ECONOMETRIC MODELS IN THE ANALYSIS OF ECONOMIC GROWTH USING THE SOLOU MODEL

Muminova Makhbuba
TMI, Senior Teacher

ANNOTATION

This article examines the analysis of factors and processes of economic growth, important quantitative relationships between these indicators, econometric research methods, the importance of econometric models in the analysis of economic growth.

Keywords: Solou model, econometric methods, descriptive models, economic growth, production function, depreciation rate, investment rate.

АНАТАЦИЯ

Мазкур мақолада иқтисодий ўсиш омиллари ва жараёнларини таҳлил қилиш, ушбу кўрсаткичлар орасидаги муҳим миқдорий боғланишлар, эконометрик тадқиқот усуллари, иқтисодий ўсишни таҳлилида эконометрик моделларни қилиш аҳамияти кўриб чиқилган.

АНАТАЦИЯ

В данной статье рассматривается анализ факторов и процессов экономического роста, важные количественные связи между этими показателями, эконометрические методы исследования, значение эконометрических моделей в анализе экономического роста.

INTRODUCTION

Today, every country achieves a macroeconomic economy and it is recognized as the main goal of public administration. Annual macroeconomic support for development in Uzbekistan is focused on addressing the problems of development and rehabilitation.

The theory of economic growth is to study the causes and consequences of the growth of GDP per capita.

Economic growth is the long-term growth of real output combined with full employment. Economic growth is reflected in the growth of GDP, the economic power of the state and the well-being of the people. Economic growth is also directly reflected in the increase in the volume of gross national product per capita and per unit of economic resource costs, as well as in the improvement of quality and composition.Among the factors influencing economic growth, the labor factor has a special place. Many factors affect the level of labor costs. Along with the amount of labor, the level of quality also plays an important role. The volume of labor expended in society is influenced by the population of the country, the number of workers, working hours, while labor productivity is affected by technical progress, investment, education, skills, organization of production and others.Another important factor in economic growth is capital expenditures, which include equipment, buildings, and inventories. Fixed capital also includes the housing stock. Because homeowners benefit from the service provided. Capital expenditures are affected by the rate of accumulation, the amount of fixed capital, the

GALAXY INTERNATIONAL INTERDISCIPLINARY RESEARCH JOURNAL (GIIRJ)
ISSN (E): 2347-6915
Vol. 10, Issue 1, Jan. (2022)

level of capital armament, and so on.The main value indicators of economic growth at the macroeconomic level are: GDP, absolute volume of national income and its growth rate, GDP, the amount of national income per capita and its growth rate, GDP, the amount of national income per unit of economic resource expenditures and its growth rate.

Thus, if the product function produced as an indicator of economic growth is used, the elasticity in consumption has a constant value for all growth factors and is equal to the corresponding regression coefficients. In other words, regardless of the volume of production, increasing the consumption of the growth factor (production resource) of type i by 1% increases the percentage a_i % of output.In addition to the elasticity of production costs in economic growth analysis, there is also a differentiated growth rate that shows the change in the amount of output produced when we multiply the consumption of any factor by one unit and other factors remain unchanged.

The general method of production factors of analysis is a method of showing how much the quantity of a product changes by 1% change of all factors at the same time.

The elasticity of the reciprocal exchange is determined by the variation of the differentiated growth of the factors by 1%.

Let us consider the following from the above production functions, which differ in technical means and meanings.

1. Cobba-Douglas function.
2. The Errow, Cheneri, Minxas, and Solow function, or in other words the constant elasticity of the factors of production, is a function of mutual exchange.

For the first time in practice, Ch. Cobba and P. Douglas study production functions based on statistics related to the U.S. light industry and propose the following production function.

$$N = a_0 L^{a_1} \cdot K^{a_2}$$

Where: N is the amount of product produced;

L is the amount of labor;

K - fixed capital.

In addition to increasing the volume of production resources, similar factors will play an important role in economic growth, such as improving equipment and technology, improving the skills of employees, proper organization and management of production.

Technical progress is given in the form of production growth trends over time in production functions. With this in mind, the Cobb-Douglas production function takes the following form:

$$N = a_0 L^{a1} \cdot K^{a1} \cdot e^{\lambda T}$$

$e^{\lambda m}$ the growth trend of production over time associated with technical progress.

A more in-depth analysis will reveal the materialized side of technical progress, the improved quality of labor and funds, and their impact on the quantities of L, Ks. The growth trend of production over time is determined by the efficiency of organization and management of production.

Macro-level production functions include the use of natural resources along with labor and capital.

The function of constant elastic exchange of factors of production:

$$N = a_0\left[\delta l^{-p} + (1-\delta)K^{-p}\right]^{-\frac{1}{p}}$$

Where: δ - parameter of the ratio of labor and capital factors in increasing production;
p- is the parameter of mutual exchange depending on the elasticity of displacement;
a_0 - coefficient of proportionality.Many scientists have resorted to the modeling method to describe complex economic processes involving many elements.
The results of scientific and technological advances are more widely taken into account in the Errow, Cheneri, Minhas, and Solow function than in other functions.

$$N = a_0 e^{\lambda t}\left[\delta h^{-p} + (1-\delta)K^{-p}\right]^{-\frac{h}{p}}$$

h-gross profit from factors of production.
One of the models trying to explain the causes and ways of forming positive trends in the economic system is the Solou model. The Solow model is an analysis of economic growth taking into account the impact of external economic development, as well as the impact of factors of production - capital and labor. Three main objectives of this model can be distinguished: The search for sustainable and high economic growth methods. Maximum consumption. Analyze the impact of demographic growth factors and introduce the latest technologies. In general, the Solou model is shown in the graph: production depends on capital and labor. To calculate capital-labor ratios, the production function is divided into labor

$$y = f(k),$$

Where: $k = K / L$ - the cost of capital spent per unit of work.
Earnings can only be considered in relation to the capital-wage ratio. The volume of capital productivity can be traced from the shift of that curve, so if the capital ratio of one employee increases by one, the production of the product can increase.
When the savings (s) and consumption rate (1 – s) are known, we find the consumption function:

$$c = (1-s)\cdot y$$

From this, $y = (1-s)\cdot y + i$, $i = s\cdot y$
In the Solou model, long-term stability (y) and (k) occur at a constant point. These variables are endogenous variables.
The savings norm (s) is exogenous.
(y) is an investment per capita
(i=sxy) is described by the labor productivity function.

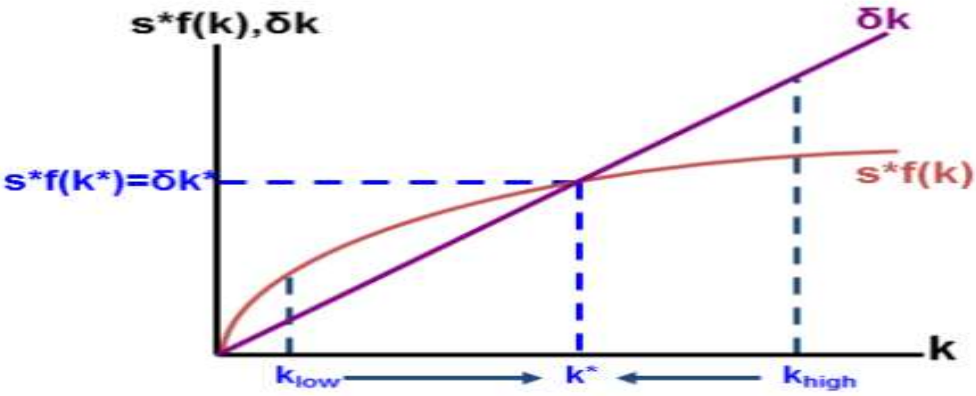
$$(i = s * f(k))$$

we enter the (δ) -depreciation rate in the model. We find the effect of investment and depreciation on capital:

$$\Delta k = i - \delta k$$

$$\Delta k = s * f(k) - \delta k$$

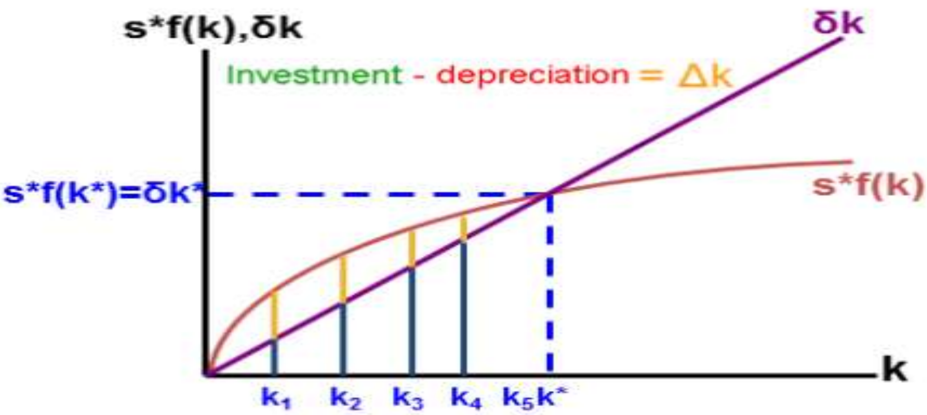
For both (k) and (y) parameters to be constant, the following inequality must be satisfied $\Delta k = s * f(k) - \delta k = 0$ or $s * f(k) = \delta k$.
This occurs at point k *.



In this case, the depreciation rate at point k * is equal to the investment rate.
Suppose the point (k_1) is very low

$$k_2 = k_1 + \Delta k,\quad k_3 = k_2 + \Delta k,\quad k_4 = k_3 + \Delta k,\quad k_5 = k_4 + \Delta k,\ldots$$

This continues to the k * point



k_2 is still very low, so… .. k_5 is still very low, therefore (is still too low so…),
Экзоген ўзгарувчи – жамғарма нормаси оша у инвестиция функциясини тепага силжитади. Бу капиталнинг янги мувазонат нуқтасига олиб келади.
I = s (k) is an investment function per unit of work. The volume of consumption and investment in the graph shows the sf (k) curve. The distance between the two graph curves shows the size of the customer demand. It should be noted that over time, the effective return on capital decreases, so entrepreneurs try to replenish their capital. The ratio of capital to labor always comes with the retirement of the former, so this does not happen, the flow of investment must be increased.The economic equilibrium of the Solow model is achieved when the decline in capital, consumption, and growth in investment are halted. This situation is called the maximum level of capital-labor force when all three of these indicators stabilize.
The essence of the Solow model is that the main task of economists is to find solutions to practical problems in the field of economic policy.
The Solou model helps to find a level of production that maximizes a society's consumption capacity at current economic growth rates. This model is called the golden rule of accumulation. Consumption of income is formed only when the maximum difference between the outflow of capital and production is reached with a stable ratio of maximum capital. It can be seen that the maximum return on investment in consumption can be achieved when the rate of growth

GALAXY INTERNATIONAL INTERDISCIPLINARY RESEARCH JOURNAL (GIIRJ)
ISSN (E): 2347-6915
Vol. 10, Issue 1, Jan. (2022)

of production is equal. Demographic growth factor as well as capital destruction will reduce its reserves. An increase in the number of people reduces the productivity of a single employee. To cover these losses, it is necessary to increase investment, taking into account the population. Decrease in consumption is also observed. Solow's model shows that with a high rate of population growth, the capital-labor force decreases, i.e., income per capita decreases.
In the Solou model, the production function is considered:
$Y = F(K, L, A)$
Variable A reflects labor-saving technical progress and is always considered in conjunction with the volume of labor L resources, i.e., the number of workers in LA is a complex factor — constant labor productivity. It can also grow by increasing the number of workers and by increasing A's work efficiency. Thus, the production function in the Soloy model has the following form:

$$Y = F(K, LA)$$

In addition, given the characteristics of linear homogeneity (return on a constant scale), it can be written in precise parameters (per unit of labor with constant efficiency):

$$\frac{Y}{LA} = f\left(\frac{K}{LA}\right) \quad \text{yoki} \quad y = f(k)$$

where y and k are labor productivity and capital-labor ratios, respectively, with constant efficiency.
An example of such a function is the Cobb-Douglas function, which returns to the scale continuously:

$$Y = K^{\alpha} \cdot (LA)^{1-\alpha} = LA \cdot (K / LA)^{\alpha},$$

where a <1, a is the coefficient of elasticity for capital, 1-a is the coefficient of elasticity for work. or. $y = k^{\alpha}$.
Income is spent on consumption and investment, corresponding to Y = S + I, or corresponding to a unit of labor with constant labor productivity - y = s + i. The investment is equal to the savings, or i = sy for each job, where s is the savings rate. The constant rate of capital depreciation is assumed to be delta d, and accordingly the capital dynamics model is as follows:

$$\dot{K} = sY - \delta K$$

or in a specific representation: $\dot{K} / LA = sy - \delta k$.
On the other hand, according to the information provided: $K = k \cdot L \cdot A$

$$\dot{K} = \dot{k} \cdot L \cdot A + k(\dot{L}A + L\dot{A}) = LA(\dot{k} + k(\dot{L} / L + \dot{A} / A)).$$

Therefore, we write the basic fundamental differential equation of the Soloy model: $\dot{k} = sf(k) - (n + g + \delta)k$,
here $n = \dot{L} / L$ - population (workers) growth rate;
$g = \dot{A} / A$ - rate of technological development.
Thus, if capital sf (k) is below the required level, taking into account population growth and capital decline and technological progress (n + g + d) k), then the capital-labor ratio of wages decreases with constant efficiency, and vice versa. The degree of equilibrium is determined on the basis of the stability condition k, i.e. k = 0}. Accordingly, the state of inpatience is as follows (compatibility of current and required investments):

$$sf(k) = (n + g + \delta)k$$

In the Soloy model in the stationary state, the growth rate of labor productivity is equal to the rate of technological development, while the economic growth rate is the sum of the rate of technological progress and population growth.As the deposit rate increases, investments begin to grow until the required level is exceeded and the balance reaches a high level. In the process of transition to a new stationary state, the rate of growth of labor productivity exceeds the rate of technological development, and when a new equilibrium occurs, they are equalized.

The Solou model allows to determine the optimal level of the maximum (specific) consumption savings rate. By definition, specific consumption $c = (1-s)y = f(k) + sf(k)$. In stationary (equilibrium) position

$sf(k) = (n+g+\delta)k$, therefore, the final specific consumption function in the stationary state has the following form: $c(k) = f(k) - (n+g+\delta)k$

Given that k depends on the saving rate, the maximum net consumption condition for s is:

$$c_s^{'} = \left[f(k) - (n+g+\delta) \right] k_s^{'} = 0$$

from here: $f_s^{'} n + g + \delta$.

On the other hand, in a stationary state - $sf(k) = (n+g+\delta)k$.

Given these two acceptable conditions - $sf(k) = f_k^{'} k$ or: $sf(k) = (n+g+\delta)k$

$$s = f^{'}(k)k / f = \varepsilon_{f/k} = \alpha$$

where a is a parameter of the homogeneous Cobb-Douglas production function. That is, the level of savings should be equal to the flexibility of the product actually produced for the capital-labor ratio.

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