ECONOMETRIC ASSESSMRNT OF THE IMPACT OF VOLUME OF RADON EMISSIONS PER CAPITA IN THE REPUBLIC OF AZERBAIJAN

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Abstract

The Republic of Azerbaijan is an oil and industrial country rich in natural resources. Determining and analyzing the activity of natural radionuclides in nature, studying the physical essence and mechanism of action of oil and gas deposits, radioactive aerosols in the environment are among the most urgent issues of the day.

It is important to study the physical nature and mechanism of action of radioactive aerosols generated in the environment in oil and gas extraction areas. The indicated radioactive substances show themselves as sources of α, β, γ - radiation, and their organotrope entering the living organism leads to undesirable pathology by having a bilateral, that is, synergistic effect. It is very important to investigate the individual and cumulative effects of these harmful effects.

Keywords: oil and gas deposits, natural radionuclides, radiation source, environment, harmful effects, radioactive substances, econometric evaluation

I. Introduction

The growing demand for oil and gas in the world economy has created conditions for increasing oil and gas production. As a result, the volume of radon gas generated during oil and gas refining has increased. Although global gas consumption in 2019 was lower than in 2018 (+2.6%), this growth continued (record year + 5.1%). Despite a 3.1% increase in natural gas demand in 2019 in the United States, the world's largest gas consumer with the emergence of new gas-fired power plants, gas prices have fallen. Growth by sector was uneven. Thus, although it was 7% in the energy sector, there no significant change in the utilities, trade and industry sectors [1].

II. Methods

In China, the increase in gas consumption has halved (+ 8.6%) due to the slowdown in economic growth and the easing of the policy of replacing coal with gas. China ranks 24% of global growth, ranking second in the world in terms of demand growth (+ 8.6%).

Consumption in the EU increased by + 3.1% due to improved demand in natural gas production countrie such as Spain, Germany and Italy, as well as Russia, Australia, Iran, Algeria and Egypt [1].

In Asia, the decline continues in Japan and South Korea due to declining demand in the energy sector (declining electricity consumption and increasing competition from nuclear and RES power plants). [2]

In Latin America, gas consumption remains stable; Brazil and Argentina saw a slight decline, while Mexic saw a 4.4% increase. Radon emissions have continued to rise in coal- and hydrocarbon-producing countries such as Russia, Australia, Iran, South Africa and Algeria. The following graph provides information on radon gas emissions in the CIS and AR [3].

As can be seen from the picture data the dynamics of radon emissions in 2000-2019, mainly in the CIS countries in 2002-2008, including the Republic of Azerbaijan, increased and in 2008-2010 this increase was observed in Azerbaijan with a decrease.

III. Results

In 2011-2016, the volume of radon emissions increased in Azerbaijan. Thus, compared to 2011, the volume of radon emissions in Azerbaijan increased by 18.9% to 33.3 thousand tons, and in the CIS countries decreased by 7.4% in the same period and amounted to 2300 thousand tons. In 2019-2022, this figure increased in the CIS and Azerbaijan.

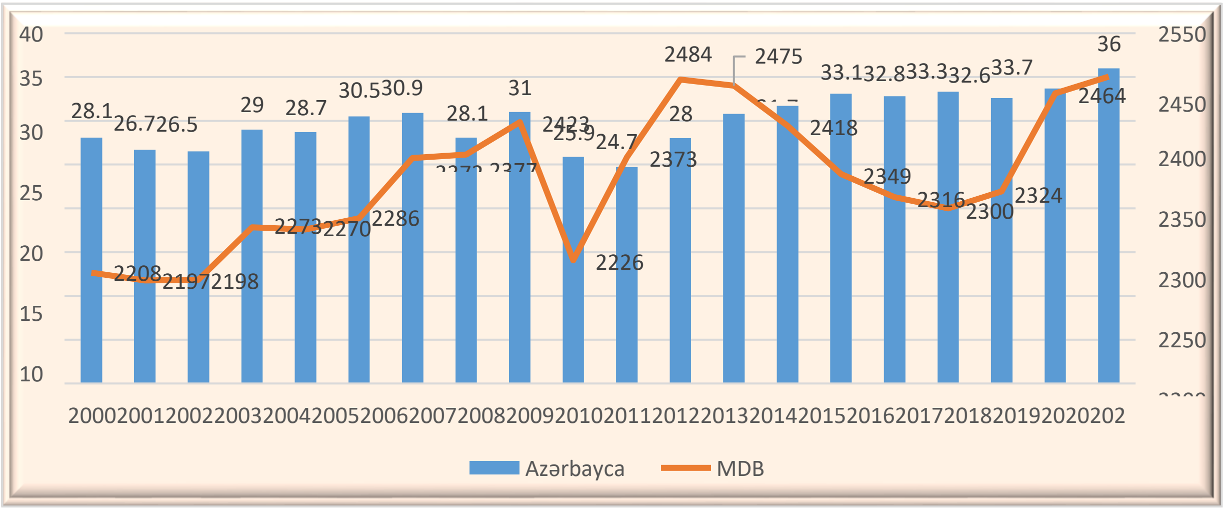

Figure 1: *Dynamics of radon gas emissions in the CIS and the Republic of Azerbaijan for 2000-2022, thousand tons*

China ranks first in the world in terms of radon emissions. The volume of radon emissions in this country at that time was 11,535,200 tons. The top ten includes China, the United States, India, the Russian Federation, Japan, Germany, Iran, South Korea, Indonesia and Saudi Arabia. Azerbaijan ranks 66th in the world in terms of radon emissions (36.0 thousand tons) [4].

The volume of CO_2 emissions in the Republic of Azerbaijan was higher during the former USSR. This can be seen more clearly in the chart below [5].

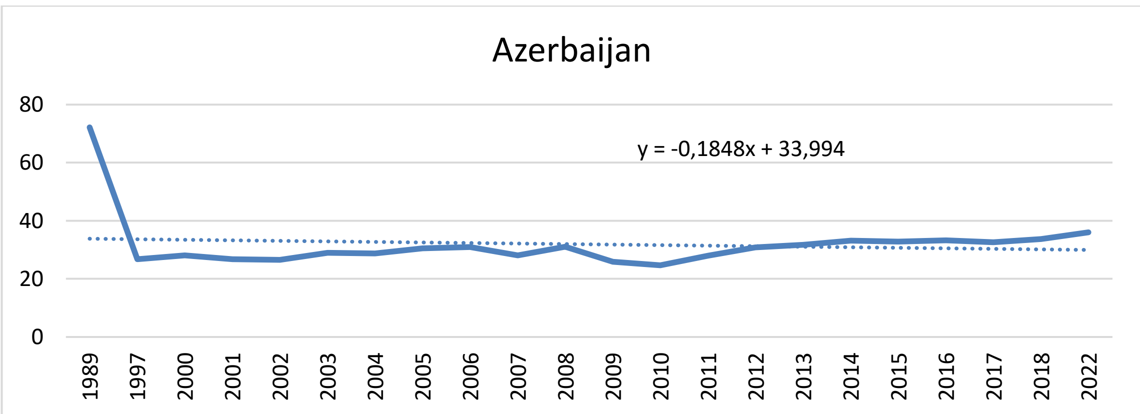

Figure 2: *Dynamics of radon gas emissions in the Republic of Azerbaijan for 1970-2022, thousand tons*

As can be seen from the data in the table, the volume of radon emissions increased to the peak in the Republic of Azerbaijan in 1970-1989. Thus, in 1989, this figure was 72.2 thousand tons compared to 1970.This means an increase of 2.23 times. As can be seen from the trend model, which shows the dependence of the volume of radon emissions in the Republic of Azerbaijan on the time factor, the time dependence is weak in terms of the correlation coefficient [1].

Increasing the amount of radon waste has a negative impact on human health by increasing the amount of waste per capita. From this point of view, one of the most important issues is the interaction of the volume of radon emissions in the Republic of Azerbaijan with radon emissions per capita. The chart below shows this information [6].

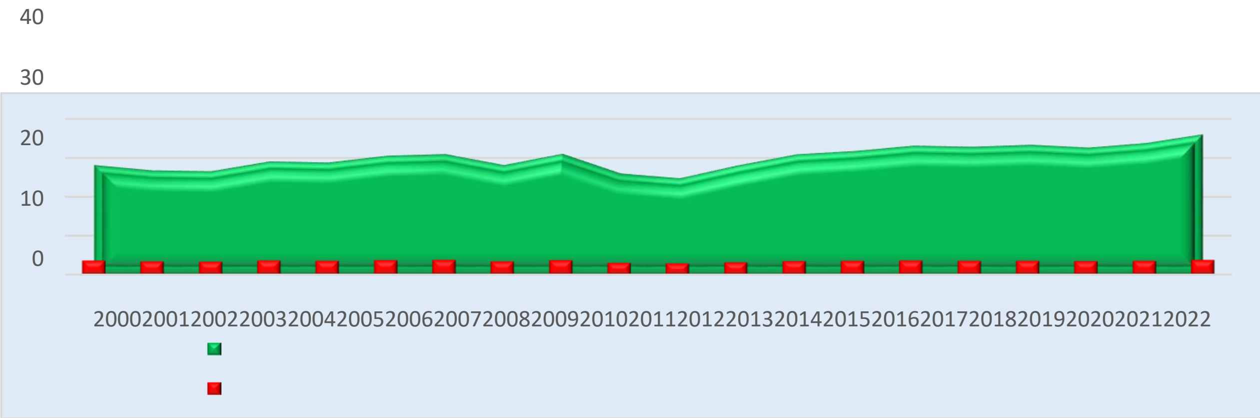

Figure 3: *Dynamics of radon gas emissions in the Republic of Azerbaijan for 1970-2022, thousand tons*

The impact of increasing radon emissions on per capita radon emissions can be explored.

Many ready-made mathematical software packages, including EViews, MatLab, MS Excel, MathCad, etc., are used to conduct regression analysis of the dependence of radon emissions per capita on the increase in radon emissions in the Republic of Azerbaijan [1]. It should be noted that the Eviews software package is more universal for the purpose of regression analysis, so using this software package, we obtain the following result based on the data in Fig. 3 above.

As can be seen from the Eviews application software package, there is an average correlation between the variables Y and X, expressed by the model Y = 0.0535 * X +1.726 (R2 = 0.524850). Thus, the degree of dependence between the indicators on the Cheddock scale, the fact that the quantitative value of the density of the connection is in the range of 0.3-0.5, show that the quality characteristic of the strength of the connection dependence is average [7], [2].

Based on this correlation equation, it can be concluded that the increase in the volume of radon emissions in the Republic of Azerbaijan is characterized by a 1.73 increase in radon gas per capita.

As can be seen, model (1) is statistically significant according to the table based on the EViews application software package. This significance is primarily explained by the fact that the coefficient of the free variable X, the free limit C, is higher than their standard errors.

Since it is important to check the adequacy of the established model, this adequacy can be determined using the F-Fisher criterion as one of the traditional methods. Expressing the regression equation as a whole (2) F-Fisher criterion to test the statistical significance of the model should be compared with the value of *F*figure (a; m; n - m - 1) [2]. Table 2 showing the results of the Eviews software package according to F- statistics (Fisher's criterion) = 19.88 .If we define the value of the table F in EXCEL using the formula *F*figure (a; m; n - m - 1)= F (0,05; 1; 18) = 4,41

When the F-Fisher criterion is compared with the value of *F* figure (a; m; n - m - 1), it appears that the F-Fisher criterion is>*F*figure (19,88> 4,41). The regression equation as a whole is statistically significant [2]. This means the adequacy of the established model (1).

Table 1: *Regression analysis of the dependence between the increase in the volume of radon waste and the radon waste per capita*

DependentVariable: Y
Method: Least Squares
Date: 27/03/24 Time: 20:02
Sample: 2000/2022
Included observations: 20

Variable	Coefficient	Std.Error	t-Statistic	Prob.
X	0.053474	0.011992	4.459007	0.0003
C	1.725654	0.362742	4.757242	0.0002
R-squared	0.524850	Meandependentvar		3.335500
AdjustedR-squared	0.498452	S.D.dependentvar		0.222154
S.E.ofregression	0.157329	Akaikeinfocriterion		-0.766310
Sumsquaredresid	0.445546	Schwarzcriterion		-0.666736
Loglikelihood	9.663096	Hannan-Quinncriter.		-0.746872
F-statistic	19.88274	Durbin-Watsonstat		0.927251
Prob(F-statistic)	0.000303			

Based on the results obtained from the Eviews application software package, the regression equation will be as follows:
EstimationCommand:
=========================LS YXC
EstimationEquation:
=========================Y =C (1) *X+C (2)
SubstitutedCoefficients:
=========================
Y=0.0534743869455*X+1.72565358101
Source. The Eviews application was developed by the author based on the software package.

The result of autocorrelation in the model can be determined based on the Darbon-Watson statistics in Table 3.1, obtained from the EViews application software package. As can be seen from the table, DW is equal to 0.927.In this case,

For 4 observational variables m = 1 and n = 20 observations at the significance level α = 0.05, the Darbon-Watson crisis points will be as follows [2].

$$d_l=0{,}902, \qquad d_u=1{,}118$$

$$d_l=0{,}902<DW=0{,}927<d_u=1{,}118 \tag{1}$$

As there is no conclusion on the existence of autocorrelation . [2].

dl = 0.902 <DW = 0.927 <du = 1.118 (3.1)

The regression equation as a whole is statistically significant and the constructed Y = 0.0535 * X +1.726 model is adequate.

Prices for radon gas per capita in the Republic of Azerbaijan and standard errors, found by the regression equation obtained on the basis of the Eviews application software package, as well as a number of characteristics of the use of the equation for forecasting purposes are shown in the graph below.

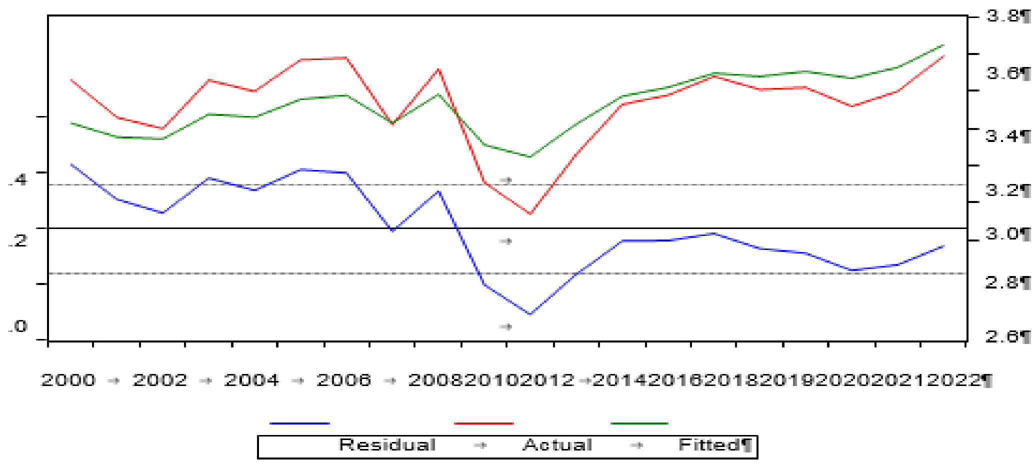

Figure 4: *Prices of radon gas per capita in the Republic of Azerbaijan by years, standard errors, characteristics for forecasting [8],[9].*

Using the graph, it is possible to determine the expected forecast prices for radon gas per capita in the Republic of Azerbaijan. Evaluation the impact of the increase in radon gas emissions during oil and gas refining in the Republic of Azerbaijan on the level of radon gas per capita by elasticity coefficient is also an important issue.

As a result of the study, by calculating the coefficient of elasticity for the linear regression equation above the degree of influence of the relationship between these indicators can be expressed as a percentage (1).It should be noted that the coefficient of elasticity is the percentage increase in the dependent variable due to a 1% increase in the free variable x included in the model or decrease is calculated according to the following formula [2].

$$E_{CO^2} = \frac{a_1 x_1}{y} \tag{2}$$

Here, αi are the coefficients of the above contact equation. $\bar{x}$ is the calculated average of CO_2 emissions for the studied periods, $\bar{y}$ is the calculated average of the level of radon gas per capita in the Republic of Azerbaijan for the studied periods. The elasticity coefficients calculated on the basis of these indicators will be as follows for the built model.

$$E_{CO^2} = \frac{a_1 x_1}{y} = \frac{0.0535 \times 30.105}{3.3355} = 0.482871 \tag{3}$$

Calculations show that a 1% increase in radon gas emissions in the Republic of Azerbaijan leads to a 0.483% increase in the level of radon gas per capita in the Republic of Azerbaijan.

If we establish a correlation-regression relationship between the volume of radon gas emissions in the Republic of Azerbaijan and the level of radon gas per capita in the Republic of Azerbaijan in MS Excel, we get the following result.

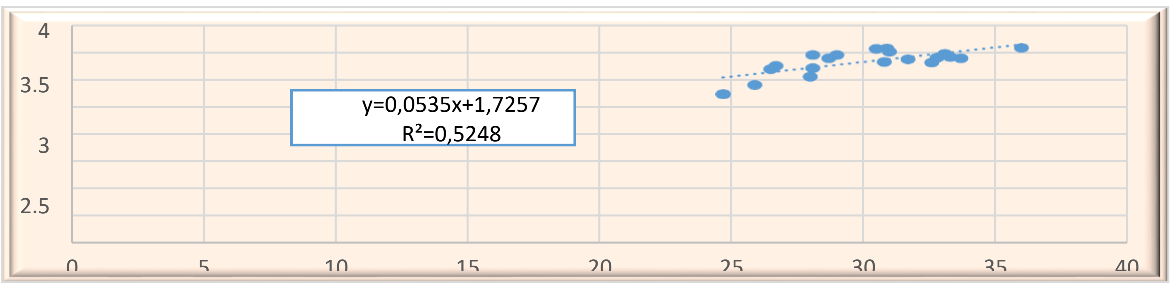

Figure 5: *Correlation-regression relationship between the volume of radon gas emissions in the Republic of Azerbaijan and the level of radon gas per capita [8]*

The correlogram of radon gas emissions of oil and gas refining in the Republic of Azerbaijan with the level of radon gas per capita in the Republic of Azerbaijan according to the Eviews software package will be as follows.

Table 2: *Oil and gas processing with per capita radon gas levels suspension of radon gas waste generated during*

Date:27/03/24 Time:20:25
Sample:2000/2022
Included observations: 20

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |*** |	. |*** |	1	0.419	0.419	4.0618	0.044
. |* . |	. *| . |	2	0.097	-0.096	4.2899	0.117
. *| . |	. *| . |	3	-0.083	-0.106	4.4668	0.215
***| . |	***| . |	4	-0.382	-0.366	8.4806	0.075
.**| . |	. | . |	5	-0.283	0.022	10.835	0.055
. *| . |	. *| . |	6	-0.201	-0.108	12.104	0.060
. *| . |	. | . |	7	-0.109	-0.032	12.503	0.085
. | . |	. | . |	8	0.055	-0.033	12.616	0.126
. *| . |	.**| . |	9	-0.115	-0.315	13.146	0.156
. *| . |	. *| . |	10	-0.100	-0.078	13.590	0.193
. | . |	. | . |	11	0.041	0.048	13.672	0.252
. | . |	. *| . |	12	-0.028	-0.108	13.715	0.319

The Eviews application was developed by the author based on the software package.

The linear coefficient of double correlation is calculated to estimate the density of the relationship between the studied indicators. This ratio is determined according to the following formula [2] [10].

IV. Discussion

Value of the coefficient [-1; 1] varies in the range. The closeness of the rxy-coefficient to the unit indicates that there is a close correlation between these indicators. The fact that rxy = 0 indicates that there is no linear dependence.

Although the ratio is zero and there is no linear relationship between the subjects, there may be a nonlinear relationship. The degree of dependence between the indicators is determined mainly by the Cheddock scale. The linear coefficient of double correlation also determines the direction of cause and effect. Thus, if rxy> 0, there is a direct relationship between the indicators. That is, as the causal factor (x) increases, so does the value of the outcome indicator (y).

If rxy<0, then there is a feedback between the indicators.is, as the cause factor (x) increases, the value of the outcome indicator (y) decreases. The CORREL statistical function is used to determine the linear coefficient of double correlation based on the Eviews application software package.

According to the table, R2 = 0.525 means that the corresponding regression equation is explained by 52.5% of the variance results, and 47.5% by the influence of other factors.

The dynamics of the Fitted and Actual values, as well as the residuals between them, according to the regression equation of the built-in model (2) and the Eviews application software package, are given in the graph below [2].

There is a mean correlation expressed by the linear regression equation Y = 0.0535 * X +1.726.

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