The Impact of EUR/RON Exchange Rate Policy on Romanian Exports

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1. Introduction

Together with the payments balance of a country, the exchange rate developments reflect the views of the national economy into the world economy and the competitiveness of the national economy - including through the perceived quality of state economic policy. If the fixed rates induced the balance of payments adjustment processes (rebalancing) within the economy, the other conditions of rate exchange make movement in itself a process of adjustment (Daianu, 1992).

In international economic relations it is very important to know the value of the monetary unit of a State with respect to another State. The ratio of these two, established at a time on the market is called currency exchange. In other words, the exchange rate is an expression of the ratio value of the two currencies (Constantin, 1994). Similarly, currency may be defined by the ratio value of a national currency and the currency of another country or the price of one currency expressed in another currency (Krueger, 1996).

Usually, banks use many types of courses in their transactions, the most used being the following (US Bank):

- **spot transactions** buy or sell foreign currency at a rate against another currency. Spot refers to the deal being processed on “the spot” or today, settling in the respective financial institutions within one or two business days after trade date;
- **forward transactions** buy or sell foreign currency to settle three or more business days after the foreign exchange trade date. A forward transaction can be delivered up to a year after the trade date for most currencies. The pricing of a forward transaction is determined by the spot rate, adjusted by the interest rate differentials of the two currencies. The availability of forward prices in any currency is always subject to changing regulations, market conditions, and other variables;
- **Wire Transfer** is the course used in the bank transfer technique.

To ensure an optimal currency exchange, the state may intervene in currency markets. The foreign exchange market intervention means the activity of the Central Bank that is to buy or sell certain currencies in order to raise or decrease these currencies relative to the national currency by influencing supply and demand. The role of the monetary authority is to intervene by selling or buying on the market of the most requested currency with a view to bringing the course to the previous level (Kiricișcu, 1978).

Trade openness of a country is measured as the sum of total exports and imports (Turan and Karakas, 2016). Often, in relation with exchange rate is studied the exports evolution. Romanian exports, the main form of foreign trade transactions, consist in the export or import of goods, especially tangible goods (according to Ministry of Economy, Trade and Business Environment Relations, Export general rules). These operations can take the form of direct export or through the involvement of producers and traders, foreign trade companies (Popa, 2013).

Romania’s export and import conditions are based on the premise that export and import of goods from and onto the customs territory of Romania is free, without being tied to the issue in advance of a license, unless those products are placed under one of the measures adopted in accordance with Government...
Section 2 describes the relationship between exchange rate and exports: literature review. The exchange rate plays a crucial role in a country’s trade performance. Various qualitative and quantitative analyses have been conducted by researchers at a national and international level to investigate the relationship between exchange rate and exports, leading to diverse results across economies and periods.

2.1 Statistical tests

In this paper, we analyse the quantitative dependence between exchange rate and exports. Bernard and Jensen (2004) found that the variability of exchange rate was an important determinant of export increases, focusing on the economy of the US over the period 1987-1992. Lemmers and Vancauteren (2009) examined the Dutch economy and discovered a positive trend over the period 1978-2007, with a 10% depreciation of the Euro leading to a 1.8% increase in exports.

In another study, Fang et al. (2006) observed that exchange rate devaluation over the Chinese Yuan had a negative effect on exports. Also, the evidence suggests that the exchange rate doesn’t have any influence over the Turkish lira, according to the findings of Faruk et al. (2004) for the periods 1987 and 2003 in Turkey. Binati and Sohrabji (2009) analysed the period 1999-2008 and concluded that a depreciation of the Turkish lira has a positive effect on exports.

For the Romanian case, Ghiba (2010) examined the relationship between exchange rate and exports for the period 2005-2010 and found that the depreciation of Romanian currency has a small effect on the exports increase. Also, Gherman et al. (2013) reveals that it is a direct relationship between exchange rate and export, resulted by regressions performed on data series for the Romanian economy.

3. Methodology

3.1 Statistical tests

In order to ascertain the correlation between Romanian exports and exchange rate, we applied statistical tests to check the normality of distribution. The statistical test helps us identify patterns and make quantitative decisions about a process or processes, enabling us to determine whether there is enough evidence to “reject” a conjecture or hypothesis about the relationship.
process. The conjecture is called the null hypothesis. Not rejecting may be a good result if we want to continue to act as if we “believe” the null hypothesis is true. Or it may be a disappointing result, possibly indicating we may not yet have enough data to “prove” something by rejecting the null hypothesis (NIST/SEMATECH, 2012).

The application of the main statistical tests on the exchange rate and exports could be traced by using: the mean, the median, the minimum and maximum values of the data series, the asymmetry coefficient, the kurtosis of time series and Jarque Bera test (Popovici, 2013).

The asymmetry coefficient is composed of several coefficients as:
1. Pearson’s coefficient that is calculated as follows (Bowman and Shenton, 2007):

\[ \beta_2 = \frac{\mu_4}{\mu_2^2} \]  

where \( \mu_4 \) represents the central moment of order four and is determined with the formula:

\[ \mu_4 = \frac{\sum (x_i - \bar{x})^4 n_i}{\sum n_i} . \]  

The interpretation of Pearson’s coefficient is: \( \beta_2 = 3 \) (mesokurtic distribution); \( \beta_2 > 3 \) (leptokurtic distribution); and \( \beta_2 < 3 \) (platykurtic distribution).

2. Fischer’s Coefficient is determined according to the following mathematical formula (Bowman and Shenton, 2007):

\[ \gamma_2 = \beta_2 - 3 . \]  

The interpretation of Fischer’s Coefficient is: \( \beta_2 = 0 \) (mesokurtic distribution); \( \beta_2 > 0 \) (leptokurtic distribution); and \( \beta_2 < 0 \) (platykurtic distribution).

After the values of these coefficients, the distribution may have the following forms from the normal one:

**Figure 1. Types of curves depending on distribution**

![Diagram showing types of curves: Positive-skewed, Negative-skewed, Leptokurtic, Platykurtic](image)


A distribution with negative skewness has a longer tail in the lower-return side and a distribution with positive skewness has a longer tail on the higher-return side of the curve (figure 1.a). There is greater downside risk than what the standard deviation measures, when we found a negatively skewed distribution. Conversely, when the distribution is positively skewed, there is less downside risk than indicated by the standard deviation.

A distribution with kurtosis greater than 3 is a leptokurtic distribution where 3 is the kurtosis of a normal distribution. A leptokurtic distribution (figure 1.b) has a sharper peak and fatter tails compared to a normal distribution. This indicates a lower probability than a normally distributed variable of values near the mean and a higher probability than a normally distributed variable of extreme values. Conversely, a
distribution with kurtosis less than 3 is a platykurtic distribution (figure 1.b). In term of shape, a platykurtic distribution has a lower, wider peak and thinner tails and it indicates a higher probability than a normally distributed variable of values near the mean and a lower probability than a normally distributed variable of extreme values (Minh P. Doan, 2011).

Jarque-Bera (JB) statistics tests if a distribution is normally divided. The test measures the difference between the asymmetry coefficient and the kurtosis of the analysed distribution in relation to normal distribution. The calculation formula according to which this test can be determined is (Jarque and Bera, 1980):

\[ JB = \frac{n-k}{6} \left[ S^2 + \frac{(K-3)^2}{4} \right] \]  

where:
- \( n \) = the number of observations (or degrees of freedom in general);
- \( S \) = the sample skewness;
- \( K \) = the sample kurtosis;
- \( k \) = the number of regressors (coefficients estimated to be used to create the series).

The Jarque-Bera (JB) statistic compares skewness and kurtosis of the return series with those of the normal distribution. In essence, when the test has a null hypothesis, the series is not normally distributed.

3.2. The model

In order to analyse the influence of the exchange rate on the Romanian exports we will use the linear regression model. The general form of the model used is (Anghelache et al., 2013):

\[ Y = a + b \times X, \]  

where:
- \( Y \) = the dependent variable (explained, endogenous, result);
- \( a \) = the \( Y \) intercept (constant term);
- \( b \) = the slope;
- \( X \) = is the vector of independent variable (explanatory, exogenous).

From an econometric point of view, the model must also include the residual component seen as a representation of the differences that occur between the values determined in terms of theory and the values measured in the real economy. Thus, the econometric model is used is:

\[ Y = a + b \times X + \varepsilon, \]  

where:
- \( \varepsilon \) = a variable, interpreted as an error (disturbance, measurement error).

4. Results related to correlation between EUR/RON exchange rate and Romanian exports

4.1. Test results on EUR/RON exchange rate

In order to present the evolution of the EUR/RON exchange rate we processed data from the website of the National Bank of Romania (Table 1), analysis conducted for a period of 9 consecutive years, respectively during 2006-2014, for each month of the year. Data processing was carried out in line with the average exchange rate - monthly series and is presented in the Table 1:

<table>
<thead>
<tr>
<th>Month</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
</table>

Source: Authors’ processing data using monthly series of average exchange rate published by the National Bank of Romania, available at www.bnr.ro

Tests conducted on the EUR/RON exchange rate helps to its more detailed knowledge, its extreme values on each individual year, and the distribution of data series. Since currency fluctuations are very high, results of these tests can be predicted. The software helps confirm suspicions on this development.
All these tests (main statistical tests, calculated using the software Eviews 7.2.), presented in theoretical methodology are illustrated and interpreted as follows (figure 2):

**Figure 2. Statistical test conducted for the EUR/RON exchange rate for the period 2006-2014**

![Graph](image)

*Source: Authors’ processing using Eviews 7.2 software*

We notice in Figure 2 that the average value of the EUR/RON exchange rate for the period 2006 to 2014 is 4.061024 RON/EUR, with a range between a minimum of 3.1337 EUR/RON (registered in July 2007) and a maximum of 4.5583 EUR/RON (recorded in October of 2012).

Therefore, in that case, the asymmetry coefficient is less than 3, value expressed in interpreting the Pearson coefficient, then the distribution is called platykurtic, the distribution is considered flat (kurtosis < 3), which means that during the studied period most data series have ranged between minimum and average exchange rate.

The Jarque Bera test conducted using the Eviews 7.2 software shows the associated probability value as close to zero, which means that the null hypothesis is denied, namely that the series is normally distributed.

### 4.2. Test results on Romanian exports

In this section were analysed data related on the amounts of exports in Romania in the period 2006-2014, from January to December of each year, in order to determine the influence of exchange rate analysis on Romania’s exports.

The Table 2 outlines the average levels of the value of exports for each calendar month of the period analysed.

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>8.1913</td>
<td>8.8724</td>
<td>10.1757</td>
<td>11.1061</td>
<td>12.3963</td>
<td>17.2999</td>
<td>17.7329</td>
<td>17.5763</td>
<td>20.1288</td>
</tr>
</tbody>
</table>

*Source: Authors’ processing data from Foreign Trade Statistics Bulletins for the period 2006-2014, available at [www.insse.ro](http://www.insse.ro)*

The above data show an increase of Romanian exports for the period 2006-2014. From month to month increases and decreases of exports show quite high changes in their activity, being influenced by the economic and financial crisis that occurred in Romania in 2008. Even if oscillations of exports were quite significant, taken by every month, if we look at the overall trends, we point out that the exports increased significantly in 2014 compared to the year beginning of the analysis.

Based on statistical tests for each indicator it was found that, overall, both the exchange rate and Romanian exports increased in 2014 by a significant percentage compared to 2006. Statistical tests performed for Romania’s exports for the period 2006-2014 are presented in Figure 3:
We may observe in Figure 3 that the average value of exports performed by Romania for the period 2006-2014 is 13.31149 billion RON, with a range between a minimum of 6.4914 billion RON (registered in January 2006) and a maximum of 21.7887 billion RON (registered in October of the year 2014). We say that these values show the minimum recorded of exports in the reviewed period that was its very beginning, the maximum level by the end of the period demonstrating once again what you can see in the Table 2 the evolution of Romania's exports in recent years, namely that exports increased considerably from year to year.

The asymmetry coefficient (skewness) is different from zero, registering a value of 0.136248 which means that the normal distribution is not perfectly symmetrical. Kurtosis has a value of 1.696163, value below a normal distribution. Since this is less than 3, we deduce that the distribution is called platykurtic, the distribution being flat (kurtosis < 3), namely most export values during the analysed period have values between the minimum and average of exports per year. In the test represented in Figure 3, we observe that the associated probability value is different from 0, and is confirmed with the value 0.018462, which rejects the null hypothesis that the series is normally distributed, namely we do not have a perfect symmetrical distribution. This is understandable due to large fluctuations in the evolution of Romania’s exports recorded from one month to another.

4.3. The macroeconomic model of the Romanian exports
The macroeconomic model of the exchange rate influence on exports to Romania was further pursued for the period 2006 - 2014. This link between the two indicators analysed in this study can be seen in the Figure 4:
As shown in Figure 4, the EUR/RON exchange rate is a mitigating factor for the size of our country's exports.

The visual analysis of the organization and form of the cloud of points contained in the obtained confidence ellipse may provide important clues to the relationship between variables. Therefore, in the cloud of points there is a tendency of growth, showing that the two variables, the EUR/RON exchange rate and exports, are related, namely the exchange rate affects exports to Romania. The analytical expression of the two variables evolution is linear and it proves that the variables are correlated.

To estimate the regression model parameters, we used the Eviews 7.2. software, where it was established that the equation has as a resultant variable the value of Romania’s exports for the period 2006-2014, and as factorial variable the EUR/RON exchange rate.

To build the linear regression model, the average of the EUR/RON exchange rate was considered as an independent variable, while the value of Romania’s exports was considered as dependent variable (the resultant).

Therefore, the regression model may be given under the following mathematical equation (Anghelache, 2011):

\[ \text{Export} = a + b \times \text{EUR/RON exchange rate} + \varepsilon \] (7)

where:
- Export = dependent variable;
- EUR/RON exchange rate = independent variable;
- \(a\) = the Export intercept (constant term);
- \(b\) = the slope;
- \(\varepsilon\) - the residual variable.

Based on the above, the following results were obtained after processing with Eviews 7.2 (Table 3):

### Table 3. Results from Eviews Report

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>Std. Error</td>
<td>t-Statistic</td>
<td>Prob.</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------</td>
<td>--------------</td>
<td>--------------</td>
<td>-----------</td>
</tr>
<tr>
<td>a</td>
<td>-22.75743</td>
<td>2.371799</td>
<td>-9.595008</td>
<td>0.0000</td>
</tr>
<tr>
<td>b</td>
<td>8.881730</td>
<td>0.581082</td>
<td>15.28482</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

R-squared                      | 0.687892         | Mean dependent var. | 13.31149   |
Adjusted R-squared             | 0.684947         | S.D. dependent var. | 4.413951   |
S.E. of regression             | 2.477531         | Akaike info criterion | 4.670747   |
Sum squared resid.             | 650.6452         | Schwarz criterion   | 4.720416   |
Log likelihood                 | -250.2204        | Hannan-Quinn criter. | 4.690886   |
F-statistic                    | 233.6256         | Durbin-Watson stat  | 0.471004   |
Prob. (F-statistic)            | 0.000000         |                           |             |

Source: Authors processing using Eviews 7.2 software

To interpret the results by using the linear regression model it is necessary to establish, from the beginning, that it can be considered as fair, and the results that it provides can be used in real macroeconomic analysis.

At first glance, the probability that this model is the correct one is very high, about 70%, this deduction can be made based on the values determined by using Eviews 7.2 software for R tests - squared (0.687892) and Adjusted R - squared (0.684947).

Durbin Watson statistic (DW) is a statistical test to test the serial correlation of errors. If errors are not correlated, then the value of DW will be around 2 (Durbin-Watson, 1951). In the situation above this indicator has the value 0.471004, and therefore there is a serial correlation of errors (residuals). The probability in this case is zero, which means that a high significance of this parameter is indicated by it.

Based on the foregoing elements, we may consider the regression model as describing the correlation between the EUR/RON exchange rate and exports as being the correct one, which faithfully reflect the real evolution of the two macroeconomic indicators. Thus, it is possible to transcribe the single factor linear regression model as having the following form:
This regression model allows us to establish a number of issues concerning the relationship between the two variables considered. We may note that between the value of the EUR/RON exchange rate and the exports recorded by our country in the period 2006-2014 there is a significant direct relationship that means the increase in EUR/RON Exchange rate will determine the increase of Exports.

5. Model testing by forecasting Romanian exports in 2015

In order to test the model and the stability of the export evolution we forecast the Romanian export for 2015 using the model developed, taking into account the evolution of EUR/RON exchange rate - monthly average for the period: January 2015 – January 2016. In table 4, we present the average EUR/RON Exchange rate – monthly series and exports registered in mentioned period, and forecasted exports.

Table 4. Romanian exports - real values and estimated values – for period January 2015 – January 2016

<table>
<thead>
<tr>
<th>Month</th>
<th>EUR/RON Exchange rate</th>
<th>Exports (billion RON)</th>
<th>Exports estimated (billion RON)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 2015</td>
<td>4.4877</td>
<td>18.7650</td>
<td>17.1011</td>
</tr>
<tr>
<td>February 2015</td>
<td>4.4320</td>
<td>19.5720</td>
<td>16.6064</td>
</tr>
<tr>
<td>March 2015</td>
<td>4.4330</td>
<td>21.3026</td>
<td>16.6153</td>
</tr>
<tr>
<td>April 2015</td>
<td>4.4166</td>
<td>19.4610</td>
<td>16.4696</td>
</tr>
<tr>
<td>July 2015</td>
<td>4.4385</td>
<td>22.4430</td>
<td>16.6641</td>
</tr>
<tr>
<td>August 2015</td>
<td>4.4230</td>
<td>17.3440</td>
<td>16.5265</td>
</tr>
<tr>
<td>September 2015</td>
<td>4.4232</td>
<td>21.7490</td>
<td>16.5282</td>
</tr>
<tr>
<td>October 2015</td>
<td>4.4220</td>
<td>22.0739</td>
<td>16.5176</td>
</tr>
<tr>
<td>December 2015</td>
<td>4.5040</td>
<td>17.6866</td>
<td>17.2459</td>
</tr>
<tr>
<td>January 2016</td>
<td>4.5303</td>
<td>18.6473</td>
<td>17.4795</td>
</tr>
</tbody>
</table>


From Table 4 we can see that exports estimated differ from real export with percent between 2.56% (in December 2015) and 34.68% (in July 2015). In Figure 5 we present the evolution of the EUR/RON exchange rate and in Figure 6 the real and estimated values of exports for the period January 2015 – January 2016.

Figure 5. EUR/RON Exchange rate

From Figure 5 we can observe the fluctuating evolution of the EUR/RON exchange rate, but with an increase tendency at the end of the interval. In Figure 6 we highlight the fluctuating evolution of the real exports, but the estimation prove that the linear function smooth the real fluctuating evolution, with very close values in some points (January 2015, April 2015, August 2015) and at the end of the analysed interval (December 2015 and January 2016).
The direct relationship between Romanian real exports registered in 2015 can be observed in the following periods: February – April 2015, May – June 2015, July – September 2015 and December 2015 – January 2016. Thus, we can conclude that forecasting method has a fair degree of accuracy, using known values of the past as close to the present moment, and especially when market conditions are, if not ideal, at least normal, linear and periods with market conditions suffering abnormalities and disruptions are not taken into account (Hada and Lazăr, 2013).

6. Conclusions

This paper offers some results related to the changing in the Romanian exports when changing in the EUR/RON exchange rate occur. In order to establish this relationship between exports and exchange rate we used the monthly evolution of these indicators in the period January 2006 – December 2014. The main statistical tests carried out separately on the exchange rate and exports for the period 2006-2014 gave the result that in both cases the asymmetry coefficient is different from zero, which means that the normal distribution of data series is not perfectly symmetrical.

Both indicators recorded Kurtosis values lower than level 3, which means that the distribution is platykurtic. This shows us that both for the exchange rate and export volumes recorded in Romania for the period 2006-2014, most data are located between the minimum and the average of all values considered.

The Jarque-Bera test gives the same conclusions for both indicators showing that the series is not perfectly symmetrical, as a result of differences between the asymmetry coefficient and the kurtosis of the analysed distributions. These data are confirmed with the help of data probability value confirmation for the average EUR/RON exchange rate and the monthly export volume.

The study conducted found that the link between Romanian exports and exchange rate is relevant and the regression model show us that between the value of EUR/RON exchange rate and the exports achieved by our country in the period 2006-2014 there is a significant direct relationship. Thus, it follows that the EUR/RON exchange rate is an influential factor in the evolution of Romania’s exports. As the exchange rate rises, Romania’s exports increase.

The regression model was tested for estimation of the Romanian exports for the period January 2015 - January 2016 in function of EUR/RON exchange rate. Comparing the real exports with estimated export we found some differences in the monthly estimated values, but in average, an increase of the EUR/RON exchange rate with 0.0971% determines an increase of real exports with 0.82%, that show that the direct relationship is maintained. So, we conclude that in Romania the exchange rate has a significant impact on exports as also found Bernard and Jensen (2004) in US and Binatli and Sohrabji (2009) in Turkey.

References


