

SYSTEM DYNAMICS MODELING OF INVESTMENT AND LABOR PRODUCTIVITY FOR UKRAINE

Productivity, in economics, measures output per unit of input, such as labor, capital or any other resource – and is typically calculated for the economy as a whole, as a ratio of gross domestic product (GDP) to hours worked. Productivity is the key source of economic growth and competitiveness. A country's ability to improve its standard of living depends almost entirely on its ability to raise its output per worker, i.e., producing more goods and services for a given number of hours of work. Economists use productivity growth to model the productive capacity of economies and determine their capacity utilization rates. This, in turn, is used to forecast business cycles and predict future levels of GDP growth. In addition, production capacity and utilization are used to assess demand and inflationary pressures. Capital is one of the basic factors of production along with land and labor. It includes all goods that are made or created by humans and used for producing goods or services.

An investment is an asset or item acquired with the goal of generating income or appreciation. In an economic sense, an investment is the purchase of goods that are not consumed today but are used in the future to create wealth. In finance, an investment is a monetary asset purchased with the idea that the asset will provide income in the future or will be sold later at a higher price for a profit.

Labor productivity measures the hourly output of a country's economy. Specifically, it charts the amount of real gross domestic product (GDP) produced by an hour of labor. It measures how efficiently labor input is combined with other factors of production and used in the production process. Labor input is defined as total hours worked of all persons engaged in production. Labor productivity only partially reflects the productivity of labor in terms of the personal capacities of workers or the intensity of their effort

The figure below shows the stock and flow diagram for the capital and productivity sector of Ukrainian economy. We consider our model in the range from 2006 to 2017 years. We used the following inputs:

- standard hours per worker which is an average hours per worker for considering range (measured in Hours/Year/Person) and equal 2000;
- initial active capital labor ratio is a measures the ratio of capital employed to labor employed. For Ukraine capital utilization was equal 75%, capital = 2.4 trillion, number of Employed = 19 million and active capital labor ratio = 94 thousands UAH per Person;
- initial labor productivity is the amount of GDP produced by one employee. For Ukraine it was equal 58.2 UAH/Year/Person;
- Also we use historical data as a input for number of Employed.

Exogenous variables for our model are:

Average life of capital = 10 years;

Expected delivery delay = 3 years;

Capital assessment delay = 1 year;
 Technology shock = 0.004 per year;
 Initial technology = 0.4.

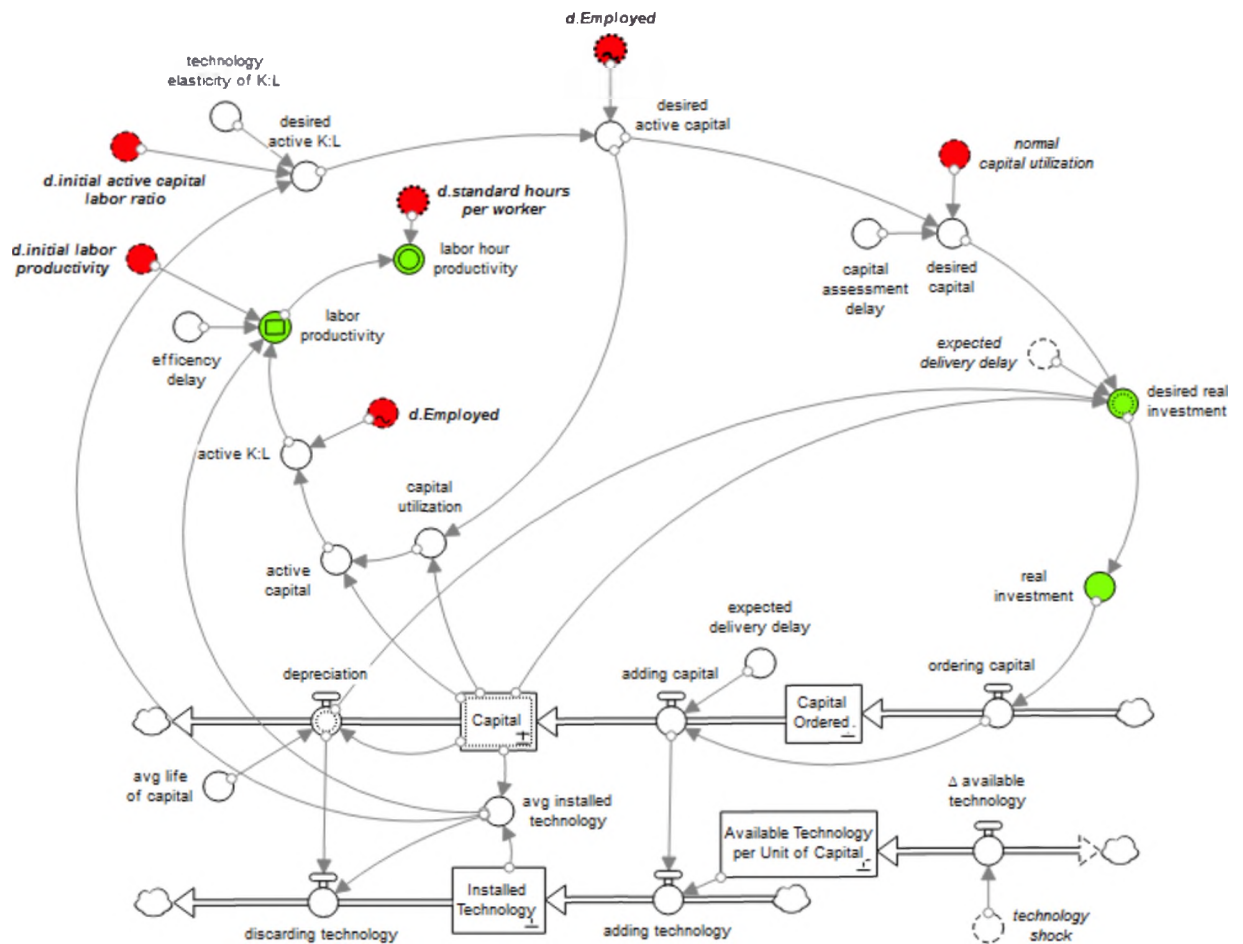


Figure 1. The system dynamics model

The outputs for this model are an Investment and Labor hour productivity. Also using historical data, we can compare with modeling results. For calculating historical labor hour productivity we used historical real GDP and number of Employed. Also using Theil statistics we can calculate the root of mean square error between historical and modeling data.

Figure 2 represents the comparison of historical and modeling data of the real Investment.

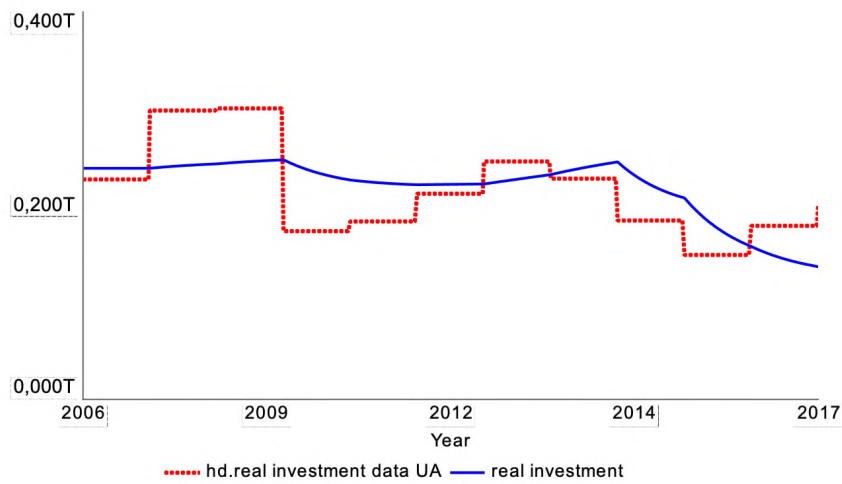


Figure 2. Actual and evaluated by model dynamic of real investment

The graph of error show us that the error is a 23%.

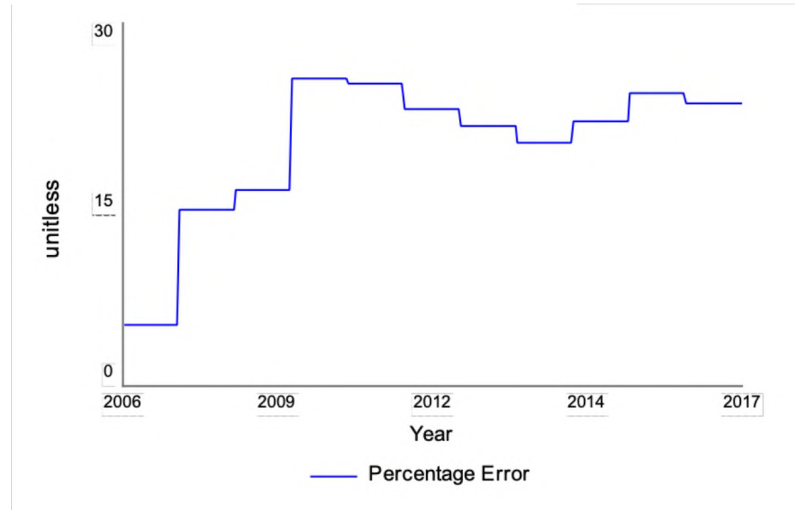


Figure 3. Percentage of error for real investment

Finally comparing data for labor hour productivity, we can say that fit of our model is pretty good.

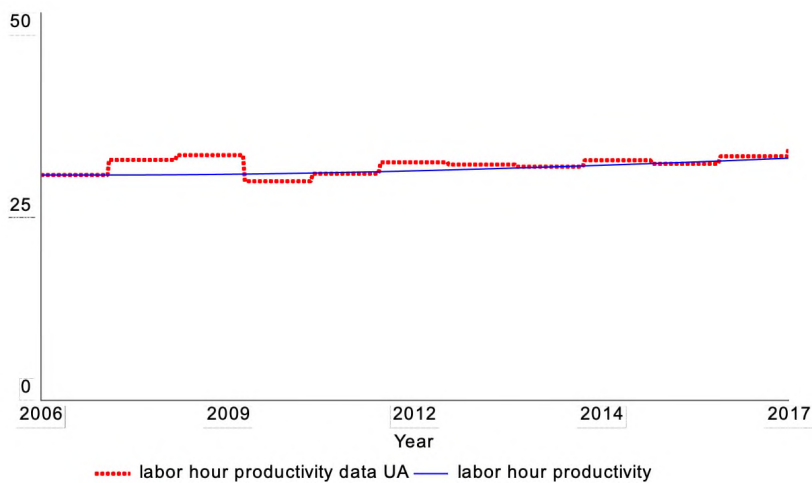


Figure 4. Dynamics of labor productivity

The graph of error shows that the maximum error is only 5%, and in average it's only 3%.

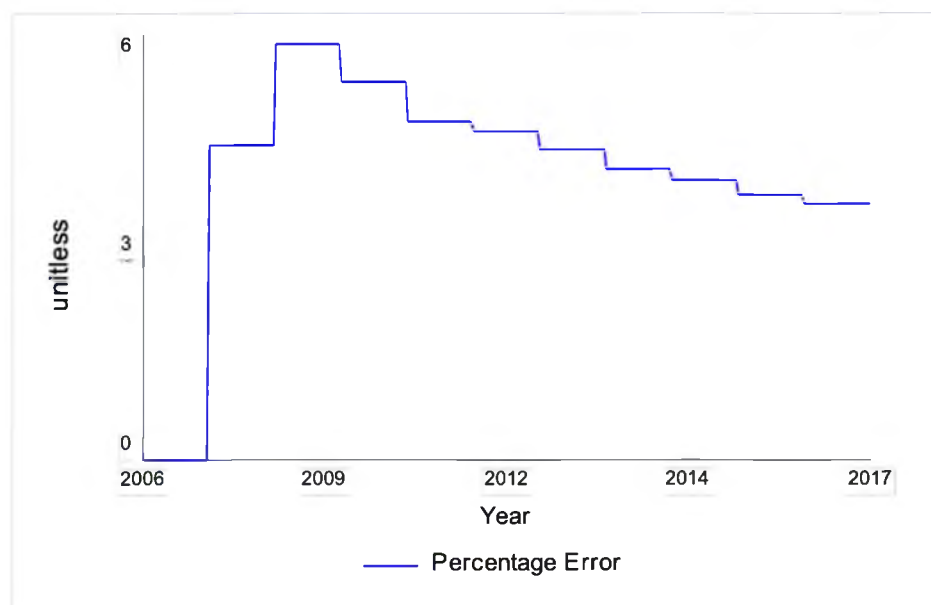


Figure 5. Percentage of error for labor productivity

Thus, the model being built is sufficiently adequate and can be used for further research and policy recommendations. One of the most important goals of the economic policy of any state is to ensure sustainable economic growth, which is understood as the growth of welfare, as well as an increase in the national wealth of the country. Then solving problems and developing mechanisms of measures to achieve this goal more and more attention is paid to the problems of investment and labor productivity and its increase.

References

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