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UDC 338.001.36
JEL 040, 047

EMPIRICAL ANALYSIS OF THE RELATIONSHIP AMONG THE GDP, CASH IN CIRCULATION, INTEREST RATE, OIL PRICES AND PRICE INDEX: ON THE EXAMPLE OF THE REPUBLIC OF AZERBAIJAN

Abstract

Our research focuses on the analysis of the relationship among Gross Domestic Product (GDP), cash in circulation, interest rate, price index and oil prices by applying modern econometric approaches. In this purpose, the stationarity, causality and cointegration relations of the appropriate (time) series were investigated, Vector Error Correction (VEC) model was developed, and the mutual variance decomposition of the model's variables were investigated. The analysis were carried out based on the quarterly statistics of [1] and [2] for 2010-2019 by implementing the EViews 11 SV Lite econometric package.

Keywords: GDP, cash in circulation, interest rate, price index, oil price, time series, stationarity, cointegration rank, VEC model, impulse response, variance decomposition.

Introduction

Money is an essential macroeconomic category that gives opportunity to analyze the inflation, periodic fluctuations, equilibrium in the economy, agreement's kind of the money and goods markets, and so on. Money is a financial asset and is used on trading purpose. A crucial feature of money is its high liquidity, it means, it can be exchanged for any other assets rapidly and with minimal losses. The amount of money in the country is controlled by the state, and in general, this function is realised by the Central Bank [4,5]. Quantitative expression of money is based on its turnover [4,5]:

$$MV = PQ, \tag{1}$$

where, M – is cash in circulation, V – the velocity of money; P – average price of goods and services; Q – the amount of goods and services sold. By using equation (1):

$$M = PQ/V \quad (2)$$

The money demand function as below:

$$\left(\frac{M}{p}\right)^d = L(r, Y) \quad (3)$$

where, r, Y and p are interest rate, income and price index, respectively.

According to (3), the amount of money demand is directly proportional to income and inversely proportional to interest rate [4, 5].

Statement of the problem

[9, 11] are devoted to the interval and point computations of single-factor relationships for macroeconomic indicators of balanced open systems. [10] is dedicated to the development of a mathematical apparatus consisting of a system of multifactorial relations of macroeconomic indicators, as the consumer and public expenditures, investment norms and tax burden, economic growth rate, general index of structural efficiency, etc. of unbalanced open economy. In [3] constructed a VECM(3) for the Azerbaijan Republic, which reflects the relations between cash circulation, GDP and interest rates, [6] was assessed the relations between household consumption, GDP and government income using the VEC (2) model.

Based on the methodology which are given in [3,6], let us analyze the state of the money market by using the quarterly indicators of the Central Bank of the Republic of Azerbaijan and Trading Economics [2] during the 2010-2019 (Table 1).

Table 1.

Some indicators that characterize the money market						
Years	Quarters	GDP (mln.man)	Cash in circulation M (mln.man.)	Interest rate r (in manats)	Crude oil price OP (in manats)	Price index p
2010	Q1	9551.6	4608.1	14.19	87.44	3.8
	Q2	19680	4855.2	14.96	78.18	4.9
	Q3	29308	5197.8	13.81	83.15	5.2
	Q4	41574.7	5793.2	13.13	101.01	5.7
2011	Q1	10421.1	5749.7	11.48	125.89	9.1
	Q2	22516.5	6198.3	10.82	116.74	8.8
	Q3	34583.1	6818.6	10.35	109.56	8.4
	Q4	50069	7658.5	9.78	110.98	7.9
2012	Q1	12289.1	7650.1	9.73	119.47	3.1
	Q2	25861.3	8183.9	9.51	104.92	2.2
	Q3	39760.6	8793.7	8.36	108.7	1.5

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	Q4	53995	9777.5	9.04	115.55	1.1
2013	Q1	12946.6	13989.2	8.64	102.37	1.2
	Q2	27202	15385	8.27	107.7	2
	Q3	42748	16366.1	10.26	108.84	2.3
	Q4	57708.2	16930	10.11	106.4	2.4
2014	Q1	13150.7	17674.7	9.77	108.07	20
	Q2	28743	18553.8	9.7	106.02	16
	Q3	44145.4	19443.1	9.66	85.86	15
	Q4	58977.8	20402.3	7.78	52.99	14
2015	Q1	11525	8055.5	8.07	66.78	2.8
	Q2	26265.1	7084.4	7.02	52.21	3.5
	Q3	40678.4	6050	6.62	49.56	3.7
	Q4	54352.1	5416.8	6.71	34.74	4.0
2016	Q1	125887	5613.5	5.88	48.13	10.8
	Q2	270023	6307	4.64	42.46	10.5
	Q3	434363	6194	5.65	48.3	11.2
	Q4	599877	6969.8	7.78	55.7	12.4
2017	Q1	152297	6661.8	11.43	51.73	13.2
	Q2	313106	7353.1	11.17	52.65	13.9
	Q3	500673	7707.8	8.44	61.37	13.9
	Q4	701351	8140.2	7.89	69.05	12.9
2018	Q1	1765	8110.5	11.8	75.17	4
	Q2	37009	7814.5	11.64	74.25	3
	Q3	57761.9	7527.1	10.62	75.47	2.6
	Q4	79797.3	8364.1	6.85	61.89	2.3
2019	Q1	18111.7	8219.9	9.27	72.8	2.1
	Q2	37825.2	9173.3	9.27	65.17	2.5
	Q3	58464.2	9352.6	9.22	60.23	2.6
	Q4	81681	10405.5	9.16	33.33	2.6

Source: Statistical reports of the Central Bank of the Republic of Azerbaijan and Statistics of Trading Economics.

Problem solution

It needs to be mentioned that whole analyzes were carried out by applying the EViews11 SV Lite package. In order to determine the relationship among the GDP, cash in circulation, interest rate, price index and crude oil price, let's use the preparation methodology of VAR and VEC models, which are the modern econometric models and express the dependence of endogenous variables on several lag prices of other endogenous variables [3, 6]:

I. Detection stationarity and integration of (time) series

In the first stage, let's detection stationarity and integration of time series in accordance with the variables GDP-general domestic product, M - cash in circulation, r - interest rate, p-price index and OP - crude oil prices. For this purpose, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests can be used, respectively. The Null and Alternate hypothesis of both tests are defined as follows: Null hypothesis (H0) states there is the presence of a unit root (indicating that this series is not stationary), Alternate hypothesis (H1) states there is no unit root. In other words, stationarity exists. Summarizing the results of these tests, we present them as in the Table 2 and Table 3:

Table 2.

Results of ADF test to detection the stationary of the series ($\sim I(0)$)

Augmented Dickey-Fuller Unit Root Test						
Null Hypothesis: Series has a unit root						
Exogenous: None						
Lag Length: 8 (Automatic - based on AIC, maxlag=9)						
Test critical values:		1% — -2.625606	5% — -1.949609	10% — -1.611593		
Indicators		GDP	M	r	p	OP
Augmented Dickey-Fuller test statistic	t-statsitics	0.40336 1	-0.354272	-1.272554	-1.780502	-1.093379
	Prob.*	0.7939	0.5507	0.1834	0.0715	0.2438

Source: Compiled on the basis of calculations made by the author.

Since all the estimated P-values (Prob) for the indicators based on Table 2 are greater than 0.05, it is feasible to mention that the series of GDP, M, r, p və OP possess unit root and they are not stationary with 95% confidence: $GDP \notin I(0)$; $M \notin I(0)$; $r \notin I(0)$; $p \notin I(0)$; $OP \notin I(0)$.

Table 3.

Results of the PP test to detection the integration of the series ($\sim I(1)$)

Phillips-Perron Unit Root Test						
Null Hypothesis: D(*) has a unit root						
Exogenous: None						
Bandwidth: 37 (Newey-West automatic) using Bartlett kernel						
Test critical values:		1% — -2.627238	5% — -1.949856	10% — -1.611469		
1-st difference of the indicators		D(GDP)	D(M)	D(r)	D(p)	D(OP)
Phillips-Perron test statistic	Adj. t-Stat	-12.32843	-5.497675	-6.148262	-6.535822	-4.976072
	Prob.*	0.0000	0.0000	0.0000	0.0000	0.0000

Source: Compiled on the basis of calculations made by the author.

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Based on Table 3, it is not difficult to remark that the series of statistical values of GDP, M, r, p and OP indicators consist of the 1st degree finite differences do not have unit root with 95% confidence (all Prob* probability values are less than 0.05) and they are stationary. Thus, the series in accordance with the GDP, M, r, p and OP indicators are first-orderly integrated, and $GDP, M, r, p, OP \sim I(1)$. In this case, it is crucial to prepare the model VAR(q) in the presence of cause and effect relationships between the indicators, and the model VEC(s) in the presence of a cointegration relationship, by using their first-degree finite differences among the given indicators [3,6].

II. Cause and effect analysis

Let's establish cause-and-effect relationships among the explored macroeconomic indicators through the Granger causality test. The results of the test are given in Table 4:

Table 4.

The results of Granger causality test			
Pairwise Granger Causality Tests			
Date: 05/11/20 Time: 01:26			
Sample: 2010Q1 2019Q4			
Lags: 5			
Null Hypothesis:	Obs	F-Statistic	Prob.
M does not Granger Cause GDP	35	0.31108	0.9014
GDP does not Granger Cause M		0.22063	0.9501
R does not Granger Cause GDP	35	3.09891	0.0268
GDP does not Granger Cause R		7.39495	0.0003
P does not Granger Cause GDP	35	3.80409	0.0112
GDP does not Granger Cause P		2.58560	0.0524
OP does not Granger Cause GDP	35	0.72501	0.6114
GDP does not Granger Cause OP		0.49917	0.7738
R does not Granger Cause M	35	0.42406	0.8273
M does not Granger Cause R		1.88483	0.1345
P does not Granger Cause M	35	0.23305	0.9442
M does not Granger Cause P		3.15347	0.0250
OP does not Granger Cause M	35	2.07787	0.1035
M does not Granger Cause OP		2.42428	0.0649
P does not Granger Cause R	35	0.56893	0.7230
R does not Granger Cause P		1.01264	0.4319
OP does not Granger Cause R	35	1.87657	0.1360
R does not Granger Cause OP		1.21909	0.3306
OP does not Granger Cause P	35	0.81038	0.5538
P does not Granger Cause OP		0.10023	0.9911

Source: Compiled on the basis of calculations made by the author.

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Audit 2 (2020), Vol. 28, pp. 74-85.

Based on Table 4, we can mention that between only two of these explored indicators including GDP and interest rate are the bidirectional causality relationship; from the price index to GDP and from currency in circulation to the price index exist an unilateral causality relationship.

III. Investigation of cointegration relationships

In order to study the cointegration relationship among indicators, let's use the Johansen cointegration test:

Table 5.

The results of Johansen cointegration test					
Date: 05/11/20	Time: 01:58				
Sample: 2010Q1	2019Q4				
Included observations: 35					
Series: GDP M OP P R					
Lags interval: 1 to 4					
Selected (0.05 level*) Number of Cointegrating Relations by Model					
Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	3	5	5	5	5
Max-Eig	4	5	5	5	5
*Critical values based on MacKinnon-Haug-Michelis (1999)					
Information Criteria by Rank and Model					
Data Trend:	None	None	Linear	Linear	Quadratic
Rank or	No 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	-950.9327	-950.9327	-947.0221	-947.0221	-940.2055
1	-920.1112	-906.9752	-903.0655	-893.3796	-886.5644
2	-903.4205	-880.9287	-877.5792	-858.5093	-852.4804
3	-891.8862	-864.3691	-861.3458	-836.7488	-830.8200
4	-886.2207	-854.8808	-852.1159	-821.5240	-817.2544
5	-885.8661	-849.2189	-849.2189	-812.5609	-812.5609

Akaike Information Criteria by Rank (rows) and Model (columns)					
0	60.05330	60.05330	60.11555	60.11555	60.01174
1	58.86350	58.17001	58.17517	57.67884	57.51797
2	58.48117	57.31021	57.29024	56.31482	56.14174
3	58.39350	56.99252	56.93405	55.69993	55.47543
4	58.64119	57.07891	56.97805	55.45851	55.27168*
5	59.19235	57.38394	57.38394	55.57491	55.57491
Schwarz Criteria by Rank (rows) and Model (columns)					
0	64.49715	64.49715	64.78159	64.78159	64.89998
1	63.75174	63.10269	63.28560	62.83370	62.85059
2	63.81379	62.73171	62.84506	61.95851	61.91874
3	64.17050	62.90284	62.93325	61.83244	61.69682*
4	64.86258	63.47805	63.42164	62.07985	61.93746
5	65.85813	64.27191	64.27191	62.68507	62.68507

Source: Compiled on the basis of calculations made by the author.

Table 5 shows that the most appropriate model, based on the lowest AIC value (AIC=55.27168), is a quadratic trend model and the cointegration rank is 4:

$$H: \Delta w_t = A * (B'w_{t-1} + c_0 + d_0t) + c_1 + d_1t + \sum_{i=1}^q B_i \Delta w_{t-i} + \varepsilon_t; \quad (4)$$

Where, $w_t = (GDP, M, r, p, OP)'$ is column vector, q – is an optimal lag length of VEC model, A and B – are the columns that are linearly independent, correction (sometimes called adaptation matrices [8]) and cointegration matrices, respectively. In addition, they are as below:

$$\left\{ A: \left| A = [a_{ij}]_{m \times r} \text{ and } rank(A) = r \right\} v \exists \left\{ B: \left| B = [b_{ij}]_{m \times r} \text{ and } rank(B) = r \right\};$$

Additionally,

$$B_i = [b_{sp}^i]_{m \times m}; \quad c_0 = [c_{oi}]_{r \times 1}; \quad c_1 = [c_{1i}]_{m \times 1}; \quad d_0 = [d_{oi}]_{r \times 1} \text{ and } d_1 = [d_{1i}]_{m \times 1}$$

m – is the dimension of w_t column vector, in other words Number of response series. In our case: $m = 5$.

IV. Defining the optimal lag length

It is known that the passing from the VEC(q) model which prepare for the indicators system, to the appropriate VAR($q + 1$) model and vice versa are feasible. This judgment can be used to determine the degree of the model to be prepared, that means, the optimal lag length. In this purpose, let's use the determining criterion of the lag length:

Table 6.

Determining criterion of the degree of VAR model						
VAR Lag Order Selection Criteria						
Endogenous variables: GDP M R OP P						
Exogenous variables:						
Date: 05/11/17 Time: 03:17						
Sample: 2010Q1 2019Q4						
Included observations: 35						
Lag	LogL	LR	FPE	AIC	SC	HQ
1	-1015.558	NA	4.63e+19*	59.46045	60.57141*	59.84395
2	-995.3194	28.91205	6.53e+19	59.73254	61.95446	60.49954
3	-984.9779	11.81877	1.87e+20	60.57017	63.90306	61.72068
4	-956.3943	24.50025	2.48e+20	60.36539	64.80924	61.89941
5	-885.8661	40.30182*	5.16e+19	57.76378*	63.31859	59.68130*
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

By considering the Akaike Information Criteria (AIC) column in Table 6, we obtained that the optimal lag length for the VAR model is 5. This means that the degree (lag length) of the VEC model to be developed is $q = 4$.

V. Development of VEC(4) model

Let's create the VEC(4) model for the vector of economic indicators $w_t = (GDP, M, r, OP, p)'$ as in formula (4), being cointegration $rank = 4, lag = 4$ by applying EViews 11 SV Lite package:

$$\begin{aligned} \Delta GDP_t &= -1.55GDP_{t-1} - 5.61M_{t-1} - 45771.66r_{t-1} - 11.54OP_{t-1} + 27099.06p_{t-1} + 0.49\Delta GDP_{t-1} + \\ &+ 5.03\Delta M_{t-1} - 7340.89\Delta r_{t-1} - 333.72\Delta OP_{t-1} - 16734.97\Delta p_{t-1} + 0.44\Delta GDP_{t-2} + 10.15\Delta M_{t-2} + \\ &+ 28997.18\Delta r_{t-2} + 329.67\Delta OP_{t-2} - 10311.68\Delta p_{t-2} + 0.24\Delta GDP_{t-3} + 9.41\Delta M_{t-3} + 35111.75\Delta r_{t-3} - \\ &- 31.36\Delta OP_{t-3} + 20566.67\Delta p_{t-3} + 0.93\Delta GDP_{t-4} + 2.75\Delta M_{t-4} + 47412.69\Delta r_{t-4} + 169.81\Delta OP_{t-4} - \\ &- 22508.2\Delta p_{t-4} + 5089.46t + 420911.33; \\ \Delta M_t &= 0.0077GDP_{t-1} - 0.206M_{t-1} - 2372.67r_{t-1} + 225.23OP_{t-1} + 609.07p_{t-1} - 0.02\Delta GDP_{t-1} - \\ &- 0.48\Delta M_{t-1} + 1515.13\Delta r_{t-1} - 37.82\Delta OP_{t-1} + 197.34\Delta p_{t-1} - 0.01\Delta GDP_{t-2} - 0.39\Delta M_{t-2} + \\ &+ 600.25\Delta r_{t-2} + 20.32\Delta OP_{t-2} + 60.56\Delta p_{t-2} - 0.01\Delta GDP_{t-3} - 0.18\Delta M_{t-3} + 35.51\Delta r_{t-3} + \\ &+ 49.52\Delta OP_{t-3} - 22.2\Delta p_{t-3} - 0.003\Delta GDP_{t-4} - 0.45\Delta M_{t-4} + 173.23\Delta r_{t-4} - 22.36\Delta OP_{t-4} - \\ &- 140.02\Delta p_{t-4} + 657.91t - 10947.06; \\ \Delta r_t &= 0.00001GDP_{t-1} - 0.0002M_{t-1} - 0.11r_{t-1} + 0.01OP_{t-1} - 0.58p_{t-1} - 0.00001\Delta GDP_{t-1} + \\ &+ 0.0001\Delta M_{t-1} - 0.32\Delta r_{t-1} + 0.01\Delta OP_{t-1} + 0.26\Delta p_{t-1} - 0.000001\Delta GDP_{t-2} + 0.00005\Delta M_{t-2} + \\ &+ 0.01\Delta r_{t-2} - 0.0019\Delta OP_{t-2} + 0.26\Delta p_{t-2} + 0.000002\Delta GDP_{t-3} - 0.000005\Delta M_{t-3} + 0.05\Delta r_{t-3} + \\ &+ 0.004\Delta OP_{t-3} + 0.28\Delta p_{t-3} - 0.000004\Delta GDP_{t-4} + 0.0001\Delta M_{t-4} - 0.08\Delta r_{t-4} + 0.03\Delta OP_{t-4} + \\ &+ 0.26\Delta p_{t-4} + 0.003t + 3.91; \\ \Delta OP_t &= 0.00014GDP_{t-1} - 0.00711M_{t-1} - 1.19r_{t-1} + 0.02OP_{t-1} - 8.88p_{t-1} - 0.00018\Delta GDP_{t-1} + \\ &+ 0.00543\Delta M_{t-1} - 3.15\Delta r_{t-1} - 0.5\Delta OP_{t-1} + 5.38\Delta p_{t-1} - 0.00011\Delta GDP_{t-2} + 0.00335\Delta M_{t-2} + \\ &+ 1.65\Delta r_{t-2} - 0.39\Delta OP_{t-2} + 4.49\Delta p_{t-2} - 0.00005\Delta GDP_{t-3} + 0.003\Delta M_{t-3} + 4.31\Delta r_{t-3} - \\ &- 0.24\Delta OP_{t-3} + 6.13\Delta p_{t-3} - 0.00005\Delta GDP_{t-4} + 0.004\Delta M_{t-4} + 5.44\Delta r_{t-4} + 0.26\Delta OP_{t-4} + \\ &+ 7.15\Delta p_{t-4} - 0.36t + 113.43; \\ \Delta p_t &= 0.00001GDP_{t-1} - 0.00008M_{t-1} + 0.39r_{t-1} - 0.15OP_{t-1} - 1.03p_{t-1} + 0.00001\Delta GDP_{t-1} + \\ &+ 0.00003\Delta M_{t-1} + 0.06\Delta r_{t-1} + 0.08\Delta OP_{t-1} + 0.15\Delta p_{t-1} + 0.00001\Delta GDP_{t-2} + 0.00003\Delta M_{t-2} + \\ &+ 0.84\Delta r_{t-2} + 0.07\Delta OP_{t-2} + 0.23\Delta p_{t-2} + 0.00001\Delta GDP_{t-3} + 0.00009\Delta M_{t-3} + 0.59\Delta r_{t-3} + \\ &+ 0.09\Delta OP_{t-3} + 0.34\Delta p_{t-3} + 0.00001\Delta GDP_{t-4} - 0.00011\Delta M_{t-4} + 0.76\Delta r_{t-4} + 0.07\Delta OP_{t-4} - \\ &- 0.16\Delta p_{t-4} - 0.49t + 25.72. \end{aligned}$$

VI. Variance decomposition

The results of the calculations for the six quarters are compiled as a Table 7 and Figures 1-4 form in order to assess the impact part of their interaction with one-another on changes in economic indicators.

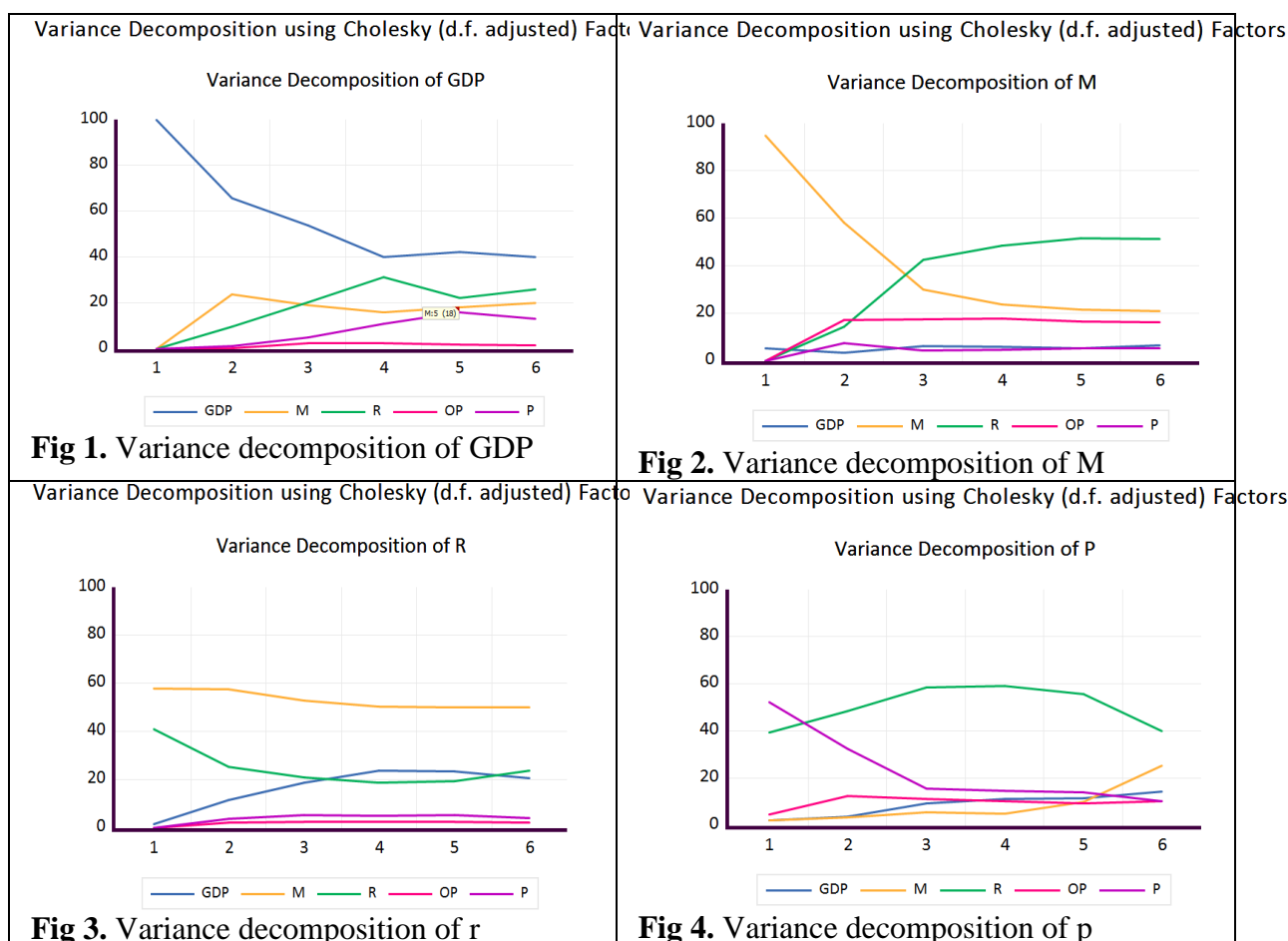
Table 7.

Decomposition of variance of indicators

Variance Decomposition of GDP:						
Period	S.E.	GDP	M	R	OP	P
1	65470.52	100.0000	0.000000	0.000000	0.000000	0.000000
2	81699.59	65.52705	23.56991	9.654180	0.292951	0.955905
3	91937.43	53.65791	18.88734	20.21805	2.299485	4.937219
4	108200.7	39.87485	15.80406	31.05089	2.460649	10.80954
5	129099.2	42.25166	18.00728	22.21780	1.770823	15.75244
6	142658.5	39.90716	19.80058	25.93723	1.451582	12.90344

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Variance Decomposition of M:						
Period	S.E.	GDP	M	R	OP	P
1	1800.278	5.174527	94.82547	0.000000	0.000000	0.000000
2	2300.295	3.199314	58.11804	14.19113	17.19124	7.300278
3	3232.493	6.180412	29.98985	42.41426	17.33070	4.084771
4	3643.554	5.759394	23.76233	48.37703	17.60981	4.491445
5	3858.803	5.137029	21.55812	51.62430	16.45307	5.227480
6	3924.282	6.380096	20.89904	51.30190	16.16449	5.254474
Variance Decomposition of R:						
Period	S.E.	GDP	M	R	OP	P
1	0.999178	1.286144	57.86646	40.84740	0.000000	0.000000
2	1.276527	11.53803	57.54690	25.28372	2.088119	3.543230
3	1.435010	18.67224	52.93005	20.87272	2.502338	5.022655
4	1.533309	23.64201	50.45320	18.78263	2.285095	4.837059
5	1.546718	23.38709	49.87351	19.27290	2.323254	5.143244
6	1.791149	20.41805	49.91200	23.76780	1.980977	3.921170
Variance Decomposition of OP:						
Period	S.E.	GDP	M	R	OP	P
1	9.550680	3.825507	32.89440	23.06320	40.21690	0.000000
2	13.63331	8.480808	18.13083	41.49428	27.96689	3.927196
3	15.97088	6.257544	33.81191	31.85528	22.24356	5.831701
4	17.28100	9.349407	36.13721	28.30656	19.37560	6.831225
5	18.65645	12.15958	40.06765	24.31433	17.05353	6.404908
6	19.99258	11.09101	44.01020	22.49527	14.85285	7.550672
Variance Decomposition of P:						
Period	S.E.	GDP	M	R	OP	P
1	1.067784	1.975070	2.064150	39.42620	4.435898	52.09868
2	1.364278	3.656329	3.251547	48.40459	12.27084	32.41670
3	1.988167	9.229032	5.620796	58.60250	10.97994	15.56773
4	2.110013	11.21464	4.993013	59.02458	10.07979	14.68797
5	2.206229	11.38228	9.765406	55.60870	9.268353	13.97527
6	2.609537	14.18812	25.36704	39.97564	10.13755	10.33164
Cholesky Ordering: GDP M R OP P						



Conclusion

Vector error correction (VEC) model was developed for expressing the long-term relationship among gross domestic product (GDP), cash in circulation, interest rate (in manats), oil prices and price index by using the quarterly indicators of the Central Bank of the Republic of Azerbaijan and of the Trading Economics in 2010-2019. Based on this model the effects of each indicator on economic indicators for the sixth research period (quarter) it can be mentioned that:

- For *GDP* :
 $\rho_{GDP}(GDP) \approx 39.91\%$; $\rho_{GDP}(M) \approx 19.8\%$; $\rho_{GDP}(r) \approx 25.94\%$; $\rho_{GDP}(OP) \approx 1.45\%$; $\rho_{GDP}(p) \approx 12.9\%$;
 $\rho_{GDP}(OP) < \rho_{GDP}(p) < \rho_{GDP}(M) < \rho_{GDP}(r) < \rho_{GDP}(GDP)$.
- For cash in circulation (*M*):
 $\rho_M(GDP) \approx 6.38\%$; $\rho_M(M) \approx 20.9\%$; $\rho_M(r) \approx 51.3\%$; $\rho_M(OP) \approx 16.16\%$; $\rho_M(p) \approx 5.25\%$;
 $\rho_M(p) < \rho_M(GDP) < \rho_M(OP) < \rho_M(M) < \rho_M(r)$.
- For interest rate (*r*):
 $\rho_r(GDP) \approx 20.42\%$; $\rho_r(M) \approx 49.91\%$; $\rho_r(r) \approx 23.77\%$; $\rho_r(OP) \approx 1.98\%$; $\rho_r(p) \approx 3.92\%$;
 $\rho_r(OP) < \rho_r(p) < \rho_r(GDP) < \rho_r(r) < \rho_r(M)$.
- For crude oil price (*OP*):

$$\rho_{OP}(GDP) \approx 11.09\%; \rho_{OP}(M) \approx 44.01\%; \rho_{OP}(r) \approx 22.5\%; \rho_{OP}(OP) \approx 14.85\%; \rho_{OP}(p) \approx 7.55\%;$$

$$\rho_{OP}(p) < \rho_{OP}(GDP) < \rho_{OP}(OP) < \rho_{OP}(r) < \rho_{OP}(M).$$

○ For price index (p):

$$\rho_p(GDP) \approx 14.19\%; \rho_p(M) \approx 25.37\%; \rho_p(r) \approx 39.98\%; \rho_p(OP) \approx 10.14\%; \rho_p(p) \approx 10.33\%;$$

$$\rho_p(OP) < \rho_p(p) < \rho_p(GDP) < \rho_p(M) < \rho_p(r).$$

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Məqalə redaksiyaya daxil olmuşdur:
02.03.2020
Təkrar işləməyə göndərilmişdir:
13.03.2020
Çapa qəbul olunmuşdur:
30.03.2020

Дата поступления статьи в редакцию: 02.03.2020
Отправлено на повторную обработку: 13.03.2020
Принято к печати: 30.03.2020

The date of the admission of the article to the editorial office: 02.03.2020
Send for reprocessing: 13.03.2020
Accepted for publication: 30.03.2020