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Analysis of Coffee Farm Productivity in Darolabu District, West Hararghe Zone, Ethiopia

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Abstract: This study was designed to identify factors affecting coffee productivity in Daro Labu district of West Hararghe Zone of Ethiopia. The study was based on data generated from 120 coffee producers selected based on simple randomly sampling technique. Descriptive statistics was employed in the process of examining and describing farm household characteristics. The Cobb-Douglas production function was used to identify and estimate the effects of socioeconomic factors on coffee productivity. Results obtained from the model indicated that among the explanatory variables included in the model; fertilizer, coffee farm size, family labor, coffee farming experience, land allocated for Khat were found to be statistically significant factors affecting coffee productivity. Among the significant variables except land allocated for Khat other variables were found to be positively related to coffee productivity.

Keywords: Coffee, Productivity, Cobb-Douglas Production Function

1. Introduction

Coffee is one of the most important commodities in the international agricultural trade, representing a significant source of income to several countries including Ethiopia. Coffee was exported to more than 165 countries and generated US$15.2 billion for producing countries in 2007/08 (ICO, 2009). According to EAFCA (2010), Ethiopia is the 5th largest global producer of Arabica coffee beans in the world, and the largest coffee producer in Africa. Ethiopia produced about 270,000 MT of coffee in the 2008/09 crop year. Annual coffee export from Ethiopia is around 200,000 tons valued at around US$ 500 million (ITC, 2011).

Ethiopia is endowed with enormous genetic diversity and different coffee types with unique taste and flavor. The country in general and study area in particular has favorable agro-ecological and socio-cultural conditions for coffee production. In Hararghe coffee is produced in highly diversified garden production systems adapted to different ecological conditions. The area is known with intercropping coffee with the mild stimulant perennial crop "khat" (*Catha edulis*), sorghum, maize, beans and sweet potato. Farmers of the area grow coffee landraces having their own characteristic features (Bayeta *et al*. 2000). Hararghe coffee fetches premium prices in the world market. The contribution of Hararghe coffee to the total country's export is 8 percent (Desse, 2008). Despite the immense potential, productivity of the coffee remained low. For instance, according to CSA (2008/09), the national average productivity has not exceeded 665kg/hectare and in the study area, west Hararghe, the average productivity is 512kg/ha which is below the national average. However, this coffee resource is under threat of erosion mainly because of khat (*cathaedulis*) expansion (Bayeta *et al.,* 2007). Hence, this study was designed to identify factors affecting coffee productivity in the study area.

2. Methodology

2.1. Study Area

The study was conducted in Darolabu district of West

Hararghe zone of Oromia National Regional State in Ethiopia. The district is situated between 7052'10" and 8042'30" N and 40023'57" and 4109'14" E. The district is characterized mostly by flat and undulating land features with altitude ranging from 1350 up to 2450 meter above sea level (m.a.s.l). The temperature of the district ranges from 14 to 26°C. Average annual rainfall is 963 mm/year. The pattern of rain fall is bimodal and its distribution is mostly uneven. The short rainy season 'Belg' lasts from mid-February to April whereas the long rainy season 'kiremt' is from June to September. Consequently, most peasant associations frequently face shortage of rain and moisture stress is one of the major production constraints in the district. Based on CSA (2007) this district has an estimated total population of 198,918 from which 102, 014 were males and 96,904 were females; 26,404 of its population are urban dwellers whereas 182,057 are rural dwellers.

2.2. Data Sources, Collection Method and Sampling Procedures

The data for this study was collected both from primary and secondary sources. The secondary data source includes different reports, census data and statistical documents whereas the primary source of data was entirely from sampled respondents of coffee farmers. This data were obtained through administration of structured questionnaire. This questionnaire was pre-tested to non-members of sample respondents to ensure the validity and improve its contents. Data was collected by trained and experienced enumerators. This study employed multiple sampling procedures. Firstly, the district was selected purposively based on its coffee production potentials. Secondly, with the support of district level officials, coffee potentials peasant associations were identified out of which six peasant associations were selected using random sampling. Finally, with the collaboration of respective selected peasant association's development agents, lists of coffee farmers of each peasant associations that to be used as sampling frame were identified. Then, a total of 120 coffee farmers were randomly selected for interviews based on proportional to sampling sizes.

2.3. Data Analysis

It is necessary to understand the major factors that affect the productivity of coffee in the study area. Cobb-Douglas production function was used by different scholars on different agricultural commodities' outputs and productivity analysis so far (Tru, 2009; and Taru *et al.* 2008).

For this study, the function used is specified below:

$$Y = AX_1^{\alpha_1} X_2^{\alpha_2}, ..., X_n^{\alpha_n} e^{\beta_1 D_1 + \beta_2 D_2, + ..., \beta_n D_n + U_i} \quad (1)$$

Equation 1 can be transformed into logarithmic function form as follows:

$$\ln Y = \ln A + \alpha_1 \ln X_1 + \alpha_2 \ln X_2 +, ..., \alpha_n \ln X_n + \beta_1 D_1 + \beta_2 D_2 +, ..., \beta_n D_n + U_i \quad (2)$$

Where:

Y: Coffee productivity (quintal/Hectare)

A: The intercept that reveals combined impact of productivity

$X_1, X_2, ..., X_n$: are continuous explanatory variables

$D_1, D_2, ..., D_n$: are dummy variables

$\alpha_1, \alpha_2, ..., \alpha_n$: are coefficients/parameters of explanatory variables

$\beta_1, \beta_2, ..., \beta_n$: are coefficients/ parameters of dummy variables

Parameters: $\alpha_1, \alpha_2, ..., \alpha_n$ and $\beta_1, \beta_2, ..., \beta_n$ will be estimated by OLS (Ordinary Least Squares) methodology via a statistical software (STAT).

3. Results and Discussion

3.1. Descriptive Statistics of Household Characteristics

The summary of the socio-economic characteristics of coffee farmer is presented in Table 1. The average age of the farmers was 44.9 years. The average family size of sample households was 7.5 persons with the minimum and maximum family size of 1 and 20 respectively. Moreover, sample households were also characterized by the presence of large number of children (50%) having age of less than 15 years which further imply shortage of active labor force to undertake various agricultural operations. Concerning education the survey result revealed that the majority of respondents have never attended formal education. There is only one farmer who has reached a 10^{th} grade level. Accordingly, the average years of formal schooling was 1.6 with a standard deviation of 2.4 years. The study also reveals supporting evidence that majority of the respondents reported to have learned coffee production practices from relatives and friends in time through experience. The average farming experiences for coffee was 19.64 years with standard deviation of 10.48. This shows that farmers have a good experience in coffee production. Land ownership status is one of the factors that affect farm productivity. Land holding of a farmer in this study is the size of land a household is entitled to, as ownership and is measured in hectare. Farming households in the study area use their land for all farming activities which include production of food crops and cash crops, house construction, tethering livestock and tree planting. The respondents' farm size ranged from 0.38 to 1.75ha. The average farm size was 0.85ha. In terms of allocation, on average the largest land allocated was to coffee (0.33ha), khat (0.3ha) and food crops (0.24ha). Therefore, agricultural land is exhausted and the scope to rotate with legumes is almost not used. Crop residues are used for fuel and animal feed. Thus, there is no much organic fertilizer left, except some animal waste to rehabilitate the soil.

Table 1. *Descriptive statistics of household socio-economic characteristics.*

Variables	Mean	SD
Family size(numbers)	7.5	3.6
Age of the farmers(years)	44.9	11.8
Educational level(years of schooling)	1.6	2.4
Farming experience in coffee(years)	19.64	10.48
Total land holding(hectare)	0.85	0.25
Cultivated land(hectare)	0.24	0.12
Coffee land(hectare)	0.33	0.13
khat land(hectare)	0.30	0.20

3.2. Determinants of Coffee Productivity

The result of model reveals that R squared is equaled to 0.7139 which implies that 71.39% changes of coffee productivity are explained by the explanatory variables included in the model. As indicated in Table 2 organic fertilizer application, family labor, farming experience and land size for coffee had positive effects on coffee productivity. This implied that if producers have more family size, farming experience, land size and apply more organic fertilizer then they gain higher productivity. Land for khat affected negatively coffee productivity.

The coefficient of organic fertilizer (farm yard manure) was positive and in accordance with the expected sign meaning that quantity of organic fertilizer applied was directly related to the output. Organic fertilizer application is a major factor that increase the productivity of coffee production in the area. However, the growers in the analyzed district prefer to utilize their limited inputs for crops which may bring higher income to them. The volume of manure available is limited and too scarce to satisfy the needs of farmers because of low livestock density in the area. Inorganic fertilizers and other inputs (like pesticides) are also poorly available in the rural areas and most of the farmers do not have enough financial capital to acquire such facilities. Most of the physical resources are underutilized due to cost of obtaining them. However, in this research both cost and poor access to appropriate inputs were responsible for underutilization of both organic and inorganic fertilizers. This implied that if producers increase fertilizer application then they gain higher productivity. Farmers also reported that they had no credit support and cash to purchase farm inputs. Hence, a one percent increase in farm yard manure application will increase the productivity of coffee by 0.241%.

As shown in Table 2 family labor was found to have a positive significant relationship with coffee productivity at 1% level of significance. This implies that if labor is increased by one unit the productivity of coffee would increase when all resources in coffee production are held constant. Primarily, coffee production is tedious and a highly labor-intensive economic activity starting from land preparation up to marketing. Family labor is often an important source of labor supply for farm operations. A farm household with inadequate family labor may wish to satisfy its farm labor demand externally, and to pay for this, which is very difficult for resource poor smallholder coffee producer in the area.

Table 2. *Factors affecting coffee productivity.*

Variables	Coefficient	Standard Error	t-value	P-value
Coffee farm size (CFAS)	0.115**	0.06	1.95	0.04
Number of livestock (NOLIV)	-0.003	0.00	-0.61	0.54
Participation in nonfarm activity (NOFIN)	-0.032	0.02	-1.44	0.15
Family labor (FASI)	1.394***	0.18	7.76	0.00
Access to extension service (EXSER)	0.010	0.01	1.17	0.25
Farming experience (FAEX)	0.024**	0.01	2.57	0.01
Educational level (EDULE)	0.006	0.00	1.68	0.10
Land allocated for khat (KHLA)	-0.586***	0.15	-3.84	0.00
Proximity to market (PRTM)	0.047	0.09	0.54	0.59
Access to credit (ACCR)	0.007	0.01	0.99	0.32
Application of farm yard manure (FERAP)	0.241***	0.07	3.33	0.00
Constant	-1.185	1.05	-1.13	0.26

Number of observation = 120, F (11, 108) = 21.09, Probability > F = 0.00, R-squared = 0.7139, Adjusted R-squared = 0.6798,***, ** indicate, statistically significant at 1% and 5% respectively.

The coefficient of farm size for coffee was positive and significant at 5%. The positive coefficient of the farm size suggests that a unit increase in the variable for coffee production when other explanatory variables are held constant is consistent with increased output level. It is in consistent with the prior expectation. The significance of farm size highlights the importance of this factor in peasant agriculture where the commonest mode of production is extensive, as opposed to intensive pattern. When land available to a household is too small to produce subsistence requirements from less profitable and risk consideration becomes increasingly important, farmers tend to shift to other high profitable cash crops like khat. But if sufficient land is available to support subsistence requirements, farmers restore more to cropping of both food and cash crops. Allocation of large area of land for coffee farm can also indicate higher degree of attention in managing the farm. Therefore, an increase in land size allocated for coffee by 1% led to increase in coffee production by 0.115% keeping other variables constant. The significance of farm size highlights the importance land as an important input to agricultural production affecting farm output.

Similarly, coffee farming experience, the number of years that farmers have been involved in coffee farming tends to increase production. Increased farming experience may lead to better assessment of the importance and complexities of

good farming decision making including the efficient use of inputs. Experience in coffee production may lead to better managerial skills being acquired over time and experience of continuous experimentation and learning. Farmers develop and accumulate experiences including farm financing over time, learn about farm technologies and subsequent productivity effects, market behaviors, general physical and economic environments to make choices. Farmers may enhance coffee production, as they get more experienced, learn how to increase income-generating capacities and become able to use cost-effective strategies to cope with adverse shocks.

Contrary to the other variables increasing land for khat production by 1% led to decrease coffee productivity by 0.586% ceteris paribus. This implied that, land has been the main limiting factor in the study area. At the same time, coffee farmers are losing their purchasing oxen power and are no longer able to buy other items with the coffee revenue they gain. Obviously, this may have caused farmers to pay more attention to other profitable cash crops like khat than coffee. On top of this, farmers in the district are now entering intensively into producing khat than coffee for its high cash earning capacity. As a result, they would allocate their potential cultivable land for khat production.

4. Conclusion and Policy Implication

The main purpose of this study was to analyze factors affecting farm productivity of coffee in Darolabu district. The estimation of the Cobb-Douglas production function demonstrated that organic fertilizer application, labor force, farm experience, and land size for coffee had statistically significant and positive impact on coffee output, implying that they are important in increasing coffee production. While land for khat affected coffee productivity negatively. The finding justifies that coffee productivity improvement demands more inputs (fertilizers, labour and land) and farming experience.. As it is observed from the econometric result that, in addition to its productivity improvements attribute, many of the fundamentals of coffee farming are not being followed and with some technical assistance, could improve plant health, yields and quality. Since, coffee from the area is one of the specialty coffees where Ethiopia has comparative advantage in international coffee market. Thus, enhancing the quality and production of this coffee bring benefits for smallholder as well as for the country through foreign exchange.

References

[1] Bayeta Belachew, Bahilu Atero and Fikadu Tefera, (2000). Breeding for Resistance to Coffee Berry Disease in Arabica coffee: Progress Since 1973. Proceedings of the Workshop on Control of Coffee Berry Disease in Ethiopia, Addis Ababa (Ghion Hotel), 13-15 August 1999, Addis Ababa, Ethiopia.

[2] Bayeta Bellachew B., Labouisse, J. P., Hamelin, C., Kotecha, S. and Bertrand, B., (2007). Collection and ex-situ conservation of coffee landraces in Ethiopia: The Example of HarergeIn: 21st International Conference on Coffee Science, Montpellier (France), 11th to 15th September 2006. ASIC, Pp. 926-930.

[3] CSA (Central statistical Agency), (2007). Summary and Statistical Report of the 2007 Population and Housing Census Results. December, 2008, Addis Abeba.

[4] CSA (Central statistical Agency), (2008/2009). Agricultural Sample Survey Report on Area and Production of Crops. September – December 2008, Addis Ababa.

[5] Desse Nure., (2008). Mapping Quality profiles of Ethiopian Coffee by Origin. In: Proceeding of a National Workshop Four Decades of Coffee Research and Development in Ethiopia, 14-17 August 2007, Addis Ababa, Ethiopia. Pp. 317-327.

[6] EAFCA (East Africa Fine Coffee Association), (2010). Coffee Outlook, 2010.

[7] ICO (International Coffee Organization), (2009). Opportunities and Challenges for the World Coffee Sector. Pp. 12.

[8] ITC (International Trade Center), (2011). Ethiopian Coffee Quality Improvement Project. Aid for Trade Global Review.

[9] Taru, V. B., I. Z. Kyagya, S. I. Mshelia and E. F. Adebayo, (2008). Economic Efficiency of Resource Use in Groundnut Production in Adamawa State of Nigeria. World Journal of Agricultural Sciences, 4: 896-900.

[10] Tru, N. A., (2009). Factors Affecting Lychee Productivity and the Choices of Fresh Lychee Marketing Channels of Producers in Thanh ha district, Haiduong Province, Vietnam. Journal of Science Development, 7: 12.