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MODELING BUSINESS PROCESSES OF AN ENTERPRISE BASED ON ADAPTIVE PRODUCTION FUNCTIONS

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Annotation: This article discusses the relevance of the study of enterprise business processes using production functions. The development of econometric approaches for the analysis and evaluation of business processes. The possibilities of applying production functions to the business processes of an enterprise are considered. A mathematical model of a business process is presented and described in the form of a set of «typical tasks» connected (by inputs and outputs).

Keywords: business process, enterprise, modeling, typical tasks, production function

At present, they talk a lot about modeling business processes, but static models are more understood in this vein, models are simply descriptions (or representations) of a business process. At the same time, there is no methodology for developing executable model models, which makes it difficult to create process-oriented information systems based on business process management systems (BMS). Modeling methods are replaced by notation, as a result, the model reflects the private view of the analyst, omitting details that are important for the purpose of modeling.

Thus, we can conclude that the development of methods for creating executable business process models is an important and urgent task. At the same time, the executable models must be flexible and dynamic. To ensure their flexibility, in our opinion, models in which the main elements are tasks (activity) described using production functions are most suitable.

As a generalization of the formal properties of production functions, we argue the following statements:

First of all, the marginal product of a factor varies only when the relative amounts of the applied factors change.

Secondly, these factors are complementary, i.e., an increase in the amount of a variable factor reduces its marginal productivity, but increases the marginal productivity of a fixed production factor.

Thirdly, the total product is exactly the sum of the payments to the factors of production used according to their marginal productivity.

An important methodological conclusion follows from this: if elasticity indicators are estimated based on the relative shares of production factors, which in total amount to total income, then it is assumed that such a production function has the form of a Cobb-Douglas function [1]

As for the economic meaning of linearly homogeneous production functions, the thesis is true: only when the production function is linearly homogeneous, payments to production factors in accordance with marginal productivity completely exhaust the product. But then the question is formulated: if the production function is not homogeneous of the first degree? In principle, it is understood that competition in the markets for factors of production provides payment for production factors in the amount of their marginal value or marginal product in monetary terms, regardless of the type of production function. But if the production function is not linearly homogeneous of the first degree, then the total product will be greater or less than the sum of the distribution shares. Obviously, in the case of negative economies of scale, the amount of factor payoffs determined by the nature of the market mechanism, will be less than the value of output, and the balances are assigned to some "fixed" factors. In the case of a positive scale effect, the total product is insufficient to pay the contribution of all factors in accordance with their marginal productivity.

That is, some factor must receive less than its marginal productivity. These statements are explained by the relationship between marginal and average costs. A linearly homogeneous production function forms a horizontal long-run average cost curve. In the case of increasing returns or decreasing costs in the long run, the marginal cost curve lies below the long run average cost curve. In this case, the enterprise begins to incur losses, since the payment of a factor according to its marginal product is the result of the pricing mechanism based on marginal cost. This reasoning is the basis of the Hotelling–Lerner thesis: marginal cost pricing in all sectors of the economy would require subsidies for any industry with a declining supply price. Wherein, as rightly pointed out, positive economies of scale destroy competition and hence the basis for paying factors according to their marginal productivity. Similarly, a price that covers long-run marginal cost when the latter exceeds long-run average cost will necessarily lead to a residual [2].

This approach to reasoning about the essential foundations of production functions allows one to touch upon the most important related areas of economic knowledge, thereby allowing for a comprehensive coverage of business processes.

Study of business processes of an enterprise using production functions: problems and solutions. The relevance of the development of econometrics for the study of business processes, in particular the search for opportunities for the application of production functions, is dictated by the apparent inadequacy of the use of econometric models in practice. At the same time, the fruitful use of econometric models allows, based on the formalization of the factors identified as the main ones, to clearly demonstrate the general and the special, which is a necessary step in understanding the essence and direction of research in Ukraine.

Let's consider the possibilities of applying production functions to the business processes of an enterprise.

The classical approach to modeling production processes using production functions is to use the time series of the studied economic system, which characterize the output in the form of production volumes for certain periods of time and the resources used for this (labor and capital), to estimate the parameters of the production function. The production function itself expresses the dependence of the result of production on the cost of resources. The exponential production function has the form:

$X(t) = A * K(t)^p L(t)^q$(1)

where X (t) is the output for the period t;

K(t) – capital (value of fixed assets) for period t;

L(t) is labor (the number of employees in the system under study) for period t.

The rest of the variables (A, p and q) are estimated parameters and can be determined using the logarithm of relation (1) by the least squares method.

Those.

q is the labor elasticity coefficient;

p is the capital elasticity coefficient.

At the same time, A is always greater than zero and is called the coefficient of neutral technical progress (for constant p and q, the output at the point (K, L) is greater, the larger A. Having sufficient time series in length, using relation (1), we can relate the output , capital and labor.

When modeling the business processes of an enterprise, an enterprise is considered as an economic system. Gross income is taken for the annual output, the value of the fixed production assets of the enterprise is taken for capital, and the average annual number of employees of production units is taken for labor.

Then the production function (1) takes the following form:

$X(r) = A * K(r)^p L(r)^q$(2)

Where r is the department involved in the production process.

A business process is defined as a logically completed set of interrelated and interacting activities that supports the activities of an organization and implements its policies aimed at achieving its goals. The ISO 9000 standard [4], which regulates the availability, documentability and measurement of the quality of business processes, defines a process as a set of interrelated and interacting activities that transform inputs into outputs that are of value to the consumer. The process can be performed within one organizational unit, cover several units or even several different organizations [3,4].

From the definition of a business process, we understand activities as a set of tasks that provide the result of a business process. These tasks belong to different departments that participate in the business process of the enterprise. We call these tasks «typical», i.e. these are the tasks that are characteristic of a particular unit that has a certain specialization.

Based on this definition, we can say that it is possible to describe the "typical task" of the unit using the production function. At the same time, in formula (2), we introduce another variable R, which shows the role of the business process task as a result of the entire business process. Thus, we get the formula for describing the "typical task" of the business process:

$R * (X(r) = A * K(r)^p L(r)^q)$(3)

The coefficient R, A, p and q ensures the adaptability of the business process model, i.e. It can be said that the set of adaptive «typical tasks» ensures the adaptability of the constructed model.

Thus, the mathematical model of a business process can be represented as a set of «typical tasks» connected (by inputs and outputs), which has the following form:

$Y = \sum_{z=1}^{n} W_z [R_z * (X(z) = A * K(z)^p L(z)^q)]$(4)

$W_z = \{w_1, w_2 \dots \dots . w_n\}$,

Where,

Y - the result (product) of the business process

W is the sequence vector for performing «typical tasks» in a business process

With this approach to modeling a business process, we can identify all the factors that affect its implementation, identify bottlenecks and be able to optimize and improve the result of the business process. Coefficients p and q have the ability to control the indicator «capital-labor ratio», which ensures the adaptability of the «typical task» of the business process to the real conditions for performing production work at the enterprise.

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