

MODELLING THE ECONOMIC EFFICIENCY OF AN ENTERPRISE

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In modern economic theory, a key area of focus is the optimisation of production processes and the improvement of enterprise efficiency, particularly in an unstable economic environment. External factors, often difficult to predict—such as wars, political crises, global economic turmoil, and climate change—significantly impact the business environment and can alter the economic landscape.

The assessment of economic efficiency plays a vital role in business operations, as it helps determine how effectively resources are utilised to achieve maximum results with minimal costs. In a market economy, businesses aim not only to generate high profits but also to ensure stability and competitiveness, which is achievable only through the optimal use of resources such as labour, capital, and materials.

The term "economic efficiency" refers to the effectiveness of resource utilisation in achieving the best possible outcomes at the lowest possible cost. This concept encompasses the optimisation of production processes, where the efficient use of capital, labour, and other resources is critical for achieving strong financial or other measurable results. Operational optimisation involves not merely cost reduction but also the rational allocation of resources, which enhances productivity and profitability.

Performance evaluation encompasses various dimensions, such as labour productivity, capital efficiency, and material intensity, requiring a comprehensive approach to analysing the interconnections among all production factors [1].

One of the most effective methods for assessing economic efficiency is the application of production functions, such as the Cobb-Douglas function. This model enables the evaluation of how individual factors, such as labour and capital, influence production and provides insights into the elasticity of output concerning changes in these factors. By employing the Cobb-Douglas function, it becomes possible to optimise the balance between labour and capital, ensuring the achievement of maximum outcomes [2].

The Cobb-Douglas production function is represented as:

$$Y=A*L^a*K^b$$

Y- the volume of output, A- a parameter reflecting the level of technological development, L- the quantity of labour employed, K- the quantity of capital employed,
, - the elasticities of output with respect to labour and capital, respectively.

The analysis applies linear regression in logarithmic form, which simplifies calculations and directly provides the values of the coefficients , . Logarithmisation reduces the influence of differing value scales by transforming the model into a linear format, thereby enhancing the efficiency of parameter estimation through regression analysis [2].

$$\ln Y = \ln A + a \cdot \ln L + b \cdot \ln K$$

It is assumed that the sum of the elasticities of labour and capital, equals one, indicating constant returns to scale. If the sum of these coefficients exceeds one, the production function exhibits increasing returns to scale; conversely, if the sum is less than one, it reflects decreasing returns to scale [2].

To estimate the net income from product sales at «Zvyagelkhlly» PJSC, a production function will be developed, incorporating the wage fund and fixed capital as key production factors. The dynamics of net income will be modelled using the company's financial statements from 2015 to 2023, which provide relevant data on these indicators. To prevent distortion in the modelling results due to inflation, the data will be adjusted to 2023 price levels. This approach enables a detailed analysis of the efficiency of labour and capital resources in generating net income and facilitates the creation of a production function reflecting their interaction [3].

Thus, after performing the calculations and regression analysis, the Cobb-Douglas production function for «Zvyagelkhlly» PJSC is represented as follows:

$$\begin{aligned} \ln Y &= \ln 10,283 - 0,401 \cdot \ln K + 0,526 \cdot \ln L, \\ Y &= e^{10,283} \cdot K^{-0,401} \cdot L^{0,526}, \\ Y &= 29237,1 \cdot K^{-0,401} \cdot L^{0,526}. \end{aligned}$$

$a=0,526$ indicates a 0,52 increase in net income with a 1% increase in the payroll.

$=-0,401$ indicates a 0,4 decrease in net income with a 1% increase in the value of fixed assets.

The model, built based on the Cobb-Douglas function, demonstrated a high correlation and statistical significance, with a coefficient of determination $R^2 = 0,949$, indicating that it explains 94,96% of the variation in the dependent variable. The statistical significance of the model coefficients ($p\text{-value} < 0,05$) confirms the importance of both capital and labour costs for output. The low standard error indicates high forecasting accuracy. Therefore, the model is adequate for analysing and forecasting production processes and can be effectively used to assess the impact of labour and capital factors on output.

By constructing trend models for labour costs and fixed capital, forecasts for these indicators were made for the coming years. The analysis revealed that an increase in capital leads to a decrease in production, suggesting its redundancy or inefficient use. This highlights the need to reassess capital investments and explore opportunities for optimisation to enhance enterprise efficiency.

The positive impact of labour on production reflects its productivity; however, a coefficient of less than one indicates diminishing returns on additional labour. The company should focus on enhancing employee skills and introducing innovations to improve labour efficiency.

The sum of the capital and labour elasticities being less than one indicates limitations in scaling production. This signals the necessity to improve technological processes in order to achieve better results with increased production volumes.

Since labour efficiency surpasses capital efficiency, the company has the potential to improve capital management. Focusing on optimising the use of capital resources can lead to higher productivity and greater production efficiency.

The analysis of the company's production activities using the Cobb-Douglas production function revealed that growth in capital does not lead to a proportional increase in production, underscoring the need to optimise capital investments. The evaluation of labour use showed that while the involvement of additional labour boosts productivity, the efficiency of its use has limitations. Overall, the findings demonstrate the need to enhance the utilisation of both capital and labour and to optimise production processes to improve the company's efficiency.

References:

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