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Factors Affecting the Profitability of Smallholder Common Bean Producers in Central Rift Valley of Ethiopia

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አህፅሮት

ቦሎቄ ከዋና ዋናዎቹ የጥራጥሬ ሰብሎች የሚመደብ ሰብል ሲሆን ለሀገሪቱ ኢኮኖሚ እንዲሁም ለአርሶ አደሩ የምግብና የገቢ ምንጭ በመሆን ከፍተኛ አስተዋፅዖ ያደርጋል። በምስራቅና ደቡብ አፍሪካ ውስጥ ኢትዮጵያ በቦሎቄ ምርት የሦስተኛ ደረጃን ትይዛለች። በ2010 ዓ.ም. ሀገሪቱ 40 በመቶ የሚሆነውን የቦሎቄ ምርት ወደ አለም አቀፍ ገበያ ልካለች። ቦሎቄ ከፍተኛ የኢኮኖሚ ጠቀሜታ ያለው ሰብል ቢሆንም ሰፊ የሆነ የተሸሻሉ የቦሎቄ ዝርያዎች ስርጭት በተለያዩ ጊዜያት ቢከናወኑም በቅርብ ጊዜ በተለይም በመካከለኛው ስምጥ ሸለቆ ያሉ አርሶ አደሮች ወደሌሎች ሰብሎች ሲያዘነብሉ ይታያል። ከዚህ ችግር ጋር በተያያዘ ሁኔታ የቦሎቄ ምርት የትርፋማነት ጥናት አለመኖር የመረጃ ጉድለት ፈጥሯል። አብዛኞቹ ከዚህ በፊት የተደረጉ ጥናቶች የሰብሉን የትርፋማነትና አዋጭነት ጥናት ያላደረጉ ሲሆን ጥናቱ ይህንን ጉደለት ለመሙላት ታስቦ የተተገበረ ነው። የአርሶ አደሩ ትርፋማነት ለማጥናት ይረዳ ዘንድ የቦለቄ አምራች በሆኑ አካባቢዎች አርሶ አደሮች በተለየ የመምረቻ ዘዴ ተለይተው የቅኝት ተሳታፊ ሆነዋል። የተሰበሰበውም መረጃ ቀለል ያሉ የመረጃ ቀመሮችና እና ለአዋጭነት አስተዋጽኦ ያለቸው ምክንያቶች ትንተና ተደርጎበታል። የጥናቱ ውጤት እንደሚያሳየው ከሆነ የአርሶ አደሩ ያልተጣራ ጠቅላላ ትርፍ በአማካይ 13486 ብር በሄክታር ሲሆን ጠቅላላ የተጣራ ገቢ ደግሞ 8127 ብር በሄክታር ይሆናል። ለቦሎቄ ምርት ትርፋማነት አስተዋፅኦ ከሚያደርጉ አበይት ምክንያቶች ውስጥ አርሶ አደሩ ከዋና ገበያ ያለው ርቀት፣ የአርሶ አደሩ የእድሜ ሁኔታ፣ የቤተሰቡ ቁጥር፤ ከግብርና ስራ ውጭ ያሉ ገቢዎች እና የማዳበሪያ ማግኛ ምንጮች አስፈላጊ ሆነው ተገኝተዋል። በአንጻራዊ መልኩ ሲታይ የወንድ አባወራ አርሶ አደሮች የተሻለ ትርፋማ ሲሆኑ፤ በግብርና ስራ ያለ ልምድ፤ በገበሬ ቡድን አባል መሆንና ምርቱ የተሸጠበት የገበያ ሰንሰለት ዓይነቶች አወንታዊ በሆነ መልኩ ተጽዕኖ የሚሳድሩ ምክንያቶች ናቸው። ስለዚህም የቦለቄ አምራች አርሶ አደሮችን ትርፋማነት ለመጨመር፤ አወንታዊ ምክንያቶችን ከፍ ማድረግና አሉታዊ ምክንያቶችን በመቀነስ የፖሊሲ እርምጃዎችን ማቀናጀት ያስፈልጋል።

Abstract

Common bean is one of the major pulse crops which played an important role to the Ethiopian national economy and to farmers as food and cash income. Ethiopia ranked third in common bean production in Eastern and Southern Africa. The country exported 40 percent of its total common bean production in 2010. Despite the wide dissemination of improved common bean varieties and its economic

importance, there is a dearth of information on the profitability of smallholder farmers from common bean production. Most of the previous studies on common bean did little on the profitability of small holder bean producers. This study is designed with the aim of assessing the profitability status of small holder common bean producers and factors correlated with it. Sample bean producers were selected randomly using simple random sampling. The cross-sectional data collected from sampled household is analyzed using descriptive statistics and Ordinary Least Square (OLS). The result of the study shows that the mean common bean gross margin and net farm income was 13486 and 8127 Birr/ha respectively. Distance from nearest market, Age, Family size, off farm income and fertilizer source are the factors influencing the profitability of smallholder common bean producers negatively. However, Gender, farm experience, group membership and target market channel had a positive significant influence on smallholder based common bean production profitability. Therefore, in order to enhance the profitability of smallholder households, among other, it is important to improve access to input and output market and collective actions by farmers. There is also a need to minimize the gender gap in the profitability through affirmative action such as provision of special credit and access to modern technologies by female farmers.

Keywords: Common Bean, Smallholder, Profitability, Ordinary Least Square

Introduction

Grain crops (cereals, pulses and oilseeds) constitute the major food crops for the majority of the Ethiopian population, used as a source of income at the household level and have an important contribution in foreign currency earnings (CSA, 2010). Pulses are important crops in agricultural production and are major sources of protein for most of developing countries in the world. Pulses are considered as input-saving and resource-conserving because of their biological nitrogen-fixing ability. The production volume of pulses increased by 71.92 percent in Ethiopia from 1994 to 2013 and with the annual growth rate of 3.78 percent. Area coverage of pulses for the same period increased by 53 percent, and had a growth rate of 3 percent per annum. The total grain yield of pulse also showed a significant increment (from 0.9 tons per hectare in 1994/1995 to 1.5 tons per hectare in 2012/2013 cropping season (Atnaf *et al*., 2015).

Common bean, also known as haricot bean, is an important pulse crop to the Ethiopian national economy and to farmers as food and cash income. Ethiopia

ranked third in common bean production in Eastern and Southern Africa. The country exported 40 percent of its total common bean production in 2010 (FAOSTAT, 2015). Fast maturing characteristics of the crop enable the farm households to generate cash income required for purchase of food and other household needs when other crops have not yet matured. Consequently, the crop is highly preferred in providing quick cash and cut hunger for the risk-prone farm households of Semi-arid region (Beshir and Nishikawa, 2012). Even though farmers grow wide range of common bean varieties in terms of color and size, the most common types are the pure red and the pure white beans. Medium and small red beans are produced, traded and consumed in domestic bean market of Ethiopia. On the contrary, white beans are exported (Ferris and Kaganzi, 2008).

The central rift valley region of Ethiopia is the main sources of exported white beans. The region is known for its white bean production and marketing. About 18% to 30% of farmland is allocated to common bean production, and 86% of the product is sold in major common beans producing districts of the region (Beshir and Nishikawa, 2012).

Despite the immense potential of common bean production in the region, information on its profitability remains missing. From some past profitability studies that have been conducted in the central rift valley region of Ethiopia, beans have been left out and most of the focus has been on horticultural crops.

Most of the previous researches which were conducted on common bean in the region focused on improving productivity through varietal development and agronomic practices (PABRA, 2008), adoption (Mulgeta, 2011; Negash, 2007) with little or no emphasis given to its profitability. This research was, therefore, intended to fill this information gap through examining the profitability status and factors affecting profitability of smallholder common bean producers in central rift valley of Ethiopia.

Limitation of the study

The limitation of this study was its restriction to specific districts. Its finding needs to be understood in this context. The final result of the study might have a practical validity mainly to the areas with similar features. It would have been ideal to use panel data to capture the time variant profitability variables like production, price and costs thereby handle the profitability issues well. However, shortage of finance, time and other resources causes the study to be limited to the use of a cross-sectional data.

Materials and Methods

Description of the study area

The study was conducted in central rift- valley region of Ethiopia, particularly in Shalla and Boset districts. Shalla is one of the districts of the Oromia regional state which is located in the central rift valley of Ethiopia. Shalla district is situated in West Arsi zone about 270 km south west of Addis Ababa. The area is lowland with an altitude of 1550m above sea level, latitude of 38° 27'10.9''E and Longitude of 7°17'08.6''N. Shalla is bordered in south by Seraro district, on the west by Southern Nations, Nationalities and Peoples' Region, on the north by Shalla Lake which separates it from Arsi Negele, and on the east by Shashemene zuria Woreda. Its western boundary is defined by the course of the Bilate River. The Administrative centre of this district is Aje city. The 2007national census reported that the total population of the district was 149, 804 of whom 74, 930 were men and 74,874 were women. 7,680 or 5.13% of its population were urban dwellers. The majority of the inhabitants were Muslim, with 94.81% of the total population.2.5% of the population is protestant and 2.12% is orthodox. The site receives 763 mm mean annual rainfall, but with much variation in distribution.

Boset district is another focus area of this study. The district found in east Shewa zone of Oromia regional state within the central rift valley of Ethiopia. It is located on a distance of 25 km from Adama and 125km from Addis Ababa. The district is located between 1400m-2500m above sea level and rests on an area of 151,406 hectares. It gets 600-900mm annual rainfall on average and it is bounded in the north by Minjar district of Amhara regional state, in the east direction by Fantale district, by Marti district of Arsi zone in the south, by Adama and Lume districts in the west. The administrative centre of the district is Welenchiti city. According to (CSA, 2007), the total population of the district is estimated around 142,112 of whom 73,925 were men and 68, 187 were women. 26, 514 or 18.66% of its population were urban dwellers. The majority of inhabitants in the district are the followers of Ethiopian Orthodox Christianity, with 60.57% of the total population. About 15.64% of the population was Muslim, 14.45% practiced traditional beliefs and 8.37% were protestant.

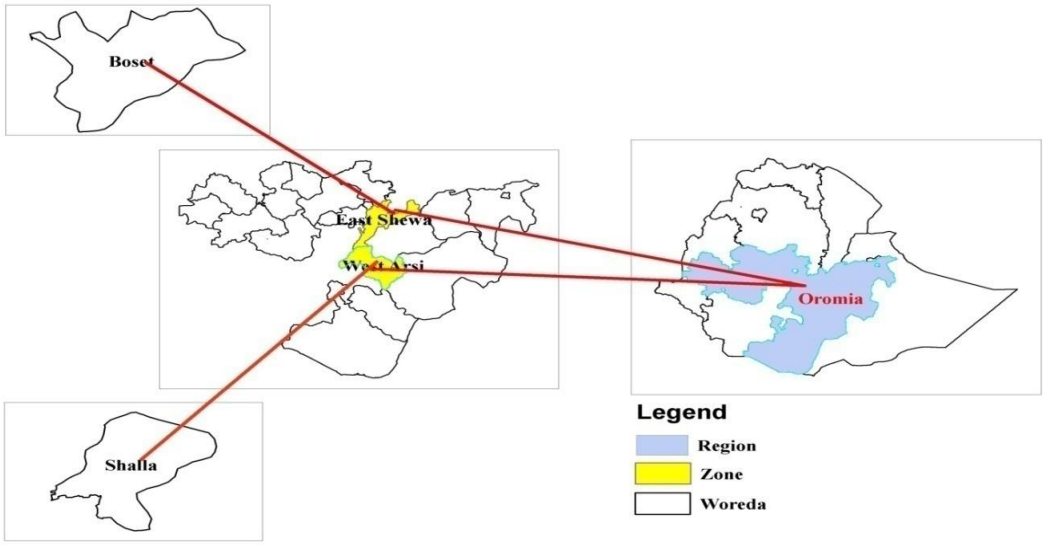

Figure2.1: Map of the study area

Sampling design and sample size

Western Arsi and East Shewa zones of the Oromia regional state were the focus areas of this research, since they are the major common bean growing zones in the central rift valley of Ethiopia. Purposive sampling technique was employed on the first stage to draw sample common bean producing districts. Accordingly, based on their area coverage of common bean production Shalla and Boset selected purposively from West Arsi and East Shewa zone, respectively. Simple random sampling technique was employed on the second stage to draw the sample kebeles. After the identification of major common bean growing kebeles in each district, the sample common bean producing kebeles were selected randomly using simple random sampling technique. Accordingly, Awara Gama and Chefa Kerensa kebeles from Shalla, and Sara Areda and Kachachule kebeles from Boset district were selected randomly for this study.

The sampling frame of common bean growing smallholder farm households from their respective kebeles was using to draw representative sample households. Accordingly, 1109 common bean producing farm households were identified and of which 582 were from Shalla district (316 from Chefa Kerens and 266 from Awara Gama) and 527 were from Boset (316 from Sara Areda and 211 from Kachachule). Total sample size of farm households was calculated using the formula of Yamane (1967). Subsequently, the number of sample common bean producers in each kebele were determined using proportionate sampling technique. Finally sample common bean producing smallholder farm households

were drawn from the target population in each kebele using simple random sampling.

The sample size of smallholder common bean producers was estimated using Yamane (1967) formula. Yamane provides simplified formula to calculate the sample size and it specified as follows.

$$n = \frac{N}{1+N(e)^2} \quad \text{..... (1)}$$

Where n is the sample size, N is a target population of common bean producers, e is the level of precision. Based on the formula, the sample size for this study was 172 smallholder farm households. The number of smallholder farmers drawn from the population in each kebele is determined by using proportional calculation based on the total sample size. The number of smallholder farmers drawn from the population in each sample kebele is summarized in table 1 below

Table 1.Summary of sample household drawn from each rural kebele
Type and source of data

Name of kebele	Total number of common bean growing households	Number of sample household selected
Awara Gama	266	41
Chefa Kerensa	316	49
Sara Areda	316	49
Kachachule	211	33
Total	**1109**	**172**

Both quantitative and qualitative data set were collected to attain the research objectives. Primary and secondary data sources were used in this study. The sample farm households were the primary data source from whom the cross-sectional household data collected. The Secondary data sources such as reports of Bureau of agriculture at different levels, NGOs, CSA, previous research findings, internet, proceedings, journals and other sources which were relevant for this study were used.

Methods of data collection

A household survey of common bean producing farmers is the method used to collect data needed for the farm-level profitability analysis in the major producing areas. The household survey enables to address individual farmer profitability status and the farm and household characteristics that influence profitability. Pre-designed questionnaire was used to gather required data. The questionnaire was pretested on five randomly selected households before its final administration on the sampled households.

Methods of data analysis

Descriptive and inferential statistics (multiple linear regression model) were the employed using SPSS (Version 20) and STATA (version 13). Descriptive statistics used for the computation of minimum and maximum values, means, and standard deviation of continuous variables. Furthermore, it was applied to analyze the frequency and percentage of categorical and dummy variables that were found important in this study.

The multiple regression model (MLRM) was used to analyze factors affecting common bean profit margin. According to Wooldridge (2012), multiple linear regression analysis is more amenable to ceteris paribus analysis because it allows us to explicitly control for many other factors that simultaneously affect the dependent variable. It allows many observed factors to affect the dependent variable thus allowing for much more flexibility. Multiple regression model is a model in which there is more than one explanatory variable, and show how the method of OLS can be extended to estimate the parameters of such a model.
The method of ordinary least squares is popularly used for estimating the parameters of the multiple regression model. Adding more explanatory variables to the model that are useful for explaining the response variable is used to explain much of the variation in the model. Hence, multiple regression analysis can be used to build better models for predicting the dependent variable. Therefore, multiple linear regression model (MLRM) was employed for analyzing the factors affecting the profit margin of common bean production in the central rift valley of Ethiopia. Multiple regression equation, involving the use of ordinary least square (OLS) estimation is used to examine the magnitude and direction of the effect of independent variables on the response variable. The multiple regression equation with four different functional forms is stated as follows.

$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots \beta_k x_k + \mathcal{E}t$ (Linear)…… (2)

$Y = \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \ldots \beta_k \ln x_k + \mathcal{E}t$ (Semi-log)…….... (3)

$\ln Y = \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \ldots \beta_k \ln x_k + \mathcal{E}t$ (Double log)……..... (4)

$\ln Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots \beta_k x_k + \mathcal{E}t$ (Exponential)…….. ..(5)

Where Y is dependent or response variable, in this case profitability (gross margin), Xs are explanatory variables affecting profitability of common bean production, $\beta_0$is the constant or intercept, the betas i.e. $\beta_1, \beta_2, \beta_3 \ldots \beta_k$ represent the regression coefficients that show the partial effects of the corresponding explanatory variables and $\mathcal{E}t$ represent an error term. Gross margin used as a proxy for the profitability of smallholder common bean producers in this study. It is calculated as the difference between revenue and total variable costs. It is computed by deducting the total variable cost from total revenue. The important

formulas used in profitability analysis of common bean production expressed algebraically as follows.

GM = TR-TVC ……. (6)
TVC = AVC X Q …… (7)
TR = P X Q…… (8)
ATR = TR/Q…… (9)
ATC = TC/Q…….....(10)
BCR = TR/TC…… (11)
ARR = GM/TVC……...(12)

Where, GM = Gross Margin, TVC = Total Variable Cost, TR= Total Revenue, AVC = Average Variable Cost, ATC= Average Total Cost, ATR= Average Total Revenue, BCR= Benefit Cost Ratio, ARR= Average rate of return, Q = Volume of production in Quintal and P=price of the product per Quintal.

Empirical model specification

The empirical model specification stated as:
CBGM=f (Gender, Dmkt, Farmsize, Age, Fmlysze, OFI, TLU, Exp, Exvst, Educ, Gmshp, ACredit, Frtlzrs, Tmktc), where definition, measurement and expected sign of each of the hypothesized explanatory variables illustrated as follows in table 2.

Table 2. Definition, measurement and expected effect of the hypothesized variables

Variable	Definition of variables	Measurement	Expected Signs
CBGM	Common Bean Gross Margin	Birr	Dependent
Gender	Gender of the household	Dummy (1 if male, 0 otherwise)	(+)
Dmkt	distance to nearest market	hour	(-)
Farmsize	farm size	hectare	(+/-)
Age	Age of household head.	Number of years	(+/-)
Fmlysze	Family size	Number of family members	(+/-)
OFI	Off-Farm Income	Birr	(+/-)
TLU	Tropical Livestock Unit	Number	(+)
Exp	Experience in common bean production	Number of years	(+)
Exvst	Access to extension visit	Dummy(1=visited,0=Otherwise)	(+)
Educ	Education level	Years of schooling	(+)
Gmshp	Group Membership	Dummy(1=Member,0=Otherwise)	(+)
ACredit	Access to credit	Dummy(1=accessed,0=Otherwise)	(+)
Frtlzrs	Source of Fertilizer	Dummy (1=Market,0= Union)	(+)
Tmktc	Target market channel	Categorical (1=Whole sellers, 2= Retailers, 3=Local Assembler)	(+)

Results and Discussion

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Socioeconomic characteristics of the farm households

From the sample smallholder common bean producers, 68.9% and 81.7% were male-headed in Shalla and Boset districts, respectively. From the overall sample farm households, 75.3% were male-headed farm households.

The mean age dependency ratio of the farm household was 1.21. This reveals that for each economically active household member there is a little more than 1 family member as dependent which is too aged or too young (Table 3). Moreover, the result indicates that the average farm size of the sample farm households was 1.63 hectares. From the average landholding of sample smallholder farm households, the common bean production takes 1 hectare on average. The sample common bean producers own an average livestock number of 4.14 in Tropical Livestock Unit (TLU). Concerning the income of the sample farm households, off-farm income is the alternative source of income other than agriculture in the study area. The average annual off-farm income of sample smallholder farm household was 1268.50 Birr with minimum and a maximum income of 160 and 5320 Birr, respectively (table 3).

Table 3. Average value and standard deviation of continuous socio economic variables

Variables	Minimum	Maximum	Mean	Std.Deviation
Education level in years	0	14	3.95	3.855
Total Family size	2	14	6.26	3.216
Age Dependency Ratio	0.26	5.13	1.21	0.869
Total farm size in hectares	0.25	7.00	1.63	1.071
land size under common bean(ha)	0.25	6.50	1.01	0.812
Number of livestock in (TLU)	0.04	6.97	4.14	1.764
Off-farm Income(Birr)	160.00	5320.00	1268.50	1566.892

*Sourc*e: survey data (2018/2019)

Gross margin analysis of common bean production

Common bean farming may not be for the purpose of satisfying the household consumption need or subsistence only. The smallholder farm households had a concern of raising their income from selling their output. Hence, farmers like any other entrepreneurs would be interested in improving the profitability of their common bean production. Therefore, efforts were made to determine the costs associated with common bean production and the revenue that accrues to the farmers.

The result in Table 4 illustrates that Mexican-142 had the lowest revenue and gross margin than all the remaining common varieties. Farmers were able to get

15,272 and 8,321.4 birr per hectare as revenue and gross margin, respectively from the production of Mexican-142. On contrary, Awash-1 had the highest revenue and gross margin followed by Awash-2 and Naser. 24536.8 birr and 15841.6 birr per hectare obtained as revenue and gross margin, respectively from the production of Awash-1 variety.

The analysis further reveals that the Benefit Cost Ratio (BCR) for all varieties of common bean was greater than one. This shows the profitability of producing all varieties of common bean in the study area. However, the magnitude of return on cost (BCR) was not the same for all varieties. Awash-1 had the highest Benefit Cost Ratio (BCR) (1.68) than all other varieties. This implies that for every one birr invested in the production of Awash-1 the farmer gets additional 1.68 birr as a gross return. (see Table 4). Furthermore, the average rate of return for Awash-1 was higher than the rest of the varieties. This reveals that for each one birr invested in Awash-1 production, a farmer receives 1.82 birr as a gross margin. Moreover, the result shows that Awash-1 is the most profitable common bean variety followed by Awash-2 and Naser.

The pooled gross margin analysis indicates that an average of 21,889.5 Birr/ha accrues to the producers as revenue and, 13486.01 and 8126.90 Birr/ha left as gross margin and net farm income, respectively. On the other hand, it costs 13,762.60 birr on average to cultivate common bean on one hectare of land. A positive mean gross margin and net farm income, and Benefit-Cost Ratio of 1.59 entails that common bean production is a profitable venture in the study area.

Table 4.Gross margin analysis in birr per hectare of common bean production

Items	Naser	Awash-1	Awash-2	Dinkinesh	Mex-142	Pooled
Average Yield/ha	20.5	17.1	20.0	18.9	18.40	18.64
price (Birr/Qt)	864.6	1434.9	937.5	868.5	830.00	1174.33
Revenue (Birr)	**17724.3**	**24536.8**	**18750**	**16414.7**	**15272**	**21889.5**
Total Variable Cost	**8356.7**	**8695.2**	**8985.2**	**7345.9**	**6950.6**	**8403.49**
Fixed Cost (Birr)	5085.4	5946.3	5300	5869.2	5600.00	5359.11
Total Cost (Birr)	13442.1	14641.5	14285.2	13215.1	12550.6.	13762.60
Gross Margin	**9367.6**	**15841.6**	**9764.8**	**9068.8**	**8321.4**	**13486.01**
Net Farm Income (Birr)	4282.2	9895.3	4464.8	3199.6	2721.4	8126.90
Average Revenue	864.6	1434.9	937.5	868.5	830.00	1174.33
Average Total Cost	655.7	856.2	714.3	699.2	682.1	738.34
Rate of Return	**1.12**	**1.82**	**1.1**	**1.23**	**1.19**	**1.61**
Benefit Cost Ratio	**1.32**	**1.68**	**1.31**	**1.24**	**1.22**	**1.59**

Source: Field Survey (2018)

Fitness tests for different functional forms in regression equation

In selecting the function that best fit to the data, different criterion like Akaike's Information Criteria, Bayesian Information criteria(BIC), the value of F-ratio and its p-value, the value of coefficient of determination(R^2) and the number of significant variables are used following Guajarati and Sangeetha (2007).The function with the lowest value of AIC, BIC and p-value; highest value of F-ratio and R^2, and with a higher number of significant variables is best fit to the data. Double log function was eventually selected since it fulfills the entire criterion (Table 5).

Table 5. Fitness test results for different functional forms

Indices	Linear	Semi log	Exponential	Double log
Akaike's information criteria (AIC)	3575.139	3570.263	269.3518	260.9430
Bayesian information criteria (BIC)	3628.647	3623.77	322.8592	314.4504
F-Statistic	1.31	1.55	18.23	19.62
Prob(F-statistic)	0.1970	0.0905	0.0000	0.0000
R squared(R^2)	0.111	0.136	0.580	0.600
Number of significant variables	1	3	10	10

Regression diagnostics

To know whether the regression model was correctly specified or not and it is in line with the assumptions of Ordinary Least Squares (OLS), the necessary regression diagnostics were conducted. Hence, data checked for different tests such as normality test, heteroskedasticity test, multicollinearity test, and test for misspecification of the model.

The normality test was conducted on the error term to suggest the distribution of the data i.e. to know whether it is normally distributed or not. Shapiro-Wilk and Skewness/Kurtosis (sktest) employed to check whether the error term was distributed normally or not. As the result shows the p-values for Shapiro-Wilk and Skewness/Kurtosis tests for normality were not significant at 5% level of significance and the null hypothesis of the error term is normally distributed is not rejected (Table 6).

It may be generally a rule instead of expectation to face heteroskedasticity problem in cross-sectional data (Wooldridge, 2012). Therefore, the data was checked for heteroskedasticity which is the violation of one of the assumptions of OLS, in which the variance of the error term is non-constant; consequences of which very high standard error, OLS is no longer BLUE (no longer efficient) and leading to the erroneous conclusions. Thus, the Breusch-Pagan test was employed

for suggesting the presence of heteroskedasticity. The result in Table 6 indicates that the test was significant at 1% level of significance. This shows that there is heteroskedasticity problem in the data set. Hence, heteroskedasticity-robust statistics was applied to correct the data against the problem.

The regression model suffers from functional form misspecification when it does not properly account for the underlying relationship between the dependent and explanatory variables. Running linear model while quadratic or the logarithmic form is appropriate results in functional form misspecification. Therefore, the Ramsey Regression Specification Error Test (RESET) was employed to detect the presence of functional form misspecification. This test shows (detects) whether there is misspecification in the model or not. In a case when the model is specified correctly, all of the independent variables are exogenous. Otherwise at least one independent variable suffers from an endogeneity problem (there exists lagged dependent variable as an independent variable in the model or two-way relationship exists).

In addition to this, the test detects whether there is an omitted variable bias or not. The significant test value shows that there is an omitted variable from the model while it significantly affects the dependent variable. This means the regression model is not specified correctly. Hence, the insignificant test value taken not to reject the null hypothesis of the model is specified correctly. The result of Ramsey Regression Misspecification Error Test (RESET) shows that the null hypothesis of there is no model misspecification problem is accepted since the p-value for the test was not significant at the 5% level of significance (Table 6). Therefore, the model specified correctly and not suffered from the problem of omitted variable bias.

A multicollinearity test was used to check whether the assumption of OLS for multicollinearity is held or violated. There is no high degree of correlation between explanatory variables. The VIF test result reports that the mean Variance Inflation Factor was 1.42 which is less than 10. Hence, based on test result there was no evidence of the presence of multicollinearity problem on the data set.

Table 6. Summary of the diagnostic tests in Ordinary least Square (OLS) assumptions

Test statistics	Type of test employed	Statistical results
Normality	Shapiro-Wilk W test on residual	Prob>z =0.79900
	Skewness/Kurtosis tests on residual	Prob>chi2 =0.4020
Heteroskedasticity	Breusch-Pagan/Cook-Weisberg	Prob>chi2 =0.0000
Model Misspecification	Ramsey RESET test	Prob> F = 0.9155
Multicollinearity	Variance Inflation Factor(VIF)	Mean VIF = 1.42

The regression results

The multiple regression result shows that the estimated F-ratio was 19.62 and it was statistically significant at 1%level of significance as the probability of F-statistic was very small (Prob>F = 0.00). This implies that the model was statistically significant, thus the joint effect of all explanatory variables on the common bean gross margin was above zero. The Adjusted R squared of 0.60 implies that 60% of the variation in common bean gross margin is explained by the explanatory variables estimated in the model.

As shown in Table 7, 9 out of 14 explanatory variables affected the farmers' common bean gross margin under varying levels of significance. Gender, Distance to the nearest market, age of the household head, Family size, Off-farm income, Experience, Group membership, Fertilizer source, and target market channel were explanatory variables affecting common bean gross margin at the different level of significance. The extent and direction of the influence of each explanatory variable which found significant discussed in detail below.

Gender of the household head

Gender of the household head had a positive and significant effect on the profit margin of common bean production at 10% level of significance (see Table 7). The effect is in line with prior expectation. Male-headed farm households had higher common bean gross margin than the female-headed farm households. Being male- headed farm household increases profit margin from common bean production by 0.45 percent in relative to female-headed farm household. This could be due to the lack of gender consideration during the dissemination of improved agricultural technologies and the provision of training on agricultural production. The result agrees with Mesfin (2005) who reported that male farmers quickly adopted new technologies as compared to female farmers.

Distance to nearest market

The result of the study indicates that the distance to the nearest market had a negative effect on the profit margin of common bean production. One percent increase in distance to market in hour causes a decrease in common bean profit margin by 0.09 percent at 5% level of significance (see Table 7). This could be because of marketing costs like grain transport cost which increases with distance. This implies that the smallholder farm households nearer to the input-output markets had an easy access to inputs of production (fertilizers, Herbicides, insecticides, improved seeds etc.) and got market price information more easily than those who are far away from the market. All these could reduce the marketing costs, thus improve profitability from the crop production. The result concurs with Mercy *et al*., (2016) who reported that the distance to input-output

market is negatively related to the profitability of legume crops production in Nandi province of Kenya.

Age of the household head

The study reveals that the age of the household head had a negative influence on common bean profit margin. As indicated in Table 7, one percent increases in the age of household head causes the decrease of common bean profit margin by 0.32 percent at 10% level of significance ($p< 0.1$). This could be because of the fact that younger household heads had a greater inclination to accept the new technologies, thus adopt the technology without any obstruction. This improves promptness of operations, reducing costs of production and it contributed to the increase in farm profit. Furthermore, mental and physical capacity of overcoming challenges and ability to undertake manual works efficiently in the agricultural production might be decreased with age. This can cause a decrease in the productivity and profitability of aged farmers in agricultural production. The result is in conformity with Matungul *et al*., (2001) who stated that younger farmers had the ability to comprehend new technologies which, therefore, contributed to the increase in their farm profit. The result was also supported by Simon, *et al*, (2011) who reported the negative effect of age of household on the profit margin of common bean production in Babati district of Tanzania. However, the finding is in contrary with Makhura (2001) who reported that age of the household head is important and positively affected profitability since the household can be benefited from the experience of an older person.

Family size

As an earlier hypothesis, the result of the study confirms that the family size of the farm household affects the profit margin from common bean production negatively. One percent increase in family size decreases the profit margin from common bean production by 0.168 percent at 1% level of significance($P<0.01$). This might be due to the reason that increased use of family income to meet the consumption, education, cloth and other demand leaving limited funds to invest on common bean production, thus reducing the profit margin from its production. The result is in line with Oband Mabvut (2012) who reported the negative effect of family size on the profitability of cassava production in Chongwe district of Zambia.

Off-Farm Income

One percent increase in off-farm income of the smallholder farm household decreases the profit margin from their common bean production by 0.07 percent (see Table 7). This might be due to the reason that as the smallholder farm household concentrates on off-farm income generating activities, they give low attention for common bean production, which in turn leads to low profit margin.

The result concurs with Simon, *et al.*, (2011) who found the negative relationship between off-farm income and the profitability of common bean production in Babati district of Tanzania. According to his study, as farmer owns more rewarding off-farm income generating activity, the more she/he concentrates to that business and light-touches the common bean business which can, therefore, lead to low profit margin from the crop. However, the result of this study disagreed with Techane, *et al*., (2006) who stated that participation in non- farm activities increase the smallholder farmers' financial capacity and their profitability from crop production.

Table 7. Factors affecting the profitability of smallholder common bean producers

Dependent: lnCBGM		Regression Coefficient (β Values)	Robust Std. Err.	t values	Level of Significance (p>|t|)
Gender		0.448*	0.257	1.74	0.084
Distance to market		-0.089**	0.039	-2.30	0.023
Farm size		-0.101	0.078	-1.29	0.200
Age		-0.322*	0.168	-1.92	0.056
Family size		-0.168***	0.062	-2.70	0.008
Off Farm Income		-0.067**	0.033	-2.02	0.046
TLU		0.064	0.054	1.18	0.240
Farm Experience		0.644***	0.206	3.12	0.002
Extension Visit		0.018	0.078	0.23	0.818
Education		0.023	0.036	0.63	0.533
Group membership		0.163*	0.095	1.71	0.090
Access to credit		0.093	0.097	0.96	0.340
Fertilizer source		-0.279***	0.104	-2.70	0.008
Target market Channel (reference category is Local assemblers)	Whole sellers	0.322***	0.110	2.92	0.004
	Retailers	0.258**	0.128	2.01	0.046
_cons		8.151	0.928	8.78	0.000

*=10% **= 5% ***= 1% Adj.R^2 =0.60, F=19.62Prob>F = 0.0000, Number of Obs = 172

Farm experience

The result of the study confirms the prior hypothesis that experience had a positive effect on the profit margin of common bean production. The number of years of the farmers' experience in common bean production positively affected the common bean profit margin at 1% level of significance($P<0.01$). One percent increase in years of experience of the farmer in common bean production increases the profit margin from common bean production by 0.64 percent (see Table 7). The result agrees with Okam *et al*., (2016) who reported a positive relationship between the farming experience and farm profitability.

Group membership

The result of the study indicates that group membership had a significant positive effect on the profit margin of common bean production. The effect was statistically significant at 10% level of significance ($p < 0.1$). The result is in line with the prior expectation regarding the effect of group membership. Those farmers engaged in group membership earned more profit from common bean production than those farmers who are non-member. As the result in Table 7 shows, being a group member increase the profit margin from common bean production by 0.16 percent in relative to being non-member. This could be due to the reason that group members can easily access credit and other agricultural extension services which in turn improve their profitability. The finding tallies with Owuor *et al*., (2004) who reported that the farmers who are member in a given group can access the agricultural credit, extension services and other necessary agricultural inputs, thus improve their farm profitability than the non-member farmers.

Farmers' fertilizer sources

Fertilizer source is considered as dummy variable with '1' representing market and '0' Farmers' cooperative union. Farmers who bought fertilizer form market earned lower profit from their common bean production compared with those who bought fertilizer from farmers' cooperative union. The difference was statistically significant at 1% level of significance ($P<0.01$). Farmers who got fertilizer from the market earned 0.28 percent less profit from common bean production than those farmers who used farmers' cooperative union as source of fertilizer (see Table 7). This could be due to high transaction costs incurred by the farmers on the way of collecting fertilizer from the market. The result matches with Haileselassie (2003) who reported that farmers' cooperative union provides fertilizer and other inputs of production at least cost since it removed the need for farmers moving a long distance to collect fertilizer and reduce the time and the finance spent on the way of collecting fertilizer from the market.

Target market channel

The target market channel, where local assembler considered as base category, had the expected positive influence on common bean profit margin. As shown on the result Table 7, smallholder households who sold their common bean to wholesalers earned 0.32 percent more profit than those who sold to the local assemblers. The difference was significant at 1% level of significance ($p<0.01$). Similarly, the producers who prefer the retailer's outlet fetched 0.26 percent more profit than those who used the local assemblers as their common bean market agent. The difference was significant at 5% level of significance ($p < 0.05$). This could be owing to the reason that wholesale and retail markets provide high prices for farmers' product in relative to marketing with the local assemblers. Ndungu *et*

al., (2013) reported that profit increased as the producers prefer to market their products through retail and wholesale markets compared to other market channels. This is consistent with the finding of this study.

Summary

Common bean is one of the major pulse crops which played an important role to the Ethiopian national economy and to farmers as food and cash income. Ethiopia ranked third in common bean production in Eastern and Southern Africa. The crop plays a pertinent role in foreign exchange earnings. The central rift valley of Ethiopia is the main sources of exported white beans. The region is known by its white bean production and marketing. About 18% to 30% of farmland is allocated to common bean production and 86% of the product is sold in major common beans producing districts of the region. Despite the immense potential of common bean production and its market in the region, there is a dearth of information regarding the profitability status of smallholder common bean producers and factors correlated with it.

Based on the above fact, this study examined the profitability status of small holder common bean producers and associated factors affecting it in Shalla and Boset districts in the central rift valley of Ethiopia. The finding indicates that the positive mean common bean gross margin and net farm income accrued to smallholder farmers shows the profitability of common bean production. The result of benefit-cost ratio also shows the profitability smallholder-based common bean production. The study further indicates that out of fourteen variables indicated in the model, nine variables have an influence on the profitability of smallholder common bean producers. Distance to nearest market, the age of household head, family size, off-farm income and fertilizer source were those factors negatively and significantly affecting the profitability of smallholder common bean producers. However, gender, farming experience, group membership and target market channel were positively and significantly affecting the profitability of smallholder common bean producers.

Recommendations

These results have important implications for the need of appropriate interventions to improve the profitability of smallholder common bean producers in the study area. From the result it was found that the common bean profit margin of female-headed farm households was significantly less than that of male-headed farm households. This suggests the need of policy geared towards improving the

female-headed farmers' access to different improved agricultural technologies and interventions that encourage female farmers' participation in the farmers' group to access the agricultural inputs and to obtain fair return for their output more easily than they are being alone.

Moreover, age of the farm household head is another important factor for smallholder farmers' profitability form their common bean production, implying that the need to establish village-based farmers' group with a greater younger farmers' participation so that the older farmers can benefited from the younger farmers' innovative skill and physical assistance on manual work. Younger farmers can also use the experience of older farmers during their production process.

Distance to the market place is one of the important factors affecting the farmers' profitability form their common bean production in central rift valley of Ethiopia. The distance to nearest market negatively affect the profitability of common bean production under smallholder based production. Hence, the efforts to ameliorate the welfare of rural society is pertinent to improve rural infrastructures like good rural transportation system. The farmers' cooperative union aimed at helping farmers should also be established on areas far from the market place to avoid the need of farmers moving along distance to bring their output to market and to collect different inputs (Seeds, fertilizers, agricultural chemicals and others) from the market.

Family size was one of the significant demographic variables that affect the profit margin of common bean under smallholder-based production. It is difficult for farmers to support large family with limited production. Hence, the government and other stakeholders should work further in integrating family planning with health extension service in the study area.

The result further shows that it costs the farmers to travel a long distance to collect fertilizer. They spent more on the way of collecting fertilizer from market. Hence, promoting collective organizations like farmers cooperatives is crucial in lowering transaction costs and improving the bargaining power of farmers. Forming and joining effective producer groups, associations and networks help the smallholder farmers to improve their access to agricultural inputs, credit, extension services and market information.

On top of this, target market channel is one of the factors which significantly influence the profitability of smallholder common bean producers in central rift valley areas of Ethiopia. Thus, policies aimed at the improvement in rural infrastructures like construction and maintenance of roads connecting rural areas

with market and further establishment of farmers' cooperative union is important to avoid the exploitation of smallholder farmers by local assemblers and brokers in common bean marketing and help them to negotiate better prices for their product.

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