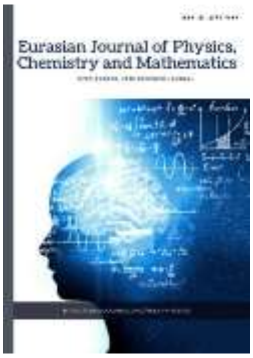

Econometric Assessment of the Perspective of Business Entities

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ABSTRACT

The article uses methods of mathematical modelling in the analysis of the socio-economic system. With the help of the Mathcad program, a multifactorial mathematical model was built for solving practical economic problems, which makes it possible to calculate the value of the production function and build multivariate regression models.

Keywords: production function, economic system, mathematical model, multidimensionality, regression analysis, Mathcad program.

Introduction

Due to the sharp difference and complex structure of research objects from natural processes in socio-economic systems, the identification of reliable sources of information that are close to the truth, with few exceptions or deviations, remains one of the urgent problems. One of the important directions of innovative development in business entities is the effective use of economic-mathematical models and information-communication systems in business and private entrepreneurship. We believe that it is appropriate to use correlation-regression, extrapolation, trend and other methods related to the formalization method of modelling this field and determining its dynamics [1-3].

The system of economic-mathematical models, the use of which is highly effective in business and entrepreneurial entities, includes the following.

1. The final result, i.e. the increase (decrease) in the volume of product production, based on the change of factors in business entities, is reflected in the production function in the following form:

$$y = f\left(x_1, x_2, \ldots, x_n\right) + \varepsilon \quad (1)$$

in which:

y- the result of the activity usually reflects the final product, profit, profitability or other similar microeconomic indicators;

$x_1, x_2, \ldots, x_n$ -factors influencing the activity;

ε- margin of error.

For example, land area, the value of fixed assets, number of employees, authorized capital, the volume of assets, loans, accounts receivable, etc. In econometric models, factors corresponding to quantitative parameters are taken into account, which ensures the adequacy and accuracy of the models. In the studies of some authors, it is recommended to include in the model the variables whose measurement unit is uncertain.

In our opinion, using the results obtained with their help in managing the activities of regional business entities is less effective than quantitative parameters [4-6].

If only two factors are studied in the model, for example, fixed capital (K) and a number of employees (L), then the formula (1) can be expressed by a function as follows:

$$\mathrm{Y} = \phi\left(\mathrm{K}, \mathrm{L}\right) \qquad (2)$$

In the construction of the production function corresponding to the small innovative activity, as a general indicator representing the state of the regional economy, the gross regional product created by business entities, i.e., in the field, and the factors affecting it include the number of employees, land area, fixed capital, wages, material reserves and others can be included.

The competitiveness of business entities is closely related to the quality and composition of their available resources. In the conditions of modernization, the most optimal option for small business entities is manifested in the optimal ratio of capital and labour. Various forms of the production function can be used to effectively manage and regulate the activities of business entities using modern methods. Among them, the Cobb-Douglas function is widely used. It is worth noting that the Cobb-Douglas production function was invented as a result of retrospective and prospective research of entrepreneurship and business entities.

$$Y = Y_0 \cdot K^{\alpha} L^{\beta} \qquad (3)$$

In this: Y_0, K, L, α, β – are the quantitative quantities determined in the model as a result of the analysis of statistical information, $\alpha + \beta = 1$ the condition is required to be fulfilled.

In general, based on the above formulas, it is recommended to use the correlation model of the following form for determining the proportionality of resources of business entities:

$$F = K \cdot A^{x} \cdot B^{y} \cdot C^{z} \cdot \ldots \cdot E^{n} \qquad (4)$$

in which: F – the volume of product production;

K – coefficient;

A, $B, C, \ldots, E$- factors affecting production;

$x, y, z, \ldots, n$- the degree of influence of factors on the volume of production.

It will be possible to determine the dynamics of the gross regional product with the help of retrospective research of the business development trend and the development of prospective parameters on the scale of a separate area.

When applying this model to business segments in the republic, it is necessary to take into account such factors as the low level of equipping farms with new equipment and technologies, insufficient use of information and communication technologies and Internet opportunities in supply and sales processes, and the high level of informal employment.

At the scale of a separate area, if the gross regional product indicator is set as the result indicator (y - function) of the mathematical model, then the variables, i.e. the main influencing factors are investments in the economy of the area (x_1), labour productivity (x_2), the production volume of small business entities (x_3), small businesses the number of people employed in the subjects (x_4), average salary (x_5), and the level of equipping labour with basic tools (x_6) are included as variables.$y x_1 x_2 x_3 x_4 x_5 x_6$

Some aspects of the application of econometric modelling at the scale of a separate region can be studied based on statistical data describing the economy of the Fergana region from 2006-2020 (see Table 1).

Table 1. Dynamics of indicators representing the development of the economy of the Fergana region in 2006-2020.

No	*Years*	*Gross regional*	*Investments in*	*The number of*	*Average salary*

		product, billion soums	*the region, billion soums*	*employees in business entities, a thousand people*	*by region, thousand soums*
1.	2006	1883.7	599.3	856.3	100.3
2.	2007	2638.5	649.2	906.4	152.5
3.	2008	3224.6	721.7	985.3	209.8
4.	2009	5011.6	785.5	1001.8	290.8
5.	2010	5417.5	849.1	1031.8	366.2
6.	2011	7228.5	1151.9	1043.9	538.6
7.	2012	9113.0	1390.9	1081.2	656.7
8.	2013	10966.4	1899.7	1129.2	760.5
9.	2014	13549.5	2295.3	1170.6	884.1
10.	2015	16342.4	2542.2	1192.5	1026.3
11.	2016	18106.3	2643.6	1214.4	1119.3
12.	2017	20749.2	2954.5	1229.3	1214.9
13.	2018	27663.1	5539.1	1144.5	1499
14.	2019	32737.8	8685.4	1181.7	1893.6
15.	2020	37612.1	11040.0	1126.7	2091.6

Based on this information, it will be possible to determine the one-factor or multi-factor regression equation, taking into account the correlation between the variable and the function, and, based on this, to determine the parameters of the short-term or long-term perspective of the resulting indicator. For this purpose, we calculate the calculations using the Mathcad program in the following steps.

When finding the production function, we calculate using the Mathcad program:

ORIGIN:= 1

$$y := \begin{pmatrix} 1833.7 \\ 2638.5 \\ 3224.6 \\ 5011.6 \\ 5417.5 \\ 7228.5 \\ 9113 \\ 10966.4 \\ 13549.5 \\ 16342.4 \\ 18106.3 \\ 20749.2 \\ 27663.1 \\ 32737.8 \\ 37612.1 \end{pmatrix} \quad x := \begin{pmatrix} 599.3 & 856.3 & 100.3 \\ 649.2 & 906.4 & 152.5 \\ 721.7 & 985.3 & 209.8 \\ 785.5 & 1001.8 & 290.8 \\ 849.1 & 1031.8 & 366.2 \\ 1151.9 & 1043.9 & 538.6 \\ 1390.9 & 1081.2 & 656.7 \\ 1899.7 & 1129.2 & 760.5 \\ 2295.3 & 1170.6 & 884.1 \\ 2542.2 & 1192.5 & 1026.3 \\ 2643.6 & 1214.4 & 1119.3 \\ 2954.5 & 1229.3 & 1214.9 \\ 5539.1 & 1144.5 & 1499 \\ 8685.4 & 1181.7 & 1893.6 \\ 11040 & 1126.7 & 2091.6 \end{pmatrix}$$

$$y_c(K, L, a_0, a_1, a_2) := a_0 \cdot K^{a_1} \cdot L^{a_2}$$

$n := 6$

$z := y$

$$Q_e(a_0, a_1, a_2) := \sum_{i=1}^{n} \left(y_i - y_c\left(x_{i,1}, x_{i,2}, a_0, a_1, a_2\right)\right)^2$$

$a_0 := 1$

$a_1 := 0.8$

$a_2 := 0.2$

$a_1 + a_2 = 1$

$$\begin{pmatrix} a_0 \\ a_1 \\ a_2 \end{pmatrix} := \text{Minimize}\left(Q_e, a_0, a_1, a_2\right) = \begin{pmatrix} 0.222 \\ 1.423 \\ 0.05 \end{pmatrix}$$

$$Q_e(a_0, a_1, a_2) = 2.752 \times 10^6$$

So the value of the production function: $Q_e(a_0 + 0.001, a_1, a_2) = 2.738 \times 10^6$

We build the regression model of the problem in the Mathcad program:

ORIGIN:= 1

$$A := \begin{pmatrix} 1 & 599.3 & 856.3 & 100.3 \\ 1 & 649.2 & 906.4 & 152.5 \\ 1 & 721.7 & 985.3 & 209.8 \\ 1 & 785.5 & 1001.8 & 290.8 \\ 1 & 849.1 & 1031.8 & 366.2 \\ 1 & 1151.9 & 1043.9 & 538.6 \\ 1 & 1390.9 & 1081.2 & 656.7 \\ 1 & 1899.7 & 1129.2 & 760.5 \\ 1 & 2295.3 & 1170.6 & 884.1 \\ 1 & 2542.2 & 1192.5 & 1026.3 \\ 1 & 2643.6 & 1214.4 & 1119.3 \\ 1 & 2954.5 & 1229.3 & 1214.9 \\ 1 & 5539.1 & 1144.5 & 1499 \\ 1 & 8685.4 & 1181.7 & 1893.6 \\ 1 & 11040 & 1126.7 & 2091.6 \end{pmatrix} \quad Y := \begin{pmatrix} 1833.7 \\ 2638.5 \\ 3224.6 \\ 5011.6 \\ 5417.5 \\ 7228.5 \\ 9113 \\ 10966.4 \\ 13549.5 \\ 16342.4 \\ 18106.3 \\ 20749.2 \\ 27663.1 \\ 32737.8 \\ 37612.1 \end{pmatrix}$$

Given

$$b := \left(A^T \cdot A\right)^{-1} \cdot A^T \cdot Y$$

$$b = \begin{pmatrix} 1.258 \times 10^4 \\ -0.284 \\ -14.589 \\ 21.373 \end{pmatrix}$$

So, $Y = 12580 - 0,284x_1 - 14,589x_2 + 21,373x_3$

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