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ECONOMIC DYNAMICS AS A SYSTEM

Vladislav V. Osadchii (a), Elmira F. Amirova (b), Alexander L. Zolkin (c)*, Inessa M. Kalyakina (d), Diana R. Giniyatullina (e)
*Corresponding author

(a) International University of Digital Economy and Technology, 93g 50let Oktyabrya Ave., Moscow, Russia, osadchiivv@gmail.com
(b) Economics and information technologies department, 65 Karl Marx St., Kazan State Agrarian University, Kazan, Russia, elmira_amirova@mail.ru
(c) Computer and Information Sciences Department, Povolzhskiy State University of Telecommunications and Informatics, 23 L. Tolstoy St., Samara, Russia, alzolkin@list.ru
(d) Economics and management department, Don State Technical University, 1 Gagarin Sq., Rostov-on-Don, Russia, inessakalyakina@yandex.ru
(e) Department of theory and practice of teaching foreign languages, 65 Karl Marx St., Kazan Federal University, Kazan, Russia, dianar.g2014@yandex.ru

Abstract

This article touches upon the issue of the development of an optimal model of economic dynamics. The economic processes associated with the modern economy are becoming more and more complicated, and their dynamism calls for an everyday search for solutions to fundamental issues of economic disciplines. One of these deep-seated problems is the problem of economic dynamics. Studies of the processes of economic dynamics are important because the cyclical rhythm, the pulsation of the economic and social sphere are very indicative in the economic sphere, also there is a constant change in the cycles of economic prosperity, stagnation, and decline as well as wave-like dynamics of generalizing indicators. Many researchers do not pay due attention to this problem, although we have the right to believe that a competent choice of this model can have a key impact on the formation of the trajectory of economic development. This question has to be faced every time there is a practical need to improve the efficiency of an existing or developing economic model. To do this, it is necessary to analyse the most famous of the existing models of economic dynamics and substantiate the processes that have a direct impact on the simulation of the economic course from a scientific point of view.

Keywords: Development, economic dynamics, efficiency, model, production function, production, return of resources, system, simulation, solution

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1. Introduction

The problem that is faced by professionals each time they try to improve the effectiveness of economic models is reviewed in this research. This issue is related to the form of the manufacturing model. Even though most researchers do not pay attention to this point, this work provides a scientific justification of the phenomenon while the form of the model has a direct impact on the course of economic development.

2. Problem Statement

As a separate science, economics has several areas that determine its practical value, and one of such research segments is the simulation of economic dynamics. Over the years, experts have created several different models with varying degrees of accuracy and realism. All of these models come from two major achievements in economic thinking (Berrznev, 2018; Kiyaschenko, 2016; Zarubezhnov, 2018).

3. Research Questions

The first achievement is the Cobb-Douglas function, which describes the process of values converting into production results. The second achievement is considered to be the gross product distribution model developed by Keynes. It defines the reverse process when the results of production become material reserves.

4. Purpose of the Study

The purpose of this study is to analyse the famous existing models of economic dynamics and substantiate the processes that have a direct impact on the simulation of the economic course from a scientific point of view.

5. Research Methods

Taken together, these models form a closed structure of equalities and inequalities, allowing the development of models that reflect the dynamic changes in the economy. This principle formed the basis for other models for determining economic dynamics, the purpose of which is to find constraints for variables, to build unique aggregated models and relationships between the main variables and the outcome of equality (Melnik et al., 2018; Mushinskiy, 2019; Pilneva, 2018).

Production function formula (Romakh, 2020; Smirnova et al., 2016):

$$Q = F(K, L) \quad (1)$$

where Q is the main funds, K is capital investments, L is labour resources.

This function is called neoclassical if the following conditions are met:

1) it is impossible to establish production of products in the absence of any resource (K or L);

2) positive effect on the increase in output is achieved by increasing resources;

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3) there is a slowdown in output growth with an increase in resources;

4) an unlimited increase in any resource affects the unlimited growth of output.

These conditions are satisfied by the exponential production function:

$$Q_t = A \cdot K^{\alpha} L^{\beta} \quad (2)$$

where A is the coefficient of "neutral technical progress"

α, β are exponents

It shall be noted that according to the "neoclassical requirements" the first derivatives of the function concerning any of the resources will be positive only if the exponents $\alpha > 0$, $\beta > 0$

This model of a power-law production function is considered as “neoclassical” if α and β are less than zero, but if they are positive, the model is not “neoclassical” and will be rejected by specialists in the formation of models of economic dynamics.

Also, this model can be "neoclassical" in case of negative values of the second derivatives, but since we found out that $\alpha > 0$, $\beta > 0$, then negative indicators of the second derivatives can be obtained if α and β are less than one, that is:

$$0 < \alpha < 1, 0 < \beta < 1$$

The Cobb-Douglas function meets all given conditions, being one of the "neoclassical derivatives".

In most cases, neoclassical production functions are considered superficially, however, for greater accuracy, it is better to understand what production type they belong to, and try to interpret all processes that occur under the influence of these functions from an economic point of view.

The economic interpretation of functions is directly related to the return of resources. With an increase in the involved resources, the return becomes higher at the beginning, then it stabilizes, and later a decline occurs. This is due to the law of change in the return of resources. Different types of resource allocation are relevant (Akhmetshin et al., 2018a, 2018b; Dmitriev et al., 2019):

1. An increase in the return of resources is noted with the development of production that has not yet reached nominal indicators. In this case, the technical potential has not yet been realized, and therefore the attraction of more resources increases the volume of manufactured products. The production process itself is not yet considered efficient, but the intrinsic value of the product is decreasing;

2. A stable level of return on resources is often an indicator of the productive use of resources. Moreover, any changes in the number of resources used lead to the same changes in the output of manufactured products. This period is distinguished by the highest efficiency with an optimal return of resources, with fully used technical means;

3. When the return on resources decreases, this indicates an overload of production equipment. At this stage, all the resources involved in production only reduce its effectiveness, and the intrinsic value of production begins to increase. Production efficiency decreases, and an increase in the volume of resources involved in the process leads to a decrease in productivity.

If we represent this situation in mathematical language, then resource productivity r depends on the ratio of the volume of the produced product Q to the nth volume of the consumed resource R:

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$$r = Q / R \quad (3)$$

An increase or decrease in resource productivity is a dynamic value when this ratio r = Q / R corresponds to a larger amount of used resource. If we express the increase in the resource in terms of ΔR, and the increment in the produced product in terms of ΔQ, then it is possible to calculate the change in resource efficiency at new values by the formula:

$$r\,\Delta = \frac{Q + \Delta Q}{R + \Delta R} \quad (4)$$

After we subtract (4) from (3), we determine the value of the function, in particular: resource productivity remains unchanged, increases or, on the contrary, decreases:

1) if resource productivity increases, then in the area where the level of production is not brought to the nominal indicators, the coefficient of elasticity of production concerning the resource will be greater than 1;

2) resource efficiency does not change. Production is efficient, brought to the nominal level, the coefficient of elasticity is 1;

3) decrease in resource efficiency. We observe overproduction, production is inefficient, the coefficient of elasticity is less than 1.

Thus, we found out that the coefficient of elasticity of production concerning the resource reflects the indicators of resource productivity in the corresponding area. Accordingly, it is possible to analyse economic processes and make their diagnostics, which will help to more widely interpret the properties of the “neoclassical derivative of a function” (Poskryakov et al., 2021; Shamin et al., 2017; Tsakaev, 2019).

6. Findings

During simulation of economic dynamics, when a specialist claims that he will use a "neoclassical production function", this means that he is signing his statement about the inefficiency of the studied production process, about inflated production costs, equipment wear, and tear, and excess production of nominal values (Lavrov et al., 2017). Here a natural question arises: what function will simulate normal production conditions? To answer this question, it is necessary to trace the relationship between the coefficients of elasticity of production in different areas of resource productivity. To simulate various production situations, it will be necessary to apply models without any constraints α and β.

In this case, it will be possible to talk about production as close as possible to the optimal level if α = 1 and β = 1 (or at least close to unity in the situation of econometric analysis). At the same time, capital investment and use of labour resources will be constant, which indicates efficient production.

If α> 1 and β> 1, then this indicates an increase in resource efficiency, a decrease in the cost of production, and insufficient utilization of production capacities.

Now let's try to apply this model of the production function based on statistical data on economic indicators of the Khorezm region of Uzbekistan for 1997-2007 (see table 1).

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Table 1. Statistical data of economic indicators of the Khorezm region of Uzbekistan for 1997-2007

Year	Investments, mln in som	Gross Regional Product, mln in som[2]	The main funds, Mln som	Amount of employed people thousand people
1997	12 354.0	140.6	609663.0	442.0
1998	17 767.0	145.6	624370.7	449.0
1999	21 670.1	152.2	640747.5	456.0
2000	25 839.5	144.3	671715.9	467.2
2001	52 614.2	148.6	713787.1	468.3
2002	68 966.9	283.5	755740.8	478.3
2003	45 404.7	372.8	799915.6	490.4
2004	123 802.6	483.2	930449.0	506.6
2005	63 263.5	562.0	1 010865.4	522.3
2006	113 406.3	930.2	1 091063.0	538.0
2007	114 503.2	1 003.7	1 230510.0	547.0

It was not possible to apply economic simulation based on the Cobb-Douglas production function using these data, since the model, the coefficients of which were calculated using the least-squares method, turned out to be like this:

$$Q_t = 0.9471 Kt^{4.0021} L_t^{-3.0021} \quad (5)$$

And, as it was found out earlier, $0 < \alpha < 1$, $0 < \beta < 1$,

Using the same OLS method, the exponential production function has been calculated:

$$Q_t = 0.87 K_t^{2.17766} L_t^{3.10876} \quad (6)$$

Based on the calculations, it can be concluded that the elasticity of capital investments for the indicated period was 2.17766 units, and the elasticity of the use of labour resources was 3.10876 units.

7. Conclusion

This situation indicates that an increase in the volume of resources has a negative impact, reducing the effectiveness of production. This means that the negativity of certain exponents in the exponential production function is accompanied by pronounced signs of the law of diminishing returns of resources. In this case, to restore productivity, it is necessary to reduce the volume of incoming resources, or completely change the technological production processes (Zhukovskyy et al., 2019).

In the past, in the USSR, preference was given to increased concentration and narrow specialization of certain production facilities. Such a development model corresponded to the interests of a centralized economy with clearly distributed positions in general (Chistyakov, 2020). However, using the example of the Uzbek SSR, one can see the negative impact of such a policy, while most of the republic's agricultural resources were devoted to growing and processing cotton. After the separation of the Uzbek SSR from the Soviet Union, the republic had an unbalanced economic system, which is especially noticeable in the Khorezm region. Thus, investments in any production areas that are not related to cotton cultivation were highly productive at this stage.

The resulting economic model showed that this method of constructing multivariate forecasts does not give accurate results, since high exponents often lead to unrealistic calculation results. For example,

under certain conditions, doubling resources theoretically led to a fivefold multiplication of production results, which is practically impossible in reality.

For this reason, to obtain a proper solution to the problem of developing models of economic dynamics, we shall turn to the production functions of complex variables.

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