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The Cointegration Relations Between Azerbaijan's GDP and the Balances of the Trade Relations of Russia and Belarus

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Abstract. An econometric analysis of the dependence of Azerbaijan's GDP from the balance of the Russian Federation and the balance of Belarus was conducted according to the 26 year's statistical indicators. Relevant statistical methods were applied to check the model's identification and the significance for each parameter and determine the adequacy. The issue of stationary of the sequences in the work was checked through the Dickey-Fuller Test and the stationary of the new sequences formed from the second-range difference operators of these time sequences were determined. And then, the mutual cause-result dependencies between these sequences were studied through the Granger Test, the cointegration vectors of these dependencies were determined by applying the Johansen Test, the error correction model was built by studying the error correction mechanisms for the operators built from the differences of the time sequences, and it was demonstrated that the assessments achieved through these models were adequate to the actual databy building cointegration models to get long-term relations ensuring the return of short-term tendencies from the balance position to that position.

Key Words and Phrases: Multiply regression analyses,stasionarity, vector error correction, Granger test, determination coefficient, cointegration.

2010 Mathematics Subject Classifications: 91B82, 91G70, 97M10, 97K80

1. Introduction

In the process of long-term joint development within the framework of the united public economy complex of post-Soviet countries, the integration relations of micro and macro indicators between the countries have developed. Under the influence of the united center, relations between the republics have been enhanced and the economic indicators between the countries have been mutually integrated into each other.

The international economic integration under the modern conditions is a rational, normal result of the transnationalization of macroeconomic processes. Comprehensive studies of the global economy's tendencies and Azerbaijan's trade relations, making of justified forecasts by considering regional characteristics and the geographical positions of countries plays a significant role in the determination of the development strategy of foreign trade.

The major part of importation and exportation transactions of Azerbaijan with the post-Soviet countries falls to Russian Federation' share. The Republics of Kazakhstan, Belarus and Ukraine rank in the second and third places respectively [1]. The direction of economic relations of the post-Soviet states from the near abroad to far foreign countries under the conditions of increasing dependence from the global market have led to significant structural changes in the structure of the import-export transactions and the manufacturing sphere in the CIS countries.

The current key tendencies in the global economy are the integration of national economies, international globalization, and increasing of labor resources and free capital between countries. The influence of this process may lead to both positive and negative results. In order to draft an economic policy with the nature of foreign integration, the dynamics of macroeconomic development indicators of the national economies of the abovementioned countries should be analyzed, the economic growth safety should be assessed potentially, and the long-term trends of the integration process should be described in comparison to statistic data. In order to achieve an effective integration, forecasting by building and analyzing of the co-integration relations between the GDPs and other inclusive economic growth parameters of these countries is a very hot topic.

It is one of the key issues set to improve the social-economic spheres in the post-Soviet countries through new innovative methods in the studies of the projects implemented in the priority directions in the spheres ensuring the sustainable economic development of the countries in the future.

2. Analyses of the recent research and publications.

According to this principle, the processes of increasing the investments in human resources, reducing the percentage indicator of poverty, developing the entrepreneurship, the social economic development of regions in addition to urban places, the restoration of the economic balance between regions, the elimination of the difference observed in the social lives of the regions, the employment of population, and the key directions of the growth of country economy for future years in the post-Soviet countries are analyzed for certain economic spheres in [2]. Also, in [1-6], the inclusive parameters and their role in the country economy are individually analyzed, and the reflection of the inclusive economic development within the development of the social-economic spheres of the country is specified. Adequate analyses show that investments in human resources, the development of infrastructure, the economic development through innovative methods, and the inclusive development of social spheres increase the tempo of the economic sustainable development in the country. For the future economic development of the countries, firstly, prioritization of the development of inclusive parameters in the country, the use of both social and economic efficiencies of the regions and the balancing of their development, the development of integration relations between the countries, including the increasing of the trade turnover between the countries, and the increasing of the quality of social services in the country may be assessed as the result of the analyses conducted in [6].

The development of inclusive economic parameters, including foreign economic relations is the key condition for the acceleration of the integration of national economies of various countries at the international economic range. In order to meet this condition, countries should join economic integration flows, thus, try to increase their manufacturing capacities, manufacturing efficiencies and ultimately, the common wealth level of their populations. The inclusive economic development between the post-Soviet countries from this point of view may be accepted as the key factor in ensuring of the sustainable economic development between the countries.

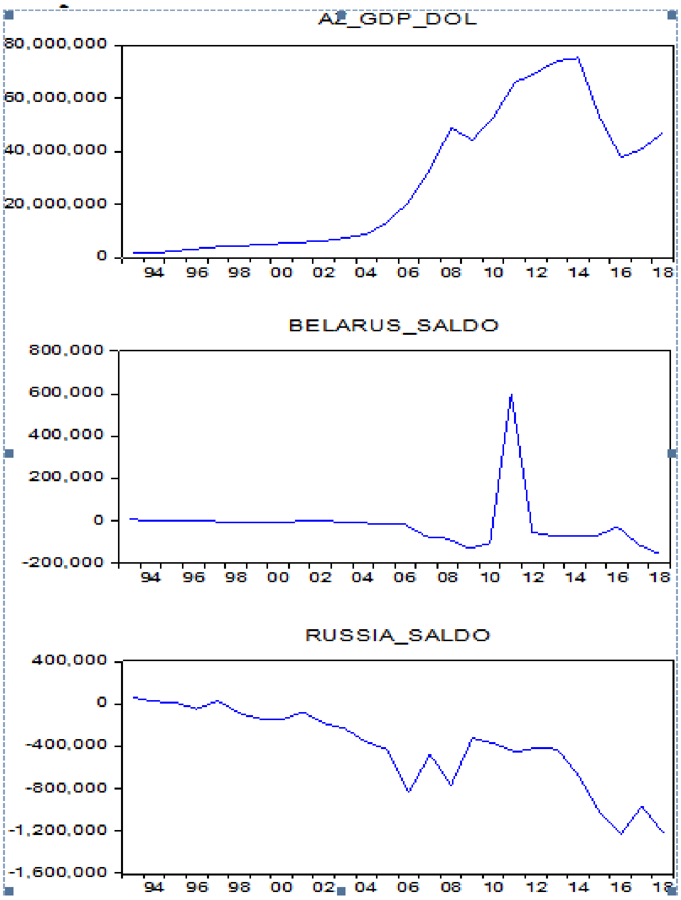
It is possible to achieve economic development between the post-Soviet countries and make a substantial turn in the inclusive economic development between the countries by maximally using the advantages of the international labor distribution and intensively enhancing all forms of foreign economic relations. In order to realize this turn, these countries try to build bilateral and regional economic relations.

For the case that we study, we should mention that the relations between Russia, Belarus and the Republic of Azerbaijan in various spheres of economy, including energetics, agriculture, trade, pharmacy, tourism and etc. are developing and there are potential capacities to enhance the cooperation.

3. Purpose of research

Taking into consideration the abovementioned, an econometric study of the dependence of Azerbaijan's GDP from certain elements of the economic inclusive parameters of the Russian Federation and the Republic of Belarus in the time period from 1993 to 2018 is conducted. According to statistical indicators, the dependence of Azerbaijan's GDP from the balance of the trade relations between Russia and Belarus is econometrically analyzed.

Time period from 1993 to 2018, dynamic description of the relationship between dependent and explanatory variables is as follows:



Graph 1:

Recommendations justified with econometric approaches are provided by using the procedures of the Eviews software package, realizing co-integration relations, analyzing the economic interpretations of results in order to give long-term forecasts.

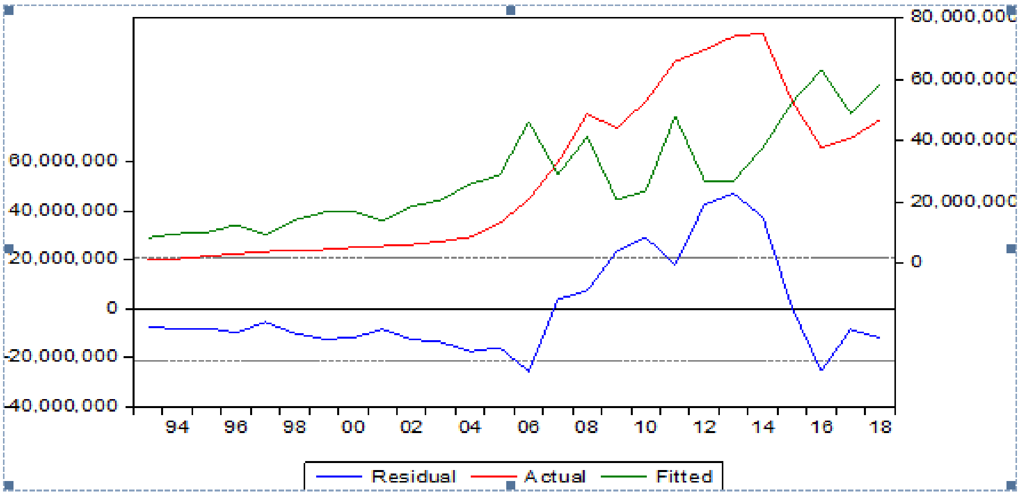
Table 1.

Dependent Variable: AZ_GDP_DOL Method: Least Squares Date: 08/25/19 Time: 21:57 Sample: 1993 2018 Included observations: 26				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
BELARUS_SALDO	29.60024	32.14483	0.920840	0.3667
RUSSIA_SALDO	-43.17594	11.18092	-3.861572	0.0008
C	10733601	6169554.	1.739769	0.0953
R-squared	0.393587	Mean dependent var		28144165
Adjusted R-squared	0.340856	S.D. dependent var		26113478
S.E. of regression	21200931	Akaike info criterion		36.68516
Sum squared resid	1.03E+16	Schwarz criterion		36.83032
Log likelihood	-473.9070	Hannan-Quinn criter.		36.72696
F-statistic	7.463984	Durbin-Watson stat		0.438622
Prob(F-statistic)	0.003176			

The linear multi-factor regression equality describing the dependency of Azerbaijan's GDP in thousands of USD (AZ_GDP _DOL) from the indicators of thousands of USD balances of Russian Federation (RUSSIA_SALDO) and Belarus (BELARUS_SALDO) will be as follows formally.

AZ_GDP_DOL = 29.6002446013*BELARUS_SALDO - 43.1759404878*RUSSIA_SALDO+ + 10733601.0684

The description of the relationship between dependent and explanatory variables is as follows:



Graph 2.

The statistical information here were taken from the official electronic sources of the State Statistics Committee of Azerbaijan [7].

The value of indicator of the determination coefficient in the table demonstrates that the variation of the independent variables provided in the model explains 39% of the variation of the dependent AZ_GDP_DOL. The density of relation is very low in this case.

Let's see the F-Fisher Test to check the significance of the built model. The significant status of the model is accepted true for the case where the result calculated through the F-Fisher Test is higher than the relevant critical value of the F-Fisher statistics, that is, $F_{calculated} > F_{table}$. In order to determine the critical table value of the F-Fisher Test, the significance level (by probability or percentage) and the independence degrees should be determined. Let's see the model in the 5% significance degree in order to check its significance. And we will determine the Test's independence degrees as $k_1 = m - 1$, $k_2 = n - m$ under the given conditions, that is, according to the number of the periods and observations [8, p.79], as it gets the values of k_1=3-1=2; k_2=26-3=23. The F-Fisher table value will be 3.42 according to the indicators we achieved. Thus, the inequality $F_{calculated} > 3.42$ is met for the model to be significant.

In order to check the significance of the built model through the t-Student criterion, the inequality $|t_{calculated}| > t_{table}$ is checked. Here, the value t_{table} is determined on the basis of the independence degree d_f = n-2, as it will be n=26, d_f = 26-2=24. According to this indicator, the table degree in the 5% significance degree of the t-Student statistics will be $t_{table} = 2.06$. In order the model to be accepted as a significant one for each parameter individually, the inequality $|t_{calculated}|>2.06$ should be met.

In order to check the existence of auto correlation, the zero hypothesis should be built firstly. The H_0 hypothesis about the absence of auto correlation is determined according to the table value of the Durbin-Watson statistics. d_L =1,16 and d_U = 1.65 are found according to the total number of observations n=23 and the variable number k=3. In order to check the auto correlation through the built model, the value of the d-statistics was calculated and was d=0.44. d <$d_{L,}d_U$ has been met for this value, the presence of positive auto correlation.

And now, let's see the issue of presence of heteroscedasticity in the model. The heteroscedasticity will lead to the ineffectiveness of the found assessment, as the assessment will not be effective, although it will be coherent. We should mention that in case of presence of heteroscedasticity, the values of standard errors found through the least squares method (LSM) decrease, which result in the decrease in the value of t-statistics and may result in inaccurate study about the significance of the assessment. The heteroscedasticity may also occur due to the inaccurate selection of a model and observation values. In case of presence of heteroscedasticity, the Summarized Least Squares Method (SLSM) is applied [8] .

The model's heteroscedasticity was checked through the White Test in the studied model according to the observation results and the following results were achieved:

Table 2.

Heteroskedasticity Test: White				
F-statistic	1.752021	Prob. F(5,20)		0.1689
Obs*R-squared	7.919399	Prob. Chi-Square(5)		0.1607
Scaled explained SS	6.273288	Prob. Chi-Square(5)		0.2805
Test Equation: Dependent Variable: RESID∧2 Method: Least Squares Date: 08/27/19 Time: 15:50 Sample: 1993 2018 Included observations: 26				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.37E+13	1.90E+14	0.177183	0.8611
BELARUS_SALDO∧2	4213.027	5318.960	0.792077	0.4376
BELARUS_SALDO* RUSSIA_SALDO	-11079.77	7874.269	-1.407085	0.1748
BELARUS_SALDO	-7.92E+09	5.53E+09	-1.432981	0.1673
RUSSIA_SALDO∧2	-784.5731	1051.186	-0.746370	0.4641
RUSSIA_SALDO	-1.44E+09	1.11E+09	-1.290682	0.2115
R-squared	0.304592	Mean dependent var		3.98E+14
Adjusted R-squared	0.130740	S.D. dependent var		5.77E+14
S.E. of regression	5.38E+14	Akaike info criterion		70.87451
Sum squared resid	5.79E+30	Schwarz criterion		71.16484
Log likelihood	-915.3687	Hannan-Quinn criter.		70.95812
F-statistic	1.752021	Durbin-Watson stat		0.919017
Prob(F-statistic)	0.168857			

And let's now see the issue of stationarity of the studied time sequences. Generally, the stationarity of the reviewed time sequence is very important in terms of econometric analysis. Although the results and the model's quality characteristics achieved when a sequence is not stationary explain the adequacy of the model, they are observed with errors and the built model lose its significance and become invalid for forecasting assessments. Therefore, in order to achieve a significant model from the model we built, the model's stationarity was checked on the basis of the Augmented Dickey-Fuller Test and appropriate results were achieved. In order to check the stationarity in the time sequences formed in the model from the variables, the tools of the united roots methods of the Eviews software package are used.

Table 3. Result of Dickey-Fuller Test

Indexs	Statistic criteria	Critic value 1%	Critic value 5%	Critic value 10%	Prob.
1-st differences, intercept					
AZ_GDP_DOL	-2.968322	-3.737853	-2.991878	-2.635542	0.0524
BELARUS_SALDO	-7.714947	-3.737853	-2.991878	2.635542	0.0000
RUSSIA_SALDO	-7.126147	-3.737853	-2.991878	2.635542	0.0000
2-nd differences ,intercept					
AZ_GDP_DOL	-5.043100	-3.769597	-3.004861	-2.642242	0.0006
BELARUS_SALDO	-4.678663	-3.808546	-3.020686	-2.650413	0.0016
RUSSİA_SALDO	-7.284538	-3.724070	-2.986225	-2.632604	0.0000
2-nd differences ,intercept and trend					
AZ_GDP_DOL	-4.904012	-4.440739	-3.632896	-3.254671	0.0038
BELARUS_SALDO	-4.521761	-4.498307	e -3.658446	-3.268973	0.0095
RUSSİA_SALDO	-11.21729	-4.416345	-3.622033	-3.248592	0.0000

Firstly, it should be checked whether the time sequence formed from the GDP is stationary in comparison to the Dickey-Fuller tests. According to the test results, the new sequence formed with the 2^{nd} range differences has been regarded stationary. We perform the hypothesis Ho: $\alpha_1 = 1$ and the alternative H1: $\alpha_1 < 1$ hypothesis on 26 observation and 1%, 5% and 10% significance level.The result of test (AR) at t = -4.904012, p = 0.0038. The obtained level of probability allows rejecting Ho hypothesis .And also the t-student statistics are less than the critical value of t (at the significance level of 1%, 5% and 10%).The result of the estimation reject Ho hypothesis and confirm the stasionarity of the time series AZ_GDP_DOL .The achieved results are described in the following table.

The interpretation of the Eviews results shows that although the sequence is not stationary, its 2^{nd} differences are stationary.

Table 4.

Null Hypothesis: D(AZ_GDP_DOL,2) has a unit root Exogenous: Constant, Linear Trend Lag Length: 1 (Automatic - based on SIC, maxlag=5)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.904012	0.0038
Test critical values:	1% level		-4.440739	
	5% level		-3.632896	
	10% level		-3.254671	
*MacKinnon (1996) one-sided p-values. Augmented Dickey-Fuller Test Equation Dependent Variable: D(AZ_GDP_DOL,3) Method: Least Squares Date: 08/25/19 Time: 22:05 Sample (adjusted): 1997 2018 Included observations: 22 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(AZ_GDP_DOL(-1),2)	-1.710050	0.348704	-4.904012	0.0001
D(AZ_GDP_DOL(-1),3)	0.515844	0.242554	2.126720	0.0475
C	1075863.	4621343.	0.232803	0.8185
@TREND("1993")	-81174.58	294535.4	-0.275602	0.7860
R-squared	0.646628	Mean dependent var		140313.6
Adjusted R-squared	0.587733	S.D. dependent var		13396262
S.E. of regression	8601475.	Akaike info criterion		34.93573
Sum squared resid	1.33E+15	Schwarz criterion		35.13410
Log likelihood	-380.2930	Hannan-Quinn criter.		34.98246
F-statistic	10.97929	Durbin-Watson stat		1.447367
Prob(F-statistic)	0.000250			

In the following step, it was checked whether the time sequence formed for the balance of the Russian Federation is stationary in comparison to the Dickey-Fuller tests and the new sequence formed with the 2^{nd} range differences has been regarded stationary. We perform the hypothesis Ho: $\alpha_1 = 1$ and the alternative H1: $\alpha_1 < 1$ hypothesis on 26 observation and 1%, 5% and 10% significance level.The result of test (AR) at t= -11.21729, p=0.000.The obtained level of probability allows rejecting Ho hypothesis .And also the t-student statistics are less than the critical value of t (at the significance level of 1%, 5% and 10%).The result of the estimation reject Ho hypothesis and confirm the stasionarity of the time series. RUSSIA_SALDO The achieved results are described in the following table.

Table 5.

Null Hypothesis: D(RUSSIA_SALDO,2) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic - based on SIC, maxlag=5)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-11.21729	0.0000
Test critical values:	1% level		-4.416345	
	5% level		-3.622033	
	10% level		-3.248592	
*MacKinnon (1996) one-sided p-values. Augmented Dickey-Fuller Test Equation Dependent Variable: D(RUSSIA_SALDO,3) Method: Least Squares Date: 08/25/19 Time: 22:09 Sample (adjusted): 1996 2018 Included observations: 23 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RUSSIA_SALDO(-1),2)	-1.783844	0.159026	-11.21729	0.0000
C	-14784.17	118218.0	-0.125059	0.9017
@TREND("1993")	1037.995	7643.434	0.135802	0.8933
R-squared	0.863362	Mean dependent var		-23625.88
Adjusted R-squared	0.849698	S.D. dependent var		625290.9
S.E. of regression	242417.9	Akaike info criterion		27.75582
Sum squared resid	1.18E+12	Schwarz criterion		27.90393
Log likelihood	-316.1920	Hannan-Quinn criter.		27.79307
F-statistic	63.18588	Durbin-Watson stat		1.387039
Prob(F-statistic)	0.000000			

In the following step, it was checked whether the time sequence formed for the balance of Belarus is stationary in comparison to the Dickey-Fuller tests and the new sequence formed with the 2^{nd} range differences has been regarded stationary. We perform the hypothesis Ho: $\alpha_1 = 1$ and the alternative H1: $\alpha_1 < 1$ hypothesis on 26 observation and 1%, 5% and 10% significance level.The result of test (AR) at t= -4.521761, p=0.0095.The obtained level of probability allows rejecting Ho hypothesis .And also the t-student statistics are less than the critical value of t (at the significance level of 1%, 5% and 10%).The result of the estimation reject Ho hypothesis and confirm the stasionarity of the time series. BELARUS_SALDO The achieved results are described in the following table.

Table 6.

Null Hypothesis: D(BELARUS_SALDO,2) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 3 (Automatic - based on SIC, maxlag=5)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.521761	0.0095
Test critical values:	1% level		-4.498307	
	5% level		-3.658446	
	10% level		-3.268973	
*MacKinnon (1996) one-sided p-values. Augmented Dickey-Fuller Test Equation Dependent Variable: D(BELARUS_SALDO,3) Method: Least Squares Date: 08/25/19 Time: 22:17 Sample (adjusted): 1999 2018 Included observations: 20 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(BELARUS_SALDO(-1),2)	-4.742076	1.048723	-4.521761	0.0005
D(BELARUS_SALDO(-1),3)	2.457792	0.874515	2.810464	0.0139
D(BELARUS_SALDO(-2),3)	1.257038	0.568264	2.212068	0.0441
D(BELARUS_SALDO(-3),3)	0.422915	0.243705	1.735358	0.1046
C	13897.35	161581.3	0.086008	0.9327
@TREND("1993")	-1181.051	9771.301	-0.120869	0.9055
R-squared	0.902155	Mean dependent var		2222.635
Adjusted R-squared	0.867210	S.D. dependent var		691339.2
S.E. of regression	251926.8	Akaike info criterion		27.95499
Sum squared resid	8.89E+11	Schwarz criterion		28.25371
Log likelihood	-273.5499	Hannan-Quinn criter.		28.01330
F-statistic	25.81654	Durbin-Watson stat		1.284084
Prob(F-statistic)	0.000001			

The Granger Test was used to determine the relationships of the reason and the result in the model. Based on the significant influence of the use of lags formed from causing factors for the dependent variable AZ_GDP_DOL on the results of this test, the lags from 1 to 4 were used. The following table results were achieved by realizing the mechanism in the Eviews software package.

Table 7.

Pairwise Granger Causality Tests Date: 08/25/19 Time: 23:06 Sample: 1993 2018 Lags: 1			
Null Hypothesis:	Obs	F-Statistic	Prob.
DBELARUS does not Granger Cause DAZ	23	0.37276	0.5484
DAZ does not Granger Cause DBELARUS		0.13553	0.7166
DRUSSIA does not Granger Cause DAZ	23	6.28225	0.0209
DAZ does not Granger Cause DRUSSIA		0.25842	0.6168
DRUSSIA does not Granger Cause DBELARUS	23	0.62666	0.4379
DBELARUS does not Granger Cause DRUSSIA		0.15265	0.7001
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
DBELARUS does not Granger Cause DAZ	22	0.65496	0.5321
DAZ does not Granger Cause DBELARUS		4.79968	0.0223
DRUSSIA does not Granger Cause DAZ	22	6.71632	0.0071
DAZ does not Granger Cause DRUSSIA		0.08865	0.9156
DRUSSIA does not Granger Cause DBELARUS	22	3.55194	0.0514
DBELARUS does not Granger Cause DRUSSIA		0.23184	0.7955
Lags: 3			
Null Hypothesis:	Obs	F-Statistic	Prob.
DBELARUS does not Granger Cause DAZ	21	2.69794	0.0858
DAZ does not Granger Cause DBELARUS		3.42787	0.0467
DRUSSIA does not Granger Cause DAZ	21	4.26936	0.0245
DAZ does not Granger Cause DRUSSIA		0.05728	0.9813
DRUSSIA does not Granger Cause DBELARUS	21	2.06580	0.1509
DBELARUS does not Granger Cause DRUSSIA		0.26156	0.8519
Null Hypothesis:	Obs	F-Statistic	Prob.
DBELARUS does not Granger Cause DAZ	20	2.32039	0.0216
DAZ does not Granger Cause DBELARUS		75.8330	6.E-08
DRUSSIA does not Granger Cause DAZ	20	3.28823	0.0428
DAZ does not Granger Cause DRUSSIA		0.22335	0.9197
DRUSSIA does not Granger Cause DBELARUS	20	9.02667	0.0017
DBELARUS does not Granger Cause DRUSSIA		1.33876	0.3161

Table 7.1 The result of Granger test (1-4 lags)

Significance level 5% ,(P value) critical value 0.05.If P value greater than 0.05 then accepted Cause hypothesis .if less than is denied.

m=1	m=2	m=3	m=4
DBEL→DAZ + DAZ→DBEL+	+ DBEL→DAZ + DAZ→DBEL -	DBEL→DAZ + DAZ→DBEL -	DBEL→DAZ- DAZ→DBEL -
DRUS→DAZ – DAZ→DRUS +	DRUS→DAZ – DAZ→DRUS +	DRUS→DAZ – DAZ→DRUS +	DRUS→DAZ - DAZ→DRUS +
DRUS→DBEL+ DBEL→DRUS +	DRUS→DBEL+ DBEL→DRUS +	DRUS→DBEL+ DBEL→DRUS +	DRUS→DBEL- DBEL→DRUS +

And now, let's test the co-integration relation between the variables. For this, the variables must be stationary. The co-integration relation of the Eviews software package with the Johansen co-integration test is studied. The co-integration test is tested through 2 statistics. One of them is the trace statistics and the Maximum Eigenvalue statistics. The difference of the co-integration test from other tests is that there are sub hypothesizes under the hypothesis H_0, which is due to the testing of the co-integration test. According to the inequalities system. The test results are presented in the following table:

Table 8.

Date: 08/27/19 Time: 13:33 Sample: 1993 2018 Included observations: 20 Series: DGDPAZZ DBELARUSS DRUSSIAA Lags interval: 1 to 3 Selected (0.05 level*) Number of Cointegrating Relations by Model					
Data Trend:	None	None	Linear	Linear	Quadratic
	No				
Test Type	Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	1	1	1	1	1
Max-Eig	1	1	1	1	1

*Critical values based on MacKinnon-Haug-Michelis (1999) InformationCriteriaby Rank and Model					
Data Trend:	None	None	Linear	Linear	Quadratic
	No				
Rank or	Intercept	Intercept	Intercept	Intercept	Intercept
No. of CEs	No Trend	No Trend	No Trend	Trend	Trend
Log Likelihood by Rank (rows) and Model (columns)					
0	-871.2538	-871.2538	-870.5876	-870.5876	-867.6674
1	-824.1520	-822.3639	-821.7698	-817.1299	-814.5934
2	-819.5036	-816.0793	-815.4944	-810.2358	-807.7022
3	-819.5001	-815.4727	-815.4727	-807.6143	-807.6143
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	89.82538	89.82538	90.05876	90.05876	90.06674
1	85.71520	85.63639	85.77698	85.41299	85.35934
2	85.85036	85.70793	85.74944	85.42358	85.27022*
3	86.45001	86.34727	86.34727	85.86143	85.86143
Schwarz Criteria by Rank (rows)and Model (columns)					
0	91.16962	91.16962	91.55236	91.55236	91.70970
1	87.35816	87.32914	87.56929	87.25510*	87.30101
2	87.79204	87.74918	87.84048	87.61419	87.51062
3	88.69041	88.73702	88.73702	88.40055	88.40055

The results are described in the following table: Thus, 5 cases are described in Table 7: $H_2(r), H_1^*(r), H_1(r), H^*(r), H(r).H_2(r)$: there is not a deterministic trend in the data. The co-integration equality does not include the intercept and the trend; $H_1^*(r)$: there is not a deterministic trend in the data. While the co-integration equality includes the intercept, it does not include the trend; $H_1(r)$: there is a deterministic linear trend in the data. While the co-integration equality includes the intercept, it does not include the trend; $H^*(r)$: there is a deterministic linear trend in the data. The co-integration equality includes the intercept and the trend; $H(r)$: there is a deterministic quadratic trend in the data. The co-integration equality includes the intercept and the trend; The co-integration range is assessed as r=1 in the first four cases and r=2 for case 5. Let's see the case of H*(1). Information criterion Akaike AIC=85.41299, and information criterion Schwarz=87.25510.

Table 9.

Date: 08/27/19 Time: 15:00 Sample (adjusted): 1999 2018 Included observations: 20 after adjustments Trend assumption: Linear deterministic trend (restricted) Series: DGDPAZZ DBELARUSS DRUSSIAA Lags interval (in first differences): 1 to 3 Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.995232	125.9465	42.91525	0.0000
At most 1	0.498130	19.03119	25.87211	0.2789
At most 2	0.230600	5.242897	12.51798	0.5619
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.995232	106.9153	25.82321	0.0000
At most 1	0.498130	13.78829	19.38704	0.2686
At most 2	0.230600	5.242897	12.51798	0.5619
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):				
DGDPAZZ	DBELARUSS	DRUSSIAA	@TREND(94)	
-1.71E-07	2.88E-05	-4.82E-06	0.014983	
1.21E-06	-1.00E-05	-4.67E-05	-0.082496	
2.75E-07	-4.35E-06	-2.99E-06	0.223320	
Unrestricted Adjustment Coefficients (alpha):				
D(DGDPAZZ)	496250.2	1407876.	-1472965.	
D(DBELARUSS)	-175420.7	6559.499	-9418.980	
D(DRUSSIAA)	176259.3	134452.6	14854.88	
1 Cointegrating Equation(s): Log likelihood -817.1299				
Normalized cointegrating coefficients (standard error in parentheses)				
DGDPAZZ	DBELARUSS	DRUSSIAA	@TREND(94)	
1.000000	-168.1797	28.14487	-87443.98	
	(4.33570)	(3.23619)	(32242.6)	

Adjustment coefficients (standard error in parentheses)				
D(DGDPAZZ)	-0.085029			
	(0.20899)			
D(DBELARUSS)	0.030057			
	(0.00142)			
D(DRUSSIAA)	-0.030201			
	(0.01104)			
2 Cointegrating Equation(s): Log likelihood -810.2358				
Normalized cointegrating coefficients (standard error in parentheses)				
DGDPAZZ	DBELARUSS	DRUSSIAA	@TREND(94)	
1.000000	0.000000	-41.90173	-66981.61	
		(6.96569)	(69321.0)	
0.000000	1.000000	-0.416499	121.6696	
		(0.04608)	(458.577)	
Adjustment coefficients (standard error in parentheses)				
D(DGDPAZZ)	1.623292	0.179233		
	(1.37960)	(34.3505)		
D(DBELARUSS)	0.038016	-5.120798		
	(0.00980)	(0.24399)		
D(DRUSSIAA)	0.132944	3.730618		
	(0.05678)	(1.41365)		

So, if we review the hypothesis Ho : r =0, we can see that the Max-Eigen Statistic statistics (106.9153) in this hypothesis are higher than the critical value (25.82321). At the same time, the probability value is less than 5%, which allows us to refuse the hypothesis H0 : r =0. In the hypothesis H_0 : r =1 and Ho : r =2, the Max-Eigen Statistic are less than the critical value. These cases are not denied. Thus, the assessed co-integration range is equal to 1.

And now, let's see the error correction model by suing the tools of the Eviews software package.

Table 10.

Vector Error Correction Estimates Date: 08/27/19 Time: 15:03 Sample (adjusted): 1999 2018 Included observations: 20 after adjustments Standard errors in ( ) t-statistics in [ ]			
Cointegrating Eq:	CointEq1		
DGDPAZZ(-1)	1.000000		
DBELARUSS(-1)	-187.0365 (6.11484) [-30.5873]		
DRUSSIAA(-1)	39.48375 (4.15389) [9.50524]		
C	-1258606.		
Error Correction:	D(DGDPAZZ)	D(DBELARUSS)	D(DRUSSIAA)
CointEq1	-0.094984 (0.18581) [-0.51120]	0.026698 (0.00161) [16.5826]	-0.027456 (0.00973) [-2.82253]
D(DGDPAZZ(-1))	-0.602554 (0.30742) [-1.96004]	-0.017007 (0.00266) [-6.38462]	-0.003006 (0.01609) [-0.18676]
D(DGDPAZZ(-2))	-1.387825 (0.32361) [-4.28859]	-0.040154 (0.00280) [-14.3201]	0.013985 (0.01694) [0.82545]
D(DGDPAZZ(-3))	-1.596729 (0.64236) [-2.48572]	-0.039092 (0.00557) [-7.02342]	0.010936 (0.03363) [0.32518]
D(DBELARUSS(-1))	-42.94828 (26.0907) [-1.64612]	2.347877 (0.22607) [10.3855]	-3.891458 (1.36592) [-2.84897]
D(DBELARUSS(-2))	-22.40927 (18.5712) [-1.20667]	1.590387 (0.16092) [9.88326]	-2.683024 (0.97225) [-2.75960]
D(DBELARUSS(-3))	5.211000 (9.40837) [0.55387]	0.842478 (0.08152) [10.3343]	-1.254013 (0.49255) [-2.54594]
D(DRUSSIAA(-1))	7.164874 (11.7190) [0.61139]	-0.890907 (0.10154) [-8.77361]	-0.359159 (0.61352) [-0.58541]
D(DRUSSIAA(-2))	7-6.256742 (14.6386) [-0.42741]	-0.600598 (0.12684) [-4.73501]	0.039066 (0.76637) [0.05098]

D(DRUSSIAA(-3))	0.936419 (10.7192) [0.08736]	-0.199827 (0.09288) [-2.15143]	-0.339240 (0.56118) [-0.60451]
C	-967907.7 (1346502) [-0.71883]	16691.73 (11667.3) [1.43064]	-21081.49 (70493.0) [-0.29906]
R-squared	0.929677	0.997809	0.914172
Adj. R-squared	0.851540	0.995374	0.818807
Sum sq. resids	2.65E+14	1.99E+10	7.26E+11
S.E. equation	5426355.	47018.86	284084.2
F-statistic	11.89805	409.8634	9.586041
Log likelihood	-330.5293	-235.5598	-271.5342
Akaike AIC	34.15293	24.65598	28.25342
Schwarz SC	34.70058	25.20363	28.80107
Mean dependent	168040.0	2222.635	-16234.49
S.D. dependent	14083265	691339.2	667384.5
Determinant resid covariance (dof adj.)	1.08E+33		
Determinant resid covariance	9.81E+31		
Log likelihood	-821.7698		
Akaike information criterion	85.77698		
Schwarz criterion	87.56929		

The co-integration relations between Azerbaijan's GDP and the balances of the trade relations of Russia and Belarus.

D(DGDPAZZ) = - 0.0949844598249*(DGDPAZZ(-1) - 187.03647441*DBELARUSS(-1)+ 39.4837469771*DRUSSIAA(-1) - 1258605.89454) - 0.602554118538*D(DGDPAZZ(-1)) - 1.3878246215*D(DGDPAZZ(-2)) - 1.59672870986*D(DGDPAZZ(-3)) - 42.9482790097*D(DBELARUSS(-1)) - 22.4092719822*D(DBELARUSS(-2)) + 5.21100047516*D(DBELARUSS(-3)) + 7.16487381453*D(DRUSSIAA(-1)) - 6.2567416052*D(DRUSSIAA(-2)) + 0.936419245415*D(DRUSSIAA(-3)) - 967907.658506

As a result of the realization of the Granger Test, we stated above that there are contra-relations between the relevant indicators. The following co-integration relations of these dependencies are achieved by conducting the analogical procedures for the indicators of the Belarus-Azerbaijan balance and the Russian-Azerbaijan balance, the Azerbaijani GDP and the Russian-Azerbaijan balance, and the Belarus-Azerbaijan balance and the Azerbaijani GDP in the Eviews software package.

D(DBELARUSS) = 0.0266976823284*(DGDPAZZ(-1) - 187.03647441*DBELARUSS(-1) + 39.4837469771*DRUSSIAA(-1) - 1258605.89454) - 0.017007108325*D(DGDPAZZ(-1)) - 0.0401542380502*D(DGDPAZZ(-2))- 0.0390922581296*D(DGDPAZZ(-3)) + 2.34787719424*D(DBELARUSS(-1))— + 1.59038730257*D(DBELARUSS(-2))+ 0.842478271487*D(DBELARUSS(-

3)) - 0.890907042377*D(DRUSSIAA(-1)) - 0.600598193779*D(DRUSSIAA(-2))- 0.199826578835*D(DRUSSIAA(-3)) + 16691.7328439 D(DRUSSIAA) = - 0.0274558819592*(DGDPAZZ(-1) - 187.03647441*DBELARUSS(-1) + 39.4837469771*DRUSSIAA(-1) - 1258605.89454) - 0.00300583691439*D(DGDPAZZ(-1)) + 0.0139845459437*D(DGDPAZZ(-2)) + 0.0109357275099*D(DGDPAZZ(-3)) - 3.89145807783*D(DBELARUSS(-1)) - 2.68302426524*D(DBELARUSS(-2)) - 1.2540132055*D(DBELARUSS(-3)) - 0.359158550711*D(DRUSSIAA(-1)) + 0.0390659710004*D(DRUSSIAA(-2)) - 0.339239605895*D(DRUSSIAA(-3)) - 21081.4895354

4. Result.

The results in Table 10 given with Lag dependencies show that the co-integration relation built may be regarded significant for the second-range difference operators formed from the tested time sequences.Thus, the error correction model built allows to assess the quality characteristics of the short-time and long-time dynamics of the relations between the time sequences of the studied indicators, as the assessment of the parameters of the co-integration relation and the determination of the speeds of accrual to the balance position are ensured here. The speeds of the processes of the return of the tendencies from the balance position in the previous time moments with 3 lags to the balance trajectory consecutively in the subsequent moments were determined through the multiplication of relevant invariables. These ratios show how many percentages the tendencies from the balance position have been corrected currently. If the values of these ratios are negative, the remaining tendencies are adequately corrected with percentage statements in the subsequent periods. In order to ensure the dynamic sustainability of the built model, the location of these ratios in the part [-1,0] may be accepted as a necessary precondition. The achieved co-integration relation allows to adequately assess the mutual relation between the studied indicators in comparison to the time moments.
These assessments achieved second difference co integration through correction mechanisms may be accepted as a significant tool in the governmental regulation of the importation and exportation transactions by also considering other influencing factors, providing dynamical analyzes in the conduction of balanced importation-exportation transactions between them in the acceleration of the mutual trade and economic integration of all of these three countries in order to ensure the long-term sustainable growth of the relevant inclusive parameters.

Research shows that without heteroskedasticity and autocorrelation unable to get correct results. Of course, it would be worth considering move from indicators to relative growth rates, and these are the research procedures above for indicators. Just like the trend in the regression modelexponential transformation must be implemented. All these cases are systematic comparisons.The analysis is taken into account in future researches of the authors.

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