Al-Muthanna J. For Agric Sci Print ISSN: 2226-4086 Online ISSN:2572-5149
Vol. 9 , Issue. 02. 2022

https://muthjas.mu.edu.iq/ http://doi.org/10.52113/mjas04/9.2/23

AN ECONOMIC ANALYSIS OF THE RELATIVE EFFICIENCY OF CUCUMBER CROP IN GREENHOUSES USING THE NORMALIZED PROFIT FUNCTION IN THE PROVINCE OF BABYLON

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Received on 25/09/2022 Accepted on 16/10/2022 Published on 15/12/2022

Abstract

The research aims to study the relative economic efficiency of the agricultural resources used to produce the cucumber crop in greenhouses, as the modified profit function method was used to assess the relative economic efficiency of a random sample of cucumber farms in greenhouses in the province of Babylon, amounting to 90 farms for the season 2021, as the number of house holders reached 956. In the province of Babylon, the results of the study of the dual production function showed that greenhouse farms achieved increasing capacity returns through the value of the capacity return of 1.226, while the binary production function obtained from the normalized profit function after the introduction of the project size gave higher capacity returns depending on the capacity return value of 1.414 and this This is due to the fact that the small farms achieved an optimum combination of the resources used and thus reflected in achieving the economic efficiency of those farms. Cucumber production in the homes is less relative in the use of economic resources compared to small farms, a study has shown. The study recommends the need to redistribute production resources, to benefit from them in achieving the economic efficiency of those resources. This will be reflected in increasing the efficiency of vegetable production in greenhouses on the one hand, and reducing production costs on the other hand.Keywords: polixal 20-8, seaweed extract (Algaren), soil salinity, yield of eggplant ***Solanum melongena L*.**

Keywords: protected agriculture, capacity returns, dual production theory.

Introduction

Vegetables grown in greenhouses are one of the effective ways to increase agricultural production, and contribute directly to increasing and diversifying the income of the agricultural sector, as it contributes to reducing the food gap caused by the difference between local production and consumption (14). Greenhouses are of great importance as a good way to use modern techniques and patterns in agriculture, in order to achieve a high economic return by increasing production and reducing the unit of the area used for agriculture, as well as providing the quantities of water used in agriculture, and on this the importance of agriculture in homes is highlighted Plastic as a possible means to increase agricultural production in light of those existing limitations (1). The Iraqi agricultural sector faces several problems, such as the continuous population increase, the relative stability of the cultivated area, and the limited water and land resources, so it has become necessary to increase agricultural production and overcome the seasonality of employment and production compared to agriculture in open fields and increase the return from the unit area and unit of water in order to use those resources optimal use, but the spread of agriculture in greenhouses in Iraq is still below the required limit. The number of greenhouses reached 29,668 houses and the number of homeowners reached 956 in the province of Babylon. As the traditional method of agriculture does not achieve an acceptable level of productive and economic efficiency due to the lack of optimal use of agricultural resources compared to the method of cultivation in greenhouses, and therefore the research aimed to identify the role of greenhouses in raising the efficiency of the use of some agricultural resources in the province of Babylon.

MATERIALS AND METHODS

Efficiency refers to the optimal use of resources, with the aim of maximizing production of goods and services. And the ability of producers to make optimal decisions regarding the use of resources (17). The binary theory has several advantages, from which it is possible to derive the functions of demand for resources and other economic relations, and it is characterized by its ease of estimation and the reduction of errors in estimation from a statistical point of view. As the estimation of cost and profit functions with the price data of independent variables will allow obtaining more accurate standard estimates of the parameters of the production function, and many studies dealt with this aspect (3, 5, 6, and 10). And the elasticities can be easily calculated from the coefficients of the binary functions. The advantage of the binary method is that data on output prices, resources, costs and profits are often more accurate than data on the quantities of resources and output (7). Wijetunga presented his study which aimed to estimate the elasticities of supply and demand of inputs for rice production using the adjusted profit function of the four major rice-producing districts of Anuradhapura, Hambantota, Kurunegala and Polonnaruwa in Sri Lanka. The results showed that changes in market prices of inputs and outputs significantly affect farmers' profits, rice supply and resource use in rice cultivation.

The elasticity of supply for rice in relation to its own price is 0.5 and the elasticity of supply of production with respect to the price of fertilizer is -0.05 on average. The demand for fertilizer in the country is inelastic but important for its own price. Therefore, fertilizer subsidy is one of the main factors for increasing the demand for fertilizer as well as rice supply in the country (19).

Rahji presented his study on the relative economic efficiency of large and small poultry farms in southwestern Nigeria. For a sample of 480 poultry eggs farmers. The results of the profit function showed that the wage rate coefficient of labor is positive. While the feed and drug treatments were negative. The fixed cost coefficient is positive, while the farm size cost is negative. As the variables significantly affected the level of profit. The relative economic efficacy test between groups was in large favour. The study concluded that small farms are more efficient than large farms (16).

Modified profit function

This model is more flexible in analyzing various agricultural problems compared to the traditional production function model, and the modified profit function is the support for the production decisions taken by producers from the production theory (11). The modified profit function method is used to evaluate the relative economic efficiency of farmers with different levels of technical and allocative efficiency.

Characterization and formulation of the model for the modified profit function

The concept of adjusted profit or restricted profit is obtained by dividing monetary profit (Π) by the unit price of output (Py), and the term (restricted) is used to emphasize that profit is due to fixed inputs obtained after deducting costs of variable inputs only. The rest of the costs are fixed costs.

And write the usual profit equation 2, depending on the production function 1:

$$Q = f(X_1, ..., X_m \text{ ‘ } Z_1, ..., Z_n) \ldots\ldots\ 1$$

Whereas:-

Q: Output.

$X_1, ..., X_m$: Input is variable.

$Z_1, ..., Z_n$: Input fixed.

$$\Pi = P \ . \ f(X_1 ‘ .... ‘ X_m ‘ Z_1 ‘ ... ‘ Z_n) - \sum_{i=1}^{m} ciXj \ldots\ldots\ 2$$

Whereas:

Π: Profit.

P: The price of a unit of output.

Ci: The unit price of the variable input.

Xj: Variable input.

Z_i: Unit price fixed input (21).

It is assumed that the firm maximizes profits given the levels of technical efficiency and fixed inputs. The marginal product conditions are conditions for maximizing profit and this requires partial derivations of Equation 2 with respect to X_i equal to zero:

$$\partial \Pi / \partial X_i = P \{ f(X,Z) / \partial Xi \} - Ci = 0$$

And by moving the price of the resource to the right, we get Equation 3:

$$P \{ f(X,Z) / \partial Xi \} = Ci \qquad i = 1.....m \ \ldots\ldots 3$$

And by dividing both sides of equation (3) by the output price (Py), the following formula is obtained.

$$\partial f(X,Z) / \partial Xi = Ci^* \qquad i=1,\ldots\ldots,m \ \ldots.. 4$$

Ci*: It represents the quotient of Py / (Ci), which is the price ratio.

By dividing equation 2 by the output price (Py), equation 5 is obtained. Here the profit will be in terms of the unit price of the output according to the following formula:-

$$\Pi^* = \Pi / P_y = F (X1، ... ،Xm ؛Z1، ... ،Zn) - 1/py \sum_{i=1}^{m} ciXj \text{ ………….. } 5$$

As the modified profit function is a function of relative prices, while the normal profit function is a function of actual prices (20).

Equation 4 can be a solution for the optimum quantities of variable inputs, X^*_i represented as a demand function for the prices of the variable inputs and the quantities of the fixed inputs according to the formula 6:

$$X^*_i = f(c^*, z) \quad i=1,\dots,m \text{ ……… } 6$$

X^*_i: The optimum quantities of variable inputs.

C^*: The vector of modified input prices.

Z: The vector of fixed input quantities.

Substituting equation 6 into equation 2, we get profit equation 7:

$$\Pi^{**} = P[\, F(X_1^*, \dots , X_m^*; Z_1 \dots, Zn) - \sum_{i=1}^{m} ci\, Xj * \,] \text{…… } 7$$

The profit function gives the maximum value of the profit for each set of values ($P, C^*, \dots, C^*M, Z_1, \dots, Z_n$).

It is noticed that the term in square brackets on the right side of Equation 7 is a function only of (C*) and (Z).

$$\Pi^{**} = p\ G^* (,c_1, \dots, c_m \ ; z_1, \dots, z_n) \text{………………… } 8$$

Through it, the profit function 9 is given:

$$\Pi^* = \Pi^{**} / p = G * (c_1, \dots, c_m \ ؛ Z_1, \dots, Z_n) \text{ ……………………… } 9$$

In this study, the profit function II^* or the profit function 5 or 9 will be used because it is easier to work with than the profit function II^{**}. The result is according to (Hoteling's - Shephard's Lemmas axiom) as in equations 10 and 11.

$$X^*_i = - \partial\ \Pi^*(c,z) \ / \partial ci \ , \ i=1,\dots,m. \text{ ……………….. } 10$$

$$V^* = \Pi^*(c,z) - \sum_{i=1}^{m} \partial\Pi^*(c,z) / \partial ci \quad , ci \ ,i=1 ,..,m \text{ ………….. } 11$$

X^*_i: The function of the demand for the supplier.

V*: The output display function.

ci: The variable factors of production.

z: The constant factors of production.

It is mentioned that the functions of demand for resources and supply of output have the same properties as the modified profit functions

The modified profit function can be written in the form CDPF) according to the general formula 12:

$$\Pi^* = A\, r_1^{b1}\, r_2^{b2}\, r_3^{b3} Z_1^{B1} Z_2^{B2} e \text{ ……… } 12$$

By converting the modified profit function from the exponential function 12 to the double logarithmic form, it becomes:

$$ln\Pi * = lnA + b_1 lnr_1 + b_2 lnr_2 + b_3 lnr_3 + B_1 lnZ_1 + B_2 lnZ_2 \dots\dots 13$$

II*: Adjusted profit.

r: The relative prices of the variable inputs.

Z_1: Fixed costs.

Z_2: Production capacity.

b: The relative price parameters of the variable inputs.

β: The factors of fixed costs and production capacity.

In order to measure the relative economic efficiency of the establishments, the dummy variable D, which represents the size of the establishment, will be entered into the modified profit function 12, 13 as follows:-

$$\Pi^* = A\, r_1^{b1}\, r_2^{b2}\, r_3^{b3} Z_1^{B1} Z_2^{B2} e\delta d$$

$$ln\Pi * = lnA + b_1 lnr_1 + b_2 lnr_2 + b_3 lnr_3 + B_1 lnZ_1 + B_2 lnZ_2 + \delta d$$

If the farm is large, the dummy variable D will be given number 1, but if it is small, then the farm will be given number 0.

Cobb-Douglas Production Function

The Cobb-Douglas production function will be used to explain the relationship between inputs and production, and this function is assumed to be homogeneous of degree 1 in the elements of labor and capital or the stability of returns to capacity (22), in addition to that this function is the tool that enabled economists to build models and discover functions Other (8). The general form of this function is:

$$A > 0, x_1 > 0, x_2 > 0, \beta_1 < 1, \beta_2 < 1$$

$$y = A x_1^{\beta_1} x_2^{\beta_2}$$

Description and formulation of the mathematical model for deriving the production function from the modified profit function

The neoclassical production function in the Cobb-Douglas formula was derived from the modified profit function according to the method of the modern binary theory that governs the relationship between them by the fact that the parameters of the two functions are interrelated; the production function can be written according to the following formula:

$$Q_i = f(X_1 ، X_2 ، X_3 ، Z_1 ، Z_2 ؛ a ، b)$$

Cobb-Douglas Production Function is as follows:

$$Q_i = K\, X_1^{a1}\, X_2^{a2}\, X_3^{a3} Z_1^{b1}\, Z_2^{b2} \quad .... 14$$

After taking the logarithm of both sides of Equation 14, the production equation will become a double logarithmic

$$lnQi = lnK + a_1 lnX_1 + a_2 lnX_2 + a_3 lnX_3 + b_1 lnZ_1 + b_2 lnZ_2 \ldots\ldots 15$$

Whereas:

Q_i: Production.
K: The fixed limit.
X_i : Variable inputs .... i = 1, 2, 3.
Z_1: Fixed factor costs (land rent and interest on capital).
Z_2: Production capacity.

As for the modified profit function 16, it will be identical to the description of the production function 15, as follows:

$$ln\Pi * = lnA + b_1 lnr_1 + b_2 lnr_2 + b_3 lnr_3 + B_1 lnZ_1 + B_2 lnZ_2 \ldots\ldots 16$$

To get the parameters of the production function from the parameters of the modified profit function, we must first obtain the sum of the relative price parameters from the estimated profit function which represents (U_N) as in the following formula:

$$U_N = \Sigma_i b_i$$

By adopting the formula (U_N) and the parameters of the profit function, the parameters of the production function can be derived according to the following relations:

$$a_1 = -b_1 (1 - UN)^{-1}$$
$$a_2 = -b_2 (1 - UN)^{-1}$$
$$a_3 = -b_3 (1 - UN)^{-1}$$
$$b_1 = \beta_1 (1 - UN)^{-1}$$
$$b_2 = \beta_2 (1 - UN)^{-1}$$

a_1, a_2, a_3, b_1, b_2: coefficients of the binary output function (4).

As for the derivation of the constant term K of the production function from the constant term A of the modified profit function:

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

Productive elasticity: - Productive elasticity is calculated according to the following formula: -

$$EP = (\Delta Y/\Delta X) / (Y/X) = MP/AP$$

Capacity Return (RTS):

∑EP>1: means that the return to capacitance increases, that is, the elasticity is greater than the correct one.

∑EP =1: means that the amplitude return is constant, that is, the elasticity is equal to the correct one.

∑EP<1: means a decrease in the yield of capacitance, meaning that the elasticity is less than the correct one (2).

Resource Efficiency:

The efficiency of resource use is an important indicator for any product to know its efficiency in the use of productive resources, as it requires that the value of the marginal product for each resource (VMP) is equal to the marginal cost of each resource (MFC) (13), and when this ratio is equal to zero, this is the case Occur when the marginal product of the resource is equal to zero, the resource efficiency is calculated through the following method (15).

AE = VMP/ MFC

VMP =MP*P_y

MFC= P_x

Calculating the amount of surplus or deficit in the use of the resource: - It is carried out according to the following formula (9).

D = (1- (MFC / VMP)*100.

RESULTS AND DISCUSSION

The modified profit function was estimated and it was found that all the model variables were significant for the t-test at the level of significance of 0.05 and 0.01, and it can be relied upon in estimating the relationship between the adjusted profit and the independent variables in the model, where the estimated transactions were statistically significant at a level of significance of 1% relative to the relative fertilizer price transactions. and area, and the other transactions were significant at the 5% level, as shown by comparing the calculated F value of the estimated function which was 24.589 with the tabular F value at a statistical level of 1% that the model has good significance, which reflects the importance of the variables included in the model from, and that The value of the coefficient of determination R2 amounted to 0.59 in the function, and it is clear from it that 59% of the changes in the value of the adjusted profit are attributed to the explanatory variables, while 41% of the changes in the value of the adjusted profit were the result of other factors not included in the model and their impact was absorbed by the random variable, as in the Table 1.

$$\boldsymbol{ln\pi = -4.159 - 0.586 lnr_1 + 0.736 lnr_2 - 0.798 lnr_3 + 0.771 lnZ_1 + 0.606 lnZ_2 \ldots\ldots\ldots.\ldots.2}$$

The autocorrelation problem was revealed by the Durban-Watson test, which showed the absence of this problem in the estimated model because the value of D was located in the acceptance region of the null hypothesis and is equal to 1.907. In order to detect the existence of the problem of inconsistency of variance homogeneity, the Breusch-Pagan test was adopted. According to this test, the estimated function was not significant under the level

Table 1. Results of the modified profit function of the greenhouse farms for the cucumber crop in the province of Babil.

Independent Variables	parameters	the capabilities	value of – t
Constant	B_0	-4.159	-1.020
Relative seed price	r_1	-0.586	*-1.939
Relative fertilizer price	r_2	0.736	**2.581
Relative price of pesticides	r_3	-0.798	*-2.333
Fixed factor costs	Z_1	0.771	*2.315
Space	Z_2	0.606	**2.462
R Square (R^2)		0.594	
Adjusted R^2(Ŕ)		0.569	
D-W Test		1.907	
F Test		24.58	
N		90	

Source: - From the researcher's work based on the questionnaire.

of significance of 5% according to the F test, and the calculated t value was less than the tabular level with a level of significance of 5% (18). It was revealed that there is a problem of linear correlation between the independent variables and it was found that this problem does not exist. And the problem of the multiple linear correlation was revealed through the (VIF) test, and it was found that the model was free of the problem. The economic analysis represented by the sign and the volume indicates that the sign of most of the variables is identical to the economic logic, except for the sign of the parameter relative price of fertilizers, which came in contradiction as in Table 1.

Derivation of the greenhouse farm production function from the modified profit function:

The production function was estimated in the double logarithmic form by deriving its parameters from the estimated modified profit function 2 according to the binary theoretical method, and that the description of the binary production function takes the description of the modified profit function itself (12). As in Equation 3:

$$lnQi = lnK + a_1 lnX_1 + a_2 lnX_2 + a_3 lnX_3 + b_1 lnZ_1 + b_2 lnZ_2 \ldots\ldots 3$$

Q_i: The amount of production for the crop (tons).

X_1: Quantity of seeds (seed envelope).

X_2: Amount of fertilizers (kg / dunams).

X_3: Pesticide costs.

Z_1: Fixed factor costs.

Z_2:- Cultivated area (dunams)

In order to estimate the parameters of the production function of greenhouse farms, the sum of the relative price parameters must be obtained from the estimated profit function 2, which represents (U_N) in the following formula: -

$U_N = \Sigma_i$ (- 0.586 + 0.736 - 0.798) U_N = (-0.648) ………….. 4

And based on (UN) formula 4 and the parameters of the estimated profit function 2:-

$$ln\pi = -4.159 - 0.586 lnr_1 + 0.736 lnr_2 - 0.798 lnr_3 + 0.771 lnZ_1 + 0.606 lnZ_2$$

lnA = - 4.159 , b_1= - 0.586 , b_2= 0.736, b_3 = -0.798, β_1= 0.771 , β_2= 0.606 .

The coefficients of the production function and the fixed limit for farmers were derived according to the previously mentioned relationships.

The estimated double logarithmic production function equation 5 can be written as in Table 2.

$$lnQ = -2.024 + 0.35lnX_1 - 0.446lnX_2 + 0.483lnX_3 + 0.467lnZ_1 + 0.367lnZ_2 \ldots\ldots\ldots\ldots 5$$

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Table 2. Results of the estimated coefficients of the cucumber crop production function in greenhouses

Variables	parameters	Capabilities
Constant	**K**	**-2.024**
Seed quantity	a_1	**0.355**
Fertilizer quantity	a_2	**-0.446**
Pesticide costs	a_3	**0.483**
Fixed Factor Costs	b_1	**0.467**
Cultivated area	b_2	**0.367**

Source: - From the researcher's work based on the modified profit function 2.

Economic analysis of the double logarithmic production function of the estimated greenhouse farms:-

The production function of greenhouse farms was estimated, and it was found that the sign of all transactions is consistent with the logic of economic theory, except for the sign of the fertilizer parameter, knowing that the value of the coefficients for the variables in the logarithmic function represents the partial production elasticity of these variables, and it appears from Table 2 that the partial elasticity of the quantity of seeds amounted to 0.355, which means An increase in the use of seeds by 1% leads to an increase in the production of the cucumber crop by 0.355%, while other factors remain constant. By 0.446% with other factors remaining constant. The negative sign is due to the presence of waste in the use of fertilizers by producers due to their lack of knowledge of the optimal fertilizer addition amounts. As for the costs of pesticides, which amounted to 0.483, which means that an increase in the costs of using the pesticide resource by 1% leads to an increase in the total output by 0.483 percent, while other factors remain constant.

Measuring return to scale for cucumber crop production farms in greenhouses in the province of Babil

Table 3 shows that the value of the capacity yield for greenhouse farms in the province of
Babylon amounted to 1.226, which is greater
than the correct one, that is, the presence of increased capacity returns, and this means that the production of the cucumber crop in the greenhouses is subject to increasing yields based on the logic of economic theory.

Measuring relative economic efficiency using the modified profit function

Table 4. Results of measuring relative economic efficiency using the modified profit function.			
Independent Variables	**Parameters**	**The Capabilities**	**Value Of – T**
Constant	B_0	**-7.531**	***-1.681**
Relative seed price	r_1	**-0.646**	****-2.148**
Relative fertilizer price	r_2	**0.828**	****2.886**
Relative price of pesticides	r_3	**-0.767**	****-2.266**
Fixed factor costs	Z_1	**0.887**	****2.640**
Space	Z_2	**0.776**	****2.955**
Dummy variable (size the project)	**D**	**-0.337**	***-1.721**
R Square (R^2)		**0.60**	
Adjusted R^2($\bar{R}$)		**0.57**	
D-W Test		**1.862**	
F Test		**21.463**	
N		**90**	

In order to measure the relative economic efficiency of greenhouse farms, the dummy variable will be included in the modified profit function, while the explanatory factors remain the same, and the dummy variable represents the size of the project, as we give 1 for large farms with more than 7 greenhouses and 0 for small farms that are less from 7 greenhouses.

Hypothesis Test

The null hypothesis states that there are no significant differences between large and small farms in terms of relative economic efficiency, and the alternative hypothesis states that there are significant differences between large and small farms in terms of relative economic efficiency. The method of least squares (OLS) was used to estimate the logarithmic modified profit function in the presence of the project size and it was found that it is compatible with the economic logic as in Table 4 and Equation 6.

$$\ln\pi = -7.531 - 0.646 \ln r_1 + 0.828 \ln r_2 - 0.767 \ln r_3 + 0.887 \ln Z_1 + 0.776 \ln Z_2 - 0.337\,D \ldots\ldots\ldots 6$$

Statistical analysis shows that all variables are significant for the t-test at the level of 0.05, 0.1 and 0.01 and it can be relied upon in estimating the relationship between the adjusted profit and the independent variables, as all the estimated relative relationship coefficients were significant at the 5% level except for the estimated dummy variable parameter, which was statistically significant. At the level of 10%, as it was shown in the light of comparing the calculated F value of the estimated function, which was 21,463 with the tabular F value at a statistical level of 5%, that the model is highly significant,

Table 3. Productive flexibility and yield capacity of cucumber crop in greenhouses.	
Explanatory Variables	**Productivity Flexibility**
Seed Quantity	**0.355**
Fertilizer Quantity	**-0.446**
Pesticide Costs	**0.483**
Fixed Factor Costs	**0.467**
Cultivated Area	**0.367**
Capacity Yield	**1.226**

which reflects the importance of the variables included in the function, and the value of the coefficient of determination amounted to 0.60 in the function Which reflects the quality of reconciling the regression line, and it is clear from it that 60% of the changes in the value of the adjusted profit are attributed to the studied independent variables, while 40% of the changes in the value of the adjusted profit were the result of other factors that were not included in the model and the effect of which was absorbed by the random variable. The statistical analysis showed that the statistical significance of the dummy variable confirms the existence of significant differences between small and large projects.

The estimated model was subjected to tests (standard, statistical, and economic) and it was found that there was no problem in the estimated model.

Economic analysis to measure the relative economic efficiency of greenhouse farms

The economic analysis of the modified profit function with the presence of the dummy variable indicates that the sign of most of the independent variables is in agreement with the economic logic, with the exception of the sign of the parameter relative price of fertilizers, as it was in violation of the logic of the economic theory as in Table 4, i.e. the same as what was stated in the estimation of the modified profit function without the dummy variable, but it happened Changes in the size of the estimated coefficients as a result of introducing the dummy variable into the estimated function. The sign of the dummy variable coefficient is negative, amounting to -0.337, which indicates that small farms whose production capacity is less than 7 greenhouses achieve greater relative economic efficiency in the use of available economic resources compared to large farms whose production capacity is greater than 7 greenhouses, as well as The statistical significance achieved for it, and accordingly, the alternative hypothesis was accepted, which states that there is no inequality between the efficiency of large and small farms.

Derivation of the greenhouse farms production function from the modified profit function with the presence of the dummy variable

$$U_N = \Sigma_i\,(-0.646 + 0.828 - 0.767)$$

$$U_N = (-0.585) \ldots\ldots\ldots\ldots\ldots 7$$

And based on (U_N) formula 7 and the parameters of the estimated profit function 6:-

$$\ln\pi = -7.531 - 0.646\ln r_1 + 0.828\ln r_2 - 0.767\ln r_3 + 0.887\ln Z_1 + 0.776\ln Z_2 - 0.337\,D \ldots\ldots\ldots 6$$

lnA = - 7.531 , b1= - 0.646 , b2= 0.828, b3 =-0.767 , β1= 0.887 , β2= 0.776 , D =- 0.337.

The parameters of the production function for greenhouse farms were derived according to the previously mentioned relationships

The equation of the double logarithmic production function for the estimated greenhouse farms can be written 8.

Relying on the equations calculated above and as shown in Table 5:

$$\ln Q = -4.285 + 0.406\ln X_1 - 0.521\ln X_2 + 0.483\ln X_3 + 0.558\ln Z_1 + 0.488\ln Z_2 \ldots\ldots 8$$

Table 5. The results of the estimated coefficients of the production function according to the binary method in the presence of the dummy variable.		
Independent Variables	**Parameters**	**Capabilities**
Constant	**K**	**-4.285**
Seed Quantity	a_1	**0.406**
Fertilizer quantity	a_2	**-0.521**
Pesticide costs	a_3	**0.483**
Fixed factor costs	θ_1	**0.558**
Cultivated area	θ_2	**0.488**

Source: - From the researcher's work based on the modified profit function

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Economic interpretation of the double logarithmic production function of greenhouse farms

The production function of farms shows that the greenhouses according to equation 8, that the sign of all transactions is consistent with the logic of the economic theory except for the reference of the fertilizer parameter. It is noted from the table that the partial elasticity of the quantity of seeds has reached 80.406, and this indicates that an increase in the quantity of seeds by 1% leads to an increase the yield of the crop increased by 0.406%, with other factors remaining constant. As for the fertilizer quantity resource, its production elasticity reached -0.521, which means that an increase in the use of fertilizer quantities by 1% leads to a decrease in the production of the crop by 0.521%, while other factors remain constant, which indicates that There is a waste in the use of fertilizers, as for the costs of pesticides, which amounted to 0.483, and this means that the increase in the costs of using the pesticide resource by 1% leads to an increase in the total production by 0.483 percent, while other factors remain constant. As for the parameter costs of fixed factors, it amounted to Its productivity elasticity is 0.558, which means that increasing it by 1% while keeping other factors constant will lead to an increase in production by 0.558 percent. In addition, an increase in the cultivated area by 1%, while other factors remain constant, will lead to an increase in the total production of the crop by 0.488%. We conclude from the economic explanation that most of the resources used in the farms have achieved technical efficiency in use, with the exception of the fertilizer resource.

Measuring return to scale for greenhouse farms in the presence of the dummy variable

Table 6 indicates that the value of the capacity return for greenhouses farms in the province of Babylon with the presence of the dummy variable amounted to 1.414, which is greater than the correct one, that is, the presence of increased return to scale this means that the production of the crop is subject to increasing return to scale.

Table 6. Productivity elasticities and capacity yield in the presence of the dummy variable.	
Independent Variables	**Productivity Flexibility**
Seed Quantity	**0.406**
Fertilizer Quantity	**-0.521**
Pesticide Costs	**0.483**

Fixed Factor Costs	**0.558**
Cultivated Area	**0.488**
Capacity Yield (Sum Of Productivity Elasticities, Bi∑)	**1.414**

Source: The researcher's work based on the binary production function.

Comparison of capacity returns achieved before and after the introduction of the dummy variable of project size

Table 7 shows that the comparison between capacity returns from greenhouse farms before and after the introduction of the dummy variable of the project size and after it, based on the estimated coefficients from production functions 5 and 8, it became clear in the light of Table 7 that there is a difference between the realized capacity returns for both equations, as it is noted from equation 5 that it achieved increased capacity returns, that is, there is a serious opportunity to increase production from greenhouses by recombining the production elements used by increasing or decreasing to reach economic efficiency, while equation 8 Achieved greater capacity returns and this is due to the strong and significant impact of the size of the farm represented by its dummy variable on the optimal economic combination of resources used for greenhouse farms according to the law of diminishing returns. Small works within the rational use of the resources used.

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Table 7. Capacity returns before and after entering the dummy variable

Explanatory Variables	Productive Flexibility Without (D)	Productive Flexibility With (D)
Seed Quantity	**0.355**	**0.406**
Fertilizer Quantity	**-0.446**	**-0.521**
Pesticide Costs	**0.483**	**0.483**
Fixed Factor Costs	**0.467**	**0.558**
Cultivated Area	**0.367**	**0.488**
Capacitance Yield Bi∑	**1.226**	**1.414**

Source: From the researcher's work based on the binary production function 5, 8.

Measuring allocative efficiency and calculating the amount of surplus and deficit of resources in the presence of the dummy variable:

Achieving this efficiency leads to an increase in economic returns and consequently an increase in the farm income of producers and in order to identify the most efficient resources in use.

1. The allocative efficiency of the seed resource is carried out according to the following steps:

AP= G(Y)/G(X)

AP= (101476.4)/ (39.58)

AP = 2563.8

MP = Bi * AP

MP = 0.406 * 2563.8

MP = 1040.9

VMP =MP*Py

VMP = (1040.9) * (328)

VMP = 341415.2

MFC= Px = 64822.2

$$AE\ or\ r = \frac{341415.2}{64822.2} = 5.26$$

2. The allocative efficiency of the fertilizer quantity resource is carried out according to the following steps:

AP = (101476.4) / (1199.43)

AP = 84.6

MP = -0.521 * 84.6

MP = - 44.07

VMP = (- 44.07) * (328)

VMP = -14454.96

MFC= Px = 3075.7

$$AE\ or\ r = \frac{-14454.96}{3075.7} = -4.69$$

3. The allocative efficiency of the pesticide supplier is carried out according to the following steps:

AP= (101476.4)/ (30.24)

AP = 3355.7

MP = 0.483 * 3355.7

MP = 1620.8

VMP = (1620.8) * (328)

VMP = 531622.4

MFC= Px = 17140.9

$$AE\ or\ r = \frac{531622.4}{17140.9} = 30.01$$

As for calculating the amount of surplus and deficit mathematically for the resources used in the presence of the dummy variable:

D = 1- (MFC / VMP)*100.

D =1- (64822.2 / 341415.2)*100

D = 80.2%

D =1- (3075.7 / -14454.96)*100

D = 121.2%

D =1- (17140.9 / 531622.4)*100

D = 96.8%

Table 8 shows the results of the allocative efficiency of the resources used in the production process, which are the quantity of seeds, the quantity of fertilizers and the quantity of pesticides 5.26, -4.69, 30.01, respectively. The allocative efficiency of the seed resource is high as it reached 5.26. This means an increase in the marginal cost of seeds by 1 dinars, which will lead to an increase in the value of the marginal product of the resource by 5.26 dinars. It is evident from the value of the price efficiency of the seed resource that it did not achieve the optimum level, that is, that the seeds are used below the required level that achieves the price efficiency. As for the fertilizer resource, it was found that the distributive efficiency of it is low as it reached -4.69 which is less than the correct one, this means an increase in the cost of the kilogram of the fertilizers used, an amount of 1 dinars will lead to a decrease in the value of the marginal product of the resource by -4.69 dinars. As for the value of the price efficiency of the pesticide supplier, it was found that the distributive efficiency was high, reaching 30.01, which means an increase in the marginal cost of

Table 8. The results of allocative efficiency and the amount of deficit and surplus of resources in the presence of the dummy variable.

Variables	D %	AE	MFC	VMP	PY	MP	AP	E
Seed Quantity	**80.2%**	**5.26**	**64822.2**	**341415.2**	**328**	**1040.9**	**2563.8**	**0.406**
Fertilizer Quantity	**121.2%**	**-4.69**	**3075.7**	**-14454.96**	**328**	**- 44.07**	**84.6**	**-0.521**
Amount Of Pesticides	**96.8%**	**30.01**	**17140.9**	**531622.4**	**328**	**1620.8**	**1620.8**	**0.483**

the pesticides by 1 dinars, which will lead to an increase in the value of the marginal product of the supplier by 30.01 dinars, and the relative change in the value of the marginal product of the pesticide resource was 96.8%.

CONCLUSIONS

In general, the study of allocative efficiency indicates that the resources used in the production of the cucumber crop in greenhouses did not achieve optimal use, that is, there was a surplus and a deficit in the use of resources, and thus it was reflected in the profits achieved from greenhouses farms. It works to guide producers in greenhouses farms on how to optimally use resources, and benefit from them, and thus will be reflected in improving production efficiency and thus achieving profitable profits for them. The study of measuring relative economic efficiency by adopting the modified profit function method showed that large greenhouse farms whose production capacity is more than 7 greenhouses achieve a lower relative economic efficiency in the use of economic resources compared to small farms whose capacity is less than 7 houses Plastic, meaning that small-holding farms achieved greater technical and price efficiency in the use of resources compared to large-holding farms. The study of the binary production function showed that greenhouse farms achieved increased capacity returns through the value of the capacity return of 1.226, that is, there is a serious opportunity to increase production from the crop by recombining the production elements used to reach economic efficiency, while the binary production function obtained from the profit function gave Adjusted after entering the project size as a dummy variable, increasing capacity returns depending on the value of the capacity return amounting to 1.414, and this is due to the fact that small farms achieved a combination of their suppliers better than large ones, and then reflected in achieving the economic efficiency of those farms. It was found that the distributive efficiency of the resources used in the production of the cucumber crop in the greenhouses did not achieve the optimal use, i.e. there was a surplus and a deficit in the use of resources, and then it was reflected in the profits achieved from the greenhouses farms.

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