Greener Journal of Business and Management Studies
ISSN: 2276-7827 ICV 2012: 6.03

Submission Date: 03/06/014 Accepted: 12/08/014 Published: 13/08/014

Subject Area of Article: Agriculture

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Research Article

Carrot (*Daucus carota* L.) Farming Agribusiness of Efficiency Analysis and Supply Behavior at Bumiaji, Batu-Indonesia

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ABSTRACT

Batu city as an administrative region islocated in East Java. The level of productivity of carrots in Batu reached 17.94 tons/ha, harvested area reached 509 hectares and production reached 9,132 tons. The aims of the research are: (1) To analyze the allocation of carrot production factors in Bumiaji district of Batu city, (2) To analyze the efficiency level of carrot production factors in Bumiaji district of Batu city, (3)To analyze the return to scale of carrot production factors in Bumiaji district of Batu city; and (4) To analyze the factors that influence supply behaviour of carrots in Bumiaji district of Batu city. Production factors are a significant effect of seed, labor, and pesticides. Results NPMx/Px or the value of marginal productivity of each input (NPMxi) that indicatesefficiency level at an input price (Px) for seed is 4.19 > 1, so it is not efficient. NPMx/Px for the use of pesticides is equal to 0.84 < 1, so it is not efficient. NPMx/Px for labor is 2.63 > 1, so it is not efficient. Production function model shows that the elasticity is 0.905 on a constant return to scale. Three variables that significantly affect the supply behavior of carrots are the harvest area in time t, the real producer price of carrot in time t, and the real retailer price of carrot in time t. Suggestions that can be given are to address the optimal use of seeds that have not been added in the area of 1 hectare of 108.61 kg and 739.11 for labor HOK. Variables of the real fertilizer price in time t and the real pesticide price in time t are not significant to the level of supply behaviour. It is necessary to be reduced in implementation in their farm.

Keywords: Production, return to scale, elasticity, supply behavior.

I. INTRODUCTION

The Agricultural sector as a driving force in the development of the national economy is being implemented atvarious development programs and cross-cutting sectors (Ministry of Indonesian Agriculture, 2012). The agricultural sector broadly consists of several sub-sectors, namely food crops, horticulture, plantation, animal husbandry, and fisheries (Larsito, 2005; Giovannucci, 2012). Manalu (2007) and Barrett et al(2010) mentioned that one of the groups of horticultural commodities potential vegetable crops are carrots (*Daucus carota* L.).

The production center of carrot farming agribusiness is located in East Java. That has reached 7,198 hectares harvested area and production reached 142,241 tonnes, so in this case the obtained productivity was 19.76 tonnes/ha. Batu city as an administrative region located in East Java is a horticultural crop production center. Based on data from the Ministry of Indonesia (2012) Agricultural productivity level of carrots in Batu reached 17.94 tons/ha, harvested area reached 509 hectares, and production reached 9,132 tons.

From theempirical application in the field, farmers face a problem of utilizing various production factors which are not effective and efficient in carrots farming. Each farmer has a different pattern in the rules application of production factors used (Onyido, 2006; Serova, 2007). There are also the problems lack of knowledge, abilities, and skills of farmers in the use of the various factors of production so that it affects the results produced in carrot farming productivity.

The importance of this research study is on theanalysis of farming agribusiness efficiency and carrots supply behavior. Dawson and Dobson (2002), and IAAE (2012) mention that the use of production should be effective and efficient in order to produce optimum productivity. Meanwhile, the size of deals is affected by the amount of a commodity produced (Friyanti, 2008; Boehlje, 2012).

The aims of this study are (1) To Analyze the allocation of carrot production factors in Bumiaji district of Batu city, (2) To Analyze the efficiency level of carrots production factors in Bumiaji district of Batu city , (3) To

Analyze the return to scale of carrot production factors in Bumiaji district of Batu city; and (4) Analyze the factors that influence supply behavior of carrots in Bumiaji district of Batu city.

II. METHODOLOGY

2.1 Conceptual Framework

Carrot production by farmers affects some factors of production as part of the inputs that affect farming. The purpose of peasant farming carrots is to obtain a high production of carrots (maximized output) with the minimum cost (minimized inputs) so as to improve the economys. Basically, the farmers in the region have implemented effectively and efficiently, the management of carrots farming. The limitation factors of production are the allocation of inputs such as seed, fertilizer, labor,and pesticides, It has an effect on production and income in carrot farming.

As the theory of supply behavior is influenced by the level of commodity production,there are several factors that affect the carrot supply, which are the pesticide price, fertilizer price, harvest area, producer price, and retailer price. As one of the biggest carrot production centers in Indonesia, Batu became the main supplier for the domestic carrot.

Based on the theoretical basis that has been discussed, it can be a structured theoretical framework that shows the range of the correlation between input variables of business scale efficiency the behavior of the carrot farm. Thus this study will hopefully be useful to take measures regarding carrot farm development. This relationship can be seen in the figure below:

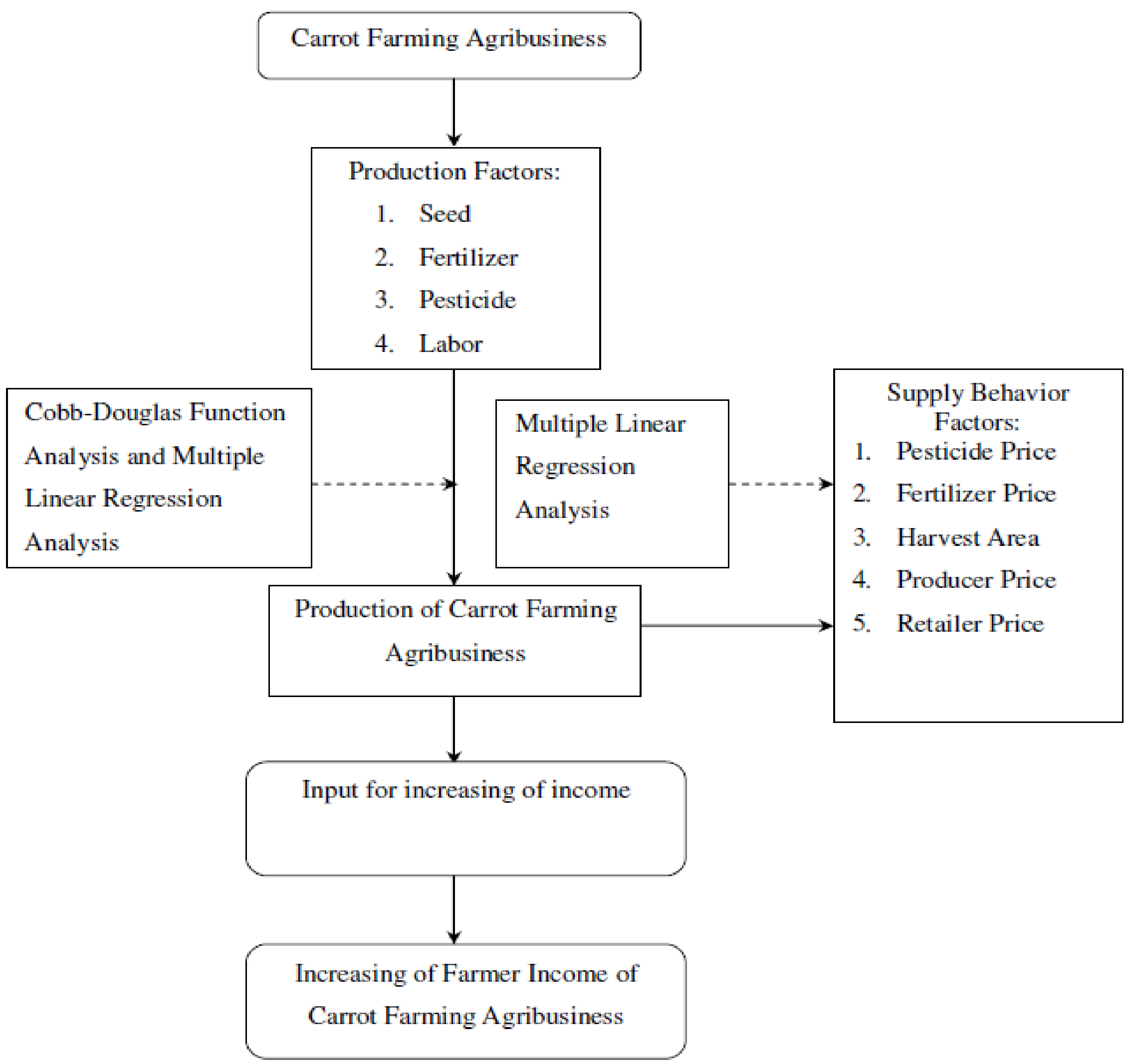

Figure 1: Flow Chart of Conceptual Framework.

Determining the research location was purposively conducted in Bumiaji district of Batu city. The determination of the research location was based on data from the Department of Agriculture and Forestry in Batu city (2012) which mentioned that research area is the center production of carrot commodity with achieving amount of land area and the largest production region compared with other districts in Batu city (Table 1).

Determining the research location mentioned thatthe set in Bumiaji district had nine villages and selected two villages as sample. The selection was purposively made from two villages namely, Sumber Brantas village and Tulungrejo village with consideration on the village that has the largest population of carrot farmers. Out of both villages were selected three hamlets from Sumber Brantas village and five hamlets from Tulungrejo village. From the selection of the two sample villages, each village was chosen and thena hamlet in the sample. The selection of the hamlet was based on the biggest carrot farmers population (Table 1).

Table 1: The number of Carrot Farmers in the research area

No	Village	Hamlet	∑ Farmer
1	Sumber Brantas	Jurangkwali	249
2	Tulungrejo	Junggo	379

Members of the population are selected at random, if the sample is selected,it can not be chosen again. The sample size is determined by the formula proposed by Parel et al. (1973) as follows:

$$n = \frac{NZ^2\sigma^2}{Nd^2 + Z^2\sigma^2} \quad \text{.........(1)}$$

where:

n : the minimum sample size
N : size of population
d : maximum tolerable error of 10%
Z : Z value at a certain confidence level, ie 90% (value = 1.645)
σ^2 : the value of population variance

Based on sample calculations that have been done, the obtained samples of carrot farmers were as many as 31 people in Jurangkwali Hamlet ofSumberbrantas village and 32 people in Junggo Hamlet of Tulungrejo village. The total number of samples in this research were 63 people.

2.2 Analysis of Carrot Production Factors

This model is transformed from a Cobb-Douglas function in the natural logarithm, the carrot production function model can be written as follows:

$LN\ Y = b_0 + b_1\ LNX1 + b_2\ LNX2 + b_3\ LNX3 + b_4\ LNX4 + u$..............................(2)

Description:

LN Y : Yield of carrot production (Kg) per growing season
LN X_1 : The amount of carrot seed (Kg) per growing season
LN X_2 : The amount of labor (HOK) or persons days of labor per growing season
LN X_3 : The amount of fertilizer (Kg) per growing season
LN X_4 : The amount of pesticide (Kg) per growing season
u : Disturbance

Based on Baklish and Hassan (2007), simple linear regression analysis will got the value of t-statistic, F-statistic, and R^2. Value of t-statistic are used to determine statistically whether the regression coefficients of each independent parameter (Xm) used are separately significant or not on dependent parameter (Y). If the t-statistic is smaller than the t-table, it means tested parameters did not significantly affect the independent parameters.

2.3 Analysis of Price Efficiency

Price efficiency associated with the success of farmers achieve maximum benefit in the short term, the efficiency achieved with equal value of marginal products are same with input prices (NPMx : Px or price efficiency index : ki : 1) (Rylko and Jolly, (2005). Nicholson (1995) and Serova (2007) mention that the price efficiency is achieved when the ratio between the marginal productivity value of each input (NPMxi) at a price inputya (vi) or ki : I. This condition requires NPMx equal to production factor price X or can be as follows:

$$\frac{by.py}{X.Px} = 1$$

Description:

by : Regression coefficient
py : Price of output production
X : Quantity of input production
Px: Price of input production

In fact many NPMx is not always the same as Px. What often happens is as follows (Soekartawi, 1990; Shagaida, 2004):

(NPMx / Px) > 1; meaning that X is efficient yet of inputs use, in order to achieve efficient X input needs to be added.
(NPMx / Px) < 1; meaning that X is not an efficient of inputs use, in order to achieve efficient X input needs to be decreased.

2.4 Analysis of Supply Behavior

Multiple linear regression analysis in this study is used to analyze the carrots supply behavior in Batu city. So the factors that influence carrot supply behavior are used as independent variables in this research. This includes; The real carrot fertilizer price in time t, The real pesticide price in time t, The carrot harvest area in time t, The real producer price of carrot in time t, and The real retailer price of carrot in time t.

$$LNQ_t = b0 + b1\ REFER_t + b2\ REPEST_t + b3\ HA_t + b4\ REPPC_t + b5\ RERPC_t + e$$

Where :

LNQ_t : The carrot production in time t
b0 : Constanta
b1-6 : Cofficient regression of explanatory
$LNREFER_t$: The real carrot fertilizer price in time t
$LNREPEST_t$: The real pesticide price in time t
$LNHA_t$: The carrot harvest area in time t
$LNREPPC_t$: The real producer price of carrot in time t
$RERPC_t$: The real retailer price of carrot in time t
e : Disturbance

III. RESULT AND DISCUSSION

3.1 Analysis of Carrot Production Factors

Statistical testing using a multiple regression model ordinary least squares method (Gujarati, 2010). Based on autocorrelation testing in the regression model obtained p value-obs *-square : 0.77 > 0.05 level. Based on these tests, it can be proved that in this regression, the model found no presence of autocorrelation. The testing of multicollinearity symptoms through EViews 6 program with partial correlation approach with the following stages:

$LN\ Y = b_0 + b_1\ LNX1 + b_2\ LNX2 + b_3\ LNX3 + b_4\ LNX4$................(1)

Then do the regression estimates for:

$LN\ X1 = b_0 + b_1\ LNX2 + b_2\ LNX3 + b_3\ LNX4$..(2)
$LN\ X2 = b_0 + b_1\ LNX1 + b_2\ LNX3 + b_3\ LNX4$..(3)
$LN\ X3 = b_0 + b_1\ LNX1 + b_2\ LNX2 + b_3\ LNX4$..(4)
$LN\ X4 = b_0 + b_1\ LNX1 + b_2\ LNX2 + b_3\ LNX3$..(5)

The results of statistical test for equation (1) obtained $AdjR^2$ is 95.24%; equation (2) obtained $AdjR^2$ is 92.35%; equation (3) obtained $AdjR^2$ is 93.36%; equation (4) obtained R^2 is 95.09%, and equation (5) R^2 obtained is 94.42%. Based on the analysis results obtained showed that the output value of equation 1 > 2, 3, 4, 5 then the model is not found multicollinearity. The test results gotten from heteroscedasticity symptom regression model were used to generate the p-value * obs-square : 0.96 > 0.05 level. Therefore, the regression model used no symptoms of heteroscedasticity. Normality test results obtained p value: 0.68 > 0.05 it can be said that the error term is normally distributed.

Table 2: Results of Regression Testing Carrot Production Factors

Variable	Coefficient	Error Standart	t-Statistic
Intercept	5.724	0.187	30.549
Seed	0.346	0.057	6.081 ***
Labor	0.381	0.077	4.991 ***
Fertilizer	0.023	0.013	1.699 *
Pesticide	0.155	0.046	3.405 ***
$AdjR^2$: 0.952			
F- Statistic : 311.324			
T-table : 2.66 (***significant with an error rate of 1%)			
T-table : 1.67 (*significant with an error rate of 10%)			

Based on table result , regression model is LN Y = 5.724 + 0.346 LNX1 + 0.381 LNX2 + 0.023LNX3 + 0.155LNX4

$AdjR^2$ value is equal to 0.952 which means that the model is able to explain the relationship between the production obtained by the respondents farmer with variable seed, fertilizer, labor, and pesticides by 95.2 %, while the remaining 4.8 % is explained by other factors that are not included in the model. The value of the F - statistic of 311.324 and a significant value of 0.000. F - table value with 99% confidence level (α : 0.01) in for df N1 : 4 and N2 : 58 at 3.36. From these results it can be concluded that the value of the F - statistic (311.324) > F - table (3.66), so that all independent variables that include seed, fertilizer, pesticide, and labor affects the dependent variables, namely carrot farming agribusiness. While the t-statistic is done by comparing the value of t-statistic with a value of t-table, with a 99 % confidence level (α : 0.01) and 90 % (α : 0.1). Degree of freedom (df) with the formula n - 1 by 62, the value of t - table value of 2.66 and 1.67.

Factor variable of seed namely total of carrot seed usage by farmers in farming agribusiness every growing season.Value of the regression coefficient on seed has a positive sign and the magnitude is 0.346 and the value of t-statistic is 6.081. T-statistic value is greater than the t-table that is 6.081 > 2.66 with an error rate of 1%. Regression coefficient of 0.346 indicates that the increased use of 1 kg seeds would increase production by 0.346 kg, as well as a reduced use of seed by 1 kg will decrease carrots production by 0.346 Kg.

Factor variable of labor, namely the usage in process of carrot farming agribusiness in a growing season starts from land preparation, planting, fertilizing, until harvest comes from within the family and outside the farmer's family. Value of the regression coefficient on labor has a positive sign and magnitude is 0.381 and the value of t-statistic 4.991. T-statistic values of 4.991 greater than t-table value of 2.66 with an error rate of 1%. Regression coefficient of 0.381 indicates that the increased use of labor by 1 HOK will increase production of 0.381 Kg of carrots, as well as a reduced use of labor by 1 HOK will decrease carrots production by 0.381 Kg.

Factor variable of fertilizer, namely; the amount of manure, urea, TSP or SP36, KCL, NPK, ZA. All of many kinds of fertilizers used on carrot farming agribusiness in particular land areas. Thevalue of the coefficient regression on fertilizer has a positive sign and magnitude of 0.023 and the value of t-statistic 1.699. T-statistic value is smaller than the t-table; 1.699 < 2.66 with an error of 1%. Regression coefficient of 0.038 Kg indicates that the increased use of fertilizer by 1 Kg will increase production by 0.023 Kg, as well as the reduced use of fertilizer by 1 Kg will decrease carrots production by 0.038 Kg.

Factor variable of pesticides, namely thematerials used to control and eradicate plant pests and diseases.Value of the regression coefficient on the pesticide has a positive sign and magnitude of 0.155 and the value of t-statistic 3.405. T-statistic value is greater than the t-table; 3.405 > 2.66 with an error rate of 1%. Regression coefficient of 0.155 indicates that the increased use of pesticides by 1 Kg will increase production by 1 Kg of 0.155 Kg, as well as a reduced use of pesticide by 1 Kg will decrease carrot production by 0.155 Kg.

3.2 Analysis of Price Efficiency

Price efficiency of production factors can be determined by calculating the ratio of NPM, an input with the price of each production input NPMx/Px. The formulation used in the analysis of the efficiency of these factors involves the regression coefficients derived from the Cobb-Douglas production function. Based on the analysis of Cobb-

Douglas production function, it is known that not all independent variables have a real influence on the carrots production. Variables of seed, labor, and pesticide have significant effects. The factors of production significantly affect the seed, labor, and pesticide.

Table 3: Analysis of Price Efficiency

No	Production Factors	Bix	Y	PY	X	Px	NPMx	NPMx/ Px
1	Seed	0.346	23278.94	2,500	25	185,400	777.76	4.19
2	Labor	0.381	23278.94	2,500	280	30,000	79.114	2.63
3	Pesticide	0.155	23278.94	2,500	47	223,450	189.42	0.84

Based on the results of analysis NPMx/P, the seeds used of 4.19 > 1, so the use of carrot seeds in the research area has not been efficient. In order for the optimal use of seeds, it is necessary to increase the use of seeds to increase production and income of farmers. So that addition to the optimal use of seeds reached 108.61 kg.

Based on the results of analysis NPMx/Px, the labor used is 2.63 > 1, so the use of labor in the farming HOK 280.27 a carrot ranging from land preparation, planting, fertilizing, weeding, and thinning, spraying, watering until harvest is yet efficient. From the addition of the optimal labor utilization reached 739.11 HOK.

Based on the results of analysis NPMx/P, the pesticides used for 0.84 < 1, so the use of pesticides in the research area is not efficient. This suggests that the use of pesticides at 47.62 kg / hectare in carrot farming in the research area is not efficient. The use of pesticides may be optimal if farmers reduce pesticide use by 7.26 Kg. Therefore the use of pesticides to achieve optimal for 40.36 Kg, so as to increase production and income of farmers in the research area.

3.3 Analysis of Return to Scale

Based on the sum of the production elasticities obtained, there are three possibilities for return to scale, namely: (1) Increasing returns to scale, (2) Constant returns to scale, and (3) Decreasing returns to scale.

Table 4: Value of return to scale

No	Production Factor	Regression Coefficient
1	Seed	0.346
2	Labor	0.381
3	Fertilizer	0.023
4	Pesticide	0.155
	Return to Scale	0.905

Based on the production function model obtained, it shows that the total value of production elasticity is 0.905 which means farming agribusiness hike was on a decreasing returns to scale. This value means that the rate of production is less than the rate of production factors. Elastistas production value of 0.905 indicates that each additional 1 unit of factors of production will lead to a reduction in production by 0.905 units.

3.4 Analysis of Supply Behavior

3.4.1. Unit Root Test

Supply behavior uses two kinds of unit root tests for non-stationaries in carrot data series. In statistics, a unit root test tests whether a time series variable is non-stationary using an autoregressive model. Unit root and stationarity test statistic have nonstandard and abnormal asymptotic distributions under their respective null hypothesis. To complicate matters futher, the limiting distributions of the test statistics are affected by the inclusion of deterministic terms in the test regressions. These distributions are functions of standart Brownia notion that critical values must be tabulated by simulation techniques.

Unit root tests on the data were evaluated. Table 5 presents the result of the Augmented Dickey Fuller (ADF) test and the Philips-Perron (PP) test with intercept and trend. The various unit root test indicates that the real price pesticide in time t ($REPEST_t$), the real price fertilizer in time t ($REFER_t$), the harvest area in time t (HA_t), the real producer price of carrot in time t (PPC_t), and the real retailer price of carrot in time t (RPC_t) remain non-stationary in level, while in the first differences are stationary.

Table 5: Unit Root Test

Variables	Augmented Dicky Fuller (With Intercept)		Augmented Dicky Fuller (With Intercept and Trend)		Philip Pheron (With Intercept)		Philip Pheron (With Intercept and Trend)	
Original Data								
Harvest Area	-1.2171	[0.6525]	-3.5333	[0.0544]*	-1.9225	[0.3178]	-3.5671	[0.0507]*
Production	0.0479	[0.9557]	-2.1563	[0.4947]	0.2424	[0.9707]	-2.2547	[0.4437]
Real Fertilizer Price	-1.2107	[0.6559]	-3.3796	[0.0739]*	-0.8601	[0.7863]	-3.3238	[0.0823]
Real Pesticide Price	-1.4216	[0.5579]	-1.9505	[0.6027]	-1.4119	[0.5626]	-1.9362	[0.6101]
Real Producer Price of Carrot	-0.6997	[0.8315]	-2.0755	[0.5372]	-0.6721	[0.8385]	-2.0882	[0.5305]
Real Retail Price of Carrot	-1.3972	[0.5698]	-1.1078	[0.9103]	-1.3668	[0.5844]	-1.0336	[0.9232]
First Difference								
Harvest Area	-7.9643	[0.0000] ***	-7.8441	[0.0000] ***	-9.7653	[0.0000] ***	-12.387	[0.0000] ***
Production	-6.4974	[0.0000] ***	-6.3583	[0.0001] ***	-6.4331	[0.0000] ***	-6.3033	[0.0001] ***
Real Fertilizer Price	-8.9996	[0.0000] ***	-9.0894	[0.0000] ***	-8.5817	[0.0000] ***	-8.6210	[0.0000] ***
Real Pesticide Price	-5.5543	[0.0001] ***	-5.5197	[0.0006] ***	-5.5543	[0.0001] ***	-5.5179	[0.0006] ***
Real Producer Price of Carrot	-5.5879	[0.0001] ***	-5.4596	[0.0007] ***	-5.5869	[0.0001] ***	-5.4588	[0.0007] ***
Real Retail Price of Carrot	-5.7630	[0.0001] ***	-5.9854	[0.0002] ***	-5.7549	[0.0001] ***	-5.9746	[0.0002] ***
Logarithm								
Log Harvest Area	-1.4082	[0.5639]	-3.3592	[0.0769]*	-2.2272	[0.2015]	-3.8399	[0.0286]**
Log Production	-0.7698	[0.8127]	-3.7986	[0.0312]**	-0.6727	[0.8383]	-2.9838	[0.1535]
Log Real Fertilizer Price	-2.4470	[0.1384]	-2.7096	[0.2402]	-2.5609	[0.1124]	-3.1547	[0.1132]
Log Real Pesticide Price	-1.0751	[0.7112]	-1.8950	[0.6313]	-0.8616	[0.7858]	-1.9329	[0.6118]
Log Real Producer Price of Carrot	-0.6640	[0.8405]	-2.9380	[0.1660]	-0.7336	[0.8226]	-2.7116	[0.2395]
Log Real Retail Price of Carrot	-0.6640	[0.8405]	-2.7096	[0.2402]	-0.7336	[0.8226]	-2.7116	[0.2395]
First Difference								
Log Harvest Area	-8.2032	[0.0000] ***	-8.0624	[0.0000] ***	-10.485	[0.0000] ***	-12.704	[0.0000] ***
Log Production	-6.8758	[0.0000] ***	-4.9453	[0.0033] ***	-6.7723	[0.0000] ***	-6.7180	[0.0000] ***
Log Real Fertilizer Price	-11.285	[0.0000] ***	-13.441	[0.0000] ***	-10.279	[0.0000] ***	-13.049	[0.0000] ***
Log Real Pesticide Price	-4.6984	[0.0008] ***	-4.6257	[0.0050] ***	-4.6626	[0.0009] ***	-4.5890	[0.0054] ***
Log Real Producer Price of Carrot	-6.2635	[0.0000] ***	-6.1058	[0.0001] ***	-9.8639	[0.0000] ***	-9.1461	[0.0000] ***
Log Real Retail Price of Carrot	-6.2635	[0.0000] ***	-6.1058	[0.0001] ***	-9.8639	[0.0000] ***	-9.1461	[0.0000] ***

Note Figures in square brackets [ ] are the significance level of residual test statistics. *t statistics significant level at 10%; **t statistic significant level at 5%; ***t statistic significant level at 1%

3.4.2. Test of Classical Assumption

A series of tests can be done so that the regression equation is established to meet the requirements of Best Linear Unbiased Estimator (BLUE), that is normality test, multicollinearity symptom test, heteroscedastisity symptoms test, and autocorrelation symptoms test. Based on tests performed on the regression model obtained p value-obs *-square : 0.55 > 0.05 level. Based on these tests, it can be proven that in this regression model found, there is no presence of autocorrelation.

Multicollinieritas testing phase through EViews 6 program partial correlation approach with the following stages:

$$LNQt = b_0+b_1REFER_t+b_2REPEST_t+b_3HA_t+b_4REPPC_t+b_5\ RERPC_t \text{.................................(1)}$$

Then do the regression estimates for:

$$LNREFER_t = b_0+b_1\ LNREPEST_t+b_2\ LNHA_t+b_3\ LNREPPC_t +b_4\ LNRERPC_t \text{................. (2)}$$
$$LNREPEST_t = b_0+b_1LNREFER_t+b_2LNHA_t+b_3LNREPPC_t+b_4LNRERPC_t \text{.......................(3)}$$
$$LNHA_t = b_0+b_1LNREFER_t+b_2LNREPEST_t+b_3LNREPPC_t+b_4\ LNRERPC_t \text{......................(4)}$$
$$LNREPPC_t = b_0+b_1LNREFER_t+b_2LNREPEST_t+b_3LNHA_t+b_4\ LNRERPC_t \text{.....................(5)}$$
$$LNRERPC_t = b_0+b_1LNREFER_t+b_2LNREPEST_t+b_3LNHA_t+b_4\ LNREPPC_t \text{.....................(6)}$$

The results of the statistical test results for equation (1) obtained $AdjR^2$ is 92%; equation (2) obtained $AdjR^2$ is 91.18%; equation (3) obtained $AdjR^2$ is 52.11%; equation (4) obtained $AdjR^2$ is 36.58%; equation (5) obtained $AdjR^2$ is 91.09%; equation and (6) obtained $AdjR^2$ is 19.6%. Based on the analysis results obtained, it showed that the output value of equation 1 > 2, 3, 4, 5, 6, then the model is not found multicollinearity.

The results of heteroscedasticity symptom against regression model used to generate the p-value * obs-square : 0.26 > 0.05. Therefore, it can be concluded that the variables used in the regression model show no symptoms of heteroscedasticity. While the model test results obtained p value : 0.58 > 0.05. So the conclusion is that, at the 95% confidence level, it can be said that the error term is normally distributed.

3.4.3. Testing of Estimators Model

Testing of estimator model is used to determine if the models are correct estimators for estimating the parameters and functions. The results of test analysis using five independent variables (that real price pesticide in time t ($REPEST_t$), the real price fertilizer in time t ($REFER_t$), the harvest area in time t (HA_t), the real producer price of carrot in time t (PPC_t), and the real retailer price of carrot in time t (RPC_t), and the dependent variable is the carrot production (Q_t). Here are the results of analysis in testing the model of supply behavior models.

Table 6: Results of Regression Test Supply Behavior

Variables	Coefficient	Std. Error	t-Statistic
Intercepts	7.265	1.356	5.358
The real pesticide price in time t	-0.001	0.000	-5.989
The real fertilizer price in time t	-0.120	0.058	-2.083
The harvest area in time t	0.310	0.154	2.004**
The real producer price of carrot in time t	0.358	0.099	3.591*
The real retailer price of carrot in time t	0.098	0.054	1.824**
$AdjR^2$ = 0.920			
F-Statistic = 67.745			
T-table = 2.064 (**significant error rate 5%)			
T-table = 1.711 (*significant error rate 10%)			

The third variables are the harvest area in time t, the real producer price of carrot in time t, and the real retailer price of carrot in time t. Based on the result table, regression model is LN Y = 7.265 - 0.001 LNREPEST - 0.120 LNX2 + 0.310LNHA + 0.358LNPPC + 0.098 LNRPC.

Based on the obtained regression models, it is known that the value of $AdjR^2$ is equal to 0.920 which means that the model is able to explain the relationship between the production obtained by the farmer respondents with variables of the real pesticide price in time t, the real fertilizer price in time t, the harvest area in time t, the real producer price of carrot in time t, and the real retailer price of carrot in time t amounted to 92%, while the remaining 8 % is explained by other factors that are not included in the model.

Based on the F-statistic by processing the data using EViews 6 program, the value of the F-statistic of 67.745 and a significance value 0.000. F-table value with 99% confidence level (α : 0.01) in for df N1 : 5 and df N2 : 24 at 2.62. From these results it can be concluded that the value of F-statistic (67.74) > F-table (3.90) , so that all independent variables that include variables of the real pesticide price in time t, the real fertilizer price in time t, the harvest area in time t, the real producer price of carrot in time t, and the real retailer price of carrot in time t affects the dependent variables namely the carrot production in time t.

T-statistic is done by comparing the value of the t-statistic and t-table, with a 95% confidence level (α : 0.5) and 90% (α : 0.10). Degree of freedom (df) with the formula n-1 by 62, the value of t-table by 2.064 and 1.711. The results of the regression analysis of independent variables that affect the production of carrot farming can be seen in Table 5.

Factor variable of the real pesticide price in time t namely relative price or pesticide price of deflation average (real price) in Batu city. The level of confidence (95%) for the value of t-statistic is smaller than t-table (-5,989 < 2,045). It means that the real pesticide price in time t variable is not significant and has a negative relationship to carrot supply in Batu city. Variable of the real pesticide price in time t has regression coefficient of -0,555, this suggests that given its negative effect, each additional price of 1 IDR/Kg will reduce carrot supply in Batu city untilit's down to 0.555 Kg.

Factor variable of the real fertilizer price in time t, namely the relative price or fertilizer price of deflation average (real price) in Batu city The level of confidence (95%) for the value of t-statistic is smaller than t-table (-2.083 < 2.045). It means that the real fertilizer price in time t variable is not significant and has a negative relationship to carrot supply in Batu city. Variable of the real fertilizer price in time t has regression coefficient of -0.939, this suggests that given its negative effect, each additional price of 1 IDR/Kg will reduce carrot supply in Batu city until it's down to 0.939 Kg.

Factor variable of the harvest area in time t, namely the amount of harvest area and produce of carrot during this year in Batu city.The level of confidence (90%) for the value of t-statistic is bigger than t-table (2.003 > 1.311). It means that the harvest area in time t variable is significant and has a positive relationship on carrot supply in Batu city. The variable of the harvest area in time t has regression coefficient of 3.572, this suggests that given its positive effect, each additional price of 1 IDR/Kg will increase carrot supply in Batu city until it reaches up to 3.572 Kg.

Factor variable of the real producer price of carrot in time t namely relative price or producer price of deflation average (real price) in Batu city. The level of confidence (95%) for the value of t-statistic is bigger than t-table (3,591 < 2.045). It means that the real producer price of carrot in time t variable is significant and have a positive relationship to carrot supply in Batu city. The variable of the real producer price of carrot in time t has regression coefficient of 4,584, this suggests that given its positive effect, each additional price of 1 IDR/Kg will increase carrot supply in Batu city until it reaches up to 4,584 Kg.

Factor variable of the real retailer price of carrot in time t namely relative price or retailer price of deflation average (real price) in Batu city. The level of confidence (90%) for the value of t-statistic is bigger than t-table (3.591 < 2.045). It means that the real retailer price of carrot in time t variable is significant and have a positive relationship to carrot supply in Batu city. Thevariable of the real producer price of carrot in time t has regression coefficient of 4,584, this suggests that given its positive effect, each additional price of 1 IDR/Kg will increase the carrot supply in Batu city until it reaches up to 4.584 Kg.

IV. CONCLUSION AND SUGGESTION

4.1 Conclusion

Factors that influence carrot farming agribusiness are seed, pesticide, and labor. For the factor have a positive sign. High quality seeds give higher carrot production. Therefore farmers in reseach area use high quality seed before using pesticide to protect carrot from pests and diseases. Usage of intensive pesticide would increase a carrot harvest. Carrot production is influence by labor quality. Increasing of labor quality such as time,work and higher skills would increase carrot production.

Price efficiency of seed is effective with capital as a barrier,. Therefore farmers would decrease seed usage in order to minimize cost production. So that carrot production would be decreased in harvest time. Price efficiency of labor has not been efficient yet. Labor in carrot farming areas come from the farmer's family. Increasing usage of labor not only consists of the farmer's family but, also non-members of the farmer's family, which would improve labor for carrot farming. Price efficiency of pesticide is inefficient. The usage of pesticide in research area by the farmer are intensive and even not measured with dosage recommendation. So, that made it a higher cost production.

Elasticity production has a condition of decreasing return to scale. This means production added smaller than production factors added. So that, the farmer has to increase production factors such as are seed, fertilizer, labor, and pesticide.

Factors that influence carrot supply behavior are the real producer price in time t, the harvest area in time t, and the real retailer price in time t which have a positive sign. Carrot price in producer and retailer to be increased would stimulate thefarmers' increase in their carrot production, so carrot supply would be increased too. One way to increase the amount of carrot production is increasing carrot harvest area. Therefore, the condition would increase carrot supply. While the real pesticide price in time t and the real fertilizer in time t have negative signs. This is because, in carrot farming areas there are excessive usage of inputs such as fertilizers and pesticides. Prices of pesticides and fertilizers for the previous year are more expensive, so the farmer would decrease their input, and given the reason for decreasing carrot production, the carrot supply would be small.

4.2 Suggestion

For farmers to solve the unoptimal usage of carrot seeds, they can increase the use of seed of 1 hectare optimal to 108.61 kg. While the use of labor needs to be added in the area of 1 hectare maximum of 739.11 HOK. 2.For the government through the department of agriculture in Batu, there is related need for agricultural extension carrot cultivation. Later, in the research area of intensive use of pesticides,. optimal use of pesticides per hectare in one cropping season was 39.84 kg.

COMPETING INTERESTS

Authors have no competing interest to declare.

AUTHORS' CONTRIBUTIONS

All authors contributed to this work. Andrean Eka Hardana participated in drafting the article, analysis data, interpretation of data, and also designed the manuscript. Yeong-Shenn Lin, Abdul Wahib Muhaimin, and Syafrial participated in revising critically for important intellectual content and gave final approval of the version to be submitted and any revised version

V. REFFERENCES

Baklish and Hassan S (2007). Relationship between Technical Efficiency and Managerial Ability: Evidence from Punjab, Pakistan. Faculty Working Paper, Department of Environmental and Resource Economics, University of Agriculture, Faisalabad, Pakistan.

Barrett CB, Bachke ME, Bellemare MF, Michelson HC, Narayanan S and Walker TF (2010). "Smallholder Participation in Agricultural Value Chains: Comparative Evidence from Three Continents."MPRA Paper, University Library of Munich. Econpapers, http://econpapers.repec. org/RePEc: pra:mprapa:27829, accessed July 2011.

Boehlje M (2012). Mid-West Food and Agribusiness Executive Seminar.

Dawson P and Dobson S (2002). Managerial Efficiency and Human Capital: An Application to English Association Football. Managerial and Decision Economics, 23 (8): 471-486.

Fariyanti A (2008). Perilaku ekonomi rumah tangga petani sayuran dalam menghadapi risiko produksi dan harga produk di Kecamatan Pangalengan Kabupaten Bandung disertasi. Institute of Bogor Agriculture. Bogor- Indonesia.

Giovannucci D (2012). Food and Agriculture: the future of sustainability. United Nations Department of Economic and Social Affairs, Division for Sustainable Development.

Gujarati D (2010). Dasar – dasar ekonometrika. Salemba Empat. Jakarta.

International Association of Agricultural Economists (IAAE) (2012). Triennial Conference: Water and Food in the Bioeconomy- Challenges and Opportunities for Development; Foz do Iguacu, Brazil.

Larsito S (2005). Analisis Keuntungan Usahatani Tembakau Rakyat dan Efisiensi Ekonomi Relatif Menurut Skala Luas Lahan Garapan. Thesis. Diponegoro university. Semarang-Indonesia.

Manalu H (2007). Analisis Finansial Usahatani Wortel. Skripsi. Departemen Sosial Ekonomi Pertanian Studi Kasus Desa Sukadame Kecamatan Tigapanah Kabupaten Karo. Bachelor Thesis. Agriculture Faculty. University of North Sumatra. Medan-Indonesia.

Nicholson W (1995). Teori Mikro Ekonomi, Prinsip Dasar dan Perluasan, Alih Bahasa :Daniel Wirajaya, Edisi ke 5, Binarupa Aksara, Jakarta-Indonesia.

Onyido I (2006). Leveraging Research on Productivity and Efficiency. An Invited paper delivered at the 5th Agricultural summit of the Nigerian Economic Summit group held at the Le Meridian Hotel on 9th Nov.

Rylko, D. and Jolly, R.M. (2005). Development of Agroholdings in Russian Agriculture. Comparative Economic Studies. Volume 47, #(1): , pp.115–126.

Serova EU (2007). Vertical Integration in Russian Agriculture. In: Global Supply Chains. Standards and the Poor: How the Globalization of Food Systems and Standards Affects Rural Development and Poverty. Ed. J.Swinnen. CABI.

Shagaida N (2004). Agricultural Land Market in Russia: Living with Constraints. Comparative Economic Studies. 47(1): 1–14.

Soekartawi (1990). Teori Ekonomi Produksi dengan Pokok Bahasan Analisis Fungsi Cobb-Douglas.Rajawali Press, Jakarta.

Cite this Article: Hardana AE, Yeong-Shenn L, Muhaimin AW, Syafrial D, 2014. Carrot (*Daucus carota* L.) Farming Agribusiness of Efficiency Analysis and Supply Behavior at Bumiaji, Batu-Indonesia. Greener Journal of Business and Management Studies, 4 (3): 092-102.