Econometric Model Applied in the Analysis of the Correlation between Some of the Macroeconomic Variables

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Abstract

This article aims to evaluate the existing relationship between the various macroeconomic variables in Romania, more precisely, between the exchange rate RON/EUR and the inflation rate as recorded for the year 2013. In order to hit this target, the macroeconomic model of regression has been utilized which revealed the fact that between the two variables subject of the analysis there is a linear and indirect connection.

Key words: *exchange rate, inflation rate, index of the consumer goods, regression model, correlation.*

General aspects concerning the exchange rate and the inflation rate

The National Bank of Romania plays the role of creating and enforcing the exchange rate policy, the exchange rate regime of the national currency, leu, being presently one of controlled floating. The exchange rate setting up is achieved in connection with the inflation targets used as instrument of the monetary policy, thus having the possibility to regulate and adapt the strategies of this policy to the effects of the unforeseen factors which influence the national economy.

The inflation is meaning the generalized and longstanding increase of the prices for the goods within the economy, accompanied by a decrease of the purchasing power of the currency and it is measured by means of the consumer goods prices index.

The consumer goods prices index is expressing the overall evolution of the purchased goods prices and tariffs for the services used by the population during the current year as against the previous year or any other year chosen as reference year.

The annual inflation rate is representing the increase of the consumer goods prices of a month from the current year as against the same month from the previous year. It is calculated as ration in percentage expression between the index of the consumer goods prices from the corresponding month of the previous year, out of which it is deducted 100.

The analysis of the correlation between the exchange rate RON/EUR and the inflation rate in the year 2013

In order to analyze the relation existing between the exchange rate RON/EUR and the inflation rate, we have generated a series of date with monthly frequencies as regards the values recorded by the two variables in the year 2013.

The monthly values of the consumer goods price index and inflation have been established by applying the following calculation relation:

$$IPC = \frac{\sum_{j=1}^{12} IPC_{month\ "i"/2013}}{\sum_{j=1}^{12} IPC_{month\ "i"/2012}}$$

Inflation rate = IPC – 100

The twelve terms of the series are submitted in the table below:

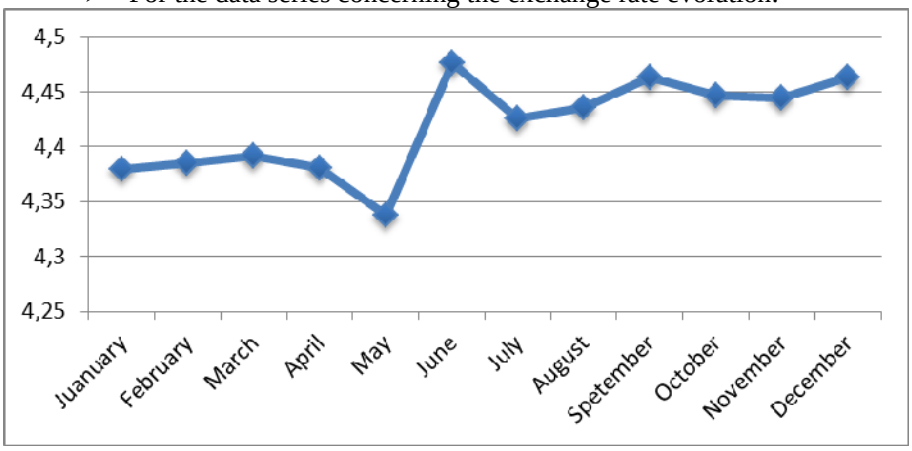
Table 1. Monthly values of the exchange rate RON/EUR and inflation rate recorded in the year 2013

Month	Exchange rate L_EUR	IPC	Inflation rate
January	4.3793	105.97	5.97
February	4.3848	105.65	5.65
March	4.3915	105.25	5.25
April	4.3802	105.29	5.29
May	4.3375	105.32	5.32
June	4.4765	105.37	5.37
July	4.4257	104.41	4.41
August	4.4353	103.67	3.67
September	4.4627	101.88	1.88
October	4.4462	101.88	1.88
November	4.4448	101.83	1.83
December	4.4633	101.55	1.55

In the frame of this analysis we used the average monthly exchange rate, calculated as simple arithmetical mean of the daily exchange rates.

In the first stage, for each of the two considered date series we applied statistical tests on the analyzed indicators and a separate graph has been achieved for their evolution, as follows:

- For the data series concerning the exchange rate evolution:

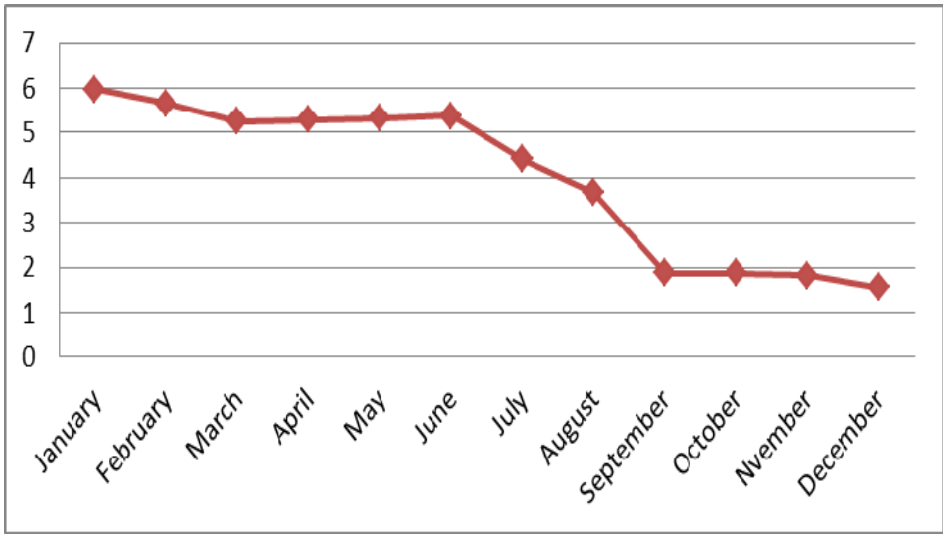


Graph 1.Evolution of the exchange rate RON/EUR in the year 2013

Table 2. Outcomes of the statistical tests applied on the series concerning the exchange rate

Series: CURSL_EURM	
Sample: 1/01/2013 12/31/2013	
Observation: 12	
Mean	4.418983
Standard Error	0.012475
Median	4.4305
Mode	#N/A
Standard Deviation	0.043216
Sample Variance	0.001868
Kurtosis	-0.85838
Skewness	-0.43206
Range	0.139
Minimum	4.3375
Maximum	4.4765
Sum	53.0278
Count	12
Largest(1)	4.4765
Smallest(1)	4.3375
Confidence Level(95.0%)	0.027458

- For the data series concerning the inflation rate evolution:

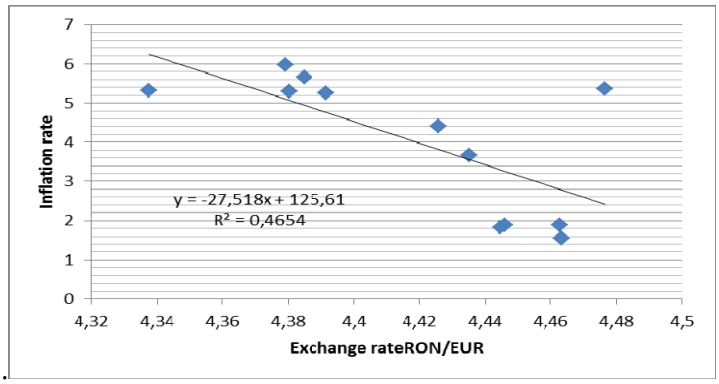


Graph 2. Evolution of the inflation rate in the year 2013

Table 3. Outcomes of the statistical tests applied of the series concerning the inflation rate

Series: Rata inflației	
Sample: 1/01/2013 12/31/2013	
Observation: 12	
Mean	4.005833
Standard Error	0.503218
Median	4.83
Mode	1.88
Standard Deviation	1.743197
Sample Variance	3.038736
Kurtosis	-1.75644
Skewness	-0.4824
Range	4.42
Minimum	1.55
Maximum	5.97
Sum	48.07
Count	12
Largest(1)	5.97
Smallest(1)	1.55
Confidence Level(95.0%)	1.107575

In order to identify the type of the regression model being used with the purpose to characterize the connection existing between the inflation rate evolution (as dependent variable) and the exchange rate RON/EUR evolution (as explicative variable), in the year 2013, we achieved the points formed graphic representation of the considered date series and, meantime, we traced the related regression line.



Graph 3. Correlogram Inflation rate Exchange rate

The analysis of the correlation graph reveals an indirect connection, of linear type, between the inflation rate and the exchange rate RON/EUR, this one being expressed through the simple linear regression model, as follows:

$$R\_INF = \alpha + \beta * CURSL\_EURM + \varepsilon$$

where:

R_INF = inflation rate (dependent variable);

CURSL_EURM = exchange rate RON/EUR (explicative variable) ;

α, β = parameters of the linear regression model;

ε = residual value of the regression model.

The estimate of the econometric model of regression submitted to the analysis is achieved the least squares method.

Table 4.Estimation of the parameters of the regression model

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.682206							
R Square	0.465405							
Adjusted R Square	0.411946							
Standard Error	1.336765							
Observations	12							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	15.55668389	15.55668	8.705764	0.014520912			
Residual	10	17.86940777	1.786941					
Total	11	33.42609167						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Upper 95.0%*
Intercept	125.6067	41.2147169	3.047618	0.012302	33.77460137	217.4388	33.774601	217.438825
X Variable 1	-27.5178	9.326333054	-2.95055	0.014521	-48.2982059	-6.737476	-48.29821	-6.7374758

The values of the two parameters, α and β, of the regression model are set up on the basis of the dates we obtained, as follows:

α = 125.6067

β = - 27.5178

The regression model characterizing the relation between the BET index and value of the stock exchange capitalization in the year 2013, is transcribed as follows:

$$R\_INF = 125.6067 - 27.5178 \cdot CURSL\_EURM$$

The determination coefficient R-squared (R^2) and the corrected determination coefficient Adjusted R-squared (R^2 adjusted) show the weight in which the dependent variable is explained by the independent variable. Thus, in proportion of 46.54% of the inflation rate value is explained by the value of the exchange rate RON/EUR, the difference up to 1000% representing the influence of other factors not included in the present model.

The regression coefficient has a negative value (- 27.5178), which means that between the two variables there is an indirect connection.

The validity of the analyzed regression model is studied and confirmed by the values recorded by the F-statistic test (the value of 8,705 exceeds the tabled reference level) and Significance F test (almost zero), so that the model describing

the relation between the inflation rate and the exchange rate RON/EUR is a correct one and the variable is a significant one from statistical point of view.

Table 5. The forecasted values of the inflation rate for the year 2014

RESIDUAL OUTPUT			
Observation	*Predicted R_INF*	*Residuals*	*Standard Residuals*
1	5.097832984	0.872167016	0.684291147
2	4.946484859	0.703515141	0.551969031
3	4.762115326	0.487884674	0.38278811
4	5.073066927	0.216933073	0.170202929
5	6.248078731	-0.928078731	-0.728158767
6	2.423098854	2.946901146	2.312101154
7	3.821005169	0.588994831	0.462117852
8	3.556833897	0.113166103	0.088788685
9	2.802845058	-0.922845058	-0.724052494
10	3.256889432	-1.376889432	-1.080289934
11	3.295414409	-1.465414409	-1.149745505
12	2.786334353	-1.236334353	-0.970012207

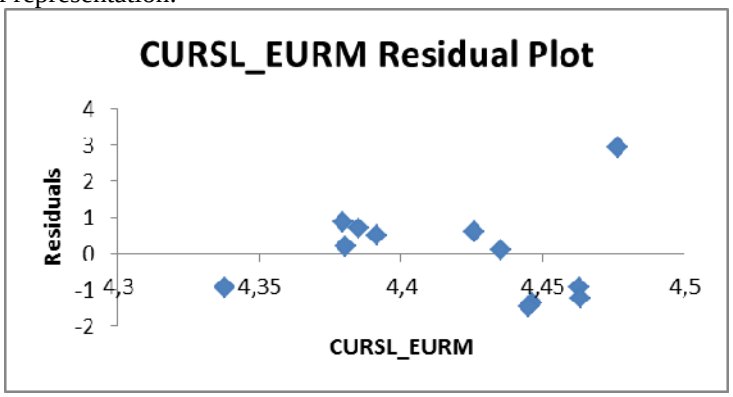
The table above is showing:

- The predicted value of the inflation (Predicted R_INF) achieved by replacing the values of the exchange rate in the estimated model;

$$R\_INF_{CURSL\_EURM} = 2125.6067 - 27.5178 \cdot CURSL\_EURM;$$

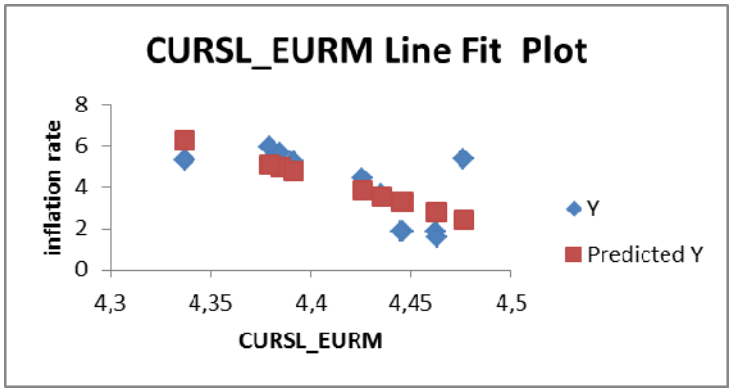
- The value of the prediction error Residuals – calculated as difference between the observed value and the predicted one;
- The standardized value of the Standard Residuals – calculated through dividing the residual by the standard deviation of the residuals.

The quality of the selected model is analyzed also through the method of graphical representation:



Graph 4. Diagram independent variable - residual

When analysing the form of the points cloud we state out that there is no correlation between the independent variable CURSL_EURM and residuals, so that we conclude that the model has been properly selected.



Graph 5. Diagram independent variable- predicted dependent variable

Conclusions

Subsequent to the performed analysis, we can conclude that the evolution of the exchange rate RON/EUR in the year 2013 did not significantly influence the evolution of the inflation rate but, on the contrary, during the periods when an upward trend of this one (depreciation of the national currency) has been recorded, the inflation rate showed, to a large extent, a downward trend. Consequently, there is no clear correlation between the exchange rate and the inflation rate.

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