

MODELING UKRAINIAN LABOR MARKET BEHAVIOUR USING METHODS OF SYSTEM DYNAMICS

Ukrainian labor market is a complex system that is constantly evolving under the influence of main macroeconomic indicator's dynamics. National labor market is characterized by a number of barriers to normal socio-economic development of the country and its individual regions. This is primarily the lack of jobs and a high proportion of jobs where working conditions are dangerous (especially in mining industry, chemical industry, construction, etc.), the unequal distribution of labor resources in the state and growing asymmetry in professional qualification stock. Analysis of the labor market structure made it possible to identify key factors of the development of the national labor market.

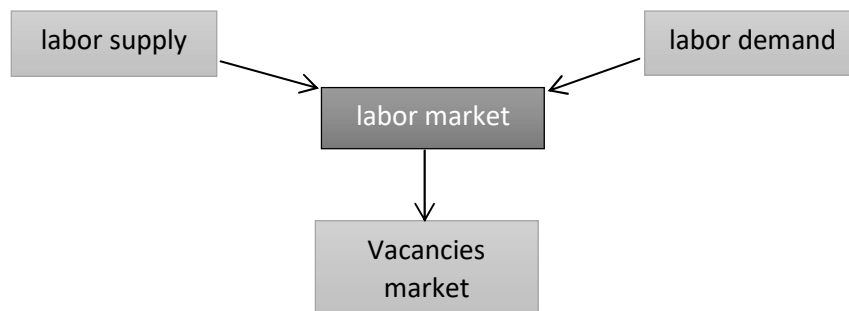


Figure 1. **Structural elements of the labor market**

Considering above structure, one can conclude that the main task of the labor market is to ensure optimal mobility of the economically active working age population and to bring demand and supply for labor in equilibrium state. Meaning that goal could be achieved only when unemployment rate equals natural unemployment rate. According to the definition, natural rate of unemployment is a combination of frictional and structural unemployment that persists in an efficient, expanding economy when labor and resource markets are in equilibrium. [1]

This paper investigates the usefulness of system dynamics methodology in the comprehensive analysis of main labor market indicators. However, there are various socio-economic destabilizing factors which increase imbalances of Ukrainian labor market. In the conducted research among the other factors, there were identified the technological impact, labor demand effect and the influence of the demographic trends, which were later studied more precisely with the designed SD model (figure 2). Worth mentioning that data for this study were retrospectively collected from International Labor Organization (ILO) and State Statistics Committee of Ukraine. [2]

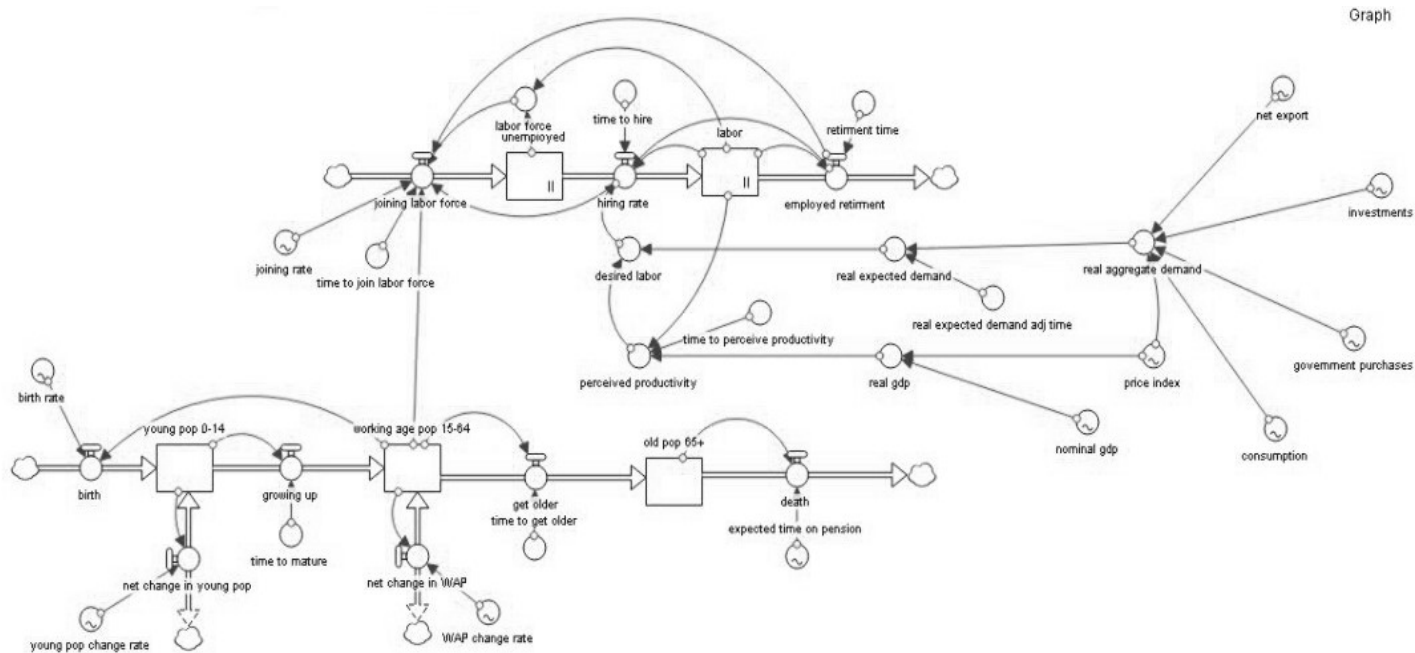


Figure 2. Overall view of the simplified Labor market model

In the abovementioned model there are three main parts: demographic sector (ageing-chain), labor demand and labor supply. Main control variables are amount of working age population, unemployment rate and labor force indicator. According to the generally accepted methodology of the ILO labor force is the sum of persons in employment plus persons in unemployment. Together these two groups of the population represent the current supply of labor for the production of goods and services taking place in a country through market transactions. Based on the latest international statistical standards, the population of working age in a country may be classified according to their labor force status in a short reference period into three mutually exclusive and exhaustive groups: Persons in employment, persons in unemployment and persons outside the labor force. [2] In order to make accurate calculations of the labor force, the primary goal was to get close fit to historical data for working age population stock. (figure 3).

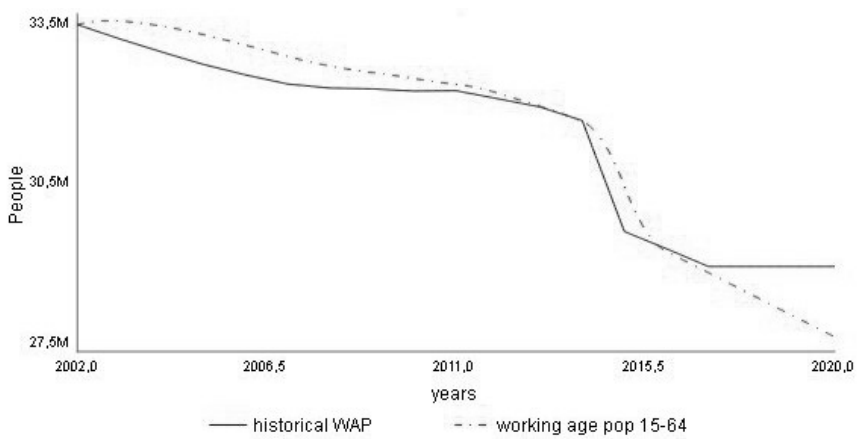


Figure 3. Comparison of model and historical data of working age population, people

The time horizon was extended up to 2020 year with the aim of forecasting future trends. It could be clearly seen that in the following 2 years working age population will continue to decrease. Current situation is explained by the negative demographic trend in Ukraine. First of all, it caused by negative balance of the Ukrainian population due to a disproportionate increase in mortality over birth rates. Figure 4 demonstrates behavior of the birth rate in Ukraine from 2002 up to 2020. Due to economic crises and political instability there is rapid decline in birth rate after 2014.

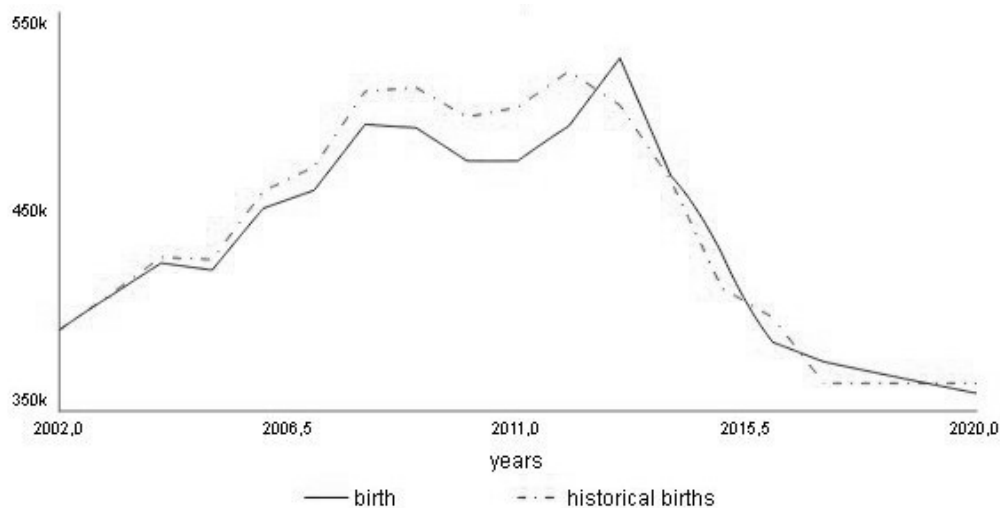


Figure 4. **Comparison of model and historical data of births, people per year**

As shown in the figures above main outcomes of the demographic part of the model follows the historical data fluctuations.

The next section of the model was concerned with identifying goal for the amount of labor. In order to find desired labor stock (in other words labor supply) labor demand part was introduced in the model. Firstly, aggregate demand was calculated with given formula:

$$\begin{aligned}
 \text{Real aggregate demand} &= (\text{Net Export} + \text{Investments} \\
 &+ \text{Consumption} + \text{Government Purchases}) / \text{Price_Index},
 \end{aligned}
 \tag{1}$$

Source:[4]

By analogy, the indicator of real productivity was calculated. The desired level for labor stock (employed people) is calculated as the product of multiplication of real productivity and aggregate demand. Hence, considering amount of working age population and aggregate labor demand the supply side of labor market could be calculated. The current study appears to be unable to represent the effect of the political crises and the rapid fall of labor force in Ukraine. At least the overall trend was captured.

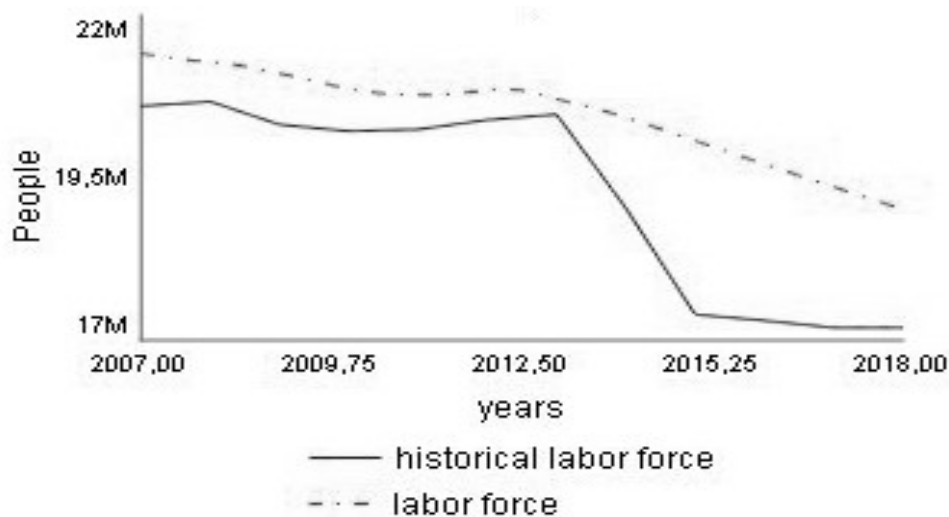


Figure 5. Comparison of model and historical data of births, people

The bar chart below demonstrates values of historical unemployment rates in comparison to the unemployment rate obtained during simulations. Despite the significant difference at the beginning of the period of the study, after first five years unemployment rate began converge to its real values (figure 6).

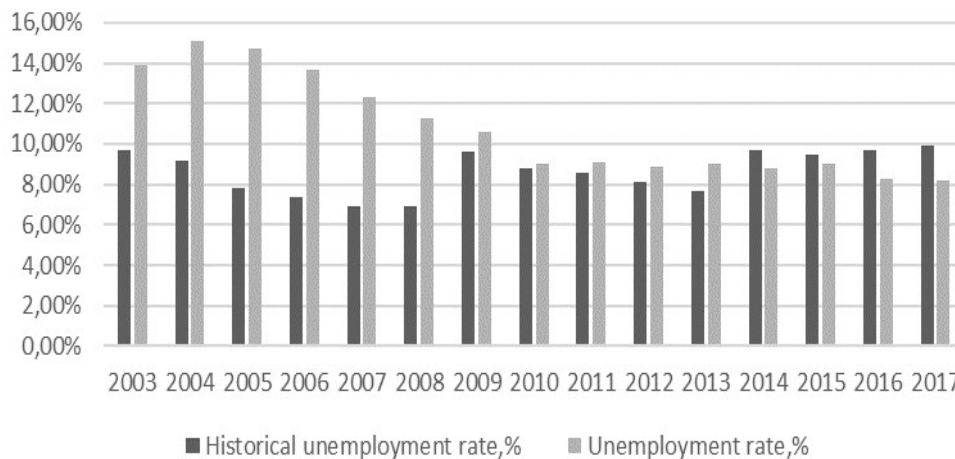


Figure 6. Comparison of model and historical data of unemployment rate, %

System dynamics analysis of the current state of Ukrainian labor market revealed that the downward trend in the change of working age population will continue at least in the short term period. It can also be concluded that the unstable geopolitical situation in the country has its negative impact on people's expectations on the growth of the economy. This trend found caused a sharp decrease in the supply of labor force in Ukraine. Nevertheless, the analysis of the unemployment rate dynamics showed that in recent years it has grown insignificantly. It could be the case that under the influence of economic crises and political instability in Ukraine, a significant part of the informal labor market was formed. According to the estimates of the Ministry of Economic Development and Trade of Ukraine, the level of the shadow economy in 2017 was 37% of GDP. Moreover, a low level of unemployment can hide considerable poverty in the country, while in countries with high levels of

economic development and low poverty rates, higher unemployment rates may be observed. In some countries, which are characterized by relatively low unemployment and low social assistance effectiveness, citizens are forced to exist under conditions of vulnerable employment. At the same time in countries with well-developed social security networks, workers can afford to wait for a job offer with a respect to their qualifications or desirable positions.

This research has thrown up many questions in need of further investigation. It would be also interesting to assess the effects of the shadow economy on the Ukrainian labor market in further researches.

References

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SYSTEM DYNAMIC MODEL OF NATIONAL INCOME AND GOVERNMENT SPENDING

Let's consider the macroeconomic model of the commodity market, which was constructed using the methods of system dynamics. The constructed dynamic model (Figure 1) describes the relationship between government spending, expenditure, income and consumption.

Variable models are described by the following equations:

$$\text{Consumption} = \text{exogenous consumption} + \\ + \text{propensity to consume} * \text{SMTH1}(\text{disposable income}; \text{time to adj consumption}); \quad (1)$$

$$\text{Investment} = \text{exogenous investment} + \\ + \text{interest effect on investment} * \text{SMTH1}(\text{interest rate 1}; \text{time to adj investment}); \quad (2)$$

$$\text{Disposable income} = \text{real income} - \text{government spending}; \quad (3)$$