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ОЦІНКА ТОРГОВЕЛЬНО-ЕКОНОМІЧНИХ ВІДНОСИН МІЖ КОРОЛІВСТВОМ САУДІВСЬКА АРАВІЯ ТА АЗЕРБАЙДЖАНОМ

Актуальність. *Торгівля - найважливіший інструмент світової економіки з точки зору налагодження зв'язків між країнами, посилення їх взаємодії у міжнародному обміні товарами, послугами та продуктами інтелектуальної праці.*

Мета та завдання. *Мета статті - оцінити торгівельно-економічні відносини між Королівством Саудівська Аравія та Азербайджаном, довести наявність співвідношень між основними економічними змінними.*

Результати. *Макро, мікро та інституційні фактори, що впливають на торгівлю, спочатку класифікуються та окремо пояснюються у статті. Більше того, всі економічні показники, що впливають на експорт, були детально проаналізовані. Потім було досліджено міжнародний досвід оцінки зовнішньоторговельного потенціалу, вказується, що існує декілька наявних моделей, але найбільш підходящою для дослідження є гравітаційна модель.*

Роз'яснено суть гравітаційної моделі та вивчається економічна література для визначення механізму її застосування. На основі гравітаційної моделі торгові відносини Саудівської Аравії та Азербайджану були оцінені методом найменших квадратів економетрики. Таким чином, спочатку були створені дві моделі із змінними експорту Саудівської Аравії та Азербайджану. Однією зі змінних є реальний обмінний курс, і ця змінна для кожної країни була розрахована і додана до моделей за роками.

Висновки. *Особливості, що характеризують адекватність цих моделей, були проаналізовані за допомогою програмного пакету e-views. Так, сезонне коригування, їх нерухомість, гетерошедастичність/гомоскедастичність, співвідношення детермінації, автокореляцію. Моделі були відповідно відрегульовані залежно від результатів випробувань. Результати інтерпретовано на основі коефіцієнтів та проаналізовано їх економічну сутність. Доведено, що існують позитивні торгівельні кореляції між двома країнами. На закінчення дослідження були підсумовані.*

Ключові слова: *торгівля, експорт, гравітаційна модель, економетричні моделі*

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ESTIMATION OF TRADE AND ECONOMIC RELATIONS BETWEEN THE KINGDOM OF SAUDI ARABIA AND AZERBAIJAN

Topicality.*Trade is the most important tool of the world economy in terms of building ties between countries, strengthening their interaction in the international exchange of goods, services and intellectual labor products.*

Aim and tasks*. The purpose of the article is to estimate trade and economic relations between the Kingdom of Saudi Arabia and Azerbaijan, to prove having correlations between basic economic variables.*

Research results.*The macro, micro and institutional factors affecting trade are initially classified and in separately explained in the article. Moreover, all economic indicators influencing exports have been analyzed in detail. The international experience on the estimation of foreign trade potential has been then investigated, it is pointed out that there are several models considering available, but the most suitable for research is the gravity model.*

The essence of the gravitational model is explained and the economic literature is studied to determine its application mechanism. On the basis of the gravity model, the trade relations of Saudi Arabia and Azerbaijan have been estimated by the method of the least squares of econometrics. Thus, two models have been set up initially with the variables of export of Saudi Arabia and Azerbaijan. One of variables is real exchange rate and this variable for each country has been calculated and added to the models by years.

Conclusion.*The features characterizing the adequacy of these models have been analyzed by using the e-views software package. So that, seasonal adjustment, their stationary, heteroschedasticity/homoscedasticity, the ratio of*

determination, autocorrelation have been analyzed. The models have been adjusted accordingly depending on the test results. The results have been interpreted on the basis of coefficients and their economic essence has been analyzed. It has been proved that there are positive trade correlations between two countries. In the conclusion, a summary of research has been noted.

Keywords: *trade, export, gravity model, econometric models.*

Problem statement and its connection with important scientific and practical tasks. Generally, there are several factors that determine and directly affect trade. These include a wide range of micro and macro factors at the economic level, as well as the institutional environment (national legislation, political stability, security, etc.). The trade tariffs and transport costs are based on micro-factors at the economic level, while macro-factors consist of economic integration, macroeconomic indicators (GDP, economic growth, inflation, currency), technological changes, business-investment environment, etc. The institutional environment includes belonging to the same language, geographical proximity, international political situation, religion and so on. Each of these determinants affecting trade between the two countries has contributed, and each can be measured in its own way.

Theoretically, looking at the export model (such as demand from abroad), it is clear that the volume of exports of any goods (1) depends on the level of income of the importing country. Thus, the higher the purchasing potential of a country, the greater the demand for goods and services of another country. (2) It depends on the prices of goods and services in the exporting country, and (3) the exchange rate. People are interested in the prices of goods in terms of their currencies. Prices depend not only on the price of goods in that country, but also on the exchange rate. It also depends on (4) transport costs, demand for trade from that country will decrease as transport costs increase. (5) It can be emphasized that it also depends on the number or growth factor of the population. It is logical to assume that the higher the population (or growth rate) of a foreign country, the greater the trade potential in that country. (6) Political reasons are also factors in order to influence trade, for example political stability in a country affects people's ability to take security into account.

While analyzing the trade and economic relations between the Kingdom of Saudi Arabia and Azerbaijan both analytical and empirical estimations have been conducted in the study. While econometric methods have been used to estimate the factors affecting trade, the logical methods such as deduction, induction and tables have been applied in the analytical analysis. Moreover, detailed information has been provided on the theoretical basis of the econometric model, the econometric method and the essence of the indicators.

Analysis of recent publications on the problem. To estimate the potential of foreign trade, researchers have used a number of different methods, including the model of gravity, the model of comparative advantage, the size of the cosine, the model of opponent substitution, the general model.

Allocation of previously unsolved parts of the general problem. In this section, the estimation of trade relations between the two countries will be set up on the basis of the gravity model. Because the gravity model has been used to estimate trade in almost all international literature. The economist Tinbergen has proved that bilateral trade flows between countries are directly proportional to GDP and inversely proportional to the distance between them in his famous book written in 1962 "Shaping the World Economy: suggestions for an International Economic Policy". The essence of this model is that because this is analogous to gravity of the earth, the economic processes with the gravitational model can be explained by trade, investment flows and the migration of population between countries around the world.

Tinbergen has also proved that it is possible to calculate international migration flows with the same functional form. Despite some ambiguity, the model of gravity realized by Tinbergen has been used the most appropriate empirical tool for understanding economic processes in the world. However, since Tinbergen's initial analysis has failed to prove the theoretical basis for this model, in 1966 Linnemann and others improved the theoretical basis of the model of gravity.

In the simplest way, if the special barriers and tendencies don't exist, the mutual trade between two countries is related to the size and the distance of the economies of the countries by using the model of gravity.

$$T_{ij} = f(GDP_i, GDP_j, D_{ij})$$

Here

Tij - the trade potential of the state of i and j

GDP_i - GDP of i country

GDP_j - GDP of j country

D_{ij} - the distance between i and j countries

In this current model, GDP indicates the size of the the economy of two countries. In fact, the larger potential of a country's economy means the more posibility to trade with other countries. Therefore, GDP should be included to the model. The distance between countries is also a factor that affects directly trade. Because this factor is connected to the transportation costs. As the distance between countries diverges, the trade potential of those countries decreases. The gravity model is set up on the basis of data of 23 countries of EU in 1994-2004 in the investigation due to 'Analysis of the gravity equation in the context of international trade' conducted by Tiuu Paas, Egle Tafenau and Nancy Scannell (2008)

$$\text{Ln}(Ex_{ijt}) = \beta_0 + \beta_1 Ln(GDP_{ijt}) + \beta_2 Ln(SIM_{ijt}) + \beta_3 LRFAC_{ijt} + \theta_{ijt} + u_{ijt}$$

Here Ex - export, GDP - logarithmic sum of GDPs of the countries included in the model, SIM - index of similarity of GDPs of the countries included in the model, LRFAC - absolute difference of GDPs of countries included in the model, θ - sum of mixed effects and u - indicates stochastic error [5].

The following gravity model with Pakistan's trade partners between 1991-2011 has been presented in the study "Potential Export Flows of Pakistan: The gravity model approach" conducted by Shujaat Abbas and Adbul Waheed (2015):

$$LnEx_{ij} = \beta_0 + \beta_1 LnGDPi_t + \beta_2 LnGDPj_t + \beta_3 LnPopj_t + \beta_4 D_{ij} + \beta_5 RPij_t + u_{it}$$

Here, the dependent variable includes the export of country i and j, and the explanatory variables includes the GDP of country i and j, the population of the country, the distance between countries, the level of price and the balance. The coefficients β_1 and β_2 are expected to be positive and β_4 to be negative [4].

Formulation of research objectives (problem statement). After analyzing the factors defining and directly affecting trade, explaining the essence of the model applied to estimate the potential of foreign trade, and identifying the variables included in the model in international practice, it will be possible to estimate the trade relations between Azerbaijan and Saudi Arabia. First of all, it should be pointed out that the estimation will be conducted on the basis of gravity model using the econometric method of the least squares. Two models will be constructed considering the exports of Saudi Arabia as a dependent variable, and considering the exports of Azerbaijan as a dependent variable and the explanatory variables will be the same in both models.

An outline of the main results and their justification. The linear logarithmic model of the demand on exports of Saudi Arabia, conducted on the basis of the gravity model, is as follows:

$$Log(Ex_{it}) = \beta_0 + \beta_1 Log(GDP_{it}) + \beta_2 Log(GDP_{jt}) + \beta_3 Log(POP_{it}) + \beta_4 Log(POP_{jt}) + \beta_5 Log(M_{it}) + \beta_6 Log(İ_{it}) + u_{ijt} \quad (1)$$

Here, i index indicates Saudi Arabia, j index - Azerbaijan, and t index - the time factor. Ex_{it}- the volume of exports of Saudi Arabia in t year, GDP_{it}- the GDP of Saudi Arabia in t year, GDP_{jt}- the GDP of Azerbaijan in t year, POP_{it}- the population of Saudi Arabia in t year, , POP_{jt} - represents the population of Azerbaijan in t year, M_{it}- the real exchange rate of Saudi currency to Azerbaijani currency in t year, $İ_{it}$ – the volume of Azerbaijani imports in t year and u_{ijt}- the stochastic error in the model. The expected signs of the coefficients are as follows:

$$\beta_1 > 0, \beta_2 > 0, \beta_3 < 0, \beta_4 > 0, \beta_5 < 0, \beta_6 > 0 \quad (2)$$

All variables have been given as a logarithmic function because the measurement of the impact of the variables included in the model on Saudi exports is indicated as a percentage, and due to the uncertainty about whether there is a linear relationship between the dependent variable and the independent variable. Moreover, economic variables with time series usually have a stationary problem. Because the variables in model (1) have economic essence and a test-based stationary problem, the variables have been previously included in the model with the first difference.

One of the explanatory variables is the real exchange rate. The real exchange rate (RER) is obtained by multiplying the nominal exchange rates set by the Central Bank of the Republic of Azerbaijan for countries by the price index of a foreign country and dividing by the price index of Azerbaijan:

$$RER = e * \frac{CP\dot{I}_S}{CP\dot{I}_a} \quad (3)$$

Here, e indicates the nominal exchange rate, $CP\dot{I}_S$ indicates the consumer price index of Saudi Arabia, and $CP\dot{I}_a$ indicates the consumer price index of Azerbaijan. $CP\dot{I}_S$ and $CP\dot{I}_a$ are obtained from website containing the statistics indicators of the International Monetary Fund.

After modeling the demand on exports of Saudi Arabia based on the gravity model, a linear logarithmic model of the demand for Azerbaijani exports has been shown in the same way:

$$Log(Ex_{it}) = \beta_0 + \beta_1 Log(GDP_{it}) + \beta_2 Log(GDP_{jt}) + \beta_3 Log(POP_{it}) + \beta_4 Log(POP_{jt}) + \beta_5 Log(M_{it}) + \beta_6 Log(\dot{I}_{it}) + \beta_7 Log(X_{it}) + u_{ijt} \quad (4)$$

Here, i index indicates Azerbaijan, j index - Saudi Arabia, and t index - the time factor. Ex_{it} - the volume of exports of Azerbaijan in t year, GDP_{it}- the GDP of Azerbaijan in t year, GDP_{jt} - the GDP of Saudi Arabia in t year, POP_{it}- the population of Azerbaijan in t year, POP_{jt} - represents the population of Saudi Arabia in t year, M_{it}- the real exchange rate of Azerbaijani currency to Saudi currency in t year, $\dot{I}_{it}$ – the volume of Saudi imports in t year, and u_{ijt}- the stochastic error in the model. Any transport costs has not been found in Saudi Arabia's trade, therefore, this variable is not included in model (1). The expected signs of the coefficients are as follows:

$$\beta_1 > 0, \beta_2 > 0, \beta_3 < 0, \beta_4 > 0, \beta_5 < 0, \beta_6 > 0, \beta_7 < 0 \quad (5)$$

All variables have been given as a logarithmic function because the measurement of the impact of the variables included in the model on Azerbaijani exports is indicated as a percentage, and due to the uncertainty about whether there is a linear relationship between the dependent variable and the independent variable. Moroever, economic variables with time series usually have a stationary problem. Because the variables in model (2) have economic importance and a test-based stationary problem, the variables have been previously included in the model with first difference.

The statistical data for 1995-2018 have been collected on an annual basis and taken from the official websites of the General Authority for Statistics in the Kingdom of Saudi Arabia, the State Statistical Committee of the Republic of Azerbaijan and the central banks of both countries (see Tables 1 and 2).

Table 1

GDP, export and import of the Kingdom of Saudi Arabia and the Republic of Azerbaijan

years	Saudi GDP billion dollar	Azeri GDP billion dollar	Saudi export billion dollar	Azeri export billion dollar	Saudi import billion dollar	Azeri import billion dollar
1995	143.2	2.4	50	0.637	28	0.67
1996	158.5	3.2	61	0.631	28	0.96
1997	165.7	4.0	61	0.781	29	0.79
1998	146.8	4.4	39	0.606	30	1.08
1999	161.7	4.6	51	0.929	28	1.04
2000	189.5	5.3	77	1.745	30	1.17
2001	184	5.7	68	2.314	31	1.43
2002	189.6	6.2	72	2.167	32	1.67
2003	215.8	7.3	93	2.59	42	2.62
2004	258.7	8.7	126	3.6	48	3.52
2005	328.2	13.2	181	4.3	59	4.21
2006	376.2	21.0	211	6.3	70	5.27
2007	414.3	33.1	233	6.05	90	5.71
2008	518.9	48.9	313	47.756	115.13	7.17

Continuation of table 1

2009	428.3	44.3	192	14.701	95.54	6.12
2010	527.3	52.9	251	26.56	106.86	6.60
2011	671.1	66.0	365	34.406	131.59	9.76
2012	734.9	69.7	388	34.161	155.59	9.65
2013	746.4	74.2	376	32.841	168.16	10.71
2014	755	75.2	342	21.828	173.83	9.19
2015	653.6	53.0	204	16.592	174.68	9.22
2016	644.3	37.9	184	13.107	140.17	8.49
2017	688	40.9	222	15.48	134.52	8.78
2018	781.1	47.1	294	20.29	137.07	11.47

Table 2

Population and real exchange rate of the Kingdom of Saudi Arabia and the Republic of Azerbaijan and transport expense of the Republic of Azerbaijan

years	Saudi population million	Azeri population million	Saudi real exchange rate	Azeri real exchange rate	Azeri transport expense billion dollar
1995	18638.79	7643.50	0.290	3.453	0.1728
1996	19033.85	7726.20	0.227	4.412	0.2130
1997	19407.14	7799.80	0.195	5.140	0.2869
1998	19783.30	7876.70	0.186	5.379	0.3302
1999	20194.53	7953.40	0.207	4.835	0.3478
2000	20663.84	8032.80	0.214	4.681	0.3174
2001	21202.64	8114.30	0.216	4.633	0.3151
2002	21805.31	8191.40	0.218	4.581	0.3167
2003	22456.65	8269.20	0.219	4.567	0.3700
2004	23132.68	8349.10	0.208	4.800	0.4640
2005	23816.18	8447.40	0.180	5.563	0.5554
2006	24498.31	8553.10	0.157	6.373	0.7606
2007	25184.60	8666.10	0.135	7.401	1.1771
2008	25888.54	8779.90	0.117	8.563	1.4748
2009	26630.30	8922.40	0.119	8.412	1.4593
2010	27421.46	8997.60	0.119	8.391	1.5554
2011	28267.69	9111.10	0.116	8.623	1.7935
2012	29155.19	9235.10	0.118	8.490	1.9866
2013	30052.52	9356.50	0.118	8.491	2.3440
2014	30916.99	9477.10	0.119	8.395	2.5377
2015	31717.67	9593.00	0.149	6.695	2.0376
2016	32442.57	9705.60	0.215	4.651	1.6974
2017	33099.15	9810.00	0.199	5.037	2.0019
2018	33699.95	9898.10	0.198	5.045	2.2956

The analysis of the features characterizing the adequacy of the models [3]:

The variables included in the model are time series, each variable must first be checked for stationary case. Any stochastic process is called stationary if, in particular, its mean and variance are constant for all periods, and the value of covariance between two periods does not depend on the period for which this covariance is computed, but on the distance or lag between these two periods.

A unit root test is set up to determine whether any model is stationary as follows:

H_0: δ = 0, the model has a single root;

H_1: δ≠ 0, the model does not have a single root.

The Dickey-Fuller test is used to determine which of the above hypotheses is refused. Acceptance-rejection limits (crisis values) for this test's 1%, 5%, and 10% the levels of significance have been calculated by MacKinnon for Monte Carlo Simulations.

If the absolute value of the Dickey-Fuller test is less than the absolute critical values corresponding to MacKinno's 1%, 5%, and 10% significance levels, then the H_0 hypothesis is accepted. This means that the model is not stationary. Otherwise, the model is considered stationary.

The economic variables are usually non-stationary. The variables included in the model are also economic variables, in this case the stationarity needs to be tested.

According to the above theoretical provisions, it is essential to determine whether all variables of the model are stationary or non-stationary.

The results of the Dickey-Fuller test made using the Eviews software package to determine whether Saudi Arabia's exports are stationary are shown in the table below (see Table 3):

Table 3

Checking the stationaryness of the model in (1): Augmented Dickey-Fuller test

Augmented Dickey-Fuller test		t-Statistic	Probablity
		-3.926677	0.0071
Critical values:	1% confidence level	-3.769597	
	5% confidence level	-3.004861	
	10% confidence level	-2.642242	

According to the results on Augmented Dickey-Fuller test in Table 3, the model is non-stationary with 99.29% confidence. So, the H_0 hypothesis is noticed. This means that the model has a unit root and is non-stationary.

After the stationary test, it is determined that all variables are non-stationary. Therefore, the first difference of the variables is included in the model. Because it is theoretically accepted that the series formed as the first difference of non-stationary series are always stationary.

As a next step, it is necessary to check whether the model shown in (2) is stationary. For this, you need to check the e-views software package according to the rule applied in (2) (see: Table 4).

Table 4

Checking the stationaryness of the model in (2): Augmented Dickey-Fuller test

AugmentedDickey-Fullertest		t-Statistic	Probability
		-7.743472	0.0001
Critical Values:	1% Confidence Level	-3.769597	
	5% Confidence Level	-3.004861	
	10% Confidence Level	-2.642242	

According to the the results of the Augmented Dickey-Fuller test (see Table 4), the model is proven to be non-stationary with 99.999% confidence. So the H_0 hypothesis is noticed. This means that the model has a single root and is non-stationary.

The system of statistical indicators used in the models (see tables 1 and 2) is in the form of a time series of indicators. It is known that having homoschedastic nature in the model is important condition in the econometric modeling.

Due to the specifics of the time series system, the problem of heteroshedasticity (non-homoschedasticity) is considered to be less common in the model compared to cross-sectional indicators. However, in any case, to check the heteroschedasticity is important factor.

Checking the heteroschedasticity of the models using the Breusch-Pagan-Godfrey test is shown as follows. There are 5 step test procedures.Based on the above theoretical provisions, it is determined whether the model shown in (1) is homoschedastic or heteroshedastic.

The results of the Breusch – Pagan – Godfrey test performed using the Eviews software package are given in the table below (see Table 5):

Table 5

Testing for heteroschedastics (absence of homeschedastics): Breusch – Pagan – Godfrey Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.505104	Prob. F(5.17)	0.7684
Obs*R-squared	2.974927	Prob. Chi-Square(5)	0.7039

According to the critical value approach, if the value of the quantity $n*R^2$ (where n is the number of observations) is greater than the value given in the table of the Chi-Square statistical distribution at 6 degrees of freedom and 5 percent significance, then the residuals of the model are heteroschedastic. At the same time, according to the p-value approach, if the probability of both the F distribution and the Chi-Square distribution is less than 0.05, then it can be said that the residuals of the model are heteroschedastic. According to the data in Table 5 (see Table 6) $n*R^2 = 0.4$ (where n is the number of observations). The table value of the Chi-Square statistical distribution is 10.4 with 5 degree of freedom and 5 percent of confidence level. Since 0.4<10.4, the model is homoschedastic. The probability value of both the F distribution and the Chi-Square distribution is greater than 0.05. Therefore, it can be said that the model is homoschedastic.

Table 6

Testing for heteroschedastic (absence of homoschedastic): Breusch – Pagan – Godfrey Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.084720	Prob. F(6.16)	0.4122
Obs*R-squared	6.650491	Prob. Chi-Square(6)	0.3544

According to the data in Table 6 $n*R^2 = 2.16$ (where n is the number of observations). The table value of the Chi-Square statistical distribution is 12.4 with 6 degree of freedom and 5 percent of confidence level. Since 2.44<12.4, the model is homoschedastic. The probability value of both the F distribution and the Chi-Square distribution is greater than 0.05. Therefore, it can be said that the model is homoschedastic.

After testing for the heteroschedasticity of the models, to check the stationary plays crucial role. Explaining the stationary situation, it has been noted that if a non-stationary model has a high coefficient of determination (R^2), this does not yet fully justify the high quality of the dependence. In other words, it is possible to speculate about the coefficient of determination (R^2) of a stationary model. The condition of stationary is tested above.

When conducting econometric analysis the best regression line is one of the main issues of the study. If all observations are on the constructed regression line, in this case the regression line is the most perfect one characterizing the dependence. However, in reality, hapenning this kind of situation becomes rare. The observations are usually set up at positive and negative u_i distances from the regression line. The coefficient of determination measures how well the regression line of a sample concentrates the set of points around it. In two-variable models (eg, Y-dependent variable, X-explanatory variable), the coefficient of regression is marked as r^2, and in a multi-variable model (eg, Y-dependent variable, X1, X2, ..., Xn explanatory variables) is marked as R^2. The ratio of this values is between 0 and 1. If the determination coefficient is 1, in this case, the change in Y is 100% and this indicator related to the change in X.

The statistical F distribution is used to check the confidence of the coefficient of determination. It has already been commonly known that there is a close relationship between the coefficient of determination and the quantity (R^2) F as follows:

$$F = \frac{R^2}{1-R^2} * \frac{n-m-1}{m} \quad (6)$$

A decision is made about how the model explains the dependence of the explanatory variables, the coefficient of determination (R^2) based on this test. The process is developing as follows:

Suppose that a regression line with the following number of explanatory variables is given:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_m X_{mi} \quad (7)$$

The following hypotheses are made:

H_0: All coefficients (except for the degree of freedom) are equal to zero at the same time (same year). For example, H_0: $\beta_1 = \beta_2 = \cdots = \beta_m = 0$.

H_1: All coefficients (except for the degree of freedom) are not equal to zero at the same time (same year)

If, the hypothesis, $F > F_\alpha(m, n-m-1)$ H_0 is rejected. Otherwise it is not rejected.

Here, this is the value obtained from calculating F. $F_\alpha(m, n-m-1)$ –α is m (numerator) and n-m-1 (denominator) at the confidence level, m (numerator) and n-m-1 (denominator) is the table of critical value at the degrees of freedom. M (numerator) is the number of independent variables and the degree of freedom in the regression equation, and n is the number of observations. For example; if for the regression equation consisting of two explanatory variables and 10 observations, m (numerator) will be equal to 3, and (B_0, X_1, X_2) n will be equal to 10. In this case, the degree of freedom will be defined as (3, 10-3-1). According to equation (7), that the coefficient of determination (R^2) is equal to zero, which also causes the value of F to be equal to zero.

Conversely, the approximation of the coefficient of the determination (R^2) to the unit leads to an infinite increase in the value of F, which is characterized as a measure of the confidence level of the regression dependence. Because the hypothesis H_0 is rejected as the calculated value of F increases relative to the critical value, which justifies the confidence level of the regression.

Based on the above theoretical provisions, there is need to first determine the statistical confidence of the coefficient of determination (R^2) of the models shown in (1). In this case, the number of observations is 24, and the number of variables (1 degree of freedom, 6 explanatory variables) is 7.

The value of the coefficient of determination (R^2) has been observed to be 0.9 from the calculations using the Eviews software package. According to equation (6)

$$F = \frac{0.9}{1-0.9} \frac{24-7-1}{7} = 15.4$$

$F_\alpha(m, n-m-1)$ is equal to 4.09 (according to the table value of the F distribution) at the confidence level of 0.05 and the degree of freedom (7, 24-7-1). Therefore, the hypothesis H_0 is rejected because of $F > F_{0.05}(7, 24-7-1)$. This means that the dependence of regression of the estimated model is significant.

The significance of the coefficient of determination must be computed in the same way for model (2). Because the number of variables is the same, there is no need to analyze again the test for this model.

After checking the significance of the models in terms of the coefficient of determination, it is necessary to analyze their autocorrelation. Autocorrelation determines the correlation dependence between indicators both in time series and in a cross-sectional system of them. In terms of regression analysis, it is assumed in the regression model of classical linear a that the residuals (u_i) do not have autocorrelation.

The Durbin-watson d test is widely used to check for the serial correlation. To perform this test, a quantity indicated with d and calculated in the following order is used:

$$d = \frac{\sum_{t=2}^{n} (\hat{u}_t - \hat{u}_{t-1})^2}{\sum_{t=1}^{n} (\hat{u}_t)^2}$$

The fact that the value of the quantity d indicated in equation (8) is equal to 2 is the the best opportunity for the researcher to reject the autocorrelation. This quantity is equal to 4 and in this case, this means that the residuals of the model has the most serious negative autocorrelation. The case d≈0 is explained as the most significant positive autocorrelation of the residuals of the model .

Determine whether the residuals of models (1) and (2) have autocorrelation:

Firstly, the significance of the *Durbin-watson d* statistics for the model shown in (1) should be examined. The value of the *Durbin-watson d* statistics from the calculations performed using the Eviews software package is 2.01. That is, there is no autocorrelation between the residuals of the model. It is necessary to determine to what extent this is allowed.

According to the table values of the *Durbin-datson d* statistics, d_L=1.4 and d_U=1.83 for a positive autocorrelation test at the level of 1% confidence and the number of observations is 24 and the number of explanatory variables is 6. For the marked model, because the value of the binoculars-watson d statistic is 2.01, in this case $d > d_U$. This means that there is really not any problem related to autocorrelation. Let us check the significance of the Durbin-watson d statistics for the model shown in (2). The value of the Durbin-watson d statistics from the calculations using the Eviews software package is 2.65. Thus, the residuals of the model have a negative autocorrelation. It is necessary to determine to what extent this is allowed.

According to the table values of the Durbin-watson d statistics, d_L = 1.74 and d_U = 1.94 for a positive autocorrelation test at the level of 1% confidence and the number of observations is 24 and the number of explanatory variables is 1. For the marked model, the value of the Durbin-watson d statistic is 2.65, in this case, $d > d_U$. This means that the negative autocorrelation is allowed at the level of 1% confidence.

The model shown in (1) has been investigated using the Eviews software package and the results are presented in Table 7.

-As can be observed, when Saudi Arabia's GDP increases by 1%, Saudi Arabia's exports rises by 2.38%, accordingly. Thus, the increase in GDP has been defined as a factor increasing exports.

-The gowth of Saudi Arabia's population has been assessed as a factor reducing the country's exports. Thus, as a result of a 1% increase in population, the export of the country decreases by 2.73%. In fact, this is true in terms of theoretical and practical aspects. Because the growth in population increases consumption in the country, in this case, exported products and services are directed to domestic consumption.

-When the real exchange rate of Saudi Arabia increases by 1%, the volume of exports decreases by 0.14%. In general, an increase in a country's exchange rate against other currencies demotivates foreign countries from purchasing goods and services from that country, because the price of products and services is rising. Therefore, the devaluation is considered more profitable for export-oriented countries.

Table 7

The Factors affecting Saudi Arabia's exports

Explanatory variables	Coefficients	Probability
The volume of GDP of Saudi Arabia	2.38	0.00
The number of population of Saudi Arabia	-2.73	0.02
The real exchange rate of Saudi Arabia	-0.140	0.08
The volume of Azerbaijan's GDP	0.03	0.09
The number of population of Azerbaijan	1.82	0.019
The volume of Azerbaijan's imports	0.08	0.1

-The Azerbaijan's GDP has been assessed as a factor increasing Saudi Arabia's exports. So, the exports increase by 0.03% in this case, GDP increases by 1% at the same time.

-The growth in the population of Azerbaijan has also been stressed as a positive factor. As can be marked from Table 5, a 1% increase in population leads to a 1.82% increase in exports.

-The last variable is the volume of Azerbaijani imports. When the volume of this variable increases by 1%, exports increase by 0.08%.

As can be noticed from Table 5, the levels of the reliability of the independent variables are over 90%. This means that the ratios of the variables included in the model are closer to reality.

The model shown in (2) has been similarly studied through the Eviews software package, and the results are presented in Table 8.

-As can be seen from the table, the volume of Azerbaijan's GDP has been estimated as a factor reducing Azerbaijan's exports. In this case, a 1% increase in GDP in Azerbaijan reduces Azerbaijan's exports by 0.1%. In fact, it should not appropriate in terms of rules. Normally, the exports should be directly proportional to GDP.

-The population of Azerbaijan is also assessed as a factor reducing exports. This means that when the population increases by 1%, exports decrease by 1.7%. Indeed, this is an economically appropriate to the rules. Because the growth of the population increases their consumption, and the products and services are consumed by a growing population.

-The real exchange rate of Azerbaijan has also been estimated as a factor reducing exports. Thus, when the real exchange rate increases by 1%, exports decrease by 1.28%. In general, an increase in a country's exchange rate comparing to other currencies reduces the tendency of foreign countries to buy goods and services from that country. Because the price of products and services is rising. Therefore, devaluation is considered more profitable for export-oriented countries.

-Transport costs in Azerbaijan's trade have been evaluated as a factor increasing exports. Thus, the cost of transport in trade increases by 1%, in this case ,the volume of exports increases by 1.4%. In fact, an increase in trade costs should decrease the exports, but normally, as the exports growth up, the transportation costs increase.

Table 8

The factors affecting Azerbaijan's exports

Explanatory variables	Coefficients	Probability
The volume of GDP of Azerbaijan	-0.1	0.08
The number of population of Azerbaijan	-1.7	0.075
The real exchange rate of Saudi Arabia	-1.28	0.1
The transport costs of Azerbaijan in trade	1.4	0.09
The volume of GDP of Saudi Arabia	3.37	0.1
The number of population of Saudi Arabia	2.7	0.054
The volume of imports of Saudi Arabia	1.74	0.11

-Saudi Arabia's GDP is estimated as a factor increasing the exports. Thus, a 1% growth in GDP increases the exports by 3.37%.

-The number of population of Saudi Arabia is also assessed as a factor increasing the exports. A 1% growth in population increases exports by 2.7%.

-The volume of imports of Saudi Arabia is also estimated as a factor increasing the volume of exports. Thus, a 1% increase in Saudi Arabia's imports will raise exports by 1.74%.

Conclusions and perspectives of further research. The models of demand for exports of Saudi Arabia and Azerbaijan have been developed and estimated by the least squares method of econometrics, the features characterizing the adequacy of the models have been analyzed, then the concrete results have been obtained and it has been proved that there is indeed a positive correlation between the existing trade and economic relations between these countries interpreting these results on the basis of this model. Thus, if the volume of imports in Azerbaijan increases by 1%, Saudi Arabia's exports will raise by 0.08%. Also, if Saudi Arabia's imports increase by 1%, Azerbaijan's exports will increase by 1.74%. So it can be concluded that the positive relations in economic and trade relations between the two countries have been observed.

ЛІТЕРАТУРА

1. Ali, Abbas J. 2005. Business and trade in Islamic thought. Chapter 1 in Islamic Perspectives on Management and Organization, edited by Abbas J. Ali. UK:Edward Elgar Publishing Limited

2. Al-Sulaim Mesaad İbrahim, Economic integration issues between the Kingdom of Saudi Arabia and Azerbaijan, and its directions in the modern development of the world economy // “İnternational Journal of Research in Social Sciences”, vol. 10, issue 02, February 2020, p. 43-57.

3. Gujarati, Basic Econometrics 4th edition. 2004, 1003 p.

4. Mammadov Fuad, Dynamics and determinants of Tourism: the world experience and Azerbaijan, MPRA Paper No. 77444, posted 13 Mar 2017 15:04 UTC

5. James E. Anderson, The gravity model, NBER Working paper series, 1050 Massachusetts Avenue, Cambridge, MA 02138, December 2010

6. Mohamed A.Ramady, 2005. The Saudi Arabian economy, policies, achievements and challenges, Springer Sciences+Business Media, USA, 489 p.

7. Leslie Alan Glick, 1980. Trading with Saudi Arabia. Rowman&Littlefield Publishers, 595 p.

8. World strategic and business information library 2009, Saudi Arabia, export-import, trade and business directory, Intl Business Pubns USA, 300 p.

9. General Authority for Statistics of Kingdom of Saudi Arabia. - [Електронний ресурс]. - Режим доступу: https://www.stats.gov.sa/en

10. Ministry of Economy & Planning of Kingdom of Saudi Arabia. - [Електронний ресурс]. - Режим доступу: https://www.mep.gov.sa/en

11. Saudi Arabia - Economic Indicators. - [Електронний ресурс]. - Режим доступу: https://tradingeconomics.com/saudi-arabia/indicators.

12. The State Statistical Committee of the Republic of Azerbaijan. - [Електронний ресурс]. - Режим доступу: https://www.stat.gov.az

13. Saudi Arabia – Economic Indicators. - [Електронний ресурс]. - Режим доступу: https://data.worldbank.org/country/saudi-arabia

REFERENCES

1. Ali, Abbas J. Business and trade in Islamic thought. Chapter 1 in Islamic Perspectives on Management and Organization/ J. Ali Abbas, UK:Edward Elgar Publishing Limited, 2005, 104 p.

2. Al-Sulaim Mesaad İbrahim, Economic integration issues between the Kingdom of Saudi Arabia and Azerbaijan, and its directions in the modern development of the world economy /Mesaad İbrahim Al-Sulaim, "İnternational Journal of Research in Social Sciences", vol. 10, issue 02, February 2020, p. 43-57.

3. Gujarati. Basic Econometrics/Damodar N.Gujarati - 4th edition. 2004, 1003 p.

4. Mammadov Fuad. Dynamics and determinants of Tourism: the world experience and Azerbaijan/ F.Mammadov - MPRA Paper No. 77444, 13 Mar 2017.

5. James E. Anderson, The gravity model/ Anderson James - NBER Working paper series, 1050 Massachusetts Avenue, Cambridge, MA 02138, December 2010.

6. Mohamed A.Ramady, The Saudi Arabian economy, policies, achievements and challenges/Ramady Mohamed - Springer Sciences+Business Media, USA, 2005. 489 p.

7. Leslie Alan Glick, Trading with Saudi Arabia/ Glick Alan - Rowman&Littlefield Publishers, 1980. - 595 p.

8. World strategic and business information library. Saudi Arabia, export-import, trade and business directory, Intl Business Pubns USA, 2009. - 300 p.

9. General Authority for Statistics of Kingdom of Saudi Arabia. (n.d.). Retreived from https://www.stats.gov.sa/en.

10. Ministry of Economy & Planning of Kingdom of Saudi Arabia. (n.d.). Retreived form https://www.mep.gov.sa/en.

11. Saudi Arabia - Economic Indicators. (n.d.). Retrieved from https://tradingeconomics.com/saudi-arabia/indicators.

12. The State Statistical Committee of the Republic of Azerbaijan. (n.d.). Retreived from https://www.stat.gov.az.

13. Saudi Arabia – Economic Indicators. (n.d.). Retreived from https://data.worldbank.org/country/saudi-arabia.