Econometric Models Of Attracting Investment Into Production Industry

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Abstract
In this article, is analysed relationship between GDP and investments and proven on the basis of econometric models. Model of GDP determination is built on the basis of Solow model with the help of Cobb-Douglas production function. Econometric models for calculating the effectiveness of attracting more investment to production in Uzbek economy are analyzed using dynamic econometric models constructed using Solow model.
Key Words: Investment costs, investment limits, capital resources, the main production funds, human resources, economic dynamics model.

1. Introduction
It is well known that the GDP and investments are closely related, and wide attractionof investment can lead to growth in GDP.

Relationship between the investment and economic growth are viewed as the main factors of a number of studies. Investment not only affects the growth of GDP, but also plays an important role in the structural changes in the production of GDP. Therefore, the relationship between the GDP and investment and creating models of investment growth are significant. Thus, it is desirable to create a dynamic economic model.

Having analysed dynamic economic models, the theory of economics can highlight the use of two lines:

1) Models not linked to the real economy, with less specific examples for modeling and experimental uses;

2) Modeling possible directions of economic development of multiple studies of real economic dynamics and coordinated in order to make management decisions.

It should be noted that the various models of the first type are built more than the second type. Because in their attempts to create models of real economic dynamics that are difficult to unravel the academic economists faced a lot of difficulties, as a result of which they were forced to build abstract models. As a result, the practical application of the model bring about unprecedented results.

Using these models taking into account the characteristics of Uzbek economy, in our view, allows to increase the role of investment in sustainable growth of GDP.

2. Literature review
Economist scientists have created models with various aspects of the connection between GDP and investment levels.

Scientific and practical significance of this models is that the connection between investment and GDP different aspects have been proven in practice. For example, the relationship between increase in the volume of investment and growth rate of GDP (J.M. Keynes model), the relationship between increase in investment and growth of macreconomic indicators (Cobb-Douglas function) are proven to have practical significance.

R. Solow who created the first model of economic dynamics, saw it as the complex function of Gross National Product (GNP) and capital resources.

Studying GDP by dividing it into two components, namely consumption and investments was carried out for the first time by academic economist J.M.Keyns [1]. During the scientific experiment, Keynes suggested to study the GDP by dividing it into two parts: consumption and savings. Also, he concluded that «as the savings are redirected into production as investment, this will lead to growth of real income». In 1928, C. Cobb and P. Douglas created economic growth model where GDP is the function of the relationship between physical capital and human resources [2]. The model of production function looks as follows:

$$Y_i = \beta_1 X_{2i}^{\beta_2} X_{3i}^{\beta_3} e^{u_i} \tag{1}$$

Here:

Y - production, GDP

X_2 - human resources employed to create the GDP

X_3 - capital resources exploited to create the GDP

u - stochastic parameter, function error

e - natural logarithmic base

O. Blanchard, a professor at the University of Massachusetts in the United States has proven the connection between investment and GDP using a model [3]. This is a very simple model (I=Ï) where investments are not significantly sensitive to changes in production.

According to G. Mankiw's conclusion [4], if we take into account that national savings equal to Y-C-G, GDP and investment will look as follows:

$$Y - C - G = I + NX;$$
$$S = I + NX \qquad (2)$$

Here:

Y – GDP;

C – consumption;

G – government expenditure;

I – investments;

NX – net export.

G. Mankiw considers net exports to be equal to net capital expenditures and offers the following equation [4]:

$$S = I + NCO \qquad (3)$$

S.V. Chepel achieved the following important scientific results in the process of applying the theoretical model of attracting direct foreign investments into the national economy in practice [5]:

- GDP deflator's decline of 10 percentage points in analyzed countries, the volume of direct foreign investments in GDP increased 0.8 percentage points;

- the decrease in the rate of inflation increase in direct foreign investments in the share of GDP.

3. Building the empirical model

If current GDP is taken as Y_t, consumption – C_t, investments – I_t, then according to the conclusion of Keynes the following formula will be true:

$$Y_t = C_t + I_t \qquad (4)$$

Volume of consumer demand consists of two indicators - consumption determined by minimum hygiene standards and income growth as a result of additional parts Keynes suggested that the second part is reflected as a percentage of GDP in the previous period: cY_{t-1}

In this case, this year's consumer demand constitutes linear function of last year's GDP:

$$C_t = C + cY_{t-1} \qquad (5)$$

If we input this into (1) formula, we get:

$$Y_t = C + cY_{t-1} + I_t \qquad (6)$$

Here:

c – share of consumption in GDP.

If investments are taken as constant, then we will have first ortder autoregressive equation. Propensity to consume affects GDP growth rate (c- share). As it is autoregressive model, we can illustrate different trajectories of GDP growth by setting initial condition and changing the value of propensity to consume.

We can create a closed model by combining Keynesian model and Cobb-Douglas production and by defining different parameters we can estimate different growth projections of the economy.

In Solow model, GDP is determined with the help of Cobb-Douglas production function as follows:

$$Y_t = aK_t^{\alpha}L_t^{1-\alpha} \qquad (7)$$

In a given time (t) GDP (Y_t) consists of investments (I_t) and consumption (C_t):

$$Y_t = I_t + C_t \tag{8}$$

Here the focus is on investment rather than consumption and share of GDP which is expected to be allocated for investments can be given as propensity to save – ρ:

$$I_t = \rho Y_t \tag{9}$$

As is known, attraction of investments will lead to the growth of production funds for the next year K_{t+1}, which is determined through old funds K_t by taking into account the share of funds from last year's production μ:

$$K_{t+1} = (1-\mu)K_t + I_t \tag{10}$$

If the number of terms in economy are labelled as L_{t+1}, taking into account annual growth rate of terms (v), it can be calculated through current number of terms:

$$L_{t+1} = (1+v)L_t \tag{11}$$

GDP, Investments and other parameters can be calculated taking into account next year's production funds and number of terms.

Equations (7) - (11) are mathematic expressions of Solow model. This model can be implemented in economic development of sectors and as well as used in working out suggestions and conclusions in further development of a particular sector.

4. **Results of the research**

In order to construct the model of economic dynamics, the indices in the table will be transferred to unlimited figures.

Simple order production function, coeffcients of which were calculated using method of least squares, looks like this:

table

Principal indicators of manufacturing in Uzbekistan

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Share of investments in main capital, %	32,6	34,3	37,7	34,5	28,4	30,4	33,8	34,2	34,2	37,4	37,8
Share of main funds in manufacturing (%)	35,5	39,1	34,7	28,9	28,7	29,6	30,3	31,3	32,9	32,8	33,2
Growth rates of industry compared to last year, in	107,2	110,8	112,1	112,7	109,1	108,5	106,4	107,9	109,6	108,3	108,0
Number of people working different sectors (in thousands)	616,7	614,7	618,3	600,4	579,0	611,6	644,2	670,5	680,3	682,4	685,7

Source: Annual statistics compilation. – Tashkent: State statistics committe of the Republic of Uzbekistan, 2013-2015. Industry of Uzbekistan. – Tashkent: State statistics committe of the Republic of Uzbekistan, compiled by the author based on the information from collection of statistical data 2006-2015.

Simple order production function, coeffcients of which were calculated using method of least squares, looks like this:

$$Q_t = 1{,}01 K_t^{1,33} L_t^{0,65} \tag{12}$$

Thus, in Uzbekistan in the years 2005-2015 capital resources elasticity is 1.33 units, labor resources elasticity is 0.65 units. Production function itself is not enough to construct the model of economics dynamics. It is important to describe other aspects of this model too. Because GDP is divided into consumption and savings, calculating the share of GDP allocated for investments ρ is necessary. This share turned out to be 0.12, which means that the level of investments in year t is determined woth the help of propensity to save as follows:

$$I_t = 0{,}12 Q_t \tag{13}$$

Investments lead to rise in the main funds of the following year K_{t+1} and calculated through the main funds of the last year K_t taking into account discounted funds of the previous year μ.

While calculating the share of discounted funds coeffcient of main funds was negative at -0.65. That maens funds are not being discounted but are rising and this rise significantly more than the volume of investments. In turn, this means that production funds are working with very little power. Taking this into account dynamics of capital resources in during the period under study can be given as follows:

$$K_{t+1}=1,065 \, K_t + I_t \tag{14}$$

Annual rise in economic bands constituted 1.01, therefore number of bands in economy is calculated through current number of bands L_t taking into account annual growth rate of bands (v):

$$L_{t+1}=1,01 L_t \tag{15}$$

It is clear from the models (10) – (13), to develop the manufacturing industry it will be required to implement a number of measures, namely, increasing the number of bands in the economy through attracting more investments, also because manufacturing funds are running very low energy production, using their potential more efficiently will lead to further development of industrial manufactruing.

5. Conclusion

1. The further attraction of investments into the Uzbek industry in the coming years will lead to an increase in the volume of production.

2. The volume of main funds in the country is increasing instead of being discounted and at the moment this growth is higher than the level of attracted foreign direct investments. This means that manufacturing funds are running with very low intensity.

3. The increase in the volume of investments in the industry in the country is necessary to increase the number of terms.

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