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Factors Affecting Cotton Supply at the Farm Level in Metema District of Ethiopia

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ABSTRACT

Current available records show that Ethiopia is receiving negligible benefits from its cotton and textile products export partly on account of low production at the farm level. Our objective was to study factors responsible for the low production. The factors affecting farm level marketable supply of cotton were analyzed using Robust OLS regression analysis. Results showed that size of land allocated for cotton, productivity per hectare and access to credit were significant factors affecting farm level marketable cotton supply. Based on the study, policy interventions required to increase the supply of cotton were suggested.

Keywords: Cotton**,** Ethiopia, farm level, marketable supply, regression analysis

INTRODUCTION

Cotton is an agro-industrial crop produced in both developing and developed countries. It accounts for more than half of all fibers used in clothing and household furnishings (Goreux, 2003). For long, cotton has maintained a significant place in the economic and political history of the world. For example, it has played an immense role since the industrial revolution of the 17th century. Currently, it is an important cash crop for a number of developing countries at farm and national levels (Baffes, 2004).

Factors Affecting Cotton Supply in Ethiopia

The largest volume of cotton production in the world is concentrated in countries like China, United States, India, Pakistan and Brazil. And yet, low-income countries in Sub-Saharan Africa (e.g. Benin, Burkina Faso, Chad) and other similarly poor countries elsewhere in the world depend heavily on cotton for earning foreign exchange (Anderson and Valenzuela, 2006). Ethiopia is one of the African countries that produce and export cotton. It has an estimated area of 2,575,810 hectares that is suitable for the cultivation of cotton (ESTC, 2006). However, the total production area is only about 100,000 hectares. According to Sneyd (2006), also the area of land allocated for cotton in Ethiopia during 2004/05 was 113,000 hectares.

In Ethiopia, spinning and weaving to make cloths from cotton is perhaps as old as the history of the country. Though written records are scarce, it is widely believed that Ethiopians wore clothes woven from cotton fibers centuries ago. Still about 85% of the total population living in rural areas of the country, produces a significant part of its textile needs from the traditional non-industrial sector. Clothes that are woven from cotton are popular also in urban areas of the country (Mulat *et al.*, 2004). However, the amount of cotton exported and the amount of revenue generated from the export is low. Mulat *et al.* (2004) indicated that the average yearly domestic production of lint cotton during 1996/97-2000/01 was only about 29,849.7 tons. Of this amount, 24,861.0 tons (nearly 83% of the total produce) was destined for the domestic market and only 4,989 tons (or 16.9 %) was exported. MoARD (2005) indicated that the average annual export of lint cotton in Ethiopia from 1998/99 to 2004/05 was 6,055 tons whereas the average revenue obtained from sales of this amount was only 52,457,000 Ethiopian Birr. Mulat *et al.* (2004) argued that despite its potential capacity to produce abundant cotton, Ethiopia performed weakly in its exports of textile and garment products.

Income generated from export of cotton and textile products in Ethiopia is low when compared to other commodities. In its September 2006 report, the Secretariat of the International Cotton Advisory Committee (ICAC) indicated that the area of land covered by cotton crop in 2005/06 was only 83,000 hectares in all of Ethiopia. The report indicated also that the productivity of lint cotton was only 265 Kg/ha and total production of lint cotton in metric tons for the year was only 22,000 tones; of this 20, 000 metric tones (about 90% of the total production) was domestically consumed and only the remaining 10 % was exported. This situation shows that the country is receiving insignificant benefits from its cotton and textile products export. It is important, therefore, to study factors that are responsible for such low production and benefits.

The Amhara National Regional State is potentially suitable for cotton production. Thus, the Agriculture and Rural Development Bureau of the region has identified districts with adequate potential. Metema district is one of the identified districts in the region as the potential district for cotton

production. In this study, we analyzed the factors affecting cotton supply at the farm level in the District.

MATERIALS AND METHODS

Study location

Metema District (Fig 1) is located about 900 km North West of Addis Ababa and about 160 and 340 km west of Gondar and Bahir Dar towns respectively. It is one of the west most Districts of Ethiopia bordering the Sudan. The district has twenty *kebeles* of which 18 are rural-based peasant administrations.

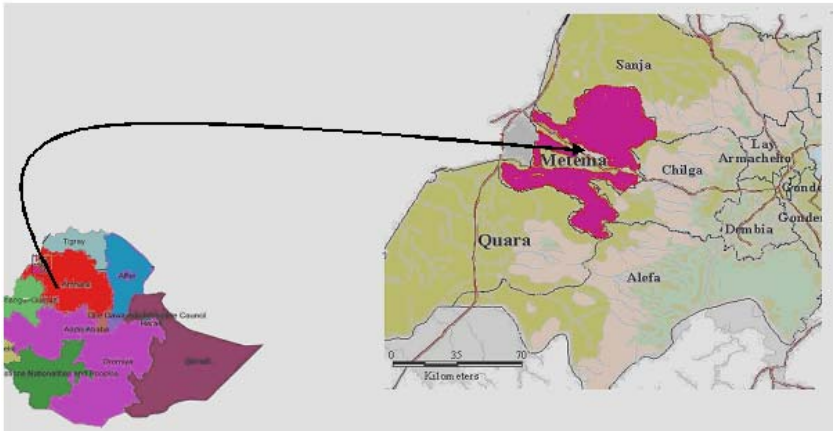

Fig. 1: Location of the study area.

The altitude of the district ranges from 550 to 1608 meters above sea level. Its minimum annual temperature ranges between $22^{o}c$ and $28^{o}c$. The daily temperature is high from March to May and sometimes reaches $43^{o}c$. The District is considerably lowland with exceptions of some mountaintops (IPMS, 2005). The mean annual rainfall ranges from about 850 mms to 1100 mms, with unimodal distribution. Thus, the rainy months extend from June to the end of September. However, a considerable amount of the rain falls in July and August.

This study was based on primary and secondary data. The primary data were drawn from small-scale farmers in fourteen purposively selected *Kebele* administrations. Different government offices having direct and indirect

relation with cotton production and marketing were also contacted. Semi-structured questionnaires and personal interviews were used to collect the data. Focused group discussions (FGDs) with progressive farmers and consultation with key informants from office of agriculture and other offices who have relation with cotton production and marketing was also performed. These were supplemented with direct observations. The secondary data were sourced from different published and unpublished reports, bulletins, and websites.

For this study, 139 farm households were sampled and interviewed from the District. A two-stage sampling technique was used to sample cotton farmers. First, 14 *Kebeles* from the District were selected through purposive approaches. During the selection, the *Kebele's* potential for cotton production and the accessibility of the areas to travel were taken into consideration. In the second stage, using the population list of cotton growers from the sampled *Kebeles*, the intended sample size was determined proportionally to population size of cotton growers. Then the predetermined size of the sample farmers from each *Kebele* were randomly selected using systematic random sampling technique.

For analyzing factors affecting marketable supply of cotton at the farm level in Metema District, the Robust OLS regression analysis was used.

Model Specification

The econometric model specification of supply function in matrix notation was used as follows: $Y = \beta' X + U$

where: Y = quantity of seed cotton supplied to market

X = a vector of explanatory variables

β' =a vector of estimated coefficient of the explanatory variables

u_i = disturbance term

The economic model specification of the variables is as follows.

$$Y_i = F(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13})$$

where: Y_i = quantity of seed cotton supplied to market

X_1 = Owned oxen number by household

X_2 = Access to credit for cotton

X_3 = Land allocated to cotton in hectare by a household

X_4 = Productivity of cotton in 2005/ 06

X_5 = Distance from main purchasers in the District

X_6 = Price of cotton in the year 2003/04

X_7 = Price of cotton in the year 2004/05

X_8 = Access to market information

X_9 = Access to extension service

X_{10} = Ownership of corrugated iron house

X_{11} = Educational level of household

X_{12} = Number of male family members aged 14 to 64 years

X_{13} = Years of experience of a household in cotton production

To overcome the problem of heteroscedasticity, Long and Ervin (2000) recommend Robust OLS analysis with heteroscedasticity consistent covariance matrix (HCCM) of which small sample versions of heteroscedasticity consistent covariance matrix HC3 was employed. This source indicates that tests based on a heteroscedasticity consistent covariance matrix (HCCM), are consistent even in the presence of the heteroscedasticity of an unknown form.

To detect multicollinearity problem for continuous variables a variance inflation factor, for dummy variables contingency coefficient was used and no multicollinearity problem was observed.

RESULTS AND DISCUSSION

The average productivity of seed cotton in kilogram per hectare for the District in 2005/06 was 812 kilogram per hectare with a standard deviation of 4.74. The maximum productivity in kilogram per hectare was 2666.00 while the minimum was 30.00 kilograms. As indicated in Table 1, the minimum area of land allocated for cotton in the production year 2005/06 was 0.25ha and the maximum was 20 ha. Table 2, shows that the minimum amount of cotton produced by a household was 20.00 kilogram. This gives per hectare productivity of 80.00 kilogram if this much amount of cotton is produced from the minimum 0.25 hectares of land. However, this figure deviated more from the average productivity of cotton for the District for the production year, which was 812.00 kilogram per hectare. This low productivity is attributed to attack by flee beetle and water logging problem. Cases of total devastation of the crop due to these two problems were observed during the survey.

Table 1: Average land holding and allocation pattern for sample farmers in 2005/06 (in hectare).

Description	Minimum	Maximum	Mean	Std. Deviation
Land holding size	1.30	132.00	14.41	18.69
Cultivated area	1.25	132.00	11.04	16.90
Fallow area	0.25	30.00	4.18	4.32
Homestead area	0.04	3.00	0.38	.37
Land allocated for cotton	0.25	20.00	2.48	2.91

Table2: Cotton produced and sold by sampled farmers in 2005/06 (in Kg).

Description	Minimum	Maximum	Mean	Std. dev.	Percent supplied to market
Production of cotton in kilogram per household	20.00	18000.00	2103.00	30.04	
Productivity of cotton in kilogram per hectare	30.00	2666.00	812.00	4.74	
Cotton supplied to market in kilogram per household	20.00	18000.00	2094.00	30.06	99.59

The survey indicated that 99.59 percent of cotton produced by farmers in 2005/06 was supplied to market. About 0.41 percent of it was retained for home consumption, payment in kind for land rent and/or other reasons. The average production of cotton per household was 2103.00 kilogram with standard deviation of 30.04. This large variation is due to difference in land holding size and also land allocation pattern for cotton production as it can be observed from table 1. The maximum production per household was 18000.00 kilogram and the minimum was 20.00 kilogram. The average amount of cotton supplied to market per household was 2094.00 kilogram with standard deviation of 30.06. This high standard deviation is also accountable to the amount of cotton produced by each household. The maximum amount of cotton supplied by farm households was 18000.00 kilogram and the minimum was 20.00 kilogram. Analysis of factors affecting farm level marketable supply of cotton was found to be important to identify

factors constraining cotton supply to market. In this respect, 13 variables were hypothesized to affect farm level marketable supply of cotton (Table 3).

From these variables, owned oxen number, and number of male family members between ages of 14 to 64 years were discrete variables. Land allocated for cotton, productivity of cotton, distance from main purchasers in the district, price of cotton, and years of experience in cotton production were continuous variable. Access to credit, access to market information, access to extension service, ownership of corrugated iron house, and educational level of household were taken as dummy variables having value of one if they had access or ownership, and zero otherwise.

Table 3: OLS estimation of factors affecting farm level marketable supply of cotton

Variables	Coefficients	Std.Err.	t-ratio	P-value
(Constant)	-25.5438	8.89928	-2.87032***	0.00481697
Owned oxen number	0.00463762	0.00268004	1.73043*	0.0860218
Access to credit	4.59118	2.27939	2.01422**	0.046133
Land allocated for cotton in ha	8.43604	1.60276	5.26344***	5.96033e-007
Productivity of cotton in 2005/06	2.34078	0.404966	5.78019***	5.60973e-008
Distance from main purchasers in the District	-0.0505963	0.070969	-0.712935	0.477215
Price of cotton in 2003/04	0.000351074	0.00201008	0.174657	0.861632
Price of cotton in 2004/05	0.000870113	0.0027974	0.311044	0.756285
Access to market information	5.58931	7.81886	0.71485	0.476035
Access to extension service	2.24376	2.40572	0.932679	0.352784
Ownership of corrugated iron house	0.0273332	2.77887	0.00983608	0.992168
Educational level of Household	-1.19367	2.61693	-0.456135	0.649084
Number of male family members between age of 14 to 64 years	0.88596	0.90338	0.980717	0.328627
Years of experience in cotton production	-0.119511	0.0764203	-1.56387	0.120377

Dependent variable: Quantity of seed cotton supplied to market in the 2005/06 production year
*** significant at 1% level of probability, ** significant at 5% level of probability, * significant at 10 % level of probability.

$F = 56.41,\ R^2 = 0.8543584,\ \overline{R}^2 = 0.8392117\ \ n = 139$

Results from Robust OLS analysis with heteroscedasticity consistent covariance matrix are considered as BLUE. The F-value for the model from

this analysis, after correcting for heteroscedasticity, was 56.41 and was significant at the 1% level of probability. This indicates that the model fit is good. The R^2 value of the model was 0.85 and adjusted R^2 value was 0.83. This result indicates that about 83 percent of the variation in farm level marketable supply of cotton was attributed to the hypothesized variables. However, from the hypothesized variables, only three variables significantly affected farm level marketable supply of cotton in the district. These variables were access to credit at 5% significance level, area of land allocated and productivity of cotton at 1% significance level.

The observed positive coefficient for access to credit, which is a dummy variable, indicates that households who took credit for cotton production supplied more cotton to market than those who did not. In this case, farm level supply of marketable cotton by farmers who took credit was greater than those who did not take credit by 459.118 kilogram keeping other factors constant.

The positive coefficient for land allocated to cotton production implies that an increase in land allocated to cotton production increases marketable supply of cotton. An increase in the size of one hectare of land allocated to cotton resulted in an increase in farm level supply of 843.604 kilogram keeping other factors constant. In support of the finding here, Kindie (2007) indicated that the area of land allocated for sesame production in Metema District significantly and positively affected farm level marketable supply of sesame. Similarly, Larsen (2006) found size of landholdings positively affected the volume of cotton sales at the household level in Tanzania.

For productivity of cotton, positive coefficient indicates that an increase in productivity of cotton increases marketable supply of cotton. Since this variable is a proxy variable for amount of cotton produced by households, it indicates that households who produced more cotton also supplied more to market than those who produced less due to insignificant consumption of cotton at home. The value of the coefficient for productivity of cotton implies that an increase in productivity of cotton by one kilogram per hectare resulted in an increase in farm level supply of marketable cotton by 234.078 kilogram, keeping other factors constant. Previous studies (for example, Wolday 1994; Wolelaw, 2005; Kindie, 2007; Rehima, 2007) showed that the amount of grain, rice, sesame and red pepper produced by households significantly and positively affected the marketable supply of each of the commodities.

Lagged prices of cotton (price of cotton in 2003/04 and price of cotton in 2004/05) did not affect farm level marketable supply in the District significantly as expected. This might be due to absence of significant variation in price of cotton received by farmers due to collusive price setting strategy adopted by purchasers of seed cotton. Ownership of corrugated iron house, which is a proxy variable for wealth, did not affect farm level marketable supply of cotton significantly. This might be due to none or low

profitability of cotton; those wealthier farmers might not have invested more of their resource on cotton.

Access to extension service that was originally expected to affect farm level cotton marketable supply did not have a significant effect. This may be attributed to lack of sound extension service for cotton production that can bring about significant difference between those who had access and those who had not. In this study, access to market information did not significantly affected farm level supply of marketable cotton and this can also be attributed to absence of much variability in access to market information. The level of education of a household and number of years of experience in cotton production had little effects on cotton supply, possibly because none or low profitability of cotton deprived individuals from investing more in cotton production. The number of male family members aged from 14 up to 64 did not substantially affect farm level cotton supply. This may be attributed to the opportunity cost of labor, that is, those family members might have involved themselves in other alternative activities than producing cotton.

CONCLUSIONS AND RECOMMENDATIONS

Ethiopia has great potential for cotton production. However, out of the country's total potential areas for cotton production, only about four percent is being utilized currently. As a result, the amount of cotton produced in the country is low. A number of factors affect the supply of cotton at the farm level. In the case of Metema District, the identified factors were land allocated to cotton by farmers, productivity of cotton, and access to credit. In addition, Structure-Conduct- Performance analysis of the cotton market chain indicated poor performance of the chain. Thus, policy interventions are required to alleviate the problem. In this respect, the following recommendations are made to increase the supply of cotton at the farm level in Metema District:

1. Strengthening the existing credit institutions and facilitation of others

Cotton production and marketing is a capital-intensive operation. Because access to credit for considerably affected the supply of cotton, it is important to facilitate friendly credit institutions for the farmers to improve their financial strength.

2. Intervention to increase productivity of cotton per unit area of land through proper utilization of land resource in the district

The area of land allocated for cotton at the farm level affected the supply of cotton positively and significantly. However, increasing the size of

landholding cannot be an option to increasing cotton supply since land is a finite resource and there are other socio-economic factors. Increasing the productivity of cotton per unit area of land would be a better alternative for sustainable supply of cotton. This will rely on intensive rather than extensive cultivation.

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