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AN ECONOMIC ANALYSIS OF COST AND PRODUCTION FUNCTION OF BOILERS MEAT IN IRAQ (2017)

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Abstract

Livestock considered an important aspect in the agricultural sector, as no less important than plant production side, for being a main source of food and provide digestible animal protein to human. Despite of development of the poultry industry in the country and increase the number of projects producing chicken meat, but they are not able to meet the domestic demand for poultry meat and fill the gap between domestic production and demand. As a result government was forced to allow import of large quantities of this item. Annual demand has been estimated up to 408 thousand in (2017). Estimation the size of the gap between expected domestic consumption and production up to 300 thousand tons per year. This study came with many result, one of them was to find the optimal combination of capital (63589 ID = 52.990 USD) and labor (757) hours of work, while the optimal production was (42.4 tons). The optimal production which minimizing the costs of production was (39.3 tons) and best number of birds at this level was (23.117) bird. The optimal production which maximizing profit was (52.4 tons). Finally the recommendations was ensured on expansion in investment projects of chicken meat products and increased government support, protect local farmer from foreign competition and increase awareness among farmers to use modern means in broiler breeding.

***Keyword*:** Cost flexibility, Gab, poultry meat, Investment, Maximum profit, Optimized size.

Introduction

The agricultural sector is the cornerstone of the economic structure of many countries in the world, especially the developing countries. Many other economic sectors depend on agriculture sector. Therefore, the state should pay attention to this sector and develop it to achieve high rates of growth in the agriculture sector that exceed population growth rates. The poultry industry, specifically the production of chicken meat, has great importance in the country's economy. Because it increases the yield and the speed of capital turnover and the low cost of obtaining the protein unit, as well as providing careers for tens of thousands of unemployed. Most chicken production projects in Iraq are small and widespread in Iraqi governorates. The study of the production of chicken meat is one of the important studies that can be used in the development of policies for the promotion of animal production because of its direct relationship with optimal use of available resources and thus the advancement of the national economy and the achievement self-sufficiency of the country (Al-Etabi, 2014).

Materials and Methods

To study the current production of chicken meat we

1- Estimate the production function of chicken meat and its economic derivatives in order to identify the relationship between suppliers and thus find the optimal quantities of inputs and outputs of this function for the purpose of finding economic efficiency in their use.

2- Derive of the long-term cost function of chicken meat in order to identify the optimum output rate (productivity), the maximal profit outcome.

The research has been divided into two sections the first topic: - The reality of the production of chicken meat the second topic: results and discussion

The reality of the production of chicken meat.

First: The reality of the production of chicken meat in Iraq and : animal wealth is essential and important part of the agricultural sector. Therefore, the poultry industry in Iraq has a clear importance in the Iraqi economy, especially in the agricultural sector. The first poultry initiatives in Iraq started through the state and its public sector in the late sixties, which represented the establishment of the General Company for Poultry in 1965. And developed further in the seventies when the State initiated the establishment of a number of fields in the outskirts of Baghdad. The competence of these companies is to import chicken meat and marketing to the provinces of the country through the Foundation As well as production of meat and table eggs, (Ministry of Planning, Central organization of Statistics, Agricultural Centre of statistics).

Second : The economic and social characteristics of the research sample The basic data were obtained from the producers directly by designing a questionnaire that included most of the data for the random sample of chicken broilers, which reached (54) felid of the total (232) represented as (20%) of the total fields. The secondary data for the research sample were obtained from the Ministry of Planning, the Ministry of Agriculture, and Agriculture Directorate and thus the total sample (54) farmers. The field survey of the sample shows that the productivity of one field (19500) tons/meal. The average bird weight per kilogram was 1,700 kg and this weight was increased during the breeding period of 40 days while the average consumption per fed was 2,750 kg. The cost of feed consumed during the meal was (41) tons / meal (Ministry of agriculture, 2016).

Third: Total cost structure of a sample of chicken meat producers Variable costs: The following items and their relative importance (chicks 18.6%), work (2.6%), feed (67%), medicine (4.4%), (Maintenance 0.33%) and (fuel 3%) and the total variable costs of total costs accounted for 95%. Fixed costs: The following components included the relative

importance of the field, instead of field rent (60%) and permanent work (40%). The total fixed costs were 5%. Average total cost for producing one (kg) for sample was estimated to be (2600 dinar/ kg).

Result and Discussion

(A) Statistical Estimation of Chicken Meat Production Function The data were obtained through a random sample of meat broilers in Wasit governorate and a questionnaire form prepared to meet the study objectives A random sample of (54) fields was selected from (232) fields, which formed (20%) of the total fields. The Kop-Douglas function was used to express the productive relationship as the dependent variable (the value of the chicken meat production) and the independent variables. Work, the capital which includes (value of chicks, feed value, value of veterinary medicine and value of family work) as independent variables according to the following equation, (Henderson, 1980):

$$y = AL^{\alpha}K^{\beta}$$

where Y= the value of chicken meat production

L = Labor value (hour)

K= Capital value (ID)

A, α, β are function parameters

2- Statistical Estimation of Chicken Meat Production Function : The least square estimation method was used In the estimation of the function of the production of chicken meat and double logarithmic formula, based on the statistical tests (t, F, R^2) and standard (Klein, Durbin-w, piark), (Koutsoyiannis,1997).

where: y = represents the value of production of chicken meat

L = labor (hour)

k = Value of capital (D)

N = 210 In y =2.92 + 0.165 ln L + 0.656 ln K.

t= (3.141) (2.479) (7.561)

R^2 = 0.88, F= 1087, D.W. = 1.91

By converting the function above into a cup-Douglas formula we obtain a production function

$$Y = 2.92\ L^{0.165}\ K^{0.656}$$

The results of the statistical estimation of the parameters of the chicken meat production function showed that the calculated value of (t) shows the significance of the two variables (labor, capital) at a significant level of 1%. And R^2 = 88%. This means that 88% of the variables in chicken meat production are explained by the changes in work and capital, while 12% of the changes are due to other factors not included in the model. The value of F) calculated from the model indicates the significance of the whole function at 5%, (Koutsoyiannis, 1997).

(B) Econometric Analysis

There was no multicollinearity problem between the two explanatory variables (the capital and the labor) using the (Klein method), where the total correlation coefficient of the multiple linear model was found by taking the square root of the selection factor of 0.93) Compared by of the correlation coefficients. it was greater than the values of the simple correlation coefficients in the matrix of the correlation coefficients and the absence of the autocorrelation between the residues through the Darban Watson test (D.W) (1.72 < 1.91 < 2.26), from which we infer that there is no self-association between random errors associated with independent variables in the chicken meat production function. Since the research is based on cross-sectional data, it is expected that there is a problem of inconsistency of homogeneity of variance, which is often accompanied by cross-sectional data, which include the estimation of regression equation as a dependent variable and the output of chicken meat as a separate variable and the estimated relationship as follow, (Johnston, 1984).

$$\text{Log } ei^2 = -1.593 + 0.108 \log y$$

t = (- 0.599) (2.180)

R^2 = 0.0041, F= 1.32

The estimated function above was not significant for a significant level of 1%, according to the F test. The calculated t-value of the function above was less than the table value and 1% significance this indicates absence of inconsistency of homogeneity problem.

(C) Economic Analysis :

1. **The parameter value of the variable in the double logarithmic function represents the production elasticity of this variable**, which shows that the productive elasticity of the work (0.165) is positive and low. And it was (0.656) for capital, which is positive and relatively high. This means that the increase of capital by 10% leads to increase of production by (6.56%). The total elasticity of production (β + α) reached (0.821) which means (decreasing returns to scale). This indicates that the increase in the quantities used by the production resources by 10% leads to an increase in production of chicken meat by (8.21%), which means that it provides the possibility of increasing production in a decreasing manner when the resources used are used at a fixed rate.(Debertian,1986).
2. **Economic derivatives of chicken meat production function**. The marginal and the average of production function for both labor and average capital suppliers were calculated as an average of (39314) thousand dinars / meal. While the marginal output and the average capital production rate were calculated when the labor component was used at an average (780) hours / meal. The final derivatives was as follows :

$$y = AL^{\alpha} K^{\beta} \rightarrow Y = 2.92\ L^{0.165}\ K^{0.656}$$

Average product of the labor resource when the average capital in the sample is (39314) thousand dinars

$$AP_L = AL^{(\alpha-1)} K^{\beta}$$

$$AP_L = 2.92\ L^{-0.835}\ (39314)^{0.656}$$

$$= 32.46\ L^{-0.835}$$

The average output of capital produced when the average work in the study sample (780) hours

$$AP\ (K) = AL^{\alpha} K^{\beta-1} = 2.92\ L^{0.165} K^{-0.344}$$

$$8.76\ K^{-0.344} =$$

While the marginal product of the labor resource

$MP_L = A\ \alpha\ L^{(\alpha-1)}\ K^{\beta} = (2.92)$

$(0.165)\ L^{(-0.835)}\ K^{\beta} = (0.48)\ L^{(-0.835)}$

$(39.314)^{0.656} = 5.3\ L^{-0.835}$

The marginal product of the capital resource

$(MP)\ K = \beta AL^{\alpha}$

$K^{(\beta-1)} = 0.656\ (2.92)\ L^{0.165}\ K^{-0.344} = 5.7\ K^{-0.344}$

3. Estimating the optimal quantities of labor suppliers and capital

It is possible to obtain at the values of the optimal quantities of suppliers of work and the capital, if we assume that the farmers work under perfect competition. This means the stability of the unit price of output and the unit price of the productive resources used in production. In order to maximize profit of this function, we take its partial differentials and, equalize it by zero. or the value of the marginal product with market price, (Debertian, 1986).

$(\alpha\ A^{(\alpha-1)}\ K^{\beta})* P = w$ (for labor)

$(\beta A^{\alpha}\ K^{(\beta-1)})* = r$ (for capital) w = wage, r = capital interest.

Since the average price of one kilogram of chicken (3000) ID which equals (2.5 USD) and the average price of the labor resource (1500) ID which equals (1.25 USD) per hour and interest on the capital (1.2%).

$y = 2.92\ L^{0.164}\ K^{0.656}$

$dy/dL = (2.92)\ (0.164)\ L^{-0.836}\ K^{0.656} *3000 = 1500$

$1.44\ K^{0.656}/\ L^{0.836} = 1.500$

Divide the two sides of the equation by 1.500

$0.95\ K^{0.656}/L^{0.831} = 1$

$L^{0.831} = 0.957\ K^{0.656}$

By dividing the two equation pairs at 1/0.831

$L = (0.95\ k^{0.656})^{1.19}$

$L = 0.94\ K^{0.605}$ (1)

As for the capital

$dy/dk = 2.92\ (0.656)\ L^{0.164}\ K^{-0.344} *3000 = 1.2$

$5.746\ L^{0.164}/K^{0.344} = 1.2$

By dividing the two sides of equation by 1.2

$4.788\ L^{0.164}\ /K^{0.344} = 1$

$L^{0.164} = 0.208\ K^{0.344}$

Divide the two ends of the equation by 1 / 0.64

$L = (0.208\ K^{0.344)\ 6.09}$

$L = 7.2* 10^{-5}\ K^{0.015}$ (2)

Equally equation (1) with (2)

$0.94\ K^{0.605} = 7.2* 10^{-5}\ K^{0.015}$

$0.94\ K^{0.605-0.015} = 7.2* 10^{-5}$

$K^{0.59} = 7.65 * 10^{-5}$

$K = (0.765 * 10^{-5})^{1.69}$

$K = 63, 589, 8$

By compensating in equation (1), optimum working hours can be found

$L = 0.94\ K^{0.605}$

Hours $757\ 6(63.589)^{0.605}$

$= 0.94$

The optimal combination that achieves efficiency is (63589 ID = 52.990 USD) of the capital and 757 hours. The optimum output of this combination can be calculated by compensation in the output function as follows:

$Y = 2.92\ L^{0.164}\ K^{0.656}$

$= 2.92\ (757)^{0.164} * (63589)^{0.656}$

$= 42.498$ tons

4- Estimation of the function of the production costs of meat chickens in the long term. The cost function was estimated to produce chicken meat from the data of the research sample where an economic relationship was obtained on the linear, quadratic and cubic image. The cubic model was preferred in the representation of the data used in the estimation, Which is included in this model on the other hand where it can be expressed in the following equation, (Gujarati,1978):

$TC = 48020 + 30215.21\ Y - 240.51\ Y^{2} + 3.031\ Y^{3}$

t = (3.812) (9.538) (-2.141) (4.221)

$R^2 = 0.92$ F = 689 D.W. = 1.84

It is clear from the above function that the value of R^2 is about 0.92. This means that about 92% of the changes in the production costs of chicken meat are due to the change in the factors of production while the rest of the changes are estimated to be 8% due to other factors not included The model also showed the absence of the self-correlation problem since the value of (D.W) is 1.84 at a significant level of 5% and the degrees of freedom 211 ($1.23 < 1.84 < 1.952$) and from this we conclude the lack of self-correlation between the residues Economically, the model showed that the reference of the parameters is identical to the economic logic . the cost function at its beginning is increasing (+) as in the Y signal and then begins to decrease (-) as shown in Y^2 and then starts increasing (+) Parameter Y^3. The model also satisfies the assumption that there is no linear relation between the independent variables, because the model is not linear in terms of variables, because the variables are Y^2, the output square Y^3, the output cube is connected to functionally, but the relationship is nonlinear (Gujarati, 1978).

5- Estimation of the optimum average production and the maximum profit for chicken meat.

A- Optimal size of production **:** When a product reaches an average is called the average total cost at the lowest possible value, (Al-Ukeili, 2015). This optimum term refers to the highest efficiency which is the level at which the efficiency of a particular size of the farm reaches as high as possible. At this output, the value of the resources needed to produce one unit of the commodity is as low as possible. The optimum rate of output does not necessarily mean the level of production that achieves the largest possible profit, because the profit is not limited only to production costs, but depends on both the volume of output and the unit sale price of output. As all production costs are considered variable costs

in the long term. The average total cost equation was derived from the total cost equation by dividing the latter on the output after excluding the fixed limit to reflect the fixed costs, (Gujarati, 1978). The average cost of chicken meat was as follows :

$$\mathbf{LRATC = 30215.21-240.56Y + 3.030Y^2}$$

In order to determine the optimal level of production which reduces costs, the first necessary condition for cost minimization was applied. This is the first derivative of the function of the average total costs for the product and its equivalent to zero. Thus, the equation is resolved for y and the optimal production level is 39.3 tons of chicken meat as shown in the following equation:

$dATC/dY = 0$

$-240.56 + 6.06\ Y = 0$

$6.06\ Y = 240.56$

$Y = 240.56 / 6.062$

$Y = 39.3$ tons

The optimal number of chickens, which reduce the cost obtained by dividing the optimum size of production (39.3) tons on the productivity of birds, which amounted to be (1,700) kg By applying this, the optimum number of chickens was 23,117 birds. While the average actual number (11,000) birds and we notice a significant difference between the two levels. As shown in table (1)

Table 1 : Optimal size and optimal number of birds at Actual and optimal levels

	Actual level (1000 bird)	**optimal levels (1000 bird)**
Production	18.7	39.3
Bird no.	11	23.117

Source: Calculated based on questionnaire form

(B) Profit maximization

The level of output that achieves the maximum profit was obtained through the equalization of the marginal cost function at the prevailing farm price of (3.000 ID = 2.5 USD)/KG.

$MC = PY\ \ 3215.2 - 481.02\ y + 9.093\ y^2 = 3000$

$215.21 - 481.02\ y + 9.093\ y^2 = 0$

the value of Y can be obtained by the equation

$$Y = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Y= 52.4 ton (amount which maximizes profit)

Conclusion

An analysis of the total cost structure shows that variable costs accounted for 95% of the total cost. The fixed costs accounted about (5%) of the total costs. The production function was estimated (Kop-Doglos) and the total production elasticity was (0.812), which is less than one, which shows a decrease in the returns of, which indicates the second stage of production. The optimum combination of capital (ID 63589 = 52.990 USD) and work (757) hours, while the optimum production is (42.4) tons**.** The optimal size of the production, which reduces the cost of long-term meat-breeding projects, was 39.3 tons and the maximum size was (52.4) tons the study estimated the number of birds optimal for production is (23,117) birds while the average actual production (18.7) tons. Directing farmers to use optimal quantities of labor suppliers and capital **.** Directing farmers to reduce the quantities of work used in sample farms to optimal quantity and increase the capital used to the optimal quantity. Increasing the government support to the owners of farms to produce chicken meat, either by supporting production requirements or to prevent loans that facilitate payment. Increase investment and expansion, especially large projects for the purpose of maximizing profits. Protecting the domestic product from foreign competition by increasing the customs tariff to the level that ensures the continuation of the production of local meat chicken. The Ministry of Agriculture to spread awareness of chicken meat breeders using the best resources and modern methods in the production of this item.

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