



MEASUREMENT THE RELATIVE ECONOMIC EFFICIENCY AND ESTIMATING THE DUAL PRODUCTION FUNCTION FOR PROJECTS OF TABLE EGGS PRODUCTION IN DIYALA GOVERNORATE USING A NORMLIZED PROFIT FUNCTION

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Abstract

The objective of the research was to measure the relative economic efficiency of the egg production projects and to estimate dual production function through a normalized profit function. The study used cross-section data according to the comprehensive inventory method consist (44) of farmers from Diyala Province A year of productivity 2018. The results of the quantitative analysis of the estimate of the a normalized profit function showed that the double logarithmic model is the most suitable for the relationship adopted in the study to express the relationship between the a normalized profit from the egg production farms as a dependent variable and the relative variable inputs (labor price, feed price, value of medicines and vaccines) and dummy variable (D), which represents the size of the farm. If we give one number to large farms, more than 10 thousand birds and zero for 10 thousand birds or less, in order to measure the relative economic efficiency of the table egg farmers. It was found that the large farms are relatively more efficient economically compared to small farms based on the positive and moral significance of the variable (farm size). The study concluded that the coefficients of the dual production function were estimated. Medicines and vaccines and the number of productive birds that have not achieved technical efficiency in use . Accordingly, the value of the return of scale (0.977) was determined, the large farms achieved decreasing returns. When calculating allocative efficiency (price), the resources used in producing the table eggs were not used optimally, which means there was surplus and inability to use the resources profit from farms producing table eggs. The study concluded that the size of the farm has a positive relationship with the relative economic efficiency of Projects of Table Eggs Production and therefore reflected in decreasing returns for the studied projects.

Key words: table eggs, relative economic efficiency, a normalized profit function, dual production function.

Introduction

The realization of the principle of economic efficiency in the use of available resources has become an issue of concern to economists in recent times as a prerequisite for achieving comprehensive economic development around the world in order to obtain the best level of production and thus high productivity and thus self-sufficiency, especially in developing countries, It relies heavily on the importation of foodstuffs in general and the production of table eggs in particular to meet the requirements of the people. This is a threat to its food security on the one hand and negatively affects the trade balance and drains its resources from the foreign currency on the one hand. Iraq is still producing 45.7%

of its domestic consumption of 89.9 thousand tons. It is the 18th largest importer of table eggs in the world. The total imports reached about 48.8 thousand tons with a value of 91.7 million tons. Million dollars, and the first place in the import of table eggs from Turkey, which reached a contribution rate of volume (www.tridge.com), (AOAD, 2017). Despite the fact that Iraq has the potential and human resources and natural resources, which makes it able to achieve self-sufficiency and this is due to the deterioration of the poultry industry for the production of table eggs, especially after the cessation or weakness of government support for the poultry industry after a year (2003) and stopped many poultry fields and some began work But not at full production capacity. The producers thought they could provide some of the production costs

and boost their profits, including Diyala. Hence, the researchers' interest in this problem and their direct relationship with the analysis of the expected effects of price and production policies and how to deal with production deficit and determine the amount of resources used and determine the relationship between levels of efficiency and size of existing farms and in the form that helps the producer to formulate and develop plans for the development and future of these projects. As well as the lack of library studies of economic analysis of the levels of efficiency of those projects livestock in general and egg production projects in particular, so this study was conducted to assess the performance of producers and to determine the level of economic use of available resources and the extent of the distance and approach of the use of table eggs and determine the levels of economic efficiency has been selected Diyala province as an applied model and started the hypothesis of research that the size of the farm has an impact on the re-Achieving economic returns and the objective of this research is to measure the relative economic efficiency of the production of table eggs and to estimate the binary production function and calculate their economic derivatives by using a normalized profit function method that works to achieve the requirements of economic efficiency because it represents a combination of technical and allocative efficiency in the profit relationship. This model calculates price efficiency and technical efficiency in one. The profit function method takes into account variations in technical efficiency, custom efficiency and effective prices to test the economic efficiency differences between groups, through which demand functions can be derived from resources and the resulting supply directly (Lema, 2013, :31-32). The a normalized profit function has the advantage of measuring the degree of return of scale through the sum of the parameters of the fixed output factors (the effects on the assets, the interest on the capital, the rents and the capacity of the plant or farm (Yotopoulos and Lau, 1973). The subject of measuring the relative economic efficiency through the modified profit function is a prominent position among economic researchers. The researchers have been interested in this concept through several studies to measure the relative economic efficiency of the farms in India using the modified profit function method, as published by Olusola and others in 2014 in search of farm size The relative efficiency of the production of meat breeds in southwestern Nigeria, Rahji and others published in 2015 an economic study on farm size and relative economic efficiency in egg production in southwestern Nigeria, in addition to a number of researchers interested in measuring relative economic efficiency such as, (Garci and other, 1982, :119) (Ume and others, 2016, :482-50) (Khan and Maki, 1980, :54) (Pudasain, 1981, :3).

Materials and Methods

The study used cross-section data according to the comprehensive inventory method consist (44) of fields in Diyala Governorate for the year 2018. Statistical data were collected through interviews with producers, which included different information on production, costs, number of fields and number of production birds, for quantitative analysis, the Ordinary Least Square (OLS) method was used to estimate the parameters of the a normalized profit function, such as to measure the relative economic efficiency of the white projects and on the basis of which the dual production function was derived using the Duality Approach.

Results and Discussion

Estimation A normalized Profit Function for of Table Eggs Production with Dummy Variable (farm size)

Various formulas were studied to determine the appropriate relationship to the variables included in the mathematical form of a normalized profit function. The double logarithmic formula was adopted and is subject to tests (economic, statistical and standard) (Yotopoulos and Lau, 1971, 1972, 1973). As follows:

$$\ln \Pi = \ln A + b_1 \ln r_1 + b_2 \ln r_2 + b_3 \ln r_3 + \beta_1 \ln Z_1 + \beta_2 \ln Z_2 + D + U_i \quad (1)$$

Π : represents the a normalized profit that is the actual yield of the eggs of the table eggs obtained from (total revenue - total variable costs) / unit price of the product (the price of the egg layer) estimated in the dinar.

r_1 : represents the relative labor price (man-hour) that is calculated by dividing the total wage paid for family work and the lessor by the number of human working hours and dividing the result by the unit price of the product (the price of the egg layer).

r_2 : represents the relative feed price (kg) that is calculated by dividing the total feed costs by the total feed quantity and then dividing the result by the unit price of the product (egg layer price).

r_3 : represents the price of medicines and vaccines that is calculated by dividing the total cost of medicines and vaccines per bird on the unit price of the product (the price of egg layer).

Z_1 : represents the number of productive birds.

Z_2 : represents costs of fixed factors that included costs of interest on capital and exchange allowance of the field is estimated in dinar.

D : Dummy variable (farm size).

A : Static function.

B_i, β : function parameters.

U_i : represents the random variable and reflects the effect of variables of the other relevant and which did not enter the model directly and difficult to quantify and quantify.

Measuring Relative Economic Efficiency by using A normalized Profit Function

To measure the relative economic efficiency of table egg farmers, Dummy Variable will be included in a normalized profit function with the same explanatory factors. The dummy variable represents the size of the farm by giving one number to large farms larger than 10,000 birds and zero for 10,000 birds or less.

Testing Hypotheses

The relative economic efficiency of table egg farmers will be tested based on the null hypothesis and the alternative hypothesis as follows:

The Null Hypothesis (H_0): The null hypothesis is that there are no significant differences between large and small farms in terms of relative economic efficiency (*i.e.*, farm efficiency equals).

The Alternative Hypothesis (HI): The alternative hypothesis is that there are significant differences between large and small farms in terms of relative economic efficiency (*i.e.*, unequal farm efficiency). The double logarithmic profit function was estimated using Dummy Variable and found to be consistent with economic logic and passed the statistical and standard tests as in table 1 and equation 2:

$$\ln = -14.157 - 0.208\ln r_1 - 2.32\ln r_2 + 0.134\ln r_3 - 0.582\ln Z_1 + 1.502\ln Z_2 + 0.288D \quad (2)$$

$\ln \Pi$: Represents a normalized profit function that is used to measure the relative economic efficiency of the table egg production farms in Diyala Governorate.

Statistical Analysis

The statistical analysis showed that all the variables were significant for the t-test at 0.05 and 0.01, which can be used to estimate the relationship between the a normalized profit and the independent variables. If the estimated relative labor price was significant at 5%, the remaining estimated transactions were statistically significant at Level (1%). A comparison of the calculated F value of the estimated function of 380.689 with the statistical value of F at a statistical level (1%) showed that the model is highly significant, which reflects the importance of the variables included in the function on the one hand and the reality of the function on the other. Variable (farm size) has become highly significant compared to the modified profit function before Dummy Variable input. The value of the determination factor was 0.98 in the function, which reflects the quality of the regression line. It is clear that 98% of the changes in the a normalized profit value are attributable to the explanatory variables studied, while 2% of the changes in the a normalized profit value were the result of other factors not included in the model the random variable was absorbed. We conclude from the statistical analysis that the statistical significance of the phantom variable (farm size) confirms that there are significant differences between small and large farms. This means accepting the alternative hypothesis and rejecting the null hypothesis.

Standard Analysis

First : Autocorrelation of Problem : The model showed the absence of the problem of self-correlation in the estimated model that the calculated value of D was in the acceptance area of the null hypothesis, that D equals 1.959 and from the DW table to a significant level of 5% and degrees of freedom (44).

$$du < D < -du = 1.835 < 1.997 < 2.165$$

From this we conclude that there is no positive or negative self-correlation of the random variable of the first order.

Second : Heteroscedasticity of problem: To detect the existence of the problem of homogeneity, the Park test, which includes the estimation of the error square slope equation, was adopted as a dependent variable of the independent variables (r_1, r_2, r_3, Z_1, Z_2) and independent variables (Gujarati, 2004).

Table 1: Results of the Estimated Normalized Profit Function with Dummy For Projects of Table Eggs Production.

Value-t	Estimator	Coefficients	Independent variables
17.508- **	14.157-	A	Fixed
2.657 - *	0.208-	r_1	Price of Work
18.595- **	2.321-	r_2	Price of feed
2.737**	0.134	r_3	Price of medicines and vaccines
5.404- **	0.582-	Z_1	Number of productive birds
17.566**	1.502	Z_2	Fixed factor costs
4.881**	0.288	D	Dummy variable (farm size)
	0.98		R- Square (R)
	0.98		Adj Square (R)
	1.997		D.W. Test
	380.689		F. Test
	44		N

Source: From the work of the researcher based on the form questionnaire.

1. Test the error limits of the a normalized profit function with the relative price variable of human action:

$$\begin{aligned} (\text{Ln } e_i)^2 &= a + b (\text{Lnr}_1) \\ &= -5.976 - 0.022 (\text{Lnr}_1)^2 \\ t &= (-6.535) (-0.017) \\ F &= (0.000289) \end{aligned}$$

2. Test the error limits of the a normalized profit function with the relative price variable of the consumer feed:

$$\begin{aligned} (\text{Ln } e_i)^2 &= a + b (\text{Lnr}_2) \\ &= -11.433 - 2.665 (\text{Lnr}_2)^2 \\ t &= (-2.572) (-1.233) \\ F &= (1.521) \end{aligned}$$

3. Test the error limits of the a normalized profit function with the relative price variable of drugs and vaccines:

$$\begin{aligned} (\text{Ln } e_i)^2 &= a + b (\text{Lnr}_3) \\ &= -5.469 + 0.827 (\text{Lnr}_3)^2 \\ t &= (-10.567) (1.127) \\ F &= (1.271) \end{aligned}$$

4. Test the error limits box for the a normalized profit function with the variable number of productive birds:

$$\begin{aligned} (\text{Ln } e_i)^2 &= a + b (\text{Lnz}_1) \\ &= 3.158 - 1.003 (\text{Lnz}_1)^2 \\ t &= (0.750) (-1.171) \\ F &= (1.371) \end{aligned}$$

5. Test the error limits box for the a normalized profit function with variable fixed factor costs:

$$\begin{aligned} (\text{Ln } e_i)^2 &= a + b (\text{Lnz}_2) \\ &= 10.126 - 0.970 (\text{Lnz}_2)^2 \\ t &= (1.415) (-1.550) \\ F &= (2.4025) \end{aligned}$$

In this test, the estimated function was not significant below 5% significance level, according to the F test. The calculated t value of the slope regression coefficients was less than the t-table value at a significant level of 5%.

Third : Multicollinearity of Problem: Klein was used to detect the existence of the linear correlation problem between the independent variables and the absence of this problem. As observed by the simple correlation matrix between the independent variables in table 2. The simple correlation coefficient between the independent variables was smaller than the total correlation coefficient of the adult model (0.98).

Economic Analysis to Measure Relative Economic Efficiency in Table Eggs Production

Table 2: Simple correlation matrix between the explanatory variables of the a normalized profit function of the table egg production farmers with of dummy variable

D	lnr ₂	lnz ₁	lnr ₃	lnr ₂	lnr ₁	
00.15	0.050-	0.005-	0.510-**	0.017	1	lnr ₁
0.341 *	0.420**	0.368*	0.192	1		lnr ₂
0.198-	0.124-	0.235-	1			lnr ₃
0.870 **	0.959 **	1				lnz ₁
0.813**	1					lnz ₂
1						D

Source: calculated by the researcher approving the questionnaire data.

The economic analysis of a normalized profit function indicates the existence of the dummy variable that the reference of most of the studied variables is identical to the economic logic, except for the reference of the relative price parameters of medicines and vaccines and the number of birds. The most important factor in the economic analysis is the highlighting of the coefficient of the dummy variable coefficient of positive value of 0.288, which indicates that large farms with a production capacity of more than 10000 birds achieve greater economic efficiency in using available economic resources than small farms with a production capacity of 10000 A bird less. In addition to its statistical significance and accept the alternative hypothesis that the efficiency of large and small farms is not equal. The economic efficiency of large farms in producing table eggs reflects the high levels of price efficiency and technical efficiency in large farms compared to small farms that reflect efficient use this is reflected in the return on capacity of the total fixed factor (0.92) obtained from the estimated profit function which the existence of decreasing returns of scale in large farms.

Derivation of the Production function of table egg farmers from the A Normalized Profit Function

The production function is of great economic importance as it is the basis on which the product is based when making agricultural productive decisions (El-Kak et al., 2017), which helps to identify the optimal production combinations of resources and their agricultural returns, which gives a clear picture of the prevailing production level (Saber et al., 2017). Therefore, it should be considered in the logarithmic formula by deriving its parameters from the estimated a normalized profit function number 2 according to the binary method developed, i.e., indirectly estimated and that the description of the binary output function takes the same characterization of the initial a normalized profit function in terms of the influencing variables according to the equation number 1. (Jones and Moussa, 1991) (Khan

and Maki, 1980, :54).

$$\ln Q = \ln K + a_1 \ln X_1 + a_2 \ln X_2 + a_3 \ln X_3 + \theta_1 \ln Z_1 + \theta_2 \ln Z_2 \quad (3)$$

whereas:

Q: The amount of egg production is estimated to be (egg layer).

X₁: Human action (man - hour).

X₂: Amount of feed consumed (kg).

X₃: Adequate costs and vaccines for each bird

Z₁: Number of productive birds.

Z₂: Costs of fixed factors (land rent and interest on capital).

a : function parameters,

K : Fixed function.

In order to estimate the parameters of the egg production function, it is necessary first to obtain the sum of the relative or a normalized price parameters from the estimated profit function 2 that represents (UN) as in the formula:

$$U_N = \sum_i (-0.208 - 2.321 + 0.134) U_N = (-2.395) \quad (4)$$

Depending on the formula (UN) No. 4 and parameters of the estimated profit function no 2:

$$\ln = -14.157 - 0.208 \ln r_1 - 2.32 \ln r_2 + 0.134 \ln r_3 - 0.582 \ln Z_1 + 1.502 \ln Z_2 + 0.288 D \quad \dots 1$$

$$\ln A = -14.157, b_1 = -0.208, b_2 = -2.321, b_3 = 0.134, \beta_1 = -0.582, \beta_2 = 1.502 \text{ and } d = 0.288.$$

The parameters of the production function of the egg farms were derived according to the following relationships:

$$a_1 = -(-0.208) (0.295)$$

$$a_1 = 0.061$$

$$a_2 = -(-2.321) (0.295)$$

$$a_2 = 0.685$$

$$a_3 = -(0.134) (0.295)$$

$$a_3 = -0.040$$

$$\theta_1 = (-0.582) (0.295)$$

$$\theta_1 = -0.172$$

$$\theta_2 = (1.502) (0.295)$$

$$\theta_2 = 0.443$$

As for the derivation of the fixed limit (K) of the production function from the fixed limit (A) of the estimated a normalized profit function, the formula mentioned above will be relied on as follows:

$$K = (1-UN) A (1-UN)^{-1}$$

$$K = (3.395) (0.0000007107) (0.295)$$

$$K = 0.0000007118$$

$$\ln K = -14.155$$

whereas: a₁, a₂, a₃, θ₁, θ₂ represents coefficients of dual production function for table of eggs.

The equation of the double logarithmic function of the estimated table egg cultivars (5) can be written based on the equations calculated above as shown in table 3:

$$\ln Q = -14.155 + 0.061 \ln X_1 + 0.685 \ln X_2 - 0.040 \ln X_3 - 0.172 \ln Z_1 + 0.443 \ln Z_2 \quad (5)$$

Economic Interpretation of the Double Logarithmic Production Function for Table Eggs Farms:

It is clear from the function of producing table egg farms according to equation 5, that the reference of all transactions is consistent with the logic of economic theory. Except for the reference of the cost of medicines and vaccines and the number of productive birds, it was found that the production regression the increase in the number of working hours by (1%) increases the production of table eggs by (0.062%) with other factors remaining constant. As for the quantity of feed consumed, it reached its productive elasticity (0.685) which means that the increase in the use of quantities of feed consumed by (1%) leads to increase the production of table eggs by (0.685%) with the remaining factors are fixed. As for the costs of medicines and vaccines, which amounted to (0.040), which is negative and low value, this means that increasing the costs of using the supplier of drugs and vaccines by (1%) leads to a decrease in gross product by (0.040%) which confirms the existence of waste by producers as a result of the heavy use of this resource to avoid the phenomenon of spread of bird flu, which spread in the province in addition to buying them from the commercial markets, which increases the cost of additional and for the parameter value of the number of birds productivity has reached its productive capacity (0.172) which represents a negative and low value, which means that an increase of (1%) with other factors remaining constant will lead to a decrease in gross output by (0.172%) due to the lack of production capacity of

Table 3: Results of coefficients the production of dual table egg projects in Diyala Governorate.

Estimator	Coefficients	Explanatory variables
-14.155	k	Fixed
0.061	a ₁	Human action
0.685	a ₂	Amount of feed consumed
0.040-	a ₃	Costs of medicines and vaccines
0.172-	θ ₁	Number of birds produced
0.443	θ ₂	Fixed factor costs

Source: From the work of the researcher, based on the a normalized profit function of table eggs no. 2.

the fields due to the risk of this sector. Their profits are consistent with the results of the study. The increase in the costs of fixed factors (land rent and interest on capital) by (1%) with other factors remaining constant, will increase the total output of table eggs by (0.443%).

To calculate the share of each factor contributing to the production of table eggs. It was found that the amount of feed consumed in the first place, followed by the costs of fixed factors and the number of productive birds, the number of human working hours and finally the costs of medicines and vaccines amounted to (70.02, 45.31, 17.56, 6.27, 4.04%) sequentially. We conclude from the economic interpretation based on the size and signal of the estimated transactions that most of the resources used in the egg production farms achieved technical efficiency in use, unlike the suppliers of medicines and vaccines and the number of productive birds that did not achieve technical efficiency in use. (Susanto and Hidayah, 2013, :623).

Measurement Return of scale for projects of Table Eggs Production:

Table 4 indicates, that return of scale value of the table egg farmers in Diyala governorate with the dummy variable was (0.977), which is smaller than the correct one, *i.e.*, there is a decreasing returns of scale. This means that the production of table eggs is subject to decreasing returns of scale based on economic theory. In other words, Will result in a increased resources values by (10%) led decrease in the value of production by (0.977%). (Nicholson, 1998).

Measurement the Allocative Efficiency (Price) and Calculating the Amount of Surplus and Deficit of Resources used in projects of Table Eggs Production:

The efficiency of the use of agricultural resources is essential for the economic well-being of the community. Achieving this efficiency will lead to increased economic returns, thereby increasing investment capacity and the ability to increase national income and provide greater opportunities for raising the standard of living (Saber *et al.*, 2017). In order to identify the most efficient resources in use, the efficiency of allocative or efficient use of resources referred to in table egg production farms was

Table 4: Return of scale for projects of Table Eggs Production.

Explanatory variables	Production elasticities
Human action	0.061
Amount of feed consumed	0.685
Costs of medicines and vaccines	0.040-
Number of birds produced	0.172-
Fixed factor costs	0.443
Return of	0.977

Source: From the work of the researcher based on the dual production function No. 5.

applied to the existence of the dummy variable (Nmadu and others, 2014) (Izkor and Alufohai, 2014, :179-190) As explained below:

1. Allocative efficiency of the human resource is carried out according to the following steps:

- We calculate the average production (AP) of the human labor resource by dividing the geometric mean of the production of table eggs divided by the geometric mean of the number of human working hours, according to the following formula:

$$AP = G(Y)/G(X)$$

$$AP = (104489.05) / (7777.79)$$

$$AP = 13.43545$$

- We calculate the marginal output of the human labor resource through the process of multiplying the average output obtained in the production elasticity of the human labor resource (regression coefficient of the function), according to the following formula:

$$MP = B_i \times AP$$

$$MP = 0.061 \times 13.43545$$

$$MP = 0.819562$$

- We calculate the value of the VMP output of the human labor resource through the process of multiplying the marginal product of the human labor resource at the price of the actual white egg product (the price of the egg layer) in which the producers sold their produce in the study area. The average egg price was about 4128.79 dinar. The value of the marginal output of the human labor resource amounted to (383.803) dinar, *i.e.*, according to the following formula:

$$VMP = MP \times P_y$$

$$VMP = (0.819563) \times (4128.79)$$

$$VMP = 3383.80$$

- We calculate the marginal cost of the human labor supply, which represents the price of the human labor resource, when the average price of the human labor resource was about 2206.00 dinar / hour. As follows:

$$MFC = P_x = 2206.00$$

After completing the above steps we apply the following law:

$$AE \text{ or } r = VMP_{x_i} / MFC_{x_i}$$

$$AE \text{ or } r = 3383.89 / 2206.00 = 1.53$$

That is the allocative efficiency of the human working hours resource was about 1.53.

2. Allocative efficiency of the quantity of feed consumed is carried out according to the following steps:

- We calculate the average production (AP) of the quantity of feed consumed by dividing the engineering medium from the production of table eggs divided by the geometric mean of the amount of feed consumed calculated by kg, *i.e.*, according to the following formula:

$$AP = (104498.05) / (405772.70)$$

$$AP = 0.25753$$

- We calculate the marginal output of the feedstock consumed through the process of multiplying the average production obtained in the production elasticity of the feed resource consumed, *i.e.*, according to the following formula:

$$MP = 0.685 \times 0.25753$$

$$MP = 0.176407$$

- We calculate the value of the VMP feedstock for the amount of feed consumed by multiplying the marginal product of the feed quantity consumed at the egg product price (the actual egg-egg price) in which the producers sold their produce in the study area. The average price of the table eggs was about 4128.79 dinar / Layer. This means the marginal product value of the resource for the amount of feed consumed amounted to (728.35) dinar, *i.e.*, according to the following formula:

$$VMP = (0.176407) \times (4128.79)$$

$$VMP = 728.35$$

- We calculate the marginal cost of the consumed feedstock, which represents the price of a resource. The average price of the feedstock consumed is about 531 dinar / kg. As follows:

$$MFC = P_x = 531$$

After completing the above steps, we apply the following law:

$$AE \text{ or } r = 728.35 / 531 = 1.37$$

3. Allocative efficiency of the supplier of medicines and vaccines shall be according to the following steps:

- Calculate the average production (AP) for the supplier of medicines and vaccines by dividing the engineering medium production of table eggs divided by the engineering medium of the costs of medicines and vaccines as follows:

$$AP = (104498.05) / (2268.89)$$

$$AP = 46.05693$$

- We calculate the marginal product cost of medicines and vaccines through the process of multiplying the average production obtained in the production flexibility of the cost of medicines and vaccines according to the following formula:

$$MP = -0.04 \times 46.03853$$

$$MP = -1.842277$$

- The VMP product value is calculated by multiplying the marginal product of the drug supplier and the vaccines at the egg product price. The actual table in which the producers sold their produce in the study area. The average price of the eggs of the table eggs was about 4128.79 dinar / layer. This means that the marginal product value of the pharmaceutical and vaccine supplier amounted to (-7606.37) dinar, according to the following formula:

$$VMP = (-1.841541) \times (4128.79)$$

$$VMP = -7606.37$$

- We calculate the marginal cost of the supplier of medicines and vaccines, which represents the price of the supplier of medicines and vaccines, when the average price of the supplier of the cost of medicines and vaccines to about 2420.32 dinar / bird. As follows:

$$MFC = P_x = 242.032$$

After completing the above steps, we apply the following law:

$$AE \text{ or } r = -7606.37 / 2420.32 = -3.14$$

The calculation of the amount of surplus and mathematical deficit of the resources used in the production of table eggs with the existence of the dummy variable is as follows (Sanusi and others, 2015):

a. Calculation of the surplus and deficit of the human resource according to the following formula:

$$D = (1 - MFC / MVP) \times 100.$$

$$D = (1 - 2206.00 / 3383.80) \times 100$$

$$D = 34.81\%$$

The D value of 34.81% indicates that there is a surplus in the amount of relative change in the value of the marginal product, which means that there is a deficit in the use of the human labor resource, which is less than 34.78%.

b. Calculation of the amount of surplus and deficit of the quantity of feed consumed according to the following formula:

$$D = (1 - 531.00 / 728.35) \times 100$$

$$D = 27.10\%$$

The D value of 27.10% indicates that there is a surplus in the relative variance of the marginal product value, *i.e.*, we conclude that there is a deficit in using the consumed feed stock resource less than 27.10%.

c. Calculation of the amount of surplus and deficit of the supplier of medicines and vaccines according to the following formula:

$$D = (1 - 2420.32 / -7606.37) \times 100$$

$$D = 131.82\%$$

The D value of 131.82% shows that there is a surplus in the relative change in the value of the marginal product, that is, we find that there is a surplus in the use of the supplier of medicines and vaccines, which is more than the equivalent use of 131.82%. Table 5 shows the results of the distributional efficiency of the resources used: human labor, the amount of feed consumed and the costs of medicines and vaccines of 1.53, 1.37 and 3.14 respectively. That the allocative efficiency of the human labor resource is high at 1.53, *i.e.*, greater than the correct one. This means increasing the marginal cost of one working hour by 2206 dinar, which will increase the marginal product value of the resource by 3382.447 dinar for the hours used by human labor by the producers Human used in the production of table eggs. The family and the lessee combine any mixed work and thus the family work is difficult to measure or control unlike the leased work that can be measured and controlled. This requires an increase in the use of hours of human labor with a lower cost due to this resource contributes to an increase in the marginal production value of the resource, which amounted to an increase of about 34.78%. As for the consumer feed supply, it was found that the distribution efficiency was high at 1.37, which is greater than the correct one. This means increasing the cost of one kilogram of feed used by 531 dinar will result in an increase of 728.05 JD for the marginal product value of the supplier. It is evident through the value of feed efficiency that it has not achieved the optimal level, that is the use of quantities of feed below the required level that achieves price efficiency and the decrease in the quantities of feed used by the producers to increase the marginal cost of it, which means the increase in the use of quantities of Feed with a lower cost due to the contribution of this resource to the increase in the marginal production value of the resource, which amounted to about 27.06% increase. The value of the cost efficiency of the drug and vaccine costs component gave a negative result of 3.141. This means that the cost of medicines and vaccines for each bird will increase by KD 32.2420, resulting in a decrease of KD 7603.33 in the value of the marginal product of medicines

and vaccines. The relative change in the value of the marginal product of the pharmaceutical and vaccine supplier was 131.83%, meaning that the costs of medicines and vaccines should be reduced by 131.83% to achieve allocative efficiency. In general, we deduce from the study of distributional efficiency that the resources used in the production of table eggs did not achieve the optimal use, *i.e.*, there was surplus and inability to use the resources and thus reflected on the profits achieved from the egg production farms. To achieve allocative efficiency, Guidance that works to guide producers in the production of eggs in how to optimize the use of these resources and thus will reflect on improving the efficiency of production and thus achieve profits for them.

Conclusions

1. The study of the a normalized profit function proved that large farms with a production capacity of more than 10 thousand birds achieve greater economic efficiency relative to the use of available economic resources compared to small farms with a production capacity of 10 thousand birds or less, based on the positive and moral signal of the coefficient of the dummy variable, that is, the large farms have achieved a price and technical efficiency in the use of resources compared to small farms. This is reflected in the return on capacity of the total fixed factor of 0.92 obtained from the a normalized profit function *i.e.*, the existence of declining capacity returns on large farms.
2. The study of the dual production function proved that most of the resources used in the egg production farms achieved technical efficiency in use, unlike the suppliers of medicines and vaccines and the number of productive birds that did not achieve the technical efficiency in use, *i.e.*, working in the third stage of the production function.
3. The study showed that the eggs production fields of the large farms achieve returns of decreasing scale through the yield value of 0.97 obtained from the total coefficients of the dual production function.
4. The study found that the allocative efficiency of the

resources used in the production of table eggs did not achieve the optimal use, *i.e.*, there was surplus and inability to use the resources and therefore reflected on the profits achieved from the egg-producing farms.

5. The research proved that the size of the large farm achieves economic efficiency. There is a

Table 5: The results of Measuring the allocative efficiency (price) and calculating the amount of surplus and deficit of resources used in the production of table eggs.

Variables	GM	MVP	MFC	AE	D %
Output (layer eggs)	104498.05		-	-	-
Human action (hour-man)	7777.79	3382.45	2206	1.53	34.78
Quantity of feed consumed (kg)	405772.7	728.06	531	1.37	27.06
Medicines and Vaccines (dinar)	2268.89	-7603.33	2420.32	-3.14	131.83

Source: From the work of the researcher based on the form questionnaire.

positive relationship between farm size and relative economic efficiency.

Recommendations

1. The study recommends that producers expand their production capacity (number of birds) both at the level of one hall or increase the number of halls in one field or adopt modern systems in education such as education with clips or batteries, because of their economic return. which can be through the expansion in size Farm Achieve economic efficiency for egg production projects.
2. In view of the surplus and inability to use available resources, the study recommends the need to redistribute and allocate the resources available by the producers to benefit from the economic efficiency of those resources, which will in turn be reflected in increasing the efficiency of production of eggs by reducing the cost of production on the other.
3. Working on finding mechanisms to support the fields of egg production through increasing support for production requirements both in terms of reducing prices or providing them in quantity and quality instead of relying on imports, as well as increasing support for the price of output according to the policy of protecting the local product because they have a role in stabilizing the profits of the producers.

References

- Al-Kaisy, E.H.A. (2009). An Economic Return of Peanut Farms (Diyla Province - Case Study). A thesis of Master, Dep. Agriculture Economics. The College of Agriculture. University of Baghdad.
- Arab Organization for Agricultural Development Aoad (2016). Statistical Year I Book, **36**: 468.
- El-Kak, A.A. *et al.*, (2017). Production and Cost Functions for Wheat Crop in Dakahlia Governorate. *Alexandria Science Exchang Jouranal.*, **35(3)**: 243-259.
- Garcia, P., S. T. Sonka and M.S. Yoo (1982). Farm Size, Tenure, and Economic Efficiency in a Sample of Illinois Grain Farms. *American Journal of Agricultural Economics.*, (**64**) **(1)**: 119-123.
- Gujararti, D. (2004). Basic Econometrics. McGraw. Hill. Book. Newyork. 1024.
- Hidayah, I. and A.N. Susanto (2013). Economies of Scale and Allocative Efficiency of Rice Farming at West Seram Regency, Maluku Province, Indonesia. *Asian Economic and Financial Review.*, **3(5)**: 624-634.
- Izekor, O.B. and G.O. Alufohai (2014). Production Elasticities, Return to Scale and Allocative Efficiency in Yam Production in Edo State, Nigeria. *Agrosearch.*, **14(2)**: 179-190.
- Khan, M.H. and D.R. Maki (1980). Relative Efficiency by Farm Size and the Green Revolution in Pakistan. *The Pakistan Development Review.*, **19(1)**: 51-64.
- Lema, H.T. (2013). Comparison of Economic Efficiency of Organic and Conventional Coffee Farming Systems in Moshi Rural District –Tanzania. A Thesis Master. Dept. Agricultural and Applied Economics. University of Nairobi, Kenya.
- Maddala, G.S. (1988). Introduction to Econometrics, 2nd Edition, Macmillan, Inc.
- Moussaa, M.Z. and T.T. Jones (1991). Efficiency and Farm Size in Egypt: A Unit Output Price Profit Function Approach. *Applied Economics.*, (**23**): 21-29.
- Memon, I.N, S. Noonari, M. Asif, M. Pathan, R. Jamali, Z. Memon, D. Khan and S.A. Sial (2015). Economic Analysis of Poultry Egg Production in Quetta District Balochistan. *J.of Marketing and Consumer Research.*, (**14**).
- Nicholson, Walter (1998). Microeconomic Theory- Basic principles and Extension. 7/ Ed. U.S.
- Nmadu, J.N., I.O. Ogidan and R.A. Omolehin (2014). Profitability and Resource Use Efficiency of Poultry Egg Production in Abuja, Nigeria. *Kasetsart J. (Soc. Sci.)*, **35**: 134-146.
- Olusola, A.T. and others (2014). Stock Size and Relative Efficiency in Broiler Production in South-Western Nigeria: A Normalized Profit Function Approach. *IOSR Journal of Agriculture and Veterinary Science.*, (*IOSR-JAVS*). **7(5)**: 43-50.
- Pudasaini, S.P. (1981). The Use Profit Function to Evaluate Relative Economic Efficiency in Agriculture in Nepal. A Post Doctoral Research Fellow in the Department of Agricultural and Applied Economics, University of Minnesota.
- Rahji, M.A.Y., M. Akinyemi and D.G. Akun (2015). Farm size and Relative Efficiency in Egg Production in South-Western Nigeria: A normalized profit function approach. *Scholarly Journal of Agricultural Science.*, **5(4)**: 141-146.
- Saber, F.H. *et al.*, (2017). The Economics of Producing the Most Important Horticultural Crops in The North West Coast. *Annals of Agric. Sci. Moshtohor.*, **55(3)**: 789-800.
- Sanusi, S.M., A.O. Ogungbile, M.T. Yakasal, M.M. Ahmad and M.I. Daneji (2015). Optimization of Resource Use Efficiency in Small scale Maize Production in Nigeria State, Nigeria *Asian J.of Science and technology.*, **6**: 1070-1075.
- Ume, S.I., M.U. Onyekwere, F.U. Okoye and A.N. Eluwa (2016). Economics Efficiency of Rabbit (*Oryctolagus Cuniculus*) Production in Anambra State, Nigeria (A Stochastic Frontier Profit Function Approach). *International J. of Environment, Agriculture and Biotechnology.*, **1(3)**: 482-490. **55(3)**: 789-800.
- Yotopolous, P.A. and I.J. Lau (1971). A Test for Relative and Application to Indian Agriculture. *American Economic Review.*, (**61**): 94-109.
- Yotopolous, P.A. and L.J. Lau (1972). Profit, Supply and Demand Functions. *Amer. J. Agr. Econ.*, (**54**): 11-18.
- Yotopolous, P.A. and L.J. Lau (1973). A Test for Relative Economic Efficiency: Some Further Results. *American Economic Review.*, (**63**): 214-223.