THE RELATIONSHIP BETWEEN EXCHANGE RATE AND EXPORTS IN ROMANIA USING A VECTOR AUTOREGRESSIVE MODEL

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ABSTRACT: *In this paper we analyze the exchange rate influence on exports volume in Romania using a vector autoregressive model (VAR). Our analysis, relative to the 2003Q2-2011Q1 period, reflects a negative relationship for the first lag and a positive one in the second lag. Considering the first lag as being significant, an increase of the exchange rate level has effects in decreasing exports volume. Also, according to impulse-response function, a shock in the exchange rate has significant effects on exports after two periods. Variance decomposition shows a weaker influence, less than 10 percent.*

Key words: *exchange rate, volatility, Romanian leu, international trade, depreciation, appreciation.*

JEL codes: *F31, C32, E31*

Introduction

After the collapse of the Bretton Woods monetary system, which was based on a fixed course, a lot of theoretical and empirical articles examined the relationship between exchange rate volatility and trade flows. The purpose was to identify specific connections regarding the transmission effects of the currency volatility, in the economy. The general idea that prevails in all these works is based on uncertainties concerning the evolution of one currency against another, and their effects on a specific national balance of goods and services.

Romania is a small, open economy that operates in the highly integrated single market of European Union and which had a strong export, import and Gross Domestic Product growth in the period before financial crisis.

Using econometric methods, our research tries to identify the nature of the connection between exchange rate and exports, in Romania. We used autoregressive vectors for the real exchange rate between Romanian Leu and euro and exports volume in millions euro in 2003Q2-2011Q1 period. The same methodology is used by Boug and Fagereng on Norwegian exports and their empirical findings indicate a weak connection (Boug and Fagereng, 2010). Other studies on the relationship between exchange rate and exports reflect a positive or negative connection that depends on risk preferences, different opportunities in the international capital markets and trade time horizon (Viane and Vries, 1992; Sercu, 1992).

Our paper is organized in four parts: in the firs part we analyze the literature review regarding the relationship between the exchange rate and exports volume (especially, the situation of other theoretical or empirical approaches concerning the relationship between exports and exchange rate in Romania), in the second part we present exports and real exchange rate data and we develop the autoregressive vector methodology, in the third part we interpret our main conclusion on the obtained results, and finally we reflect detailed conclusions compared to previous studies. The main concepts used are the exports volume and exchange rate volatility, the nature of the relationship between variables and the vector autoregressive methodology.

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Literature review

Hall et al. consider that states economic development influence the obtained results by using econometric methods. Compared to superior developed economies, emerging countries react more rapidly so that exchange rate volatility influences the real economy, in short time. An emerging economy (similar to the one in Romania), compared to a developed one, is more fragile to shocks, due to inferior efficiency mechanisms and reduced financial resources available (Hall et al., 2010).

The elasticity of the relationship between exchange rate and exports depends on the analyzed region. In Eastern Asia, international trade is discouraged by exchange rate volatility, which is stronger than in Europe (Kazunobu and Fukunari, 2009).

During the recent crisis, exchange rate volatility increased caused by serious macroeconomic imbalances. The "contagion effect" determines the Romanian leu, to be more perceptive to the volatility of the other currencies from the Eastern Europe. In the same time, exports volume reduced as a response to a decreasing foreign demand. In this case, the exchange rate has lost a part of its influence in the exports evolution. Some authors consider that national currency depreciation may be a necessarily, on short term incentive for economic recovery (Hall et al., 2010). Different points of view don't agree with this idea and sustain that exchange rate depreciation may have more negative than positive effects (Ripoll-i-Alcon, 2010).

Financial market development influences the exchange rate fluctuations intervals. Under these conditions, volatility has strong implications on international trade if financial market development is lower (Aghion et al., 2009). This idea is developed by Rahman, in 2009, which pays special attention to the position of the partners involved in international trade, concerning currency risk. The same author presents some noteworthy factors when performing an analysis of the relationship between exchange rate and exports: the existence of multinational companies involved in international trade and participants expectations regarding the exchange rate volatility (Rahman and Serletis, 2009).

The main empirical conclusion about the connection between exchange rate and exports volume is presented below (table no. 1).

Table no.1

Main empirical studies on the relationship between exchange rate and exports (Hall, 2010: p.3)

Author/-s, publication year	Period, frequency	Considered countries	Conclusions (results)
Doroodian (1999)	1973-1996, quarterly	India, Malaysia, South Korea	Significant negative impact
Arize (2000)	1973-1996, quarterly	13 economically weak countries (SDE): Ecuador, Indonesia, Korea, Malaysia, Malawi, Mauritius, Mexico, Morocco, Philippines, Sri Lanka, Taiwan, Thailand, Tunisia	Significant negative impact
Sauer, Bohara (2001)	1973-1993, annual	91 countries: 22 economically developed, 25 Latin countries, 25 African countries, 12 Asian countries and other 17 states	Significant negative impact for Latin America and African countries
Doganlar (2002)	1980-1996, quarterly	Turkey, Korea, Malaysia, Indonesia, Pakistan	Significant negative impact
Rahmatszah (2002)	1970-1997, quarterly bilateral exports and imports between the U.S. and Japan	Thailand	Significant negative impact for Japanese exports and inconclusive results about exports to USA

Esquivel, Larrain (2002)	1973-1998, annual	G3 (Germany, Japan, USA), 40 countries in Asia, Africa, Europe and Latin America	Currencies volatility from G3 countries has significant negative impact on emerging countries
Bahmani-Oskooee (2002)	1974-1994, quarterly	Iran	Significant negative impact
Arize, Malindretos and Kasighatla (2003)	1973-1996, quarterly	Burkina Faso, Colombia, Costa Rica, Jordan, Kenya, Korea, Myanmar, Pakistan, South Africa, Venezuela	Significant negative impact
Poon (2005)	1973-1997, quarterly	Indonesia, Japan, South Korea, Singapore, Thailand	Significant negative impact, excepting Thailand – a positive impact
Rey (2006)	1970-2002, quarterly	Algeria, Egypt, Tunisia, Turkey, Israel, Morocco (exports to EU countries)	Inverse relationship to Algeria, Egypt, Tunisia, Turkey and a positive relationship to Israel and Morocco
Wang, Barret (2007)	1989-1998, monthly	Taiwan	Volatility affects only the trade in agricultural products
Baak (2007)	1981-2004, quarterly	Hong Kong, South Korea, Singapore and Thailand	Volatility affects only the trade in agricultural products
Tenreyro (2007)	1970-1997, annual	87 countries, bilateral exports	Volatility has no effect on exports
Arize (2008)	1973-2004, quarterly	Bolivia, Colombia, Costa Rica, Dominican Republic, Ecuador, Honduras, Peru, Venezuela	Significant negative impact of volatility in short and long term in all countries
Egert, Morales-Zumaquero (2010)	1993-2004, annual and monthly	Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia, Russia, Ukraine	Slovenia, Russia, Romania: weak connection; for the other countries considered a strong negative impact

Exchange rate volatility impact on Romanian trade was analyzed considering the group of countries of Central and Eastern Europe. Ferto and Fogarasi (2011) explore the effects of exchange rate and institutional quality on international trade between 1999 and 2008 and their findings show a negative relationship between the exchange rate and agricultural export in the Central Europe, including Romania. Another study on Romanian and Bulgarian example reflects an insignificant impact on export development of the real exchange rate appreciation (Penkova-Pearson, 2011).

Data and methodology

Using VAR modeling, for 2003 Q2-2011 Q1 period, we estimate a connection between real exchange rate EUR/RON (CSR) and exports volume (EXPORTURI). We selected this period, on account of using euro as reference currency in Romania, in the context of the adoption of the single currency in 2015. Since April 2003, the National Romanian Statistics Institute also refers to developments in trade with Euro as reference currency. We used quarterly and logarithmic expressed series in order to avoid eventual heteroscedasticity problems. The real exchange rate is obtained by multiplying the nominal exchange rate (CS) with the ratio between domestic and foreign price index.

The methodology is based on the lagged values of both variables and it is used for the analysis of multivariate time series. Hence, the VAR model is useful for describing the exports' behavior under exchange rate influence.
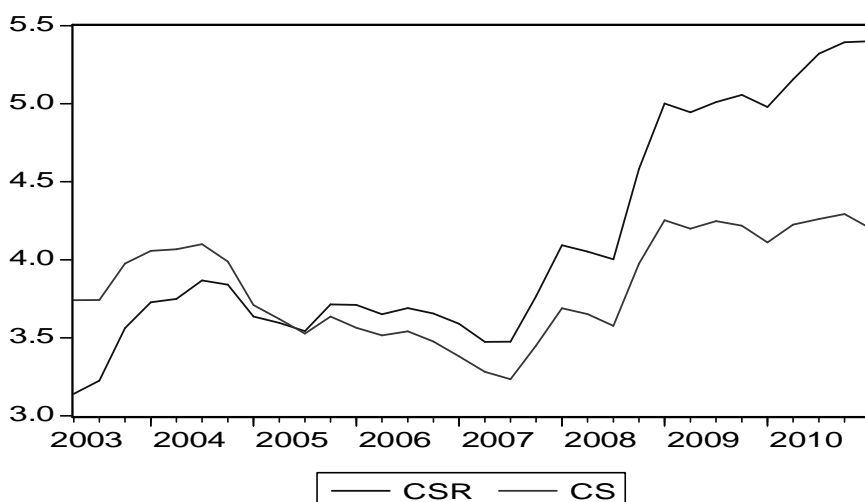
Fig. no. 1. - The evolution of nominal (CS) and real exchange (CSR) rate between euro and Romanian new leu during 2003(Q2)-2011(Q1) period

Source: Data provided by the National Bank of Romania regarding the nominal exchange rate (CS) and deflated with inflation in Romania (Romanian National Institute of Statistics) and inflation in Eurozone (Eurostat) in order to obtain the real exchange rate (CSR)

The real exchange rate in Romania is superior to the nominal rate due to a higher domestic inflation rate, compared with the Euro zone (graphic no. 1).

On the other side, the Romanian exports volume decreased during crisis (after 2008) and then increased again on account of successful international brands as Dacia (a national low-priced car built by Renault). In 2006, we observe a rapid decrease as a response to the Romanian leu depreciation (graphic no. 2).
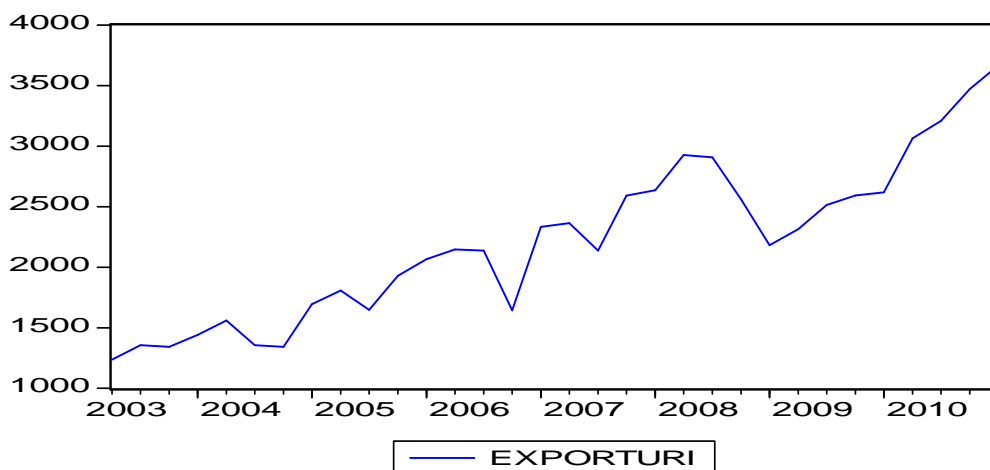

Fig. no. 2. - The exports volume (EXPORTURI) in Romania during 2003(Q2)-2011(Q1) period in millions euro

Source: Data provided by National Bank of Romania (Interactive Database)

After testing variables stationarity, we estimate the impulse response-function and variance decomposition.

Results and discussion

Using augmented Dickey Fuller and Phillips Perron stationarity tests we find a unit root presence in level. After we made the first difference, we observed that the exchange rate is stationary (table no.2).

Table no.2

Exchange rate stationarity tests

Stationarity test	Level/First difference	t-statistic	Prob.
ADF	Level	0.201187	0.9683
	First difference	-4.014379	0.0043
PP	Level	0.053724	0.9566
	First difference	-3.907190	0.0056

The results are similar for the second variable – exports volume (table no. 3).

Table no.3

Exports volume stationarity tests

Stationarity test	Level/First difference	t-statistic	Prob.
ADF	Level	-0.398052	0.8976
	First difference	-6.081640	0.0000
PP	Level	-0.398052	0.8976
	First difference	-6.091914	0.0000

Using stationarity results we conclude that both used variables are stationary – an eventual shock on them is temporary. Their evolution varies around a mean value and the condition required for further analysis is met.

After testing lag relevance, we found a more relevant relationship in the first one. For the first lag, an increase in the exchange rate level (equivalent with national currency depreciation) leads to a decrease in exports volume. On the other hand, depreciation in the second lag has obviously effects on exports which are increasing, but the relevance is lower compared to the first case. Considering the lag relevance (tested through Schwartz criterion), we suppose a negative relationship between real exchange rate and exports volume statistically significant, as table no. 4 reflects:

Table no.4

Vector Autoregression Estimates

	L_EXPORTURI
	0.657143
	(0.19591)
L_EXPORTURI(-1)	[3.35427]
	0.187326
	(0.19768)
L_EXPORTURI(-2)	[0.94760]
	-0.342533
	(0.17453)
L_CSR(-1)	[-1.96260]
	0.606275
	(0.55071)
L_CSR(-2)	[1.10090]
	0.872313
	(0.70565)
C	[1.23617]
R-squared	0.843556

Our results show that an eventually shock in the exchange rate volatility is noticeable after two periods. The impulse-response function marks the answer of exports to a shock in exchange rate (graphic no.3). The dashed lines enclose intervals of plus or minus two standard errors.
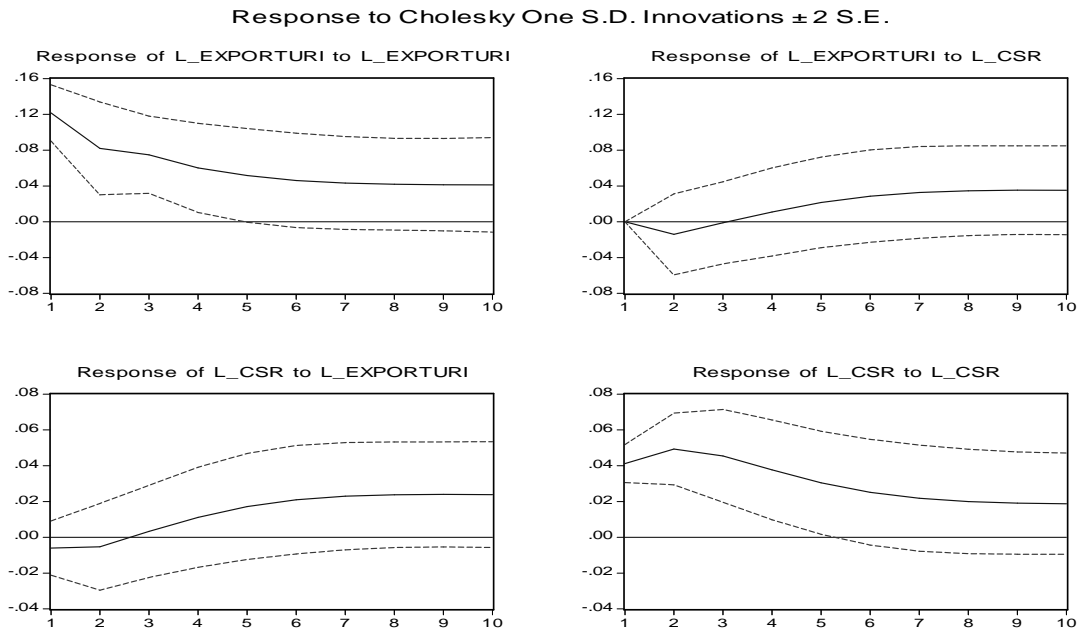

Fig. no. 3. - The impulse-response function

Exchange rate influence on exports is weak, with a percent under 10%. This weakness can be explained by the higher price competitiveness of Romanian products. In the last months, auto industry has been the main engine of domestic international exchanges due to the lowest prices compared with other international competitors. International trade trends have possible influences in exchange rate evolution through their role on market perception. The influence reflects on medium and long-term; information confirmed by variance decomposition. In our search most of the variance comes from the "own-shock", rather than the shock to the other equation.
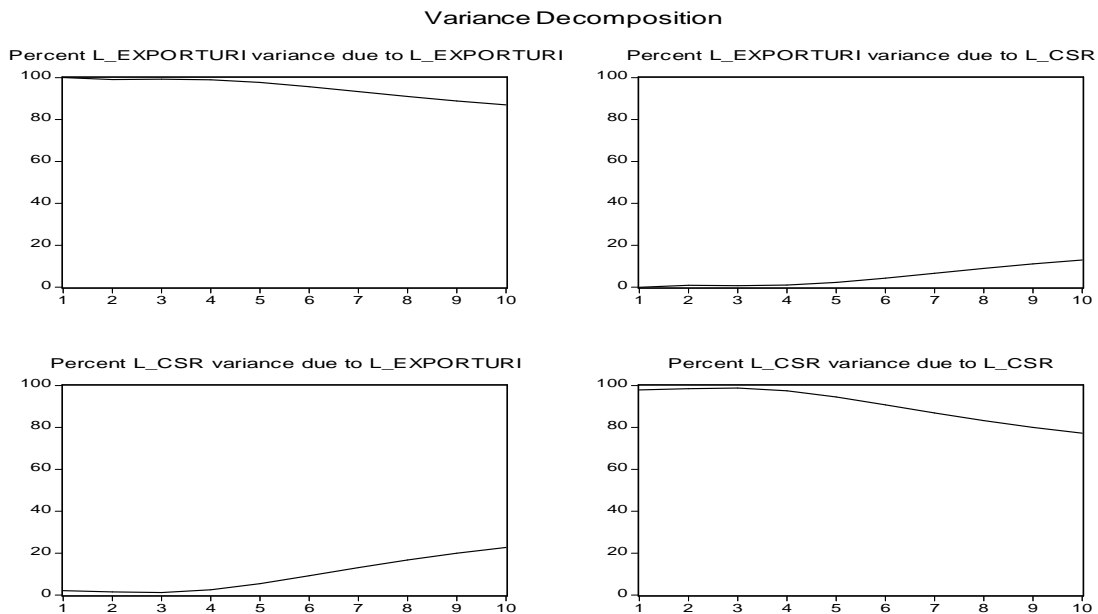

Fig. no. 4. - Variance decomposition

Asymmetry has a negative value and close to zero that reflects a trend of decreasing error model. Kurtosis coefficient is less than 3: a situation corresponding to a low possibility of occurrence of extreme events that influence in short time export activity in Romania. The model is stable. In addition, specifically tests on residuals show that our results are conclusive.

Conclusion

Our results show that exchange rate had a weak influence on exports volume, less than 10 percent. In the first lag, there is a negative relationship between variables: the depreciation of Romanian leu determined a decrease in domestic exports. We argue this fact through a lower price level of Romanian products compared to others. On the other side, in the second lag the influence is positive with a superior coefficient, although the relevance in this lag is weaker. The impulse-response shows the reaction of exports to a shock in error terms. The results reflect an exports response after two periods.

The negative relationship between real exchange rate and exports volume in Romania, significant for the first lag, is similar with the results obtained by Ferto and Fogarasi (2011), even if they consider just the agricultural goods. Also, we obtained an opposite result from Penkova-Pearson (2011), based on a more significant coefficient.

After establishing the connections between variables and highlighting a series of characteristics, this article represents a starting point for the development of a similar analysis on the exchange rate influence on Romanian imports.

Acknowledgments

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