Determinants of Coffee Production in Melong Coffee Zone, Cameroon

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ABSTRACT

This study determinant of Coffee Production in Melong Coffee Zone, Cameroon has made use of the Cobb Douglas production function via primary data collected among 120 coffee farmers. The result shows that, farmers' income level, years of experience, access to credit, fertilizer application, farm size and farmers training principal determinants of coffee production in Melong Coffee zone. Other problems observed constraining coffee farmers include: climate, transportation cost, land tenure system, method used in dried coffee, price per kg, farmer's cooperatives, cost of chemicals and farming equipment. Policy should focus on the amelioration of economic and environmental variables as they are observed to be very vital in coffee production.

Keywords: Coffee, farmers, production, Melong, zone, Cameroon

1. INTRODUCTION

Agriculture is the livelihood bases for 60 % of the world's population. About 40 % of the world population live below the national poverty line and spend about one third of their income on food (Rondon, 2013). The significant role of coffee as a driver of economic growth has gained overall acceptance in all coffee growing economies. According to the United Nations Conference on Trade and Development, (UNCTAD, 2004), coffee is a highly competitive and lucrative economic cash crop and ranked highest in terms of income generation amongst other agricultural products.Coffee makes positive contributions on the economic side to maintain substantial rural employment and stable communities.

Improving the living standards of coffee producers, especially smallholders, is a priority for Governments, as highlighted at the last World Coffee Conference. Over 90% of coffee production takes place in developing countries, mostly South America, while consumption occurred mainly in the industrialized economies (David et al, 2001).Brazil is the biggest coffee producing country in the world, with seemingly endless landavailable for its production. Coffee plantations in Brazil often cover immense portions of land, needing hundreds of people to manage and operate them to produce huge quantities of coffee. Both Arabica and Robusta are grown, and the climate, soil quality and altitude determine which variety will grow best in which region (World Bank, 2009). Coffee is one of the most traded agricultural commodities in the world and is traded in futures contracts on many stock exchange including New York board of trade, New York Mercantile exchange and London international financial futures and options exchange. The world's largest transfer point for coffee is the Hambury, Germany (MINADER, 2009).

As one of the most important commodities in terms of value traded, coffee plays a crucial role in the livelihoods of rural household across developing countries. Over 25 million small coffee farmers depend directly on coffee as their primary source of income (UNCTAD, 2004). Ethiopia produces large volumes of coffee beans every year, with 384,000,000 kilograms in 2015 alone. Ethiopia is the origin of Arabica coffee, the most popular beans worldwide. Over 28 % of Ethiopia's yearly exports are as a result of coffee and an estimated 15 million citizens are employed in coffee production. Ethiopia has a very rich coffee culture. For over 1100 years, beans with a stimulating effect have been noted in the nation by lucky farmers. Since domestication of the plant and the beginning of farming the coffee bean, regional variants of the Arabica bean have been developed, each with their own characteristic name and taste (World Bank, 2009). MINADER (2009) argued that the greatest threat to the social sustainability of coffee production results from the economic conditions facing coffee producers. They added that coffee farmers typically depend

upon coffee as their primary source of income. As a result, low yield had a direct negative impact on access to education, housing, food, health, and other basic needs.

Agriculture is the backbone of Cameroon's economy. It employs about 70 % of its workforce and provides 25 % of its GDP and 30 % of its export revenue (Food and Agriculture Organization, 2008). Blessed with fertile land and regular abundant rainfall in most regions, Cameroon produces a variety of agricultural commodities both for export and for domestic consumption. About 55 % of the Cameroonian population live in the rural environment with agriculture as its main activity (Etoundi & Dia, 2008). Coffee production is very important for the economy of Cameroon, ranked 20th with an annual production of 34200000 tons (Etoundi & Dia, 2008). Coffee is currently the fourth largest agricultural export commodity (by volume) in Cameroon and the country is the world nineteenth largest exporter. Nearly all coffee (more than 98 %) is exported and less than 2 % is consumed domestically. In 2009, Cameroon exported 34,611 tons of coffee (3,611 tons of Arabica and 30,555 tons of Robusta) and earned foreign exchange worth CFAF23,147 million US$ (World Bank, 2009) . The crop is grown extensively in the country, with *Robusta* more prevalent in the coastal areas and *Arabica* more widespread in the Western Highlands. The two varieties of *Arabica* cultivated are Java and Jamaïca of which only Java is resistant to pests such as Coffee Berry Disease and rust.

Coffee is grown in seven regions of Cameroon; West, North West, Littoral, South West, South, Centre and East regions. The high plateau of Bamileke and Bamoun are areas where *Arabica* plantations are located. *Robusta*, which is a more dominant crop of the country, is grown in the Littoral region and also to some degree in Abong Mbang. *Arabica* and *Robusta* are partly processed within the country. The production of Cameroon's coffee is placed under the responsibility of the Ministries of Agriculture and Rural Development (MINADER) and that of Scientific Research and Innovations (MINRESI). Under these ministries there are various projects to boost coffee production. According to the United Nations FAO statistics, coffee production in 2013 was 41,800 tons in an area of 212,000 hectares .Under the Coffee Sector Development Strategy for 2010-2015, production was aimed at 125,000 tons comprising 25,000 tons of *Arabica* and 100,000 tons of *Robusta*. The export was targeted to achieve 80,000 tons (15,000 tons of *Arabica* and 65,000 tons of *Robusta*). Domestic consumption was gauged at 10,000 tons of coffee. On September 30, 2014, the government of Cameroon validated and launched a new plan to revive the coffee sector, hoping to boost production; Robusta Coffee to 120.000 tonnes and Arabica coffee to 35 000 tonnes by 2020. This was marked by a 100% increase in export levies on coffee to finance the project (MINADER, 2009).

The coffee industry currently has a commodity chain that involves producer, middle men exporters, importers, retailers before reaching the consumer. Middlemen exports purchase directly from small farmers. Large coffee estates and plantations often export their own harvest or have direct arrangement with a distributing company (World Bank, 2009). The marketing of Coffee in Cameroon is placed under the control of the National Cocoa and Coffee Board, an autonomous government institution under the technical supervision of the Ministry of Trade. Over the years coffee marketing has witnessed a sharp decline owing to the liberalization of the sector in the early 90's. In 2014, Cameroon traded 32,808 tonnes of its production. The most active exporters of coffee in Cameroon include: Olam-Cameroon, a subsidiary of Olam International Limited, Union trading international, and North West Cooperative Association.

It is important to talk about the socio-economic life of the inhabitants of Melong Subdivision making illusion to their main source of income-coffee production. Coffee (coffea) feeds, cloths, shelters and takes care of the livelihood needs of the inhabitants of Melong Subdivision. This cash crop thrives well within this area and is even more important because it tolerates the growing of their major staple food crops (plantains, Cocoyams, bananas and cassava). The important role of coffee production in this Subdivision could be clearly identified during the period of harvest, which begins in December to February. There are many factors which determine coffee production in Melong Subdivision of the littoral region of Cameroon, ranging from natural factors (soil, rainfall, temperature and humidity) to human factors (Labour, Capital, Price, Education, Gender, Culture). In line with Coelli & Battese (1996) that analyzed the factors affecting the technical inefficiency of Indian coffee farmers, and found a negative correlation between inefficiency and variables such as farm size, the level of education and age of the farmer.

It important to mention that the government of Cameroon has been involved in a number of moves towards providing improved farming inputs provided through the cooperatives in the area so as to enhance production and productivity. The dawn of liberalization in the agricultural sector also meant little government intervention to boost the sector. Unfortunately, little has been done to actually establish the degree to which socio-economic variables determine the success of coffee production. This calls for a study of this nature so as to ascertain the degree to which socio-economic variables influence the performance of coffee production in Melong Subdivision 6. Food and Agriculture Organization (2008) carried out a similar study in which he concluded changes in agricultural supply result from a combination of changes in yields and changes in crops acreage as a result of the effect of both climatic (natural) and human factors.

Richman (2010) investigated the determinants of technical efficiency using a balanced longitudinal (panel) data on Ghanaian cocoa farmers for period of 2001 to 2006, in which he concluded that both natural and socio-economic factors greatly affect cocoa production. From the above studies and others carried out by earlier researchers in this domain, it is clear that production and productivity in the coffee sector is greatly affected by both human (socio-economic) and natural factors. However, Cameroon was once reportedly the second leading coffee producer and exporter in Africa with annual production of 132,000 tons in 1986. Since then, the production has been steadily declining with swinging annual production that went down as low as 36, 000 tons in 2010. The production over the last 12 years (2000-2011) ranged between 66,780 in 2000 and 36,480 in 2010 with an annual average of 49,505 tons indicating a trend of stagnation. The productivity is also very low, about 204 kg/ha for Arabica and 340 kg/ha for Robusta according to ICO statistics reports.

According to earlier reports of Nchare (2007), not only annual production but the cultivated area has also declined. On the average, the cultivated coffee area was about 280,606 ha between 1969 and 1973 but this has dwindled to 187,119 ha between 1999 and 2003. The problems encountered in Cameroon are similar to those experienced in most African coffee producing countries. This resulted in dramatic reduction of African export share in the world market. Africa's global export share was about 30% in the 1970s and 80s but it is only between 11–12 % at present. Based on the discussions held with various stakeholders, there are several reasons for low productivity of coffee in Melong Subdivision. Poor and traditional management practices, old age of coffee trees, lack of improved planting materials, inadequate supply of fertilizer and other necessary inputs, poor soil fertility.

Further, the current price of coffee is fair even though the farmers complain that it is not proportional to production cost. It is about 1500 CFA/kg at farm gate and 1690 CFA/kg at export levels for *Arabica* and 700 CFA/kg at farm gate and 946 CFA at export level for *Robusta*. However, during international coffee crisis of 1999 that extended up to 2004, the price of coffee had gone down as low as 200 CFA/kg. This crisis has taken its toll on coffee production leading to abandonment of the coffee farms by the farmers and shifting to other alternative crops. The farmers have developed negative image and still questioning after improvement in the price of coffee. This study therefore is interested in the following research objectives: examine the factors affecting coffee production in Melong Coffee zone and identify the problems faced by coffee farmers in Melong Coffee zone.

2. LITERATURE REVIEW

Coelli & Battese (1996) did a study on the factors affecting Kenya's tea and coffee export products. They find out that capital has a positive and significant impact on the volume of coffee production. Their results further reveal that the role of capital in coffee production is crucial since capital may be used to acquire all the other factors of production (labour, material inputs and machines). While looking at the factors affecting the technical efficiency of Arabica coffee producers in Cameroon, Nchare (2007) found out that the educational level of producers and access to credit are the main socio-economic variables that significantly affect the technical inefficiency of farmers. He also found out that age has a negative effect on technical efficiency, implying that older farmers are technically more inefficient than younger ones. Other variables that are positively associated with adoption of technologies and hence higher yields are: increased farming experience, access to extension services and access to credit services (Food and Agriculture Organization, 2008).

Nchare (2007) concluded that there is the need to promote credit institutions which specializes in savings, mobilization and credit supply to smallholders. To them, when loans are made available to cocoa farmers without much emphasis on collateral security, the problem of poor harvest will become history as smallholder cocoa farmers will be empowered to go for any chemical without concern for the cost. Their survey showed that about 54% of cocoa farmers in Nigeria have access to credit, 37% in Cameroon, while in Ghana and Ivory Coast, only a few cocoa farmers have access to credit. Peasant households depend on agriculture and related activities for whatever livelihood its members are able to echo out of their environment. Cocoa production is not only affected by natural factors, a number of socioeconomic determinants of cocoa production exist and their understanding is crucial in agricultural planning.

Coelli & Battese (1996) also argued that the cost of labor has also increased significantly for example; the daily wage for casual labor has increased from 1275 fcfa in 1900 to around 2685fcfa in 2001. Equally the cost of harvesting coffee has increased from 500fcfa in 1990 to the current rate of 900fcfa per 50kgs bags. This increase in labor cost has occurred despite the high unemployment rate especially in rural areas. This wages are usually negotiated between Kenya plantation Workers Union (KPAU) and plantation owners. Smallholder farmers are forced to pay similar wages as plantations in order to attract laborers during the peak (labor-shortage) period. This has put most small holder farmers especially the labor deficit household at a disadvantage due their low productivity as compared to plantations. Food and Agriculture Organization (2008) argued that the greatest threat to the social sustainability of coffee production results from the economic conditions facing coffee producers. They added that coffee farmers typically depend upon coffee as their primary source of income. As a result, low yield had a direct negative impact on access to education, housing, food, health, and other basic needs.

Wokia-azi, et al. (2008) in their study on cocoa production in Southern Cameroon ascertained that gender disparity with regards to land occupation is one of the factors affecting the multiplicity and increasing harvest in the cocoa growing communities of Southern Cameroon. According to them, women are highly disfavoured and certain cultures sometimes do not allow them to own land and as such, access to land is limited when compared to the men. Through different mechanisms, women are strongly disadvantaged when it comes to extension services and marketing (sales). Coelli & Battese (1996) stated that coffee productivity levels can be enhanced either by improving technical efficiency or by improving technological application. He further added that a relevant burden for agricultural policy-makers should either be to pursue a strategy directed towards technological change by bringing new technologies, or a strategy geared towards efficiency by improving the use of existing technologies. Also older farmers are less likely to have contact with extension workers and are equally less inclined to adopt new techniques and modern inputs than younger farmers.

According to Nchare (2007), changes in agricultural supply result from a combination of changes in yields and changes in crop area. Changes in crop yields are the result of climate changes and any human mitigating responses (such as increasing fertilizer or water use or adoption of new crop varieties), while changes in area are affected by producers' expectations concerning changes in relative crop prices and per acre returns. Crops that decline in supply will rise in price, *ceteris paribus*. Higher prices reduce consumption levels and adversely affect consumer welfare. In some cases, the negative effects on consumers may be partially or totally offset by producer gains from higher prices, but in general, total welfare tends to decline when supply is reduced. In the long term, higher prices stimulate producers to seek ways to increase supply, resulting in new equilibrium levels of prices and quantities. So, the long term effect of a drop in coffee yield per hectare negatively affects the welfare of the coffee farmers in Melong Subdivision.

Waller et al. (2007) noticed that with the long run falling in real international prices in cocoa, there has been a general stagnation in the sector in Cameroon. One consequence of this diminished profitability is the decline in the use of pesticides; control of both Black Pod disease and capsid bugs is well known to be essential for high quality cocoa and for increasing yields. He further mentioned that government had subsidized the cost of this control, but with the structural adjustment, the government stopped the input subsidies and farmers are no longer effectively controlling these pests. Based upon expert's estimates of the degree of pest control, he noted that in the interiors villages, pests are very serious leading to low output in cocoa production. Coffee has been successfully produced in many parts of the world on a wide range of

soils, but the ideal soil type is sandy-loam. It can do well in any fertile soil, provided the weather condition is favourable. To produce high yield, the coffee tree requires deep permeable soil, of good structure, that contains enough organic matter and it also requires a favourable water balance. In very sandy or clayey soils, the clay content of the soil should be between 15 and 35%. The optimum PH is between 5.0 to 6.0 and the coffee plant can still grow around neutrality (PH=7). Coffee grows well where natural forests occur.

3. METHODOLOGY

This study is carry-out in Melong Subdivision. Melong Subdivision is found in Moungo Division of the littoral region of Cameroon, with the head quarter being Moungo. This Subdivision has a geographical location of 5^0 North and 9^0East.It has a total surface area of about 497km^2. A cosmopolistic Council of 40 villages, situated between Nkongsamba and Bafang. This Subdivision was created in 1962 by the decree N^o 62/17 of 26 December 1962. The Council shares common boundaries to the North by the Santchou Council, to the North East by the Nguti Council which is situated in the South West region, to the West region by the Bangem Council, to the South West by the Nkongsambe Council, to the South by the Council of Bare Bakem, to the the East by river Nkam and Kakem Council in the West region. The population is estimated at about 54279 inhabitants spread in about 40 Villages and 11 urban quarters. The study is focused on some selected villages within this Sub-division where coffee farming is highly concentrated. The choice of this study area is justified first of all by the fact that it is located in the Coastal low lands with moderate temperatures suitable for coffee cultivation. In addition, there is vast and sufficient farm land conducive for the production of food crops and cash crops like coffee. Even though with these advantages, certain factors still affect the realization of the expected yield in this area, the reason why this research is carried out to assess the determinants of coffee production associated to the study area.

The climate of the Melong Council area is equatorial, with heavy rainfall fairly well distributed throughout the year and giving rise to forest vegetation and fertile soils. The dry season runs from the month of November to march. During this period, the weather is bright with little rainfall, cold nights and hot days. The rainy season, on the other hand, starts gradually from April and heaviest from August till late October. It has an average relative humidity of about 80% and annual temperature of 15-25 degrees centigrade. The soil is a volcanic soil, black in nature which is mostly exploited by the agriculturalist of the rural and urban population. At least 40% of the soil is being exploited. About 90% of the population carried out intensive agricultural activities which constitutes of food and cash crops. The natural vegetation of Melong Subdivision is made up of Primary forest, Secondary forest and Savanna grass land. Due to the practised of intensive agriculture, we observed equally the cultivation of plants like: Robusta coffee, Palm trees, and divers' fruits. Also due to the presence of diversified vegetation, the fauna of Melong Subdivision is sufficiently full of bush animals like Chimpanzee, Gorilla, Monkey, Buffalo etc.

Following the Population and Housing Census of November 2005, Melong Subdivision was endowed with a population of 54 279 inhabitants. This area is demarcated into fourty villages marked by demarcated boundaries based on Administrative unit and chiefdoms. Land is acquired through customary law and through heritage. The Population within this area varies based on the degree of accessibility of roads and availability of basic infrastructures. The large population of the youthful age acts as a major asset for farming, especially for coffee cultivation. Some farmers of the subdivision due to their self-reliant-spirit organize themselves in co-operative units, credit unions, common initiative groups, farmer's unions, and Njangi groups, which contribute greatly to their output.

The population of Melong Council area consists predominantly of farmers. Over 80% of the population is involved in agriculture which therefore constitutes the basis of the local economy. The main activities in this area included; Agriculture, livestock breeding, fishing, pottery and petty business**.** Cash crops common within this area are coffee and cocoa while food crops vary from, maize, tubers, vegetable crops (okra, peppers and tomatoes). Fishing is mostly common at the suburbs especially during the raining seasons. We also note the presence of fruit trees (mango, plum, pear etc.) and medicinal plants. Robusta coffee is widespread throughout the area why maize and other food crops are dominant in some spotted areas. These food crops are mostly meant for consumption with the surplus sold to generate more income to meet other pertinent needs. Farmers in the area also attach importance to small livestock (pigs, poultry,

goats, and sheep). The rest 20% of the population is involved in other sectors including administration, teaching, petit trading, transportation and forest exploitation

3.1 Data setting

This study made use of primary data. The main primary data source of information was obtained from the field, which contributes to the achievement of each research objective. This was obtained through interviews, direct observations and questionnaires. Data was collected using questionnaires and involved information concerning; the annual yield of coffee, per quantity of mineral fertilizer used, the quantity of herbicides, surface area cultivated, labour (measured in hours), transport cost, and coffee sale price. The data concerning farmers also embodied their years of experience, income levels, education, farm sizes and types of coffee produced.

The study population consisted of coffee farmers but during the study due to time constraint only 120 respondents could be sample. Multi-stage random sampling technique was applied in order to select the study sites that will represent diverse ecological and socio-economic environment and varying coffee production systems in the Melong Subdivision. The Subdivision was stratified into four villages to allow capturing of variability in the whole Subdivision and two quarters were purpose fully selected from each village making a total of eight quarters. The major criteria for stratification were; relative importance of coffee, agro-ecological zones and devotedness of farmers to the coffee production sector especially for commercial purpose. In these quarters, we purposefully selected 25farmers per quarter, for which questionnaire will be administered in order to get reliable information for the study.

3.2 Empirical specification

As seen in the theoretical framework, we make used of the Cobb Douglass production function developed by Doll & Orazem (1984). This forms the conceptual basis for our analysis of the contribution of Farmers' Training on agricultural production. As indicated in chapter two, we are interested at using the Cobb Douglass production function to estimate our result. An extension of the function from chapter two holds that, its general form is given as follows:

$$Y = \beta_0 \prod_{j=1}^{k} X_j \beta_j \qquad (1)$$

This equation can also be express in log form. This is done by introducing the natural log on both sides of the equation: $LnY_i = Ln\beta_0 + \sum_{j=1}^{k} \beta_j . LnX_{ji} + u_i$. More specifically:

$$\begin{aligned} LnY_i &= Ln\beta_0 + \beta_1 LnX_{1i} + \beta_2 Ln_{2i} + \beta_3 LnX_{3i} + \beta_4 LnX_{4i} + \beta_5 LnX_{5i} + \beta_6 LnX_{6i} \\ &+ \beta_7 LnX_{7i} + \beta_8 LnX_{8i} + \beta_9 LnX_{9i} + \beta_{10} LnX_{10i} + \beta_{11} LnX_{11i} + \beta_{12} LnX_{12i} + u_i \end{aligned} \qquad (2)$$

Where: $Y_{i:}$ Yield of coffee in bags per hectare, $X_{1:}$ Amount of mineral fertilizer used in kg / hectare, $X_{2:}$ Amount of herbicide used in L / hectare, $X_{3:}$ Farm size measured in hectares, $X_{4:}$ Income level, X_5: Age of coffee farmer, X_6: plantation ages, X_7: Price of coffee per bag of 100kg, X_9: Educational level of the coffee farmers, X_{10}: Transport cost of coffee 100kg bag, X_{11}: Years of experience in farming, X_{12}: Cost of labour per hectare of land and μ: Error term. From these variables, a series of tests will be carried out to ensure that the variables are normally distributed, no collinearity exists between the variables and no endogeniety exist between the error term and the independent variables.

4. RESULTS

4.1 Socio-economic characteristics of coffee farmers

This section discusses the socio-economic characteristics of the respondents, sampled coffee farmers in Melong Subdivision. These socio-economic variables include: age, gender, marital status, level of education, occupation, income level, years of experience and number of households. The age groups of the respondents were divided into four groups: The results reveal that majority of the respondents in different villages are above 46 years (36%),followed by 35-45years (32%), then 25-35years (26%), and the lowest is

the age group less than 25years (6%). This shows that, the older people are more involved in coffee farming than other age groups.

Table 1. Socio-economic characteristics of coffee farmers

Description	Percentage
Distribution of respondents by age group	
< 25years	6
25-35years	26
35-45years	32%
> 46 years	36
Distribution of respondents by gender	
Male	67
Female	33
Level of education of respondents	
No education	3.3
Primary	63. 3
Secondary	29.2
Tertiary	4.2
Distribution of respondents according to marital status	
Single (bachelor, spincers, widows, widowers)	44.2
Married	55
Distribution of respondents according to land tenure	
Ownership	71
Rents	29
Distribution of respondents according to their main occupation	
Trader	22.5
Civil servants	16
Agriculture	61.7
Others (students, mechanics, … etc	2.5

Source: Author

The respondents were classified according to their gender and the results of this study reveal that, 67% of coffee farmers interviewed are male while 33% are female. This might be explained by the fact that women don't generally have easy access to land as men and certain cultures sometimes limits them to own land. This finding is in line with a study carried out by Wokia-azi et al. (2008) on cocoa production in Southern Cameroon who ascertained that gender disparity with regards to land occupation is one of the factors affecting the multiplicity and increasing harvest in the cocoa growing communities of Southern Cameroon. According to them, women are highly disfavoured and certain cultures sometimes do not allow them to own land and as such, access to land is limited when compared to the men. Through different mechanisms, women are strongly disadvantaged when it comes to extension services and marketing.

Table 1 shows that63.3% of the coffee producers interviewed had attained primary level of education. Also 29.2% had received secondary education and 4.2%had received tertiary education. Therefore, it can be concluded that coffee production can be carried out by a person with any level of education.Generally, the more educated people are, the more efficient producers they become (Coelli & Battese, 1996). The result in Table 1 reveal that 55.8% of the respondents are married meaning that more married people are actively involved in coffee farming. It is equally observed that 25.0% of the respondents are single, 12.5% are widows and 6.7% are widowers. Family sizes within this Subdivision are so large that the married people with more responsibilities turn to be massively involved in the activity in order to take care of their large families. Reasons for which more married people are involved in coffee production than the unmarried.

Table 1 shows that the sampled coffee farmers were asked if they were land owners, it was realized that some of the respondents actually rent in and out parcels of land. Area of land ownership by respondents ranged from a less than one hectare to above10 hectares. It was also observed that the greater majority of the respondents are land owner (71%) whereas 29% are those who rent land which they said it is expensive and difficult to get land of their own. Table 1 shows that 61.7% of sampled coffee farmers have as main occupation agriculture .This can be explained by the fact that agriculture is found mostly in the rural zone and coffee production is their primary source of income. Also, 22.5% are traders and 13.3% are civil servants who don't really depend on coffee production since they are always busy in doing others activities.

4.2 Determinants of coffee production

To carry out any linear regression certain assumptions must be fulfilled. That is, the variables to be tested must be normally distributed, no multi-collinearity, no correlation should exist between the independent variables and also the error term should be normally distributed with zero mean and constant variance (no endogeneity). This model was designed to establish the link between the dependent variable and the independent variables. Better still, it tries to explain the different factors that affect coffee production or output which will answer the second question in this study. The coefficient of the coffee plantation ages is negative (-0.019). This can be interpreted that an increased in plantation ages by 1unit would lead to a decrease in the yield of coffee by 0.019kg all other factors held constant. This is in conformity with the responses of the respondents where majority of coffee farmers in the different villages say most of the coffee plants are old and need to be replace. Its t-valve -0.09 and it is statistically insignificant meaning plantation ages is not a factor that affects coffee production in Melong subdivision.

The coefficient of labour cost is positive 0.426 .The coefficient shows that a unit increase in the cost of man power put in for production in the farm will increase total coffee output by 0.426kg, all other factors held constant. This implies that increase in labour could result to the expansion of coffee farms which will leads to an increase in total output. Its t-value 0.24and it is statistically insignificant meaning labour cost is not an important factor that affect coffee production but should not be given due consideration when examining the pertinent factors that affect coffee production in Melong subdivision. The price of coffee per 100kg bag has a positive coefficient of 2.744. This can be interpreted that an increase in the price of coffee per bag of 100kg by 1 FRS will lead to an increase in the quantity of coffee produced by 0.411 kg all other factors held constant. This ties with the responses of the respondents in the different villages who feel that an increase in price will provoke an increased in coffee production since people will invests more in coffee production than other sectors.

Taking into consideration the t-value, it is 0.33 and is statistically insignificant. Therefore price of coffee is not considered as one of the factors that affects the production of coffee in Melong subdivision. The coefficient of income is positive (13.508) indicating that an increase in income will necessitate an increase in coffee production. This value implies that an increase in the income level of the farmer by 1 unit will lead to a 13.508kg increase in the output of coffee, all other factors held constant. Income enables us to acquired capital goods and modern equipment which in return bring efficiency in the production of goods. With a statistics value of 7.12, the test is highly significant at 1%. This means that income level is a factor among the different factors that influence the production of coffee in Melong subdivision. The findings are in line with Waller et al. (2007) who concluded that income has a positive and significant impact on the

volume of coffee production. Their results further revealed that the role of income in coffee production is crucial since income may be used to acquire all the other factors of production (labour, material inputs and machines).

The coefficient for years of experience is 0.757 which is interpreted that an increase in the number of years of a coffee farmer will lead to an increase in production by 0.757kg per hectare, all other factors held constant. It has a t-value of 2.72; the test is statistically significant at 1%. This implies that years of experience are considered as an important factor that affects coffee production in Melong subdivision. The more experienced a coffee farmer, the higher is his/her output. These ties with the responses given by the respondents who have been producing coffee. Experienced farmers above 40years are entitled to big harvests while the inexperienced below 20 years managed low or moderate harvests. Thus years of experience have a positive impact on the quantity of coffee realized per harvest annually. The coefficient of the quantity of herbicide is positive (0.215). This means that an increase in the quantity of herbicide application will increase the quantity of coffee produced. In other word when there is an increase in herbicide application per 1liter, it will lead to an increase in coffee production by 0.215kg/hectare all other factors held constant. The t-value is 0.032 and is statistically insignificant indicating that the quantity of herbicide should not be considered as an important factor when examining the factors affecting coffee production in Melong subdivision even though it influences coffee production positively (Table 2).

Table 2. Factors affecting coffee production in Melong coffee zone

	Coefficient/t-statistics
Variables	**Quantity of Coffee production**
Log of age of Coffee plantation	-0.019 (0.08)
Log of Cost of labour	0.426 (0.24)
Log of Price of coffee per 100kg	2.744 (0.33)
Log of Income level	13.508***(7.11)
Log of Years of experience	0.757***(2.71)
Herbicide (yes)	0.215 (0.03)
Access to credit (yes)	6.141**(2.17)
Log of Fertilizer (quantity)	-6.247*(1.89)
Log of Farm size	3.318*(1.71)
Training (yes)	5.155 (1.56)
Marital status (male)	-1.397 (0.88)
Log of Age of coffee farmers in complete years of living	-0.189 (0.11)
Log of Educational level (primary)	3.154 (1.35)
Gender	-0.534 (0.19)
Constant	-20.598 (0.81)
Observation	F-Stats 11.464 [14, 119; 0.0000]; R^2=0.6075; Adjusted R^2=0.552

Source: Author.
Note: * 1%, ** 5%, ***10%

The coefficient of access to credit is positive 6.141.The can be interpreted that an increase in credit at lower interest rates to farmers will lead an increased in coffee production by 6.141kg, all other factor held constant. This implies that if farmers have access to credit at lower interest rates to purchased inputs like

fertilizers, herbicide and modern farming equipment like vehicles automatic sprayer, it will lead to an increase in coffee production. Its t-value is 2.17 and it is statistically significant at 5%.This implies access to credit is one of the necessary factors among others that affect coffee production in Melong subdivision. This findings is further confirmed by Waller et al. (2007) who concluded that there is the need to promote credit institutions which specializes in savings, mobilization and credit supply to smallholders. To them, when loans are made available to cocoa farmers without much emphasis on collateral security, the problem of poor harvest will become history as smallholder cocoa farmers will be empowered to go for any chemical without concern for the cost.

The coefficient of fertilizer intensity is negative (-6.247). This implies that an increase in the quantity of fertilizer application by 1kg will result in a decrease in the output of coffee by 6.247kg/hectare, all other factors held constant. The t-value is -1.89 and is statistically significant at 10% level. This therefore means that quantity of fertilizer application in coffee production is a necessary factor that affects coffee production in Melong subdivision. The coefficient of farm size is positive (3.319). This indicates that, an increase in the size of a farm in any cultivable area (measured in hectare) will lead to a 3.319 increase in the quantity of coffee produced all other factors held constant. The t-value is 1.71 and is statistically significant at 10%. Hence it can be interpreted that farm size when measured in hectares is a necessary factor that affects coffee production in Melong subdivision. This is in conformity with most of their responses in which they said they have abundant land to cultivate coffee and need other resources to invest in the land.

The coefficient of training is positive 5.155. This indicates that, an increase in the training of farmers will lead to a 5.155kg increased in the quantity of coffee produced all other factor held constant. This tie with the responses of the respondent who says skilled farmers will come within innovative techniques to boost the production process and output. The t-valve is 1.564 and is statistically significant at 10%. This implies that training is one of the factors that affect coffee production in Melong subdivision. The finding is confirmed by Richman (2010) who suggest that providing farmers with extension service on best maintenance practices will positively impact technical efficiency. The study recommends that efforts aimed at raising productivity and efficiency must concentrate on eliminating farmer's problems and intensification of fertilizer usage.

The coefficient of marital status is negative -1.397. This can be interpreted that an increased in marital status will lead to a decreased in yield by 1.397kg all factor held constant. Its t-valve -0.888 and it is statistically insignificant meaning marital status is not a pertinent factor that affects coffee production in Melong subdivision. The coefficient of age of coffee farmers is -0.189. This means that an increase in the age of a coffee farmer will lead to a decrease in coffee production by 0.189kg all other things held constant. However the t-value is -0.177which is statistically insignificant. This is in conformity with the responses of the respondents where majority of coffee farmers in the different villages fall within the age groups 46 and above giving a total of 44 respondents in this age group with a percentage of 36%. Therefore one can say that the age of coffee farmers is not an important factor when examining the factors affecting coffee production in Melong subdivision. Also Nchare (2007) found out that age has a negative effect on technical efficiency, implying that older farmers are technically more inefficient than younger ones.

The coefficient of educational level of coffee farmer is 3.154 which indicate that an increase in the level of education will lead to an increase in the yield of coffee by 3.154kg all others factors held constant. This is related to the responses of the respondents who were educated and said maize is not the only crop they produce, they forecast the market and produce crops whose demand is high or expected to rise. They therefore diversify their production to other crops and do not give a lot of attention to maize. Educational level equally has a t-value of 1.35 which is statistically insignificant implying that the level of education is not an important factor in the production of coffee in Melong subdivision. The coefficient of gender is negative -0.534. Its t-value is -0.192 and it is statistically insignificant. This can be explained by the fact that coffee production is an easy activity which when enough capital is cheap in, can be done by either a male or a female who is willing to do it. Therefore coffee production in Melong subdivision does not depend on the gender. We can therefore say that even though gender is a factor in the production of coffee in Melong subdivision, much preference should be given to other factors that are more pertinent in case of priority.

The adjusted R^2 represents the degree at which the changes in the dependent variable (Yi) are explained by the changes in the independent factors (Xi).It is said to be good when its value is greater than 50%.The coefficient of adjusted R^2in this study is 0.605.This shows that the factors affecting coffee production are more than 60.5% accounted for by coffee plantation ages, cost of labour, price of coffee per bag of 100kg,income level, years of experience of the farmers,, quantity of herbicide used in L/hectare, access to credit, quantity of fertilizers used in Kg/hectare, farm size measured in hectares, training of coffee farmers, age of coffee farmer, educational level of the coffee farmer, years of experience and sex. On the other hand less than 39.5% of these changes are accounted for by variables not included in the model (stochastic error term). This indicates that R^2 was a good indicator of the factors.

4.3 The challenges in the production of coffee

Considering Table 3, Climate is 100% considered to be a constraint in the study. This is due to the fact that majority of the respondents (120) accepted that climate is a pertinent constraint that limit the production of coffee in Melong subdivision. The result reveal that transportation cost is 98.3% indicating that transportation cost has an inverse relationship with total output of coffee yield. In nearly all these areas, transportation remains a plight to the people. Coffee products from the farm gate have to be carried on the head for long distances to neighboring villages before they can be marketed. This situation has gone a long way to discourage farming among young school leavers. From the response of the respondents, transport cost is one of the constraints that affect coffee production. 119 of the respondents strongly believed that transport cost negatively affect the production of coffee. They complained that bad road conditions discourage most of farmers from increasing their yield since they will not have the means in transporting the products. Hence it can be said that transport cost is one of the constraints to the production of coffee in Melong subdivision. This result also ties with that of Waller et al. (2007) on problems faced by rice growing farmers and their behavior to government policies (Pakistan).

Table 3. The Challenges in the production of coffee

Variables	Observation	Constraints	Non constraints	Differences	Percentage (%)
Climate	120	1 (120)	0.000	-1	(100)
Transportation Cost	120	0.9916 (1gy19)	0.008 3 (1)	-0.9833	(98.33)
Land tenure system	120	0.725 (87)	0.275 (33)	-0.45	(45)
Method used in dried coffee	120	0.80833 (97)	0.19166 (23)	-0.616	(61.66)
Price per kg	120	0.975 (117)	0.025 (3)	-0.95	(95)
farmers cooperatives	120	0.6583 (79)	0.3416 (41)	-0.317	(31.7)
Cost of chemicals	120	0.85 (102)	0.15 (18)	-0.7	(70)
Farming equipment	120	0.6916 (83)	0.3083 (37)	-0.3833	(38.33)

Source: Author

This system is very typical in the Melong coffee zone 45%. Here, land ownership is by ancestral inheritance. The findings shows that some indigenous people (33) have vast land which is idle while others respondents (87) ready to take on coffee production lack enough land. This system of land acquisition constitutes a major constraint in coffee production in Melong subdivision. The method the people used in dried their coffee is a problem affecting coffee production 61.6%.Majority of the respondents (97) dried their coffee on the ground compared to 23 that dried theirs on cemented camps. This results in low quality of coffee at the international level, hence a fall in coffee prices. Therefore, the method used in dried coffee is a constraint that limits coffee production in Melong subdivision. Due to fluctuation in coffee prices in the international markets, price has become a major constraint in coffee production. Majority of the respondents (117) say that, the instability in coffee prices has discourage most of the farmers to abandon the coffee farms leading to low annual productivity. Meaning that price is a major constraint in coffee production in Melong subdivision.

Though Melong is a large coffee zone, the findings shows that majority of the respondents (79) don't belong to cooperatives that can regroup their output in a warehouses and sell them when prices are favourable. As a result of this farmers cannot benefit from incentives from the state or any related NGO's. Thereby, constituting a major constraint in coffee production in Melong subdivision. The cost of chemical inputs is considered as an important constraint in the study. This is due to the fact that most respondents (102) complain that the cost of chemical inputs like fertilizer, pesticide, new variety of seeds are too high that most of them are unable to purchase, leading to low annual harvest. The farming equipment 38.3% is considered to be a constraint in the study. This is due to the fact that majority of the respondents (83) used local tools like cutlasses, hoes, diggers in coffee production compared to modern equipment. This has led to fall in the output of coffee. Farming equipment is constraints that limit the production of coffee in Melong subdivision.

5. CONCLUSION

Coffee farming still remains a profitable and most important activity in Melong subdivision. Since this activity is a profitable one, the government and institutions (including NGOs) aimed at providing jobs and profitable livelihood activities for Cameroonians especially in the coffee growing regions should promote the production of coffee. This will equally boost the foreign exchange earning capacity of the agricultural sub-sector of the economy thus helping in accelerating the economic growth of the agricultural sector of Melong subdivision in particular and the economy as a whole.

Since it has been proven that Coffee production in Melong subdivision is affected by a number of variables such as labour, capital, price, education and gender, it implies that a unit increase or decrease in any of these variables will lead to a significant increase or decrease in output. Based on the above conclusion, we recommend that; Looking at the case where the farmers complaint that they lack means to purchase chemical fertilizers, they are advised to use compose manure obtain from the accumulation of sewage from their houses and excrement gotten from their local livestock. This will enable them get manure which has high fertility content. Community participation on road maintenance is recommended. This should be done through the collective amalgamation of physical labour, finances, material and ideologically contributions and it should be done every year before the start of rains. In addition, there should be inter-village collaboration in the maintenance of roads in cases where evacuation roads link one village to the other.

Considering the case where farmers complaint of inadequate financial means it is recommended that they form farming groups like Common Initiative Groups through which they can team up and contribute to help each other in area of need. Through this groups also, they can solicit help from other donors, MINADER and other philanthropist. They can also borrow money from financial institutions at moderate interest rates and repay after harvest. The government should create more agricultural financial institutions that will offer loans to farmers at moderate interest rates to support them in their productive endeavors.

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