraints, as well as the factors influencing the movement into and out of cotton production often leads to faulty interventions that have little or no effect in achieving an increase in household welfare.

1.3 Objectives

1.3.1 Main objective

The overall objective of this study was to determine the factors that affect smallholder decision to participate in cotton production.

1.3.2 Specific objectives

i) To characterize the socio economic, institutional and demographic factors of smallholder cotton farmers affecting production participation.

ii) To measure the extent to which the farmers participate in cotton production

1.4 Rationale

Cotton production through contract farming is viewed as a tool for creating market opportunities to farmers and for providing credit and training leading to welfare gains of farmers as well as a reduction in poverty levels. The statistics are such that about 80% of the population in Zambia live in rural areas and are dependent on agriculture for their livelihoods (Chapoto and Banda 2011). Thus encouraging farmer participation would in turn result into increased production of cotton as well as increased income for the farmers. This is possible only if studies such as this one support the policy by identifying factors that influence the farmers' decision to participate. Henceforth the purpose of this study is to gain the capacity to obtain an accurate and deep understanding of the existing but limited literatures regarding farmers' participation in cotton production and serve as a framework for policy formulation concerning the subject matter.

1.5 Organization of study

This study is divided into five chapters. Chapter 1 gives an overview of the background, statement of the problem, objectives and the justification of the study. Chapter 2 discusses the literature review and highlights the areas suitable for cotton production and the fluctuations in the Zambian cotton production as well as an overview of other related studies. Chapter 3 discusses the methodology employed in this study which was the theoretical basis for the empirical approaches that were used to achieve the study objectives. Chapter 4 discusses the results of the analysis while Chapter 5 gives the conclusions and recommendations.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Improved farmer cotton production participation is important for both developing and developed countries as this has the potential to increase agricultural production.

This Chapter highlights the areas suitable for growing cotton in Zambia. Section 3.3 highlights the trends that have taken place in Zambian cotton production as the cotton sector evolved. Section 3.4 shows the review of other related studies.

2.2 Agro-ecological regions in Zambia

Cotton is a semiarid crop grown mainly in areas with low rainfall or moderate rainfall (Jayne 1994). The main cotton producing provinces in Zambia are Eastern, Southern and Central provinces (Likulunga 2005). The Agro-ecological regions of Zambia (AEZ) map show the suitable areas for growing cotton. The ideal AEZs for growing cotton are AEZ 1 and AEZ 2a (Goeb 2010). Cotton is a drought tolerant crop and receives the right amount of rainfall when grown in AEZ region 1 as the figure 1 show. AEZ region 1 is characterized with rainfall less than 800 millimeters. Region AEZ 2a is characterized with rainfall between 800mm to 1000mm and has clayey soils that allow for proper growth of cotton. AEZ 2b has sandy soils that do not allow for the production of cotton despite having the same annual rainfall as AEZ 2a. AEZ 3 is characterized with high rainfall of more than 1000 mm that does not allow for proper growth of cotton. AEZS 1 and 2a are made up mainly of the Eastern, central and southern provinces. Cotton production is heavily concentrated in Eastern province followed by Central and Southern provinces (Tschirley and Kabwe 2009). However, the concentration levels are not as high as compared to a food crop like maize.

Figure 1: Zambia Agro-ecological Zones
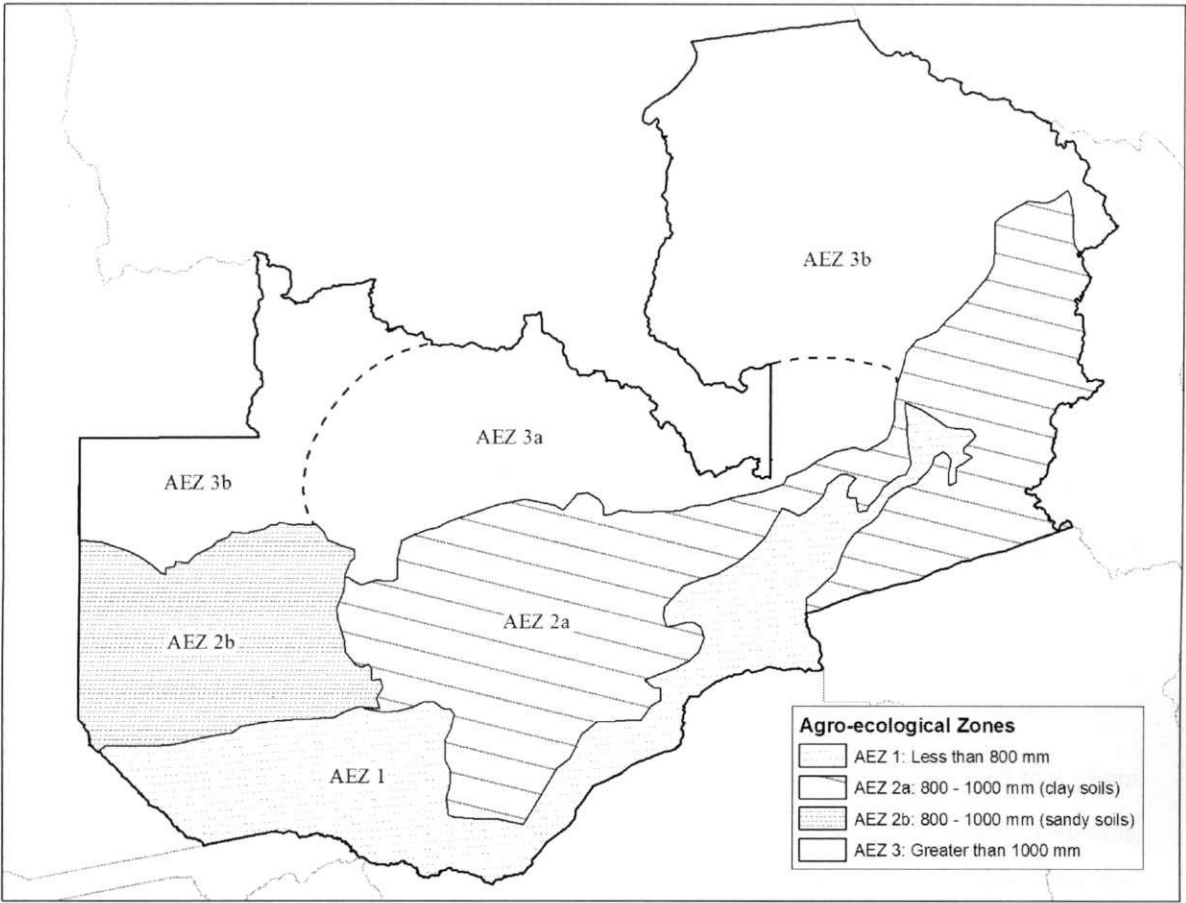
Source: Goeb (2010)

2.3 Zambian cotton production trends

In the early 1990s, Zambia implemented more liberalized agricultural policies and opened up its cotton sector to competition after the sale of LINTCO. Since the sale of LINTCO the cotton sector has evolved through five phases. The first phase which was from 1995 to 1998 composed of the post reform boom were the sector remained concentrated with private companies and was unregulated by the government (Brambilla and Pourto 2007). The second phase was between 1999 to 2001this is where the sector experienced the first crash and during this time there were high default rates as a result of new entries and other buyers were more interested in trading cotton than in promoting cotton production. According to Brambilla and Pourto 2007, the third phase between 2000 and 2005 saw a boom in the sector resulting from private sector efforts in

curbing the default crisis. The Zambian government during this phase became more involved and introduced the cotton Act of 2005 (CBZ 2012). According to Kabwe 2008, the fourth phase marked the second crash of the sector between 2006 and 2007; the crash was as a result of many factors ranging from the sharp appreciation of the kwacha which in turn reduced the profitability of exporting cotton to the unhelpful public government remarks that increased tension between farmers and the ginners. Cotton production in the end plummeted. Cotton production began to recover in 2008 during the fifth phase but remained somewhat unvaried in 2009 but then dropped by 18 percent in 2010 (Kabwe 2008). In 2010 season more farmers were attracted into cotton production by the high prices ranging for K1.6 to K 2.8 per kg of cotton but this increase in production could not be sustained because of the fluctuating international prices that in turn reduced the profitability of cotton exports. This then calls for the need of looking at ways in which the cotton sector can grow and maintain sustainability one such way is through identifying the factors affecting smallholder farmer participation in cotton production and the next section looks at what other related studies have done.

2.4 Other related studies

Siegel and Alwang (2005) in their study on smallholder agriculture in Zambia showed that given the then prevailing cash and food security constraints caused smallholders to choose producing food crops such as maize, groundnuts and millet in the Eastern province of Zambia than any other cash crop. The results in the Northern and Southern provinces of Zambia also showed that the food security constraint pushed smallholders in these provinces to primarily produce maize and groundnuts for own consumption.

Jayne (1994) in her study suggested that households that engage in substantial cash cropping may have higher returns, however in an environment of high food marketing costs, the decision to participate is dependent on adequate household productive assets. The author argued that the high costs associated with buying food on the market make cash crop production such as cotton an unattractive venture. According to Jayne, food security maybe among the reasons that affect a farmers decision to produce a cash crop. Cadot et al (2006) also proposed that private asset accumulation is a prerequisite for the graduation of smallholders from subsistence production.

A study done in Mozambique by Benfica and Tchirley (2006) on tobacco (a cash crop) revealed that female headed households were less likely to engage in production and the study also

pointed out that the availability of draft power and marketing equipment including bicycles are positively associated with the participation decision in tobacco production.

Similarly. Kabwe and Tshirley (2008) in their study pointed out that prices are key determinants along with productivity and cost of production, of the returns farmers earn from the crops that they grow and sell. The high returns will act as an incentive to encourage farmer participation in cotton production. These are important elements in the ability of a crop like cotton, produced almost entirely by poor smallholder's farmers to reduce poverty (Kabwe and Tschirley 2008). Another study done in Zimbabwe by Musara and Zivenge (2011), examined the determinants of farmer participation in cotton contract farming and revealed that education significantly influenced farmer participation in contract farming but with more achievements in academics the likelihood of participation reduced. Educated people tended to move away from agriculture in search for white collar jobs or turn to quick return and profitable ventures such as broiler production. Yet in another study done by Randela 2008 in South Africa, revealed that education was found to positively affect the farmer's decision to participate in cotton contract farming.

2.5 Conceptual framework

The supply of agricultural commodities in local and international markets depends largely upon the activities of many farm households. These farm households choose whether or not to produce a food crop (such as maize, millet, sorghum) for home consumption or a cash crop (such as cotton) for the market. The household chooses the level of land (l) and capital (k) to use in the production of the crop with which the household has a comparative advantage in. These choices are made to maximize their expected utility from consumption of food crops (C), Leisure (L) and all other goods obtained from the market (M). With this the households' optimization problem can be specified as

$$U = U(C, M, L) \tag{1}$$

The Utility maximization goal is therefore assumed to be maximized subject to a set of prevailing production technology constraints, resource constraints and allocation constraints and income constraints. The production technology constraint is specified as

$$Q = Q(q, n, Zq) \tag{2}$$

where Q is the quantity of produce, n is the input used in production such as land, labor, capital, time and Zq describes unknown shocks to production that are realized after production decisions are made by the household. The income constraint is such that income from the sale of produce, plus off farm work minus the cost of purchased variable inputs must not exceed the sum of available cash for household expenditure. The income constraint can be specified as

$$pC + mM + wL = wL + R + \pi = Y \qquad (3)$$

where p is the price of the home produced goods , m is the price of purchased consumer goods, w is the labor price(wage), Y describes the full income from farm profit together with total value of off-farm incomes and transfers (R). Maximization of the household utility subject to these constraints can be worked out by maximizing the corresponding langragean function and the optimal production can be obtained by differentiating the langragean with respect to the variables.

Three main paradigms defined by Adesina and Zinnah (1993) have guided the choice of covariates used in empirical adoption or participation studies: i) the innovation-diffusion paradigm, ii) the adopters' perception paradigm, and iii) the economic constraints paradigm. The economic constraint paradigm emphasizes the factors that affect the profitability or utility of innovations, while the innovation-diffusion-adoption paradigm emphasizes the key role of access to information to understand the process of adoption or participation. The adopter perception paradigm in turn focusses on the important role of attitudes and perception in the decision-making process of smallholder farmers. However, prices are rarely included in adoption models as they are regarded as implicit in the choice being modeled and are often further determined by farm size and location variables (Tembo 2011). These considerations form the basis of our empirical model.

2.5.1 Empirical model specification

The Tobit alternative (Cragg 1971) presents a variation of the Tobit model that allows for separate estimation of the probability of participation in cotton production and the level of that participation. The Cragg double hurdle model was created out of the Tobit model which is nested within the Double hurdle model in such a way that the Tobit is a special case of the double hurdle (Woodridge 2002). The Cragg model splits the Tobit model into a two-stage model that

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includes an estimation of participation in the first stage followed by an estimation of quantity conditional on participation. Double-hurdle models such as this consist of a Probit and truncated regressions. In this particular case, the first stage will model the smallholders decisions to own a cotton field or not and the second stage will model the extent (area in ha) of participation given that they chose to own a cotton field. Based on this the double hurdle model can be specified as

Stage 1 $Sit^* = \beta_1 x_1 t + ei$ $\qquad\qquad ei \sim N(0, \sigma 2)$ $\qquad$ (5)

where $Si = 1 \; if \; Si^* > 0$, otherwise $Si = 0$,

Stage 2 $Wit^* = \beta_2 x_2 t + ui$ $\qquad\qquad ui \sim N(0, \sigma 2)$ $\qquad$ (6)

where $Wi = Wi \; if \; Wi^* > 0 \; and \; Si = 1, otherwise \; Wi = 0,$

Sit^* is the latent variable of Sit which is the observed binary variable representing a household's decision to own a cotton field or not. Wit^* is the latent variable of Wit which is the observed continuous variable of actual level of cotton production. The subscripts i and t refer to the ith household during time period t. β_1 and β_2 are vectors of estimated parameters from their respective variable vectors $x_1 t$ and $x_2 t$. Table 1 lists the variables that are postulated to affect the household participation decision in cotton production and the variables that are expected to affect the extent of cotton production and their expected signs.

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Table 1 Explanatory variables postulated to affect the participation decision and extent of cotton production

Variable label	participation	Extent of participation
	(1)	(2)
	----------- sign ------------	
Household characteristics		
Household size	ı	ı
Effective dependency ratio	-	-
Adult equivalents	+	+
Age of the household head (years)	+	+
Sex of the househead, 1 male	ı	ı
Education of household head	ı	÷
Marital status		
Monogamously married, 1=yes	+·	+
Polygamously married, 1=yes	+	+
Divorced 1=yes	+	+
Separated 1=yes	+	+
Widowed 1=yes	+	+
Net off-farm income (ZMW)	-	
Number of cattle owned	―	+
Access to credit, 1=yes	+	+
Farm characteristics		
Distance to nearest main road (km)	-	-
Total farm size in ha	·	ı

Other studies have proposed that a household decision's to participate is influenced by demographic factors, transaction costs, socioeconomic and institutional factors .Demographic variables included are age, sex and educational levels of the household head. Age is defined as the number of years of the household head. It is hypothesized that as the age increases, households tend to acquire knowledge and experience via continuous exposure which enables them to participate. In terms of sex, it is assumed that male household heads are more likely to participate in production as they tend to have more exposure and access to information and new interventions. Thus the likelihood of a male household to participate is expected to be higher than that of a female household to participate. Education in general equips individuals with the knowledge necessary to make a living. The education level of the household head is assumed to increase the households' ability to take advantage of the present opportunities and decide to participate. Education is also postulated to affect the extent of production positively.

Socio economic variables included are the number of cattle owned and the farm size. The number of oxen owned serves as the most important means of land cultivation in rural areas. It is one of the major assets of household. It is hypothesized that the higher the number of oxen owned the greater the likelihood of the farmer's decision to participate and increases the extent of production. The farm size in terms of land serves as a limiting factor in production. Land is a major asset to household and it is assumed that households with a greater farm size are more likely to participate.

The proxy used in the study to represent transaction costs is the distance to the nearest transport and a binary variable equal to one if the respective household is located in a district near the line of rail and zero if not. It is assumed that proximity to transportation gives farmers the incentive to participate as they gain access to inputs. This then entails that households with lower transaction costs are likely to participate in production as they will likely recover their costs.

Institutional factor included is access to credit. Access to credit is an important variable since production of a cash crop such as cotton needs huge capital investments which smallholder farmers cannot afford. This variable is expected to increase the likelihood to participate in cotton production and increase the extent of production.

The adult equivalent and dependency ratio are postulated to affect the production participation decision and the extent of production. It is postulated that the more adults a household has the more productive a household is in terms of supplying labour. The dependency ratio when high also affects the participation decision, when they are too many dependents the household would

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rather indulge in subsistence farming than producing a cash crop. The adult equivalent is the proxy used to represent supply of household labour.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This Chapter outlines the methods and procedures used to achieve the stated objectives. Section 3.2 gives an overview of the main study areas and why these were the areas of interest, section 3.3 shows the data collection method and analysis tools that were employed.

3.2 Study area

The study areas of focus were Central, Eastern, Southern and Lusaka provinces. These are the main cotton producing provinces in Zambia. The 4 (four) provinces are suitable for growing cotton because of their conducive climatic conditions.

3.3 Data Collection and analysis

This study uses nationally representative longitudinal survey data collected from small and medium scale rural farmers in Zambia in 2004 and 2008. The two waves of the survey were obtained from the Indaba Agricultural Research Policy Institute (IAPRI). The surveys followed the same households that were interviewed during the 1999/2000 Post-Harvest Survey (PHS). Each wave collected data on the households' crop production patterns, income sources, and various retrospective/current socio-demographic information on the household members. The data was analyzed in excel and SPSS to produce descriptive statistics .

Using data from the survey in 2004 and 2008 as longitudinal data, this paper, examines the factors influencing farmers' participation in cotton production by combining descriptive and econometric analysis. The factors examined included education level of the household head, sex of household head and household size. Of the 4135 households, 3137 where non-participants and 998 were participants in cotton production.

CHAPTER 4: STUDY FINDINGS AND DISCUSSION

4.1 Introduction

This Chapter presents and discusses the study findings of the research. Section 4.2 highlights the descriptive statistics, including the household and farm characteristics. Section 4.3 shows the results of the respective regression. Section 4.4 discusses the results of the household characteristics.

4.2 Descriptive statistics

Table 2 presents the household and farm characteristics of smallholders in the study area, comparing non-participants to participants in cotton production. The results indicate that on average, farmers that participated in cotton production were 48.4 years old while those that did not participate were on average 52.1 years old indicating that the non-participants were on average older than the participants by about 4 years. Most of the households were male headed (79 percent) and had married heads (63 percent). The results indicate that households had average sizes of 7.18 and these households were mostly male dominated, with male-headed household accounting for 78 percent of heads and only 22 percent for female-headed households. The household-size for participants was on average higher by one member than the non-participating household. Both households were more likely to keep at least one person on average as a dependant. The results also showed that the education level of the head was quite low; most household heads did not have any secondary education or tertiary level of education. The results also suggested that the farm size for participants was on average larger than that of non-participants.

Table 2 continued

Distance to nearest main road (km)	5.01	7.92	4.54	6.46
Farm size (ha)	3.31	13.20	3.21	3.63

* = Significant at 10%; ** = Significant at 5%; *** = Significant at 1%

`Source: Authors computation, data from IAPRI, panel data 2004 and 2008

4.3 Results

Table 3 presents the regression marginal effects and parameter estimates of the probability of participation and extent of cotton production. The effects (column 1) and estimates (column 3) where obtained from the Probit regression analysis and the Truncated regression analysis in Cragg's double hurdle model.

Table 2: Household characteristics of smallholder farmers

Variable label	Full sample		Non-participation	Participant
	(1)	(2)	(3)	(4)
Number of sample observations	4135		3137	998
	Mean	Standard deviation	----------- Mean ------------	
Household characteristics				
Household size	7.18	3.88	7.02	7.71
Effective dependency ratio	1.00	0.84	0.99	1.04
Age of the head (years)	51.20	15.10	52.07	48.44
Sex of the head, male=1	0.79	0.41	0.87	0.76
Education level of head (base= single)				
Primary education of head, grade 1-7, 1=yes	0.05	0.21	0.05	0.05
Junior secondary education of head, grade 8-9, 1=yes	0.05	0.25	0.06	0.05
Secondary education of head, grade 8-9, 1=yes	0.08	0.26	0.08	0.07
Tertiary education of head,1=yes	0.08	0.21	0.07	0.10
Adult equivalence	5.54	2.97	5.41	6.00
Marital status of head (base= single)				
Marital status, 1 single	0.02	0.13	0.02	0.01
Monogamously married,1 =yes	0.63	0.48	0.63	0.65
Polygamously married,1=yes	0.15	0.36	0.13	0.22
Divorced, 1=yes	0.40	0.19	0.45	0.02
Widowed, 1=yes	0.15	0.35	0.17	0.09
Separated 1 yes	0.07	0.09	0.01	0.03
Net off-farm income (ZMW)	1542.318	6730.366	1760.560	856.321

Farm characteristics

Table 3: Cragg double hurdle model results

Variable description	Stage 1 Probit Marginal effect		Standard error	Stage 2 Truncated regression Parameter estimate	Standard error
	(1)		(2)	(3)	(4)
Intercept				-0.109	0.088
Age of household head (years)	-0.014	***	0.003	-0.002**	0.001
Sex of head, 1=male	0.456	**	0.166	0.102**	0.041
Marital Status of head (base = single)					
Monogamously married, 1=yes	0.168		0.290	0.048	0.082
Polygamously married, 1=yes	0.530	*	0.300	0.265***	0.085
Divorced, 1=yes	0.150		0.351	0.064	0.094
Separated, 1=yes	-0.343		0.643	0.050	0.142
Widowed, 1=yes	0.293		0.306	0.117	0.083
Education level of head (base = none)					
Primary education, 1=yes	0.357	*	0.179	0.021	0.050
Junior secondary education, 1=yes	0.208		0.162	0.009	0.046
Secondary education, 1=yes	-0.020		0.139	0.048	0.040
Tertiary education, 1=yes	0.216		0.132	0.045	0.040
Household size	-0.025		0.028	0.007	0.008
Dependency ratio	-0.082	*	0.048	-0.012	0.012
Adult equivalent	0.077	**	0.037	0.010	0.011
Net off-farm income (ZMW)	-4.01e0	***	0.000	-	-
Cattle owned	-0.002		0.003	0.000	0.001
Distance from homestead to nearest transport (km)	0.014	***	0.004	0.002	0.001
Farm size (ha)	0.005		0.003	0.003***	0.001

Access to credit. 1 yes   2.798   ***   0.126   0.700***   0.025

	Probit	Truncated regression		
Number of observations	4135	4135		
Wald chi^2	496	1041.33		
Log likelihood	-1253	-4162		
Prob > chi^2	0.000	0.000		
R squared		0.512		
Adjusted R squared		0.512		

* = Significant at 10%; ** = Significant at 5%; *** = Significant at 1%

Source Authors computations, IAPRI panel data 2004 and 2008

The results from Table 3 indicated that the age of the head (years), sex of the head, polygamously married heads, off-farm incomes, distance to nearest main road, access to credit and primary education significantly affected the households decision to participate in cotton production as well as the extent of production with the exception of net off farm income and primary education. The dependency ratio and adult equivalent significantly affected the production participation decision but were insignificant in affecting the extent of production participation. The net off-farm income and farmer participation in cotton production were significantly negatively related. The farm size significantly affected the extent of participation.

4.4 Discussion

From the results, participation in cotton production was influenced by human capital (marital status, education, adult equivalent ratio, and dependency ratio), demographic factors (age of head, sex of the head), institutional factors (access to credit, distance to nearest main road) and socio economic factors (net off farm income, farm size).

Marital status was an important factor in affecting the production participation decision. compared to single headed households, having a polygamously married head significantly increased the propensity to participate in cotton production by 0.53 percent relative to those that were single and increased the extent of production by 0.27 percent. These results seem to indicate that marital status is a proxy for the other factors such as household size in explaining

the production participation decision. It can be hypothesized that households with polygamously married heads are more likely to have larger household sizes as compared to single-headed households. With larger household sizes and hence more labour for agricultural tasks, households with polygamously married heads are more likely to participate in cotton production especially because cotton is a labour intensive crop.

Also households having more dependents were less likely to participate in cotton production by 8 percent and if these households decided to participate in cotton production their extent of participation would have been reduced 1.3 percent despite not been significant. Therefore, households which had a higher adult equivalent were more likely to participate in production by 7.6 percent relatively as this showed that they had more adults in their households. If the household had decided to allocate some portion of their land to cotton, there level of cotton production would increase by 1.1 percent.

The education level of the household was significant in influencing the production participation decision. Household heads that had attained primary education were more likely to participate by 35 percent compared to their counterparts that had attained no levels of education. Despite having an effect on the participation decision, the primary education level of the head had no significant influence on the extent of participation. These results seem to reflect the level of decision making that takes place in crops that are produced by the households depending on the heads education level.

The age of the household head significantly affected the participation decision and the level of production participation. The results showed that a one year increase in the household head's age reduced the probability of participation in cotton production by 14 percent and if the farmer decided to participate in production, the level of participation would increase by 0.17 percent. Male headed households were more likely to participate in cotton production by 46 percent unlike female headed households. Therefore male-headed household would increase the extent of cotton production by 10 percent if the household decided to participate. These results are similar to a study done on tobacco where less of female farmers would engage in tobacco production (Benfica and Tchirley 2006). A reason could be that men in rural societies are more privileged than women as input support programs are often centered on males rather than females despite them been more involved in production than their male counterparts in terms of supply of labour.

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The net off-farm income and farmer participation in cotton production were negatively related. Households that engaged in other off-farm activities were less-likely to participate in growing cotton by the probability of over 400 percent. Usually households involved in off farm activities would venture in activities that offer quick returns to investments. Therefore they are less likely to participate in cotton production. The farm size did not significantly affect the participation decision despite it significantly affecting the extent of production participation 0.3 percent.

Access to credit was directly related to the participation decision and the distance to the nearest road had a similar effect. Being a capital intensive crop, cotton can only be produced where credit is readily available. Households that had access to credit were more-likely to participate in cotton production by over 270 percent and those that decided to produce cotton increased their hectarage by 70 percent. These results are similar to what was found in a study done by Geremew (2013) on farmer participation in sesame production. The results also indicated that the distance from the household home to the nearest transport was positively related to the production participation decision. Hence, those farmers that lived in remote areas increased their likelihood of participation by 14 percent and if they decided to participate their extent of cotton production would increase by 0.2 percent. A plausible reason could be that farmers closer to the road have wider-business choices; which include off-farm business while remote-farmers have fewer business choices and option and hence are more likely to grow cotton.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.2 Introduction

This chapter highlights what was concluded and the recommendations that were prescribed in this study. Section 5.2 shows the conclusions made. Section 5.3 shows the policy implications or recommendations prescribed.

5.2 Conclusion

The results indicate that participants and non-participants were on average different with respect to a number of household characteristics and that participants were in some respects better off than their non-participating counterparts. In summary, those who participated in cotton production had lower net off-farm incomes and lower dependency ratio they also had larger farm sizes than their counterparts.

The Cragg's double hurdle analysis identified a number of factors that seemed to explain the participation decision and the extent of participation. Specifically, the results, which were largely consistent with *a priori* expectations, indicated that participation in cotton production was directly related to the head's marital status, educational attainment by head, adult equivalent, access to credit and distance to nearest transportation. Participation was also, as expected, inversely and significantly related to the net off farm income and the dependency ratio. The extent of participation was directly related to the total farm size, access to credit, polygamous marital status and the sex of the head. The age of the head was negatively related to the extent of production participation.

5.3 Recommendations

There is a clear need to recognize that high payoffs could be attained, as far as participation is concerned, from broad-based investments in infrastructure (roads), rural education and credit institutions. There should be more credit channels that would encourage production participation as cotton is both a capital and labour intensive crop. This would involve subsiding of cotton inputs by the government and encouraging more private sector involvement in the transfer of inputs and credit facilities. Furthermore, it is important, in placing participation-enhancing interventions that education and other attributes of not only the household head but the entire household are explicitly taken into account. Also, there is need for huge investment in human

capital in order to realize full participation by farmers. Therefore, an understanding of factors that affect cotton participation and how they relate to the participation decision, should be an important part in design of interventions aimed at improving production participation.

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