

Estimation of the Production Function of Diyala State Company for Electrical Industries for the Period 2010-2019

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Abstract

To research the production function of the Diyala General Company for Electrical Industries as part of the industrial companies operating in the public sector is of clear importance within the framework of developing the field of the electrical industry, as the study of the production function has effects in improving the management of the company's economics, which increases the contribution of this sector to the inputs of other economic sectors in a way that enhances the comprehensive development process. This study aims to estimate the production function of the aforementioned company and analyze it in a standard way to show the contribution and impact of each of its elements on changes in the quantity of production, and then shed light on the production structure and technology. In this study, the production function of Diyala State Company for Electrical Industries was estimated and analyzed for the period 2010-2019, as the method of least squares (OLS) was applied to reach the results of the analysis using the Eviews 10 program. In a functional relationship that was characterized by statistical significance in its estimated transactions and the estimated model in its general form, the model was analyzed economically by indicating the existence of a functional relationship between the quantity of production on the one hand and capital, labor and production requirements on the other hand. The company's use of labor-intensive technology. While the relationship of fixed capital formation and production requirements with the production quantity had a marginal effect, it justified not modernizing (mechanization) and adopting the labor component more than others.

Keywords: Production Function, Electrical Industry, The Estimated Model.

Introduction

The study of production functions occupies a strategic importance in the development and management of the resources of economic units, including the analysis of the components and structures of the techniques of the production process, and the statement of their effects on the outputs. Therefore, this study aims to analyze the reality of the production process of Diyala General Company for Electrical Industries for the period 2010-2019 using the method of least squares to measure and diagnose the production function with its variables (production quantity, capital formation, labor, production requirements) and the significance of the estimated model and the coefficients of its variables, to reach the technology in which the company operates, assessing its economic reality, including formulating and directing the company's resources and exploiting them in an optimal manner that prepares for the company's management and proposing and creating the necessary economic policy.

Research Problem

Diyala State Company for Electrical Industries for the period 2010-2019 suffers from low production quantities and their volatility as a result of not using the appropriate technology. Therefore, the research is focused on estimating the production function, building the standard model and analyzing it statistically, econometrically and economically to reach the results and recommendations.

Research Hypothesis

The analysis of the production function of Diyala Company depends on the hypothesis that production is affected by the inputs of its components from capital, labor and supplies, and from it there is a significant relationship between the independent variables and the dependent variable.

Research Aims

1. Giving an overview of Diyala Company and defining the production function.
2. Analysis of production indicators and its requirements and related variables in Diyala State Company for Electrical Industries.
3. Specifying the standard model, and conducting statistical, standard and economic tests.
4. Estimating the production function of Diyala Company for the period 2010-2019 and analyzing the economically estimated model.

Previous Studies

The efforts of many previous studies and research focused on estimating the production functions of many production units and industrial and agricultural facilities in different and varied ways through diagnosing many of the functions that have been studied and taken as a reference framework for research, including the following:

1. The study (Al-Jabri, November 1991) was concerned with analyzing the production function of the Light Industries Company for the period (1969-1989) using several functions, including linearity, the Cobb-Douglas function, and the CES function through the method of least squares (OLS) in the analysis of production data and production factors. And tested statistically, statistically and economically under the standard model, where the thesis concluded that the production function of the light industries company is statistically significant for the parameters and the model in its general form, and the study concluded that the production function is logical economically.
2. The study (Al-Mousawi, Al-Dama'i, and Nasser, 2007) dealt with measuring and analyzing the production function of the Noura factory in Karbala using standard analysis to find out the variables affecting the production process. The study concluded that the production process in the Noura factory is in the stage of diminishing returns.
3. The study (Al-Fahdawi and Al-Jumaili, 2017) aimed to measure the impact of the technical variable in the agricultural sector using the OLS method for the time series data 1990-2013, and the study reached the significance of the estimated function. It recommended the introduction of the modern technical method in improving the productivity of the agricultural sector, especially the fertilizer industry.

This study comes within the framework of analyzing and estimating the production function of Diyala State Company for Electrical Industries for the period 2010-2019 to supplement the previous studies in that it is concerned with estimating the production function through the contribution of work as an independent variable. And the addition of fixed assets (at their book value) to reflect the real additions to the production process.

Research Methodology

The research adopted the descriptive and standard method in analyzing and estimating the function and analyzing its inputs and outputs based on the least squares method of the transcendental production function in analyzing the elements of production (capital, labor and production requirements) as independent variables that affect the quantity of production as a dependent variable, leading to the appropriate conclusions and recommendations for the research objectives.

1. Diyala State Company: History

Diyala State Company for Electrical Industries was established in 1974 and was called at that time the Industrial Complex. Since its establishment, the company has included four experimental production laboratories, which are the Electrical Measurements Factory, the Fans and Irons Factory, and the Mug Candles Factory. The company witnessed a continuous growth in demand for its products, which helped in the expansion of its projects. In (1983) the electrical transformer project was started, and in (1984) the construction of the new spark plug factory was initiated under the management of the Qadisiyah General Establishment for Electrical Industries, which included the old factories. In the nineties, the company continued to expand and grow for many electrical industries, such as the Al-Arkoun plant, which opened in 1990. The company witnessed a change in its system, so it was transferred from the facility system to the company system in 1998, while the name of Al-Qadisiyah Company was changed in 2003 to Diyala State Company for Electrical Industries after the opening of the photovoltaic laboratory (Electricity, 2021).

2. The Concept of Production Function

Describes the relationship between the amounts of production factors of labor, capital and other resources used on the one hand and the amount of production that the product reaches through mixing these factors and in certain technical proportions with the production function assuming the use of the most efficient production methods through which the producer can achieve the largest possible quantities of production And at the lowest possible cost (Ahlersten, 2008). Thus, the production function is that table that explains how to reach the largest possible amount of production through mixing units of production elements and using the best production techniques available during a certain period of time (Salvatore, 1983).

It is also known as a tool for describing the method of production quantitatively, economically and technically. From the first angle, the function targets the close relationship between the quantity of production and its elements, while it is viewed from the second angle as the process of synthesis between the elements of production according to the available capabilities and choosing the appropriate alternative, while looking at the production function from the technical angle. It is the technology used by the company to achieve the quantitative change that occurs in production according to the change in the contribution rates of the production factors. (Ali, Year 4 1999).

Since production is every addition of a new value to the existing capital, the production function studies the combination that achieves the increase in production through the functional relationship between the independent variables and the dependent variable in light of the technical condition of the impact of the constraints of the inputs of the function on its outputs represented by production (Al-Haboubi, 2017).

3. Analysis of the Reality of Diyala Electrical Industries Company

By compiling the company's data on the production process, the contribution of the two components of work, the formation of fixed capital, and production requirements, they could be included in Table (1), the following analytical points become clear.

Table 1: Production Quantities, Number of Employees and Total Fixed Capital Formation in Diyala State Company for Electrical Industries for the Period 2010-2019 Value (In Dinars)

Annual percentage change %	The value of merchandise and service supplies M	Annual percentage change %	The value of gross fixed capital formation K	Annual percentage change %	production quantity Q	Annual percentage change %	Number of employees	Years
-	26860494342	-	15065807180	-	2932	-	3441	2010
72.4	46309893248	21.1	18250299534	71.4	5024	-2.4	3360	2011
-85.9	46540550555	9.3	19948176884	15.3	5793	-7.7	3100	2012
782.7	57731529053	63.9	32692645887	10.1	6378	-4.3	2966	2013
-11.3	51231804512	14.5	37430249330	-8.7	5825	-3.7	2856	2014
-52.9	24108899286	3.7	38827997235	-58.8	2397	-7.2	2651	2015
3.8	25022444349	6.0	41151666357	0.3	2404	-5.2	2513	2016
-30.4	17418602181	0.0	41151666357	2.2	2457	-3.0	2437	2017
69.8	29571515697	0.0	41151666357	30.6	3209	-3.2	2359	2018
67.7	49588078172	0.0	41151666357	60.1	5137	-3.5	2276	2019
	6.3		23.3		5.8		-4.0	compound growth rate %

Source: Diyala Company, Public Administration, 2020

1. The quantity of production in the company has been increasing in the years 2011, 2012, 2013 and 2014 in a volatile manner, ranging from (2932) in 2010 to (5024) in 2011 with an annual change rate of 71.4%, to continue increasing to (5793) in 2012 with an annual change of 15.3%. By following the table, we see the continuation of the annual increase, but at a decreasing rate to 10.1% in 2013. This fluctuation indicates the disruption of the company's production in managing its outputs due to the impact of the production process on the variables of production elements in a varying manner from year to year, which reinforced the volatility and volatility of production, as it is noted that the increase in change The annual fixed capital accumulation in 2012 increased from (18250299534) dinars by 21.1% to increase in 2013 to (199481176884) dinars, at a rate of 9.3%. The high variable of production requirements has contributed to the increase in the quantity of production since the beginning of the series until the end of 2014, as the quantities of production for the subsequent years since 2015 began to decrease in a non-static manner compared to the production requirements of the aforementioned years, we find that they have increased and exponentially It was decided from the year 2016 until the end of the series at (41151666357) dinars, as this explains that the company followed a wrong investment policy for the labor and capital elements and the failure to reconcile them to reach an economic mixing ratio in favor of stabilizing or increasing production, which led to a decrease in fixed capital formation as equipment The machines are old, and modern mechanization has not been introduced into the company's factory lines. The old, dilapidated mechanization is satisfied. The stability of the annual percentage change figures for the formation of fixed capital indicates that no new money has been invested despite the increase in production in the years at the beginning of the series. This may be due to the fact that the year 2015 It has been affected by the atmosphere of austerity suffered by the public finances.
2. The fluctuation of the change in production requirements, which reached an amount of (463,0989324) dinars, with an annual change of 72.4% in 2011, to decrease to the reality of (6540550555) dinars, with a negative change rate of -85.9%, to confirm this that the fluctuation in the function variables took varying proportions and appeared in the decrease in the quantity Production throughout the time series in question, as it was noted that the percentages of change of the labor factor continued to decline from 2010 until the end of 2019, which confirms the decrease in the contribution of the labor element to the production function of Diyala Company.
3. From observing the data of the year 2014, we find that the quantity of production has decreased to (2,397) productive units with an annual change of -8.7%, accompanied by an increase in the accumulation of fixed capital to (374,30249,330) dinars, with a change of 3.7%, with a decrease in production requirements of (24108899286) dinars. An annual change rate of -52.9%. This year, and the one that followed, witnessed government austerity policies, as well as inefficient administration in mixing the resources of the production process.

4. Table (1) shows, in the years 2016-2017-2018-2019, the continued decline in the number of labor force to 2513 with a change rate of -5.2% accompanied by a change in the production quantity to 2404 with an annual change rate of 0.3%. While the production quantity decreased to (2404) units at a rate of 0.3% in 2016 and the quantity of production decreased by 2437 units with a change rate of -3.0% for the year 2017, and the constant decrease in fixed capital formation to (41151666357) dinars with a rate of change of 0% and the increase in production requirements to (17418602181).) dinars after it was an annual change rate of -30.4%.
5. While we note the stability of the 0% decrease in the number of employees and fixed capital formation to -3.2 for the years 2018 and 2019, while production requirements decreased in 2019 to 49588078172 at a rate of 69.8% after it was 29571515697 at a rate of 67.7%. This confirms the previous justifications that the blending of production factors was not stable and suffered from fluctuations.

4. Characterization of the Standard Model

By extrapolating the reality of the activity of the Diyala Public Company and studying the relevant variables, despite the intertwining of the economic relations of the variables involved in the production process of the company and the varying impact of those variables, which makes it difficult for the researcher to design the model. Related to the operative theory of economics, a logarithmic Dali model has been chosen that aims to measure the impact of (labor, capital and production requirements) on the production process as follows:

1. The dependent variable (output of the function):
The symbol (Q) was used to express the amount of production that was actually reached from the production process of the electrical industry in the company.
2. Independent variables (function inputs):
Three independent variables were diagnosed whose impact extended to the quantity of production, which are: The number of workers assigned to the letter (L) where it represents the number of units of workers actually contributing to the production process. While the second variable was the formation of fixed capital and is symbolized by the symbol (K) expressing the company's assets Of (machines, machinery and equipment, as well as buildings, land and means of transportation), while the third variable was the value of commodity and service requirements in the production function and symbolized by the symbol (M) and expressed by working capital = current assets - current liabilities + fixed assets at book value.
3. Formulating the function
The production function is concerned with the interpretation of the relationship (production) and (labor, capital and requirements), as the function depends, in theory, on the contribution of the aforementioned production factors and in a specific combination that will lead to an increase in (production). Therefore, it was possible to formulate the equation of the function, which describes the relationship between the independent variables on the one hand and the dependent variable on the other hand, based on the data of the study and in light of the natural logarithmic adjustment of the time series data of the function and for technical reasons related to the measurement method, as follows:

$$\ln Q = B_0 + B_1 \ln L + B_2 \ln M + B_3 \ln K + U_t$$

Where:

output logarithm	$\ln Q$
Labor logarithm	$\ln L$
The logarithm of production inputs and expresses production costs	$\ln M$
The logarithm of fixed capital formation	$\ln K$
random error limit	U_t
Parameters of the independent variables	B_0, B_1, B_2, B_3

5. Estimation of the Standard Model

The standard model for the logarithmic production function in question was estimated using the Ordinary Least Square method after taking the natural logarithm of all the model variables, since the logarithmic formula is the appropriate formula for the method of least squares, and based on the Eviews 10 program, it was possible to obtain the following equation:

$$\ln Q = 26.434559 + 2.070209 \ln L + 0.160152 \ln K + 0.596085 \ln M + U_t$$

Table 2: Results of the Standard Estimation of the Model

Variable	Coefficient	t-Statistic	f-Statistic	Prob	R ²	$\bar{R}^2$	D.W
LNK	0.160152	1.293372	42.96824	0.0045	0.726346	0.704096	1.777294
LNL	2.070209	3.530778		0.0006			
LNLM	0.596085	9.737985		0.0000			
C	26.434559	3.738074		0.0003			

Source: see Appendix (1)

The data in Table (2) shows the results of the standard estimation of the production function model of the Diyala General Company for Electrical Industries for the period 2010-2019, which can be summarized in the following points.

6. Test the Model Statistically and Standardly

- **Coefficient of Determination R²**

According to this indicator, the parameters of the independent variables (the logarithm of work Lnl, logarithm of fixed capital formation LnK and logarithm of production inputs LnM) are statistically significant, which is reflected in a statistical ability to explain 72% of the changes that occur in the dependent variable (logarithm of LnQ production quantity) with 28 % of changes of the dependent variable to the effect of the random variable Ut, which includes the effect of other variables on the standard model and errors of aggregation and measurement. As the value of (R²) approaches the correct one, this means that the statistical ability of the model parameters to clarify their effects on the dependent variable in the estimated relationship.

- **Corrected Determination Coefficient $\bar{R}^2$**

When the value of the corrected coefficient of determination $\bar{R}^2$ is observed, which amounts to 70%, which reveals the ability of the statistical parameters of the independent variables to explain changes in the quantity of production, while 28% of the changes of the dependent variable are attributed to the effect of the random variable Ut, which includes the effect of other variables on the standard model. assembly and measurement errors.

- **t-Statistic Test**

This test showed the significance of the estimated parameters of the function as follows:

1. When comparing the tabular value (t) of the fixed term C (efficiency parameter) with its calculated value of (3.738074) at the level of significance (5%), there is a high statistical significance of (Prob 0.0003).
2. A high significance (Prob0.0003) of the logarithm of fixed capital formation LnK becomes clear when comparing the tabular value (t) with its calculated value of (1.293372) at the significance level of 5%.
3. When comparing the tabular value (t) of a parameter of the work logarithm Lnl with its calculated value (3.530778), it is noted that its high statistical significance reached (Prob 0.0045). at a significance level of 5%.
4. While the significance of the logarithm of production requirements was LnM (Prob 0.0000) after comparing the tabular value (t) with its calculated value of (9.737985) at the significance level of 5%.

- **f-Statistic Test**

This test showed the statistical significance of the estimated model of the production function, after comparing the tabular value (F) with its calculated value of (42.96824) at the level of significance (5%), which reflects the high statistical ability of the function to clarify the impact of changes in the dependent variable according to the change of independent variables.

- **The Durbin-Watson Test**

One of the standard tests to test for the existence of the autocorrelation problem, when comparing the calculated (DW) value of (1.777294) with its tabular value at the level of significance (5%), it falls within the acceptance region of the null hypothesis $P^{\wedge}=0$) (HO: which states that there is no Autocorrelation problem in random error limit Ut.

7. Economic Analysis of the Production Function of Diyala State Company for the Period 2010-2019

Based on the results of statistical and standard tests, the results can be analyzed economically through the following three points:

1. The existence of a relationship between the parameter of the logarithm of labor $B1LnL$ and the logarithm of the quantity of production indicates that increasing the labor element by one unit, assuming that the rest of the production factors are fixed, will lead to an increase in the logarithm of the quantity of production LnQ by (2.070209) units, which indicates that Diyala State Company depends on an intensive technology. It employs a large number of workers to carry out the production process.
2. It is noted from the aforementioned table that there is a relationship between the parameter of the logarithm of fixed capital $B3LnK$ and the logarithm of the quantity of production LnQ . It indicates that the increase of the fixed capital component by one unit assuming that the other factors of production are fixed will lead to an increase in production by (1.293372) units only, and this means that the relationship between fixed capital formation and production quantity is not a close relationship, because fixed capital does not significantly affect the formation of production, its impact is positive and low. Which enhances the low productivity of the fixed capital formation component, as well as reduces the productivity of labor as well due to the presence of disguised unemployment.
3. It is also noted that there is a relationship between the parameter of the logarithm of production inputs $B2LnM$ and the logarithm of the production quantity LnQ , indicating that the increase in production requirements by one unit, assuming that the rest of the production elements are fixed, will increase the logarithm of the production quantity LnQ by (0.596085) units, which indicates that the effect of production requirements in The amount of production is a marginal effect.

Conclusions

Based on the results of econometric and economic analysis, the following conclusions were reached:

1. The alternative hypothesis was accepted, and there is a relationship between the variables of the production function of the Diyala State Company for Electrical Industries for the period 2010-2019, according to the standard model, which had a statistical significance and was free from statistical and standard problems and in conformity with the economic logic.
2. The production function of Diyala General Company for Electrical Industries operates with a decreasing volume yield, as the sum of labor and capital transactions is less than the correct one.
3. The labor factor has a marginal effect on the quantity of production due to the imbalance in the ratio of capital and labor, as it follows from this that the intensification of work has an impact on the effectiveness of the labor element in the production process because the increase in the number of labor force causes disguised unemployment that distorted the production structure in favor of a decrease in the quantity of production on the long term.
4. The Diyala State Company's use of the labor component in a way that exceeds the use of fixed capital formation and production requirements led to a decrease in their contribution to the quantity of production, as well as a decrease in production.
5. The fact that the company relies on machines and machines with old technology, which resulted in a decrease in the impact of the element of fixed capital formation and production requirements, due to the limited and low production.

Recommendations

Based on the previous conclusions, the researcher recommends the following:

1. Paying attention to the industrial policy of the public sector in order to develop the structure of the existing industries to bring them to the stage of increasing yields by providing material and investment support.
2. Formulation of a commercial policy that works to protect the local industry from foreign competition.
3. Paying attention to an economic policy that plans to import the necessary technology in order to enhance the productive capacity of public sector companies.
4. Follow a financial policy that supports industrial production by increasing financial allocations in the general budget.
5. In order to increase the impact of the two factors of fixed capital formation and production requirements, they must be developed through the introduction of modern technology that contributes to improving the performance of fixed capital formation.
6. Reconsidering the technique of labor intensification, in order to raise the productivity of capital as well as the labor component itself, by adopting the previous point, and avoiding disguised unemployment.

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Supplement 1: The results of the estimated standard form for the Diyala State Company for Electrical Industries for the period 2010-2019

Dependent Variable: LNQ
Method: Least Squares
Date: 03/03/22 Time: 11:36
Sample: 2010M01 2019M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	26.434559	7.071705	3.738074	0.0003
LNK	0.160152	0.123825	1.293372	0.0045
LNL	2.070209	0.586332	3.530778	0.0006
LNLM	0.596085	0.061212	9.737985	0.0000
R-squared	0.726346	Mean dependent var	8.080838	
Adjusted R-squared	0.704096	S.D. dependent var	0.805231	
S.E. of regression	0.561300	Akaike info criterion	1.715644	
Sum squared resid	36.54675	Schwarz criterion	1.808561	
Log likelihood	98.93865	Hannan-Quinn criter.	1.753378	
F-statistic	42.96824	Durbin-Watson stat	1.777294	
Prob(F-statistic)	0.000000			