APPLICATION OF METHOD LAGS MODEL FOR THE ANALYSIS OF THE IMPACT ECOLOGY ON HEALTH

Oksana Matkovskaya
Belarus State Economic University
Minsk, BELARUS

Abstract

In this direction there is identification of problems the effects of long-term exposure of air pollutants on human health.
Keywords: multivariate statistical analysis, component analysis, ecological indicators, correlation analysis lag, Almon method

The relevance of the statistical analysis of the environmental impact on the demographic processes in the context of the territories of Belarus is due, on the one hand, the increase of anthropogenic load on the air, and all the more apparent relationship of demographic and ecological processes, and on the other — insufficient development of the mutual influence of ecological and demographic processes. The present study is intended to fill the gaps in quantitative analysis in this area, to create a system of indicators and models to describe and analyze the environmental characteristics in relation to the demographic development of certain areas. Our study is a response to the increased attention of all countries with developed market economies to environmental issues, including a debate on the adoption of the Kyoto Protocol, as declared by the international community of the Millennium goals for sustainable development. The selected object - the state of the atmospheric air is vital to ensure the normal life of the people, for the demographic reproduction, achieving the goals of economic and social development.

The impact of environmental factors on human activity is a complex and multifaceted socio-economic process, which covers all aspects of society. This raises the problem of assessing the changes in the environment and public health. For the said task, you must use the aggregate, to absorb all information necessary to analyze the influence of the environment on human health. Moreover, in practice there are different variants of general indicators, making it difficult to achieve the goal.

To construct the integral index (regardless of the method of its calculation) you need to define an initial set of features and the degree of influence of each of them on the outcome. Included in the comprehensive indicator parameters and their weights should be chosen so that the composite indicator best reflects the true picture of changes in the environment and public health. Two different approaches to the solution of the issue can be used.

The first way — is to use expert estimates. In this case it is necessary to collect a large enough group of experts, each of whom will have to rank the proposed indicators on him the degree of public health impact, based on his personal judgment. The disadvantage of this method is the subjectivity of expert evaluations, so that the results

do not reflect the actual situation and its representation, understanding of specific people.

The second possible way to solve this problem — is the use of multivariate statistical analysis. These methods allow us to determine the hidden, implicit laws objectively existing in the study of social and economic processes, but not directly measurable. The most promising in economic studies are a factor or component analysis. It enables the reduction of extensive numerical material to several independent and simple factors.

The choice of system baselines largely determines the results of the analysis and therefore is a very responsible stage of the study. In our study we propose to distinguish four groups of indicators that describe the basic directions of changes in environmental conditions impact on population health. The study examined the effect of 10 characteristics of the environment on human health, and in the initial set of indicators included in the Republic of Belarus for 15 years, from 2000 to 2014.

As a result of two factors were obtained:

the first factor (F_1) — indicator of anthropogenic load on the environment;

the second (F_2) — integral index of resources and development of society.

In the future, we assessed the relationship of the processes on the basis of the time series (F_1 and F_2). Evaluation was performed using correlation analysis lag (Almon method).

As a result it was found the presence of certain speakers depending on the values of the factor F_2 (building society development) on the dynamic changes of anthropogenic load level on the environment (F_1).

Selecting the maximum lag length and degree of the polynomial carried out empirically. The proposed 3-year lag polynomial first degree possible to obtain cost-interpretable model parameters, namely, the influence of one orientation of the time factor on the exogenous variable. Model relationships of society's development potential (F_2) from the change of anthropogenic load on the environment (F_1) is as follows:

$$F_2^t = -1.15F_1^t - 0.475F_2^{t-1} - 0.2F_2^{t-2} - 0.88F_2^{t-3},$$
$$R^2 = 0.735,\ n = 12,\ F_{\text{calculated}}(4,8) = 5.548 > F_{\text{tabular}} = 3.838.$$

Relative regression coefficients in the model are:

$$\beta_0 = \frac{1.15}{2.703} = 0.425 \text{ or } 42.5\%$$
$$\beta_1 = \frac{0.475}{2.703} = 0.176 \text{ or } 17.6\%$$
$$\beta_2 = \frac{0.2}{2.703} = 0.074 \text{ or } 7.4\%$$
$$\beta_3 = \frac{0.88}{2.703} = 0.324 \text{ or } 32.4\%.$$

Thus, 42.5% (F_1) general decline in society's development potential (F_2), due to the increased anthropogenic load on the environment, there is in the current time; 17.6% — at time $t + 1$; 7.4% — at the moment $t + 2$ and 32.4% of this decrease occurs at time $t + 3$.

Average lag in this model is:

$$\bar{l} = \sum_j j\beta_j = 0 \cdot 0.425 + 1 \cdot 0.176 + 2 \cdot 0.074 + 3 \cdot 0.324 = 1.296.$$

On average, most of the effect of anthropogenic load growth on the natural environment manifests itself almost immediately (more precisely through 1,296 years) on reducing the development of society. As a result of constructing distributed lag model it was established and demonstrated statistically significant presence of feedback between the factors F_1 and F_2. It should be noted that 43% of the overall society development potential (F_2) in the current period due to increased anthropogenic load on the environment (F_1) in the same period. However, increased anthropogenic load on the environment in the current period and has a deterrent nature of the impact, causing 32,4% of the overall society development potential reduction after only three years. Given the dynamic relationship established as a result of the lag analysis, short-term positive changes will not have a significant positive impact on the stabilization and even more to improve the health of children conditional aged 0-14 years. In this case, the stabilization of (maintaining the current level) of healthy children aged 0–14 years is a long-term nature, as shaped by the degree of anthropogenic load both current and previous periods.

Achieving sustainable improvement of healthy children aged 0–14 years, perhaps through an annual sustained reduction of anthropogenic load on the environment by increasing the level of dust and gas cleaning equipment manufacturing equipment; activation and diffusion of energy- and resource-saving technologies; ensure environmentally optimal spatial planning in the implementation of economic activities which are harmful to the environment.

References

[1] Republics scientific-practical health center (2010). *Health and the Environment (2010). Sat. scientific. tr.*. Minsk.

[2] Matkovskaya O. G. (2009). Technique of construction of integrated indicators of air condition. *Statistics of Ukraine*. Vol. **2**(45), pp. 12–17.

[3] Soshnikova L.A. (1999). *Multivariate statistical analysis in economics*. M.: UNITY-DANA.

[4] National Statistical Committee of the Republic of Belarus (2015). *Protection of the environment in Belarus (2015): stat. sb.*. Minsk.

[5] National Statistical Committee of the Republic of Belarus (2015). *Statistical Yearbook (2015): stat. sb.*. Minsk.