MEASUREMENT THE RELATIVE ECONOMIC EFFICIENCY AND ECONOMICS OF SCALE FOR PROJECTS OF BROILER PRODUCTION IN BAGDAD GOVERNORATE

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Abstract

The objective of the research to measure the relative economic efficiency and economies of scale for projects of broiler production and estimate dual production function through a normalized profit function to measure technical efficiency, returns to scale, The study used cross-sectional data for a random sample consisting of 60 fields from Baghdad governorate. The results of the quantitative analysis of the estimate of the a normalized profit function proved that small farms have 20000 or less birds achieve high economic efficiency compared to large farms have more 20000 birds The study showed that the negative signal of the dummy variable, which is the number of days of breeding bird by a normalized profit function that farms equal to breeding period is less than 40 days economically efficient compared to farms have breeding period of more than 40 days higher profits as a result of the period in which the value of production costs is lower ,the study a normalized profit function proved increasing economies of scale for projects of the broiler production, The study of the dual production function proved that estimated coefficients most of the resources used in broiler production farms achieved technical efficiency in use, except for human labor and feed that did not achieve technical efficiency in use.

The study concluded that increasing the size of the farm and the breeding period has a negative relationship with the relative economic efficiency of projects of broiler production and therefore reflected in decreasing returns for the studied projects.

Keywords: broilers, relative economic efficiency, a normalized profit function, economies of scale.

Introduction

The poultry industry, including broilers production projects, is a lucrative agricultural industry that contributes to the economic development of any country (1), as its projects are characterized by the fact that its production throughout the year and its production cycle is short 6-7 weeks, reflecting the speed of capital turnover compared to the capital cycle in other types of animal production projects that need between 3-12 months, ease of management and low capital investment (14).These projects face many challenges that pose a barrier to the expansion of the industry, especially in developing countries, including technical, economic and marketing, and it should be noted that most producers are not effective in allocating available resources in agricultural production, including meat frog production projects, measuring and addressing these challenges is an important step in the productive process, which leads to significant cost savings, which has important implications in formulating productive and price policies and project management economics(3) , (13) stated that efficiency measures can have important implications on issues related to the distribution of farm size and the use of total inputs in the poultry sector, and achieving capacity savings, which is a very useful decision-making tool when considering expanding farm production, is very important because it is the most important

source of animal protein if it contributes 92% of poultry meat about 137 million tons (4). at the level of Iraq about 156. 800 ton , despite this economic and food importance of meat chicken projects, its domestic production in Iraq is still below the required level, if it covers only 11.6% of the average of domestic consumption (2), reflecting a decline in the Iraqi per capita consumption rate of 9.44 kg, which is very low when compared to Malaysia's per capita(4) consumption rate of 63 kg, Hence the motivations of the researchers to study the efficiency and economics of the performance of producers and to identify the most important problems and difficulties they face and to know the levels achieved by technical and price efficiency and the extent to which the savings of capacity achieved for meat chicken projects and thus find possible means for producers that help them achieve and improve the efficiency of production represented by selecting the optimal production capacity and determining the optimal age of the bird and to investigate the requirements of study Baghdad was chosen as a case study , the aim of the research was to measure relative economic efficiency and determining economics of scale for the projects studied through the use by a normalized profit function and derived the indirect production function according to the method of my function, which is a common task method to assess the efficiency of the performance of farms that work to achieve the requirements of technical and price efficiency in one in addition to studying the economies of scale and its returns achieved from them.

Materials and Methods:

The study used cross-sectional data for a random sample consisting of 60 fields from Baghdad governorate for the year 2018 .Statistical data were collected through interviews with producers, which included different information on production, costs, number of field 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 for broiler projects and economics of scale.

Results and Discussion :-

Measuring Relative Economic Efficiency by using A normalized Profit Function:

Estimation A normalized Profit Function for of broilers Production :

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)(10,11,12). As follows:

$$\mathbf{Ln\ \Pi = LnA + b_1Lnr_1 + b_2Lnr_2 + b_3Lnr_3 + \beta_1LnZ_1 + \beta_2LnZ_2 + D_1 + D_2 + Ui\ ..(1)}$$

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

r_1: represents the relative labor price (man-day)that is calculated by dividing the total wage paid for family work and the lessor by the number of human working days and dividing the result by the unit price of the product (the price of kg of broiler meat).

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 (the price of kg of broiler meat).

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 kg of broiler meat)

Z_1: represents the number of 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.

D1: - Dummy variable (farm size).

D2: - Dummy variable (breeding period: Number of days for breeding birds).

A: Static function.

Bi, β: - function parameters.

Ui: 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.

To measure the relative economic efficiency of broiler production projects, 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 20,000 birds and zero for 20,000 birds or less. As for the breeding period, by giving one number to farms in exceed breeding period 40 days, and zero for every 40 days or less.

Testing Hypotheses for farm size : -

The relative economic efficiency farmers of broiler production 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 (ie, 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 (mean 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): -

Testing Hypotheses Breeding period **: -**

The Null Hypothesis (H_0):- The null hypothesis is that there are no significant differences between breeding period exceed 40 days, and zero for every 40 days or less. in terms of relative economic efficiency (farm efficiency equals)

The Alternative Hypothesis (H_I) :- The alternative hypothesis is that there are significant differences between breeding period exceed 40 days, and zero for every 40 days or less in terms of relative economic efficiency (farm efficiency unequal). 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): -

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

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

Independent variables	Cofficients	Estimator	Value-t
Fixed	A	- 5.907	-4.014
Price of Work	$_1$r	0.173	1.875
Price of feed	r_2	-1.506	-7.102
Price of medicines and vaccines	$_3$r	0.060-	-1.037
Number of productive birds	Z_1	0.714	3.135
Fixed factor costs	Z_2	0.416	1.896
Dummy variable (farm size)	D1	- 0.066	-0.710
Dummy variable (Breeding period)	D2	- 0.029	-0.54
R- Square (R)	0.84		
Adj Square (R)	0.83		
D. W Test	2.055		
F Test	156.932		
N	**225**		

$$LnII - 5.907 + 0.173Lnr_1 - 1.506Lnr_2 - 0.060\ Lnr_3 + 0.714\ LnZ_1 + 0.416LnZ_2 - 0.066D_1 - 0.029\ D_2 \ldots 2$$

LnII: Represents a normalized profit function that is used to measure the relative economic efficiency of the broiler production farms in Bagdad Governorate.

Statistical Analysis:-

Statistical analysis showed that most variables were significant for t-test at 0.05 and 0.01, which can be used to estimate the relationship between standard profit and independent variables. with the exception of the parameter costs of medicines and vaccines are not significant because most of the medicines and vaccines are purchased from commercial markets and are ineffective, if the estimated relative feed price is at 1%, the remaining estimated transactions including the relative labor price, number of birds and fixed costs were statistically significant at the level (5%). Comparing the calculated F value of the estimated function 156,932 with the statistical value of F at a statistical level (1%) showed that the model is highly significant, reflecting the importance of the variables included in the function on the one hand. on the other hand, the reality of the function. The value of the coefficient of determination was 0.84 in the function, which reflects the quality of the regression line. It is clear that 84% of the changes in the standard profit value are attributable to the studied explanatory variables, while 16% of the changes in a normalized profit value were the result of other factors not included in the model. we conclude from the statistical analysis of two dummy variables (farm size and breeding period). The analysis confirmed the non-significance of the dummy variable D1 (farm size), meaning that there were no significant differences

between small and large farms. This means accepting the null hypothesis and rejecting the alternative hypothesis. As for the variable number of days of bird rearing, the analysis confirmed the lack of significance of the dummy variable D2 (breeding period), meaning that there are no significant differences between farms that are equal to or less than the number of days of bird breeding for more than 40 days and between farms that increase the number of bird breeding days For 40 days, this means accepting the null hypothesis and rejecting the alternative 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.W was in the acceptance area of the null hypothesis, that D.W equals 1.804, and from the DW table to a significant level of 5% and degrees of freedom 44 (5)

du <D <4 -du

= 1.746 <2.055 < 2.254

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 (5).

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

$(\text{Ln ei})^2 = a+b\ (\text{Ln } r_1)$

$= -3.615 + 0.309\ (\text{Lnr}_1)^2$

t=(-6.753) (0.780)

F = (0.608)

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

$(\text{Ln ei})^2 = a+b\ (\text{Ln } r_2)$

$= -1.455 + 1.222\ (\text{Lnr}_2)^2$

t = (-0.792) (0.961)

F = (0.924)

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

$(\text{Ln ei})^2 = a+b\ (\text{Ln } r_3)$

$= -0.814 + 0.810\ (\text{Lnr}_3)^2$

t =(-0.893) (0.668)

F = (0.711)

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

$(\text{Ln ei})^2 = a+b\ (\text{Ln } z_1)$

$= -5.518 + 0.240\ (\text{Lnz}_1)^2$

t=(-2.473) (1.034)

F = (1.070)

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

$(\text{Ln ei})^2 = a+b\ (\text{Ln } z_2)$

$= -6.542 – 0.229\ (\text{Lnz}_2)^2$

t=(-1.905) (0.970)

F = (0.941)

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 (0.91).

Table 2. Simple correlation matrix between the explanatory variables of the a normalized profit function of the broiler production farmers with of dummy variable

	lnr_1	lnr_2	lnr_3	lnz_1	$lnrz_2$	$D1$	$D2$
lnr_1	1	**.2520	0.120	0.637**	0.655**	0.503**	**0.185
lnr_2	.252**0	1	0.075	-0.013	0.030	-0.060	-0.139*
lnr_3	0.120	0.075	1	-0.177	-0.081	-0.169	0.001
lnz_1	0.637**	-0.013	0.177-	1	0.901	0.847	0.081
$lnrz_2$	0.655**	0.030	-0.081	0.901	1	0.832	0.069
$D1$	0.503**	-0.060	0.169-	0.847	0.832	1	0.073
$D2$	**0.185	-0.139*	0.001	0.81	0.069	0.073	1

Source: calculated by the researcher approving the questionnaire data.

*** Indicates a significant level of 0.05, ** indicating a significant level of 0.01.**

Economic Analysis to Measure Relative Economic Efficiency in the broiler Production:-

The economic analysis represented by the reference and size indicates that the indication of most of the variables studied corresponds to the economic logic except for the reference parameter of the relative price of human labor, which is contrary to economic logic as in table 1. A normalized profit function of broiler production farms is decreasing relative prices of relative feed and the value of medicines and drags , with the expectations of economic theory that it is negative, which means that there is an inverse relationship between them and shows the value of adjusted and increasing profit relative to the relative price of human work. any violation of For economic logic and reflects the positive signal of the human labor factor rather than the negative existence of an inverse relationship between the value of human work and A normalized profit, This means that human labor is wasted in use. The analysis indicated that A normalized profit function is increasing relative to the bird count factor (production capacity) and the fixed cost factor for being positive In line with the theoretical economic projections, as for the economic explanation of the imaginary variables the size of the farm and the number of days of raising the bird, the negative signal to them indicates for the size of the farm that farms with a production capacity equal to or less than 20000 birds achieve high economic efficiency mean reflects the high levels of price efficiency and technical efficiency in compared to farms with a production capacity of more than 20000 birds, This may imply that in broiler production, the supervisory role of the owner-manager of a farm may be crucial for attaining high levels of economic efficiency ,while negative signal for dummy variable, which is the number of days of breeding bird it shows that farms that are equal to The breeding period is less than 40 days more economically efficient than farms with a breeding period of more than 40 days, i.e. higher profits as a result of the period in which the value of production costs is lower, especially feed, in addition to technical matters related to the food transfer of the bird.

Economic of scale for projects of the broiler production:-

one of the advantages form A normalized profit function that measures the economies of scale in addition to her in measuring relative economic efficiency (12) by The analysis A normalized profit function, found that sum value parameters number of birds produced(production scale) and the fixed cost factor equal at 1,130, which greater than the correct one As shown in the table 3,which mean increasing economies of scale for projects of the broiler production.

Table 3. Economic of scale for projects of broiler production.

Explanatory variables	value
Number of birds produced	**0.714**
Fixed factor costs	**0.416**
Economic of scale	1,130

Source: - From the work of the researcher based on the a normalized profit function No 2.

Derivation of the Production function of the broiler Production farmers from the A Normalized Profit Function:

To determine the effects of the production factors on broiler output the identities that linked the self dual profit function and the primal production function were used (8) (9).The production function is helps to identify the optimal production combinations of resources and their agricultural returns, which gives a clear picture of the prevailing production level. 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, which 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 (7).

$$LnQ=LnK+ a_1LnX_1+ a_2LnX_2 + a_3LnX_3 + \theta_1LnZ_1 + \theta_2LnZ_2 \text{ .....} 3$$

whereas :-

Q: The amount of the broiler Production is

estimated to be (kg).

X_1: - Human work (man - day).

X_2: - Amount of feed consumed (kg).

X_3: - drugs and vaccines for each bird.

Z_1: - Number of productive birds.

Z_2: - Costs of fixed factors (land rent and interest on capital).

a: - function parameters ,

K: - Fixed function.

In order to estimate the parameters of the broiler 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:

$U_{N} = \Sigma_i$ (0.173 - 1.506- 0.060)
U_N = (- 0.0377) …….. 4
Depending on the formula (UN) No. 4 and parameters of the estimated profit function No(2): -

$$\boldsymbol{Ln\Pi = - 5.907 + 0.173Lnr_1 - 1.506Lnr_2 - 0.060\ Lnr_3 + 0.714\ LnZ_1 + 0.416LnZ_2 - 0.066D_1 - 0.029\ D_2 \ldots 2}$$

lnA = - ***5.907*** , b1= ***0.173***, b2= -1.506 , b3 = – 0.060, β1= ***0.714***, β2= 0.416 and D_1 = ***-0.066*** , $\boldsymbol{D_2}$ = ***-0.029***

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

a_1 = - (0.173) (0.963)
a_1 = - 0.166

a_2 = - (-1.506) (0.963)

a_2 = 1.450

a_3 = - (- 0.060) (0.963)

a_3 = 0.058

b_1 = *(0.714)* (0.963)

b_1 = 0.687

b_2 = (0.416) (0.963)

b_2 = 0.401

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 = (1.0377) (0.0027203357) (0.963)

K= 0.0027184453

Ln K = - 5.908

whereas :- a1, a2, a3, b1, b_2 represents coefficients of dual production function for broiler.

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:

$$\boldsymbol{LnQ = -5.908} - 0.166\ \boldsymbol{LnX_1} + 1.450\ \boldsymbol{LnX_2} + 0.058\ \boldsymbol{LnX_3} + 0.687\boldsymbol{LnZ_1} + 0.401\ \boldsymbol{LnZ_2} \quad \boldsymbol{\ldots. 5}$$

Table 3. Results of cofficients the production of dual the broiler projects in Bagdad Governorate.

Explanatory variables	Cofficients	Estimator
Fixed	k	*- 5.908*
Human action	a_1	- 0.166
Amount of feed consumed	a_2	1.450
Costs of medicines and vaccines	a_3	0.058
Number of birds produced	b_1	0.687
Fixed factor costs	b_2	0.401
RTS =($a_1 + a_2 + a_3 + b_1 + b_2$)		2.43
$b_1 + b_2$		1.088

Source: - From the work of the researcher, based on the a normalized profit function of the broiler No. 2.

Production Function Analysis and Technical Efficiency of the Broiler Farms:-

It is clear from the function of producing broiler 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 human work, Technical efficiency could be viewed from its elasticity value , technical efficiency would be achieved if farmer producing at areas with elasticity value between zero until one (6). An increase of 10% in labour will decreases output by (1.66%) with other factors remaining constant , mean in the third stage of the production function , Similarly, a 10% increase in feeds is expected to lead to about 14.50% increase in broiler output with the remaining factors constant , mean results

show that feeds is the most limiting input in production in this study However, a 10% increase in drug use will lead to a 0.58% decrease in broiler production with the remaining factors constant. The fixed factors are highly inelastic in production. The sum of the elasticities obtained is more than one in absolute terms. This result tends to imply that the production function is characterized by increasing returns to scale (RTS).We conclude from the economic interpretation based on the size and signal of the estimated coefficients that most of the resources used in broiler production farms achieved technical efficiency in use, except for human labor and feed that did not achieve technical efficiency in use.

Conclusions:-

1. The study of the a normalized profit function proved that small farms have 20,000 or less birds, achieve high economic efficiency mean reflects the high levels of price efficiency and technical efficiency in compared to small farms have more 20000 birds.
2. The study showed that the negative signal of the dummy variable, which is the number of days of breeding bird by a normalized profit function it that farms that are equal to The breeding period is less than 40 days more economically efficient than farms with a breeding period of more than 40 days ,higher profits as a result of the period in which the value of production costs is lower, especially feed, in addition to technical matters related to the food transfer of the bird.
3. The study of the a normalized profit function proved increasing economies of scale for projects of the broiler production
4. The study of the dual production function proved that estimated coefficients most of the resources used in broiler production farms achieved technical efficiency in use, except for human labor and feed that did not achieve technical efficiency in use.
5. The research proved that the small farm and the breeding period or less 40 days achieves the relative economic efficiency. That is, there is a negative relationship between the size of the farm and the breeding period on the one hand, and the relative economic efficiency on the other hand.

Recommendations:-

1. The study recommends that producers decreasing their production capacity (number of birds) and breeding period because of their economic return form broiler production projects.
2. Based on the lack of technical efficiency in the use of resources in the production of broilers. The study recommended the need to redistribute and allocate the resources available by producers to take advantage of the economic efficiency of those resources, which in turn will be reflected in increasing the efficiency of broiler production.
3. According to the findings of study that feed is the most restrictive input to production, in this study it is necessary to monitor and support feed mills that can produce feed of the required quality for industry at low cost.

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