

# ЭКОНОМИЧЕСКИЕ НАУКИ

## EVALUATION OF THE EFFICIENCY OF INVESTMENT PROJECTS BY THE METHOD OF THE COBB DOUGLAS DERIVATIVE FUNCTION

DOI: [10.31618/ESU.2413-9335.2020.1.74.729](https://doi.org/10.31618/ESU.2413-9335.2020.1.74.729)

*Bekimbetova Gulnora Maratovna*

*Head of the Department of Scientific Research and Training of Scientific and Teaching Personnel of the Academy of Public Administration under the President of the Republic of Uzbekistan*

### ABSTRACT

The article substantiates the use of the method of analysis of the Cobb-Douglas derivative function, which contributes to an additional evaluate of the effectiveness of investment projects, giving investors and managers confidence in the implementation of investment projects in the production process.

### АННОТАЦИЯ

В статье обосновывается использования метода анализа производной функции Кобба-Дугласа способствующий дополнительной оценки эффективности инвестиционных проектов, дав инвесторам и руководителям уверенность в внедрение инвестиционных проектов в процесс производства.

**Key words:** elasticity of labor and capital, productivity, production function, efficiency.

**Ключевые слова:** эластичность труда и капитала, продуктивность, производственная функция, эффективность.

### Introduction.

Nowadays, in science, mathematical methods and models use widely with the helping of formalization and abstract description of the most significant relationships of economic variables of systems. And addition objects is carried out at a high level, the forms and parameters of the dependencies of these variables are evaluated, and new knowledge about objects is obtained; the best decisions are made in a given situation; conclusions are formulated that are adequate to the object under study; the main theoretical points are stated compactly<sup>1</sup>. In the context of the structural crisis in the domestic economy, it is necessary to formulate a strategy for economic activity, both in the near and distant future, which is fundamental and necessary to maintain competitiveness.

The state program for the implementation of the Action Strategy for the five priority areas of development of the Republic of Uzbekistan for 2017-2021 in the year "Development of Science, Enlightenment and Digital Economy" sets the task to develop specific criteria and targets for evaluating the performance of executives<sup>2</sup>. That is why nowadays analyze of theoretical aspects of the methods and goals in assessment of young leaders is relevant.

### Research methodology.

The concept of a production function as a model of a sufficiently large production facility or system

(production association, industry, economy of a region, country) is based on the assumption that the value of output is uniquely determined by the set and level of use of production factors. Moreover, the internal structure of the investigated production facility is considered insignificant for the purposes of the study and it is assumed that production factors are used rationally. Rationality in this context means that the personnel of this facility works as best as possible in accordance with the legal goals of production activities, external conditions (primarily prices and demand for manufactured products), and qualifications and level of organization<sup>3</sup>. Moreover, the goals of production activities usually understood as maximizing profits or minimizing costs when choosing options for using production factors taking into account external conditions.

As you know, the Cobb-Douglas function is a production function that reflects the dependence of the volume of production on the factors of production that create it, the cost of labor and capital. Knut Wicksell first proposed it. In 1928, Charles Cobb and Paul Douglas in Theory of Production tested the function on statistics. This article attempted to determine empirically the effect of capital and labor spent on output in the US manufacturing industry<sup>4</sup>.

Of course, the most famous production function named after its authors, the American economist P.

<sup>1</sup> Yusupova M.D. The production function of Cobb-Douglas, as a tool for analyzing mathematical models of news, Publisher: Chechen State Pedagogical University (Grozny), ISSN: 2587-6074, Volume: 17, Number: Four (20) Year: 2017, 304-309 pp., UDC: 330.43.

<sup>2</sup> Decree No. PF-5953 of March 2, 2020 on the state program for the implementation of the action strategy on the five priority areas of development of the

Republic of Uzbekistan for 2017-2021 in the "Year of Science, Enlightenment and Digital Economy".

<sup>3</sup> Gorbunov, V. K. Production functions: theory and construction: a training manual / V. K. Gorbunov. - Ulyanovsk: UISU, 2013. - 8 p.

<sup>4</sup> Yusim V.N., Filippov V.S. Cobb-Douglas production function and management of economic and technological development, Theory and Practice of Management DOI: <http://dx.doi.org/10.21686/2413-2829-2018-2-105-114>, Russia.

Douglas and mathematician C. Cobb processed the economic statistics for the manufacturing industry, considering the growth of fixed capital, the amount of time worked and the volume of production. The volume of production during this time increased by 140%, and the growth occurred due to an increase in fixed capital and due to an increase in working hours. As a result, this function is used by many scientists to assess the level of reproduction both at the macro level and within individual industrial enterprises.

The most important features of the Cobb-Douglas function when interpreted in a non-classical spirit can be formulated as follows<sup>5</sup>:

- the constancy of profit and unit costs with no accumulation is assumed. The degree of interchangeability of factors ranges from zero to one and is usually less than one. The limits of interchangeability are determined by a given level of technical development;

- theoretically possible unlimited replacement of labor by capital.

Based on the conditionally introduced substitutionality of production factors, the following two conclusions can be made regarding the functional relationship of these factors: *ceteris paribus*, an increase in one of them leads to an increase in output - the first derivative is positive. However, the marginal productivity of an increasing factor decreases with an increase in the magnitude of this factor - the second derivative is negative.

#### Analysis and results of research.

The level of organizational and technical knowledge is displayed in appropriate forms of factor interactions. In this case, the level of knowledge is constant, i.e. within this framework, a lack assumed of technological progress. Thus, the economic specification of the econometric model is:

$$Y = A * L a_1 * K a_2 \quad (1)$$

where: Y is the total volume of production; L - labor contribution; K is the amount of capital spent; A is the total productivity of all factors; a1 and a2 are the elasticity of labor and capital.

An important role in calculating the estimated volume of production using the Cobb-Douglas formula is played by the parameters a1 and a2. The elasticity of factors shows the effect of changes in their ratio on physical production, taking into account the equality of other conditions. If the value of a0 is 0.45, then an increase in the use of labor resources by 1% will lead to an increase in output by approximately 0.45%.

The power-law Cobb-Douglas production function is as follows:

$$Y = a_0 K^{a_1} L^{a_2} \quad (2)$$

where, L and K are the source data, a0, a1, a2 are the uncertain values that need to be found.

$$\ln(Y) = \ln(a_0) + a_1 \ln(K) + a_2 \ln(L), \quad (3)$$

$$\begin{aligned} \text{Replace change, } \ln(Y) &= Y', \quad \ln(a_0) = a'_0, \\ \ln(K) &= K', \\ \ln(L) &= L' \end{aligned} \quad (4)$$

It turns out this formula, which we will use later.

$$Y' = a'_0 + a_1 K' + a_2 L', \quad (5)$$

When constructing and analyzing the derivative Cobb-Douglas function of the power type according to table No. 1 using the example of Uzmetkombinat using formulas (1-5), the following are obtained initial values:

Table 1.

**Construction and analysis of the derivative Cobb-Douglas function of the power type of "Uzmetkombinat" JSC<sup>6</sup>**

Period	Y	K	L	Y'	K'	L'	Y calculated
2015	6	64	102	1,79	4,16	4,62	7,1
2016	65	76	102	4,17	4,33	4,62	75,4
2017	431	111	125	6,07	4,71	4,83	350,5
2018	4165	232	204	8,33	5,45	5,32	1278,1
2019	1150	288	228	7,05	5,66	5,43	3353,4

In order to find a0, a1 and a2 we use a linear function and we obtain the following value:

<sup>5</sup> Zyukin D.A., Gurova I.E. The study of the level of use of production factors in a pharmaceutical enterprise based on the Cobb-Douglas function // Modern scientific research and innovation. 2016. No. 5, URL:

<http://web.snauka.ru/issues/2016/05/67831> (accessed: 02.02.2020).

<sup>6</sup> Calculated by the author based on information reports of "Uzmetkombinat" JSC (2015-2019).

Table 2.

Indicators for calculating the uncertain values of $a_0$ , $a_1$ and $a_2$		
$a_2$	$a_1$	$a_0'$
-18,0	13,7	28,3
13	7	28

Knowing  $a_0'$ ,  $a_0$  is found using this formula  $\ln(a_0) = a_0'$  and we get  $1.85778E + 12$ . Thus, in the course of analysis of the activity of the "Uzmetkombinat" JSC, it was established that the enterprise is one of the leading manufacturers of finished products.

#### Conclusions.

Analysis of the financial results of the enterprise revealed that the growth of revenue and the share of net profit in it also characterizes the activity of the enterprise as effective. The performance remains high and we can expect improved production results in the future.

According to the results of the research, we received the following:

-firstly, based on analyzes, an increase in the use of labor resources will lead to an increase in the volume of output. The value of  $a_0$  according to calculations was  $1.85778E + 12$ , which determined the influence of labor resources on the growth of output.

-secondly, in this case, the production function of the total output of goods turned out to be  $a_1 + a_2 < 1$

Result the returns to scale increase. With perfect competition and equal elasticity of capital and labor, the coefficients  $a_1$  and  $a_2$  reflect the shares of each factor in total production.

УДК 339.1  
ГРНТИ 06.71

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### DYNAMICALLY DEVELOPING MARKETS: OUTLOOK OF CURRENT TRENDS AND IMPLICATIONS FOR BUSINESS PROCESSES

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DOI: [10.31618/ESU.2413-9335.2020.1.74.732](https://doi.org/10.31618/ESU.2413-9335.2020.1.74.732)

**Valchuk Petr A.**

*Bachelor in Business Administration  
Economics and Management Department,  
Czech University of Life Sciences,  
Czech Republic, Prague, 16500, Kamýcká 129;*

*Marketing and Trading Business Department, Kuban State University,  
Russia, Krasnodar, 350040, Stavropolskaya Str. 149;*

**Bespalykh Angelina V.**

*Bachelor in Business Administration  
Economics and Management Department,  
Czech University of Life Sciences,  
Czech Republic, Prague, 16500, Kamýcká 129;*

*Marketing and Trading Business Department, Kuban State University,  
Russia, Krasnodar, 350040, Stavropolskaya Str. 149;*

**Kivi Svetlana S.**

*Bachelor in Business Administration  
Economics and Management Department,  
Czech University of Life Sciences,  
Czech Republic, Prague, 16500, Kamýcká 129;*

*Marketing and Trading Business Department, Kuban State University,*