ANTHROPOGENIC LOADS IN THE MOUNTAIN SHIRVAN ECONOMICAL AND GEOGRAPHICAL REGION OF AZERBAIJAN, THEIR EVALUATION AND MODELING

©*Aliyeva G., Baku State University, Baku, Azerbaijan, gulnar.ali.orujova@rambler.ru*
©*Afandiyeva A., Ph.D., Baku State University, Baku, Azerbaijan, gulnar.ali.orujova@rambler.ru*

АНТРОПОГЕННЫЕ НАГРУЗКИ В ГОРНО-ШИРВАНСКОМ ЭКОНОМИКО-ГЕОГРАФИЧЕСКОМ РЕГИОНЕ АЗЕРБАЙДЖАНА, ИХ ОЦЕНКА И МОДЕЛИРОВАНИЕ

©*Алиева Г. С., Бакинский государственный университет,
г. Баку, Азербайджан, gulnar.ali.orujova@rambler.ru*
©*Эфендиева А. Т., канд. экон. наук, Бакинский государственный университет,
г. Баку, Азербайджан, gulnar.ali.orujova@rambler.ru*

Abstract. The study assessed the impact of the environmental situation on development of demographic process, and analyzed the dependence of birthrate, death rate, rate of natural population growth and infant mortality on the ecological situation for Mountain Shirvan economic and geographical region of Azerbaijan by using economic-mathematical modeling methods.

Аннотация. В исследовании оценивается влияние экологической ситуации на развитие демографического процесса, а также проанализирована зависимость рождений, смертей, темпов естественного прироста населения и младенческой смертности от экологической ситуации для Горно-Ширванского экономико-географического района Азербайджана с использованием методов экономико-математического моделирования.

Keywords: atmospheric pollution, industry, pollution, anthropogenic loads, ecosystems, birthrate, death rate, natural population growth, infant mortality, modeling.

Ключевые слова: загрязнение атмосферы, индустрия, загрязнение, экосистемы, рождаемость, смертность, естественный прирост населения, младенческая смертность, моделирование.

Mountainous Shirvan economic-geographical region is located in the eastern part of the southern slope in the Greater Caucasus, covering Aghsu, Ismayilli, Shamakhi, Gobustan regions. Although the economic region is an ancient settlement, it is relatively underdeveloped in terms of industry. With regard to being a relatively large area, it is very convenient to place economic and social facilities in the area more and without interfering with each other, to develop and use the lands on a larger scale. Its border with the industrially and agriculturally developed regions of the republic makes its economic geographical position even more favorable. This is more evident in economic relations. The main advantage of the Mountainous Shirvan economic region is its proximity to the main socio-political center of the republic, the Absheron economic region, especially Baku and Sumgayit. The industry of the economic region is based on the food and light industry processing local agricultural products. The light industry of the economic region is mainly represented by winemaking, fruit growing, sewing, and carpet weaving. The main activity in the

food industry is winemaking, which processes local grape products. In addition, the economy of the region includes forest and wood processing, production of construction materials (wood processing plant in Ismayilli, brick factory, and stone quarries in Shamakhi and Gobustan), repair of agricultural machinery. The land of Shirvan has historically been a center of crafts and weaving. Lahij settlement is well-known for its copperware, while Basgal village is notable for its kelagayi. In Shamakhi, there are workshops for silk kelagayi. For most villages, carpet weaving is a traditional craft.

However, the Mountainous Shirvan economic-geographical region is one of the regions most exposed to anthropogenic loading in the country. The anthropogenic load is the degree of the direct and indirect impact of a human being and his economy on nature and its individual components. In the economic-geographical region, all forms of anthropogenic overload are found, except for heavy industries. In the Mountainous Shirvan economic-geographical region, industries polluting the environment with toxic substances are underdeveloped. The reason is that there is no local raw material base for the creation of heavy industries, and it is not economically viable to work on the basis of imported raw materials. However, environmental pollution, especially atmospheric pollution, is observed in the region. The reason for air pollution is that the economic region has an extensive transport network. The strategically important Baku–Shamakhi–Aghsu–Kurdamir highway passes through the region. A railway line has been laid between Padar Station and Chol Goylar village. Roads are also one of the factors affecting ecosystems. Ecosystems along highways are exposed to greater environmental impact. Toxic gases from automobile engines enter the atmosphere, poison the air, and have a negative impact on human health.

Atmospheric, water, and other pollution in the Mountainous Shirvan economic region also plays a role in the natural growth of the population in the region (Table). Therefore, the number of births, deaths, natural population growth, and infant mortality in the economic region was studied, and the elimination of the results was tested on several models. Using economic-mathematical modeling methods, the dependence of births, deaths, natural population growth, and infant mortality on the ecological situation for the economic regions of the Republic of Azerbaijan was analyzed [1].

Table.

INFORMATION ON THE WATERS OF MOUNTAIN SHIRVAN [2]

Mountainous Shirvan	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*
Population (end of year, thousand people)	304.0	308.2	311.9	315.3	318.6	317.4
Natural population growth (per thousand people)	14.7	14.0	12.1	10.8	10.3	10.1
Births	21.2	20.0	18.5	16.8	16.3	15.9
Deaths	6.5	6.0	6.4	6.0	6.0	6.0
Including children died before reaching the age of 1	6.9	10.1	12.8	12.7	16.2	16.1
Emission of pollutants from stationary sources into the atmosphere (thousand tons)	0.03	0.06	0.2	0.1	0.1	0.1
Water taken from natural sources (million cubic meters)	80.6	90.0	70.0	75.8	77.9	78.8
Water used for domestic purposes (million cubic meters)	1.6	2.1	2.4	2.5	3.4	3.2

Models based on official statistics of the State Statistics Committee (SSC) were found on a personal computer using the "EViews" application program using the smallest squares method and evaluated by correlation-regression analysis [3].

Specifically, the model we analyzed is as follows.

$$\log(B_{ER}) = c_1 + c_2 E_{ER} \tag{1}$$

$$\log(D_{ER}) = c_1 + c_2 E_{ER} \tag{2}$$

$$\log(NG_{ER}) = c_1 + c_2 E_{ER} \tag{3}$$

$$\log(IM_{ER}) = c_1 + c_2 E_{ER} \tag{4}$$

B_{ER} — births, D_{ER} — deaths, NG_{ER} — natural growth, IM_{ER} — total infant mortality, E_{ER} — volume of pollutants from stationary sources in the economic zone, c_1, c_2 — parameters are estimated on the basis of statistics covering 2014–2019 [2].

Here c_1 is the coefficient of semi-elasticity. The following expression is used to interpret c_2 coefficient economically.

$$\log y = \log y_0 + c_2 x$$

$$\frac{y}{y_0} = e^{c_2 x}$$

if $c_2 < 0$, then $e^x \approx 1 + x$ will be written. Thus, when the factor influencing x is changed by 1 unit, the result indicator — y shows a change of c_2 100% relative to the base level — y_0.

Thus, in accordance with the results for the implementation of models in "EViews" application software package on the personal computer, based on official statistics of the State Statistics Committee, dependent on births, deaths, natural population growth and infant mortality on ecological situation, more precisely emissions of pollutants into the atmosphere (thousand tons) in the Mountainous Shirvan economic region in 2014–2019, regression equations were obtained as follows pursuant to the outcomes for the implementation of the model on a PC [3].

$$\log(B_{DS}) = 3{,}084 - 0{,}004 E_{DS} \tag{5}$$
$$t - stat. \quad (29{,}013) \quad (0{,}870)$$
$$R^2 = 0{,}159, \quad DW = 0{,}310$$

The econometric model shows that the birth rate per 1 000 people decreases by 0.4% as a result of the release of 1 000 tons of air pollutants into the Mountainous Shirvan economic region (5).

$$\log(D_{DS}) = 1{,}948 + 0{,}002 E_{DS} \tag{6}$$
$$t - stat. \quad (56{,}222) \quad (1{,}379)$$
$$R^2 = 0{,}322, \quad DW = 0{,}800$$

The econometric model shows that the death rate per 1 000 people increases by 0.2% as a result of the emission of 1 000 tons of air pollutants into the Mountainous Shirvan economic region (6).

$$\log(NG_{DS}) = 2{,}666 - 0{,}005 E_{DS} \tag{7}$$
$$t - stat. \, (17{,}974) \quad (0{,}677)$$
$$R^2 = 0{,}102, \quad DW = 0{,}244$$

The econometric model shows that the natural population growth rate per 1 000 people decreases by 0.5% as a result of the emission of 1 000 tons of air pollutants into the Mountainous Shirvan economic region (7).

$$\log(IM_{DS}) = 2{,}612 + 0{,}004E_{DS} \qquad (8)$$
$$t - stat.\ (31{,}634) \qquad (1{,}33)$$
$$R^2 = 0{,}470, \qquad DW = 2{,}523$$

The econometric model shows that as a result of the release of 1 000 tons of air pollutants into the Mountainous Shirvan economic region, the infant mortality rate per 1 000 people increases by 0.4%. As it is seen in the statistical analysis, the results obtained in the econometric models (5–8) are not statistically significant [4–5].

In general, the study and statistical models show that the impact of air pollution on births, deaths, natural population growth and infant mortality in the Mountainous Shirvan economic region is very low. Other factors will be studied in future studies.

References:

1. (2017). Report on human development in the Republic of Azerbaijan, UN Development Program, Azerbaijan.

2. (2018). Statistical indicators of the Republic of Azerbaijan. Baku.

3. (2000). EViews 4: User's Guide. Quantitative Micro Software, LLC, USA.

4. Goychayli, Sh. Y., Ismayilov, T. A. (2009). Economic and ecological bases of nature use. Baku, MBM Publishing House.

5. Verdiyeva, N. (2019). How the population of the Republic of Azerbaijan is ageing: causes and potential for social and economic development. *Population and Economics*, *3*(3), 23-42. https://doi.org/10.3897/popecon.3.e47233

Список литературы:

1. Отчет о достижении целей устойчивого развития в Азербайджане. Организация Объединенных Наций. Нью-Йорк, 2017.

2. Статистические данные Азербайджанской Республики. Баку, 2018.

3. EViews 4: User's Guide. Quantitative Micro Software, LLC, USA, 2000.

4. Гейчайли Ш. Ю., Исмаилов Т. А. Экономические и экологические основы природопользования. Баку, 2009.

5. Verdiyeva N. How the population of the Republic of Azerbaijan is ageing: causes and potential for social and economic development // Population and Economics. 2019. V. 3. №3 P. 23-42. https://doi.org/10.3897/popecon.3.e47233

_____