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Research Paper

Economics

Estimation and Analysis of Walnut Production Function in Kohgiloyeh Va Boyer-Ahmad Province

Saeid Mousavi Doctoral student, University of Mysore- India.

ABSTRACT

This study employed production functions to examine the factors effective on walnut production in Kohgiloyeh VA Boyer-Ahmad province. The cross-sectional data collected from 100 Walnut Growers by questionnaire with interview schedule. The variables of this study were Zulonfloo poison, labour, machinery, Iron fertilization, water and acreage. The Cob-Douglas production function selected as the most appropriate model to analyze the walnut production function. The result of this paper showed that Walnut growers have used the factors of production in the second area of production. The Findings also showed that the elasticity of factors production such as Zulonfloo poison, labour, machinery, Iron fertilization, water and acreage were 0.810, 0.169, 0.097, 0.212, 0.158 and 0.093 respectively. The result of Wald test showed that there is increase of Returns to scale (IRS) in walnut orchards of Kohgiloyeh VA Boyer-Ahmad province.

KEYWORDS : Cob-Douglas production function, transcendental production function, returns to scale and Elasticity of production

INTRODUCTION

Today, a wide range of world gardens is dedicated to the cultivation of walnuts. Walnut is one of horticultural products which has special place in Iranian's diet.it can use as fresh fruits and keep it in a long time. The specific climatic conditions of Kohgiloyeh va Boyer Ahmad province is suitable conditions for producing excellent quality of walnut. There are Facilities capable of actual or potential available in this province to increase the production of this crop by increasing the area under cultivation of it.

Absorbed of This product by domestic market is limited, so access the foreign markets is essential to enhance production. To achive the global markets while other countries like America, China and Turkey have a long history of exporting the product, without improving quality, reducing cost of production and export infrastructure would not be possible. Walnut exports directly led to an increase in employment in manufacturing and ancillary industries and indirectly led to growth, rural development, poverty reduction and to achieve sustainable development. These days, the government has supported the export of agricultural products. Therefore, economic analysis of the walnut production like cost, technical, economic and allocate efficiency, productivity of factor production and problems of export in third province which has ranks seventh of walnut production in the country is essential.

Walnut is one of the Iran's agricultural products that cultivated in some areas, such as Kohgiloyeh Va Boyer-Ahmad province which enjoys a comparative advantage. Therefore, determination of effective factors on the production of walnuts and estimation of walnut production function in Kohgiloyeh va Boyer-Ahmad province and the estimate of walnut production could be particularly important in this regard. The objectives of this paper are:

1. To determine the effective factors of production of walnut.
2. To consider the different region of walnut production function for different inputs.

Review of literature:

Cumbacaro (1994) examined the efficiency farmers using random sampling in India. Translog production function was estimated using maximum likelihood. The results of this study showed that the mean technical efficiency is 46/75 percent. Binam and et al (2004) determined the effective factors on technical efficiency of farmers in Cameroon forests and agricultural systems, including groundnut, maize and groundnut - maize using stochastic frontier Cobb - Douglas production function. The variables were acreage, labor, production costs, seeds and tools of production. The total observations of these systems were 450 farmers. The results showed that the average of technical efficiency of the systems were 77, 73 and 75 percent respectively. Oslo the result indicated that education, distance to roads, soil quality and join to agricultural communities and cash were had been affected on technical efficiency of farmers. Alvarez and Arias (2004) studied the relationship between technical efficiency and size of farm in the north of Spain during 1993 to 1998. In this paper production function was used which technical efficiency was used as one of their variables. The finding revealed that the influence of technical efficiency on size of farm depend on fixed inputs, inputs prices and price of variables. The results also indicated that there is positive relationship between farm size and technical efficiency. Barys and Robert (1994) have investigated the efficiency of rural farm in East Paraguay. Stochastic frontier production function has been used to determine efficiency of cotton and Sava. Their results showed that with current technology, there is a possibility of increasing profits. They stated the improvement of efficiency as a solution rather than increasing the acreage. Mirotchie and Taylor (1993) examined the allocation of resources in cereal production in Ethiopia using Translog production function. The finding concluded that using of fewer workers, new modern machinery and inputs can be more desirable. The result also has been reported Low elasticity of substitution between labor and new inputs. Kalirajan and Flinn (1983) estimated technical efficiency of production function in Malaysia. Stochastic frontier production function was used while the parameters of this model estimated maximum likelihood. The result showed that the average of technical efficiency was 75 percent. Jafarzadeh (1995) estimated wheat production function using annual time series data during 1980 to 1994 in Khorasan. The relevant data of this article was collected through questioner. The result showed that the best consumption of fertilizer were 235 kg in watery cultivation and 335 kg in rainy cultivation. The result also showed that rain has positive effects on productivity of wheat production. Karianpour (1996) has evaluated Tarom rice production function and have considered the effective factors on it in Babolsar using cross-sectional data. The variables were acreage, seeds, labour, fertilizer, poison, water, education and Planting time. Quadratic production function using weight linear square (WLS) were estimated. The results showed that partial elasticity of acreage, labour and seeds were 10, 34, and 4 percent respectively. Rostamiyan (2001) analyzed economical production of Kolza in Mazandaran. The data was collected through questionnaire. Cob-Douglas and transcendental production functions were estimated while Cob-Douglas was selected as the best model. The results showed that increasing of Kolza production up to increasing of acreage and other variables such as poison and fertilizer have effective significant on production of Kolza. Safavi (2005) estimated kiwi production function in mazandaran. Data of this paper was collected through questionnaire using systematic sampling method. Quadratic production function was selected as the best model to analyze the data. The result showed that the fertilizer, labour and acreage were used less than Optimal. Noroozi (2006) have considered the optimal Production function and technical efficiency of rice in Kohgiloyeh VA Boyer-Ahmad province. Data required of this study was cross-sectional which was collected through questionnaire and interview with farmers. Cob-Douglas and transcendental production functions were estimated while Cob-Douglas was selected as the best model. The result showed that the technical efficiency of farmers had been 67.01 percent.

Materials and Methods:
The cross-sectional data has collected from farmers of Kohgiloyeh va Boyer-Ahmad province and Agricultural Organization. To achieve the research objectives, the data required for this study were collected through questionnaire by the method of interview. The kind of question in the questionary is open. To ensure the validity of the questionnaire, the experts in this field will be used. To check the validity of the questionnaire, Cronbach's alpha test was used. In order to analyze the data and to estimate the models *EVEIWS* software package was used.

Methods of analysis:
After collecting the required data to achieve the research objectives, Cob-Douglas and transcendental production functions were estimated. Douglas and transcendental production functions are as follows respectively:

$$LNY_i = B_1 + B_2LNX_1 + B_3LNX_2 + B_4LNX_3 + B_5LNX_4 + B_6LNX_5 + B_7LNX_6 + U_i$$

$$LNY_i = B_1 + B_2LNX_1 + B_3LNX_2 + B_4LNX_3 + B_5LNX_4 + B_6LNX_5 + B_7LNX_6 + B_8X_1 + B_9X_2 + B_{10}X_3 + B_{11}X_4 + B_{12}X_5 + B_{13}X_6 + U_i$$

Where *Yi* is walnut production (in kg per), *X1* is Zolonfelo (in liter), *X2* is labour (in day), *X3* is machinery (in hour), *X4* is iron fertilizer (in kg), *X5* is water (in hour), *X6* is acreage (in hectare), *B1* to *B13* are estimated parameters and *Ui* is error term.

General F-test was used to select the best model between the estimated production functions as follow:

$$F = \frac{R^2_{UR} - R^2_R/M}{1 - R^2_{UR}/(N-K)}$$

Where is determination coefficient of the unconstrained model (larger), is determination coefficient of the constrained model (smaller), *M* is number of linear constraints, *N* is observations and *K* is parameters in the larger model. If the calculated *F* exceeds from the critical value (Table *F* and the degrees of freedom), we reject the null hypothesis, otherwise accept the unconstrained model.

Estimation of Cob-Douglas production function:
The cross-sectional data was used to estimate the Cob-Douglas production function. The estimation result of Cob-Douglas production function shows in table 1.

TABLE – 1 COB-DOUGLAS PRODUCTION FUNCTION

variables	Coefficient	t-statistics	Prob.
C	4.856	11.366	0.0000
LNX1	0.810	15.495	0.0000
LNX2	0.169	2.185	0.0314
LNX3	0.097	2.056	0.0426
LNX4	0.212	2.600	0.0108
LNX5	0.158	2.204	0.0229
LNX6	0.093	2.500	0.0142
R^2 = 0.79 F = 53.306 (0.0000) D-W = 2.035 N =100	AKIC =-0.040 SC = 0.141 SEE = 0.233		

Source: research findings

Now the econometric problems of regression like autocorrelation, multicolinearity, heteroscedasticity and specification error of the model are considered. Auxiliary regression test was used for detection of multicolinearity in the model which it indicated that calculated F for all variables were significant at 1% level and it was less than critical F (so there is no multicolinearity in the model. Heteroscedasticity is a problem in cross-sectional data. Arch and White test were used to detect hetroscedasticity which they confirmed that there is no heteroscedasticity in the model. For detection the existence of autocorrelation in the model, Durbin-Watson and LM test were used. DW, du and dl are 2.03, 1.826 and 1.528 respectively, 2 < 2.03 < 2.174 so there is no autocorrelation in the model at 5% level of significance. RESET Ramzi test was used for specification the mode. The calculated F equal 0.125 that rejected existence of error specification in the model. Determination coefficient of this model is 0.776 which shows 78 percent of Changes in the dependent variable has been explained by explanatory variables. The F of overall the regression is significant at 1% level of significance that indicated overall goodness of fit.

Estimation of Transcendental production function:
The estimation result of transcendental production function shows in table 2.

TABLE – 2 TRANSCENDENTAL PRODUCTION FUNCTION

variables	Coefficient	t-statistics	Prob.
C	4.582	2.369	0.02
LNX1	0.343	1.407	0.1630
LNX2	1.020	2.638	0.0099
LNX3	0.242	1.529	0.1296
LNX4	0.005	0.024	0.9809
LNX5	0.083	0.205	0.8379
LNX6	0.144	1.641	0.1044
X1	0.293	1.976	0.0512
X2	-0.051	-2.299	0.0238
X3	-0.026	-0.802	0.4243
X4	0.014	0.987	0.3268
X5	0.001	0.236	0.8140
X6	0.158	-0.638	0.5251
R^2 = 0.810 F =30.929 (0.0000) D-W = 2.151 N =100	AKIC =-0.021 SC = 0.317 SEE = 0.225		

Source: research findings

Now the econometric problems of regression like autocorrelation, multicolinearity, heteroscedasticity and specification error of the model are considered. Auxiliary regression test was used for detection of multicolinearity in the model which it indicated that calculated F for all variables were significant at 1% level and it was less than critical F (so there is no multicolinearity in the model. Heteroscedasticity is a problem in cross-sectional data. Arch and White test were used to detect hetroscedasticity which they confirmed that there is no heteroscedasticity in the model. For detection the existence of autocorrelation in the model, Durbin-Watson and LM test were used. DW, du and dl are 2.15, 1.84 and 1.27 respectively, 2 < 2.14 < 2.16 so there is no autocorrelation in the model at 5% level of significance. RESET Ramzi test was used for specification the mode. The calculated *F* equal 1.339 that rejected existence of error specification in the model. The result of histogram normality showed that *JB* is 1.54 which accepted normality of error term. Determination coefficient of the model is 0.81 which shows 81 percent of Changes in the dependent variable has been explained by explanatory variables. The *F* of overall the regression is significant at 1% level of significance that indicated overall goodness of fit.

Selection of the suitable model:
Different production functions were estimated to analyze the walnut production in Kohgiloyeh VA Boyer-Ahmad which Cob-Douglas and transcendental production functions were selected between them. Other functions have been rejected because was very low, insignificant variables and Non-compliance with the methodology. For comparison Cob-Douglas and transcendental production functions and to choice the more appropriate Model, *F* test was used as follows:

$$F = \frac{R^2_{UR}{}_{-}R^2_R/M}{1 - R^2_{UR}/(N-K)} = \frac{(0.810107 - 0.789991)/6}{(1 - 0.810107)/87} = 1.535$$

Calculated *F* (1.536) is less than critical $F(F_{0.05}\ (6,87) = 2.25)$ at 5% level of significance, therefore Cob-Douglas production function is preferred.

Elasticity of production:
After selection Cob-Douglas production function as the suitable function, is calculated Elasticity of production as follows:

$$E_p = \frac{dLNy}{dLNx}$$

The variables of this function were used as logarithm form, thus the coefficient of each variables are elasticity of its variable. The equation of this function is as follow:

$$LNY = 4.856 + 0.810LNX_1 + 0.169LNX_2 + 0.097LNX_3 + 0.212LNX_4 + 0.158LNX_5 + 0.09LNX_6 + U_i$$

According to the above equation, elasticities of production shows in table 3.

TABLE – 3 NPUTS ELASTICITY OF WALNUT PRODUCTION

Input		Coefficient
Zulonfloo poison	X1	0.810
labour	X2	0.169
machinery	X3	0.097
Iron fertilization	X4	0.212
water	X5	0.158
acreage	X6	0.093

Source: research findings

According to table 3, all coefficient are between 0 and 1 means Walnut growers have used the factors of production in the second area of production. The elasticity of factors production such as Zulonfloo poison, labour, machinery, Iron fertilization, water and acreage were 0.810, 0.169, 0.097, 0.212, 0.158 and 0.093 respectively. In other word, 1% increase in these factors causes 0.810, 0.169, 0.097, 0.212, 0.158 and 0.093 increases in product respectively.

Returns to scale:
Returns to scale are calculated from the whole elasticity in Cobb - Douglas production function.

E=0.810 + 0.169 + 0.097 + 0.212+ 0.158 + 0.093 = 1.539

The result of Wald test showed that there is increase of Returns to scale in walnut orchards of Kohgiloyeh VA Boyer-Ahmad province. Therefore Returns to scale is 1.539 means Increase of one percent of all production factors simultaneously causes 1.539 present increases in product.

Conclusion:
This study employed production functions to examine the factors effective on walnut production in Kohgiloyeh VA Boyer-Ahmad province. The cross-sectional data collected from 100 Walnut Growers by questionnaire with interview schedule. The variables of this study were Zulonfloo poison, labour, machinery, Iron fertilization, water and acreage. The Cob-Douglas and transcendental production functions were estimated. But Cob-Douglas production function selected as the most appropriate model to analyze the walnut production function. The result of this study showed that Walnut growers have used the factors of production in the second area of production. The Findings also showed that the elasticity of factors production such as Zulonfloo poison, labour, machinery, Iron fertilization, water and acreage were 0.810, 0.169, 0.097, 0.212, 0.158 and 0.093 respectively. Finally, the result of Wald test showed that there is an increase of Returns to scale (IRS) in walnut orchards of Kohgiloyeh VA Boyer-Ahmad province.

Population growth, change of consumption habits, increase of daily consumption and its diversity has impact on increase of agricultural production. Therefore quantitative analysis of production through amount of optimum factors production in agriculture is major agricultural policies which it can increase production by ideal consumption of accessible sources.

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