EXCHANGE RATE DURING THE FINANCIAL CRISIS

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Abstract:

The paper analyzes the evolution of the exchange rate in Romania during the financial crisis in order to offer some information regarding how the exchange rates react in the presence of some socks. We used a Vector autoregressive technics and impulse function and the conclusion is that in the case of It is observed that an unexpected shock in the interbank operations and aggregate supply leads to a slight increase of 0.2% in the exchange rate leu / euro and a shock in the foreign exchange market trading volume may lead to a negative shock in the exchange rate leu / euro, with a continuing influence of 6 months before returning to the previous situation before the shock. The exchange rate channel is an important tool in taking shocks in national and international economy and the loss of this channel by fixing the exchange rate of the European currency would make it difficult to accept such shocks to the labor market and goods market.

Keywords: exchange rate, vector autoregressive, financial crises.

Introduction

The economic and financial crisis started at the end of 2008, globally extended, highlighted the importance of knowing the nature and the propagation of the shocks and the interaction of various economic measures over national and international developments. A series of studies both in the international and national literature focus on highlighting the impact of various shocks on economic aggregates, seeking for proper solutions to enhance the positive effects and decrease the negative ones. The aim of these studies is to focus on either analysis of a single country, two or a group of countries (the Euro zone or OECD). The analysis tools are being influenced by this aspect and are focused over the development of the exchange rate in the economic crisis.

The exchange rate is one of the major macroeconomic indicators, representing an essential element in a globalized world, providing along with its evolution information on how to integrate the national economy into the world economy in terms of competitiveness.

For Romania, as a member of the European Union, maintaining the stability of the exchange rate is an essential criterion but not enough to be able to start negotiations to entry into the euro area. Although the country is prepared to make its entrance in the Exchange Rate Mechanism of the European Union (Exchange Rate Mechanism ERM II) in 2015, Romania was seen in the situation to delay the decision due to the the impact of economic crisis on both the deficit and exchange rate stability and inflation.

This paper aims to analyze the impact of economic crisis on the exchange rate stability and highlight the response of this macroeconomic variable at some shocks generated by the economic and financial crisis.

The paper is divided into two subchapters, the first one dedicated to an analysis of the exchange rate fluctuations around an annual average value and the second is based on a Vector Autoregressive model and momentum function. The goal is to highlight how the exchange rate react to certain shocks generated by the crisis. The paper ends with results and conclusions based on the topic.

The analysis of the exchange rate

The rate analysis from the perspective of the accession process to the euro is related to the stability of its evolution according to the central parity, a process that involves finding a country that has a balanced proportion between the national currency and euro. However, the central parity exchange rate may differ from the market exchange rate, so it is essential, that the deviations of the two values to be in a band of variation without exceeding ± 15% which can be negotiated on a narrow band of + / - 2,25%.

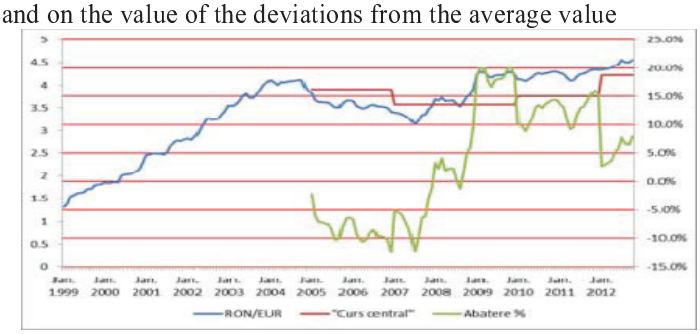
In the exchange rate stability analysis, we start from the hypothesis that the market equilibrates the supply around an equilibrium value that could be determinated, in the simplest way, as an average monthly rate determined by the market, given a minimal intervention from the Central Bank. Assuming that this has happened, the exchange rate fluctuations could be due to changes in demand and supply on the substance of the various economic fundamentals. Therefore, the nominal average monthly balances should show monthly local currency versus the European currency.

Significant is that the average exchange rate may vary depending on the chosen period, monthly averages indicating even the existence of three levels of evolution correlated with the progress of our country in terms of the real and nominal convergence.

During the analysis interval, between January 2008 and October 2012 it is noted that the two trends, depreciation and appreciation of the national currency, alternated, the longest period being marked by a steady depreciation between 1999 - October 2004, when it reached a level of 4,108 lei / euro. Other periods of depreciation and appreciation were shorter. It is also noticeable the fact that in July 2007 the national currency reached an historic minimum (3.1345 RON / EUR) and the maximum depreciation of 4,562 RON / EUR was recorded in October 2012 (Figure 1). If we take into consideration the fluctuations of the exchange rate compared to the monthly average, we can notice a relative stability of ± 0.24%, on the exchange rate band variation with three levels evolving changes: over 4 lei / euro in 2004 under 4 lei / euro between January 2005 to December 2008 and a recovery to more than 4 lei / euro during January 2008 - to October 2012.

Figure 1

The evolution of the exchange rate leu / euro compared to the average of the year and on the value of the deviations from the average value



Source: data from Eurostat

The analysis of the evolution of the national currency- leu against the euro reveals that the monthly changes of the rate have evolved into a band of ± 4.5% between January 2004 and December 2007 before the real estate crisis in America, became later a global financial and economic crisis. After this date, the fluctuations become larger so that in January 2009 compared to December 2008 there was a massive monthly depreciation of 7,98% and in March 2011 the maximum monthly appreciation of -1,97%, as we can observe in figure 1. Compared to the average period of January 2004 through October 2012 whose level is 3,946 lei / euro the exchange rate variation was within a band of ± 15% with the exception of seven values (between April and September 2007 six of which exceed 15% evolved in a

wide band up to -20,6% and an amount exceeding 15%, in October 2012, to a level of 15,62%). It is though remarkable that in 2009, under the effect of the financial crisis fluctuation band, the exchange rate went from the accepted landing of the EMR mechanism II criteria wtih (± 15%), reaching 20% in February, October and November 2009. The chance that Romania would be able to maintain its calendar entry in ERMI decresead, therefore, under this circumstances and on this point, the delay decision is justified.

The dates shown in the figure, underline clearly the exit of the variation band of the exchange rate leu / euro confirming that under the influence of the financial crisis, Romania lost the ERMI start mechanism and its entry into the euro area, which is actually in agreement with the government's decision to postpone this moment without mentioning a later date.

Shaping the shocks on the exchange rate

In order to highlight the exchange rate and its reaction when it comes to shaping on various shocks we have used the autoregression vector methodology that allows applying impulse function and highlight the rate behavior at different shocks.

The reduced form VAR is expressed as a linear function of each variable according to its past values, the past values of other variables considered by the series of uncorrelated errors as in the mathematical expression:

[1] $y_t = \alpha_1 y_{t-1} + ...+\alpha_p y_{t-p} + \beta x_t + \varepsilon_t$ – the equation includes exogenous variables

[2] or $y_t = A(L)y_t + u_t$ - equation contains only endogenous variables

where y_t is a vector of k endogenous variables; x_t is a vector of *d* exogenous variables and α and β, are matrices of coefficients to be determined and ε_t is the vector of the uncorrelated errors with their own lagged values and uncorrelated with all of the righthand side variables and A(L) represents a polynomial of p order which delays error terms in equation [2] is the sudden change of variables, after taking account of the past values. If different variables are related to each other, as usually happens in macro applications, then the u_t terms of the error in the reduced model form are corelated between equations. Therefore we can not simply change one of the elements of u_t to see what happens due to the fact that these errors are correlated with each other. That is why we have

to identify octagonal shocks denoted with e_t base as shown in the equation of the dynamic environments [3].

[3] $B(L)y_t=e_t$

where B(L) is an infinite number of polynomial delay.

Generalization of the VAR representation for k variables and p differences - noted VAR (p) – is written (Dorin Jula, 2007) in the following matrix form:

[4] $Y_t = A_0 + A_1Y_{t-1} + A_2Y_{t-2} + \ldots + A_pY_{t-p} + v_t$

where $Yt = \begin{bmatrix} y_{1,t} \\ y_{2,t} \\ \vdots \\ y_{k,t} \end{bmatrix}$, $Ap = \begin{bmatrix} a_{1p}^1 & a_{1p}^2 & \ldots & a_{1p}^k \\ a_{2p}^1 & a_{2p}^2 & \ldots & a_{2p}^k \\ \vdots & \vdots & \vdots & \vdots \\ a_{kp}^1 & a_{kp}^2 & \ldots & a_{kp}^k \end{bmatrix}$; $A0 = \begin{bmatrix} a_1^0 \\ a_2^0 \\ \vdots \\ a_k^0 \end{bmatrix}$;

$vt = \begin{bmatrix} v_{1,t} \\ v_{2,t} \\ \vdots \\ v_{k,t} \end{bmatrix}$

Note $\Sigma v = E(vtvt)$ variance-covariance matrix of errors. The matrix is unknown.

Model [4] can be written using the delay operator as follows:

[5] $(I – A1L – A2L2 – \ldots – ApLp)Yt = A0 + vt,$

or

[6] $A(L)Yt = A0 + vt.$

A VAR model is stationary if it satisfies the following three classic conditions:

$E(Yt) = \mu$, "t;

$Var(Yt) < \infty$;

$Cov(Yt,Yt+k) = E[(Yt – \mu)(Yt+k – \mu)] = \Gamma k$, "t.

Demonstrating (Hamilton JD, 1994 Times Series Analysis, Princeton University Press, p.259) that the the VAR (p) is stationary if the determinant polynomial is a defined from:

$det(I – A1z – A2z2 – \ldots – Apzp) = 0$

has its roots outside the unit circle from the complex plane.

It is worth mentioning that in this case, the order of the variables is extremely important because it defines the direction of the causal relationship. Keep in mind that the parameters of the VAR process can not be estimated only from stationary time series. Therefore the first step in the estimation of this model is to test the stationarity of the used series.

In order to determine the p order of the VAR model (number of delays) can be used Akaike and Schwartz criteria. Order selection procedure consists in estimating the VAR representation of all VAR models for an order between 0 and h, where h is the maximum possible delay allowed by economic theory or data available, in which case the delay model for AIC and SC criteria values are minimum.

The data used in the model are monthly data, tested for stationarity, all stationary series under ADF test results, as shown in the subchapter regarding data analysis.

The variables used in constructing the model were: the changing exchange rate leu / euro as monthly average (IL_EUROM) changing the volume on the interbank foreign exchange market (IOP_INTB) real GDP change (in 2000 prices) - IPIB, the movement of ROL / USD as monthly average (IL_USDM) changes in the volume of transactions in the foreign exchange market (ITRANZ) and changing labor income inflows (IVD).

The model expressed in mathematical form is shown below:

IL_EUROM = C(1,1)*IL_EUROM(-1) + C(1,2)*IOP_INTB(-1) + C(1,3)*IPIB(-1) + C(1,4)*IL_USDM(-3) + C(1,5)*ITRANZ(-1) + C(1,6)*IVD(-1) + C(1,7)

IOP_INTB = C(2,1)*IL_EUROM(-1) + C(2,2)*IOP_INTB(-1) + C(2,3)*IPIB(-1) + C(2,4)*IL_USDM(-3) + C(2,5)*ITRANZ(-1) + C(2,6)*IVD(-1) + C(2,7)

IPIB = C(3,1)*IL_EUROM(-1) + C(3,2)*IOP_INTB(-1) + C(3,3)*IPIB(-1) + C(3,4)*IL_USDM(-3) + C(3,5)*ITRANZ(-1) + C(3,6)*IVD(-1) + C(3,7)

IL_USDM(-2) = C(4,1)*IL_EUROM(-1) + C(4,2)*IOP_INTB(-1) + C(4,3)*IPIB(-1) + C(4,4)*IL_USDM(-3) + C(4,5)*ITRANZ(-1) + C(4,6)*IVD(-1) + C(4,7)

ITRANZ = C(5,1)*IL_EUROM(-1) + C(5,2)*IOP_INTB(-1) + C(5,3)*IPIB(-1) + C(5,4)*IL_USDM(-3) + C(5,5)*ITRANZ(-1) + C(5,6)*IVD(-1) + C(5,7)

IVD = C(6,1)*IL_EUROM(-1) + C(6,2)*IOP_INTB(-1) + C(6,3)*IPIB(-1) + C(6,4)*IL_USDM(-3) + C(6,5)*ITRANZ(-1) + C(6,6)*IVD(-1) + C(6,7)

By substituting the coefficients in this mathematical model we obtain the following equations:

IL_EUROM = 0.3927900713*IL_EUROM(-1) + 0.01478758142*IOP_INTB(-1) + 0.08638837716*IPIB(-1) + 0.104759141*IL_USDM(-3) - 0.02563998202*ITRANZ(-1) + 0.0003294992089*IVD(-1) + 0.4295703476

IOP_INTB = - 1.527320675*IL_EUROM(-1) - 0.3408455535*IOP_INTB(-1) - 1.199976399*IPIB(-1) - 0.1426872273*IL_USDM(-3) + 0.06377543295*ITRANZ(-1) - 0.01915424372*IVD(-1) + 4.22722914

IPIB = 0.1057233914*IL_EUROM(-1) - 0.02077611032*IOP_INTB(-1) - 0.5083370287*IPIB(-1) - 0.06606650279*IL_USDM(-3) + 0.03784994565*ITRANZ(-1) - 0.000511455621*IVD(-1) + 1.456291896

IL_USDM(-2) = 0.2988149888*IL_EUROM(-1) - 0.02148283294*IOP_INTB(-1) - 0.05996998681*IPIB(-1) + 0.3426095519*IL_USDM(-3) + 0.02295344488*ITRANZ(-1) - 0.0003496012203*IVD(-1) + 0.4192367127

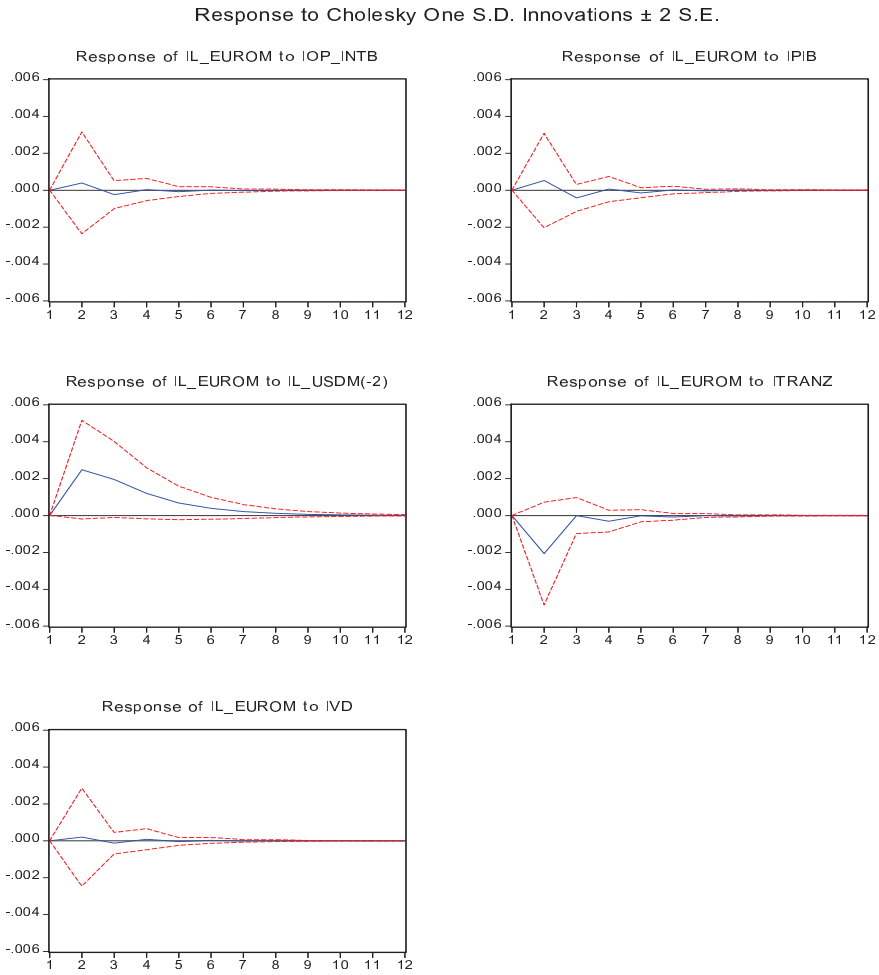
ITRANZ = - 1.080984231*IL_EUROM(-1) - 0.08282775602*IOP_INTB(-1) - 1.027342986*IPIB(-1) - 0.2175749967*IL_USDM(-3) - 0.1378995831*ITRANZ(-1) - 0.005353531551*IVD(-1) + 3.599926184

IVD = 1.394035242*IL_EUROM(-1) - 0.1753299201*IOP_INTB(-1) - 2.404066354*IPIB(-1) - 0.2491517037*IL_USDM(-3) - 0.0214649769*ITRANZ(-1) - 0.3540135313*IVD(-1) + 3.001769915

The model satisfies the stability and the residues, the results of these tests. The advantage of this model is that it allows testing different reaction of exchange rate shocks through impulse function and variance decomposition. Based on the model and application of the impulse response functions as shown in Figure 2, responses of macroeconomic variables to a positive shock, unanticipated 1% in interbank operations (shock 1) in global supply (shock 2) in the leu/ dollar – (shock 3), in foreign exchange transactions (shock 4) and labor income entries (shock 5).

Figure 2

The exchange rate reaction to a shock



Source: processed by the author

It is observed that an unexpected shock in the interbank operations and aggregate supply leads to a slight increase of 0,2% in the exchange rate leu / euro slightly more pronounced when it is followed by a decrease in aggregate supply and return to the previous level after a period of about 4 months.

The impact of a shock in the exchange rate leu / dollar is strong, considering how computing Romanian exchange market by the parity of euro /

dollar. Significant is also the fact that returning to the previous level occurs after a longer period, about after 8 months, comparing to the other situations.

It is though easily remarkable that a shock in the foreign exchange market trading volume may lead to a negative shock in the exchange rate leu / euro, with a continuing influence of 6 months before returning to the previous situation before the shock. It is obviously that if a speculative attack is development this evolution indicates the need for a vigorous action taken by the Central Bank to counter the lingering effect of a possible attack. Egert (2007) showed that the Central Bank interventions in the foreign exchange market sales in the Czech Republic, Croatia, Hungary, Romania and Slovakia have reversed the trend appreciation in the short term and that combined measures of central bank foreign exchange interventions (communication between the central bank and agencies and interest rate changes) lead to a lower exchange rate appreciation trend even after 60 days (about 2 months), lower than in Romania's case highlighted by extending the series until 2012.

Regarding the labor income inflows it is noted that the influence, although small, is positive followed by a slight decrease with a barrier effect after 6 months, which show-importance of remittances from Romanians abroad on exchange rate developments.

Conclusions

The results show that due to the the opening of the Romanian economy, the exchange rate is still sensitive when it comes to shocks coming from capital inflows, internal demand and supply and the intensity of trade highlighted in large part of the volume of transactions in the foreign exchange market.

Currently, according to the dates, in Romania, the exchange rate channel is an important tool in taking over the national economy and international shocks. The loss of this channel by fixing the exchange rate of the European currency would make it difficult to accept such shocks to the labor market.

We can conclude that in Romania, the exchange rate channel is an important tool in taking shocks in national and international economy and the loss of this channel by fixing the exchange rate of the European currency would make it difficult to accept such shocks to the labor market and goods market.

Another important conclusions is that the exchange rate had an evolution that was within a band of ± 15%, (excepting a few months) which allows to determine the average exchange rate of the currency market and indicate a level of

equilibrium of the exchange rate, a conclusion supported by the study Anghel and others (2012). However, the massive depreciation of the national currency makes Romania not being able to fulfill the criterion on exchange rate stability as stipulated in the Maastricht criteria. The outputs of the fluctuation band during the international financial and economic crisis are justifying the decision to postpone the entry of Romania into eurozone.

Selective Bibliography

1. Alberola, Enrique şi Humberto Lopez, 2001, „Internal and External Exchange Rate Equilibrium in a Cointegration Framework. An Application to the Spanish Peseta", Spanish Economic Review 3, 23-40

2. Anghel L, Ciurila Nicoleta, Bojesteanu Elena, 2012, Rata de schimb de echilibru si factorii sai. Cazul Romaniei, Editura Economica, Bucuresti, 2012

3. Buldorini L., Makrydakis S., Thimann C., (2002), "The Effective Exchange Rates of the EURO", in Occasional Paper Series No.2, European Central Bank

4. Calvo G.A., Rodriguez A.C. 1997, Model of Exchange Rate Determination under Currency Substitution and Rational Expectations în The Journal of Political Economy, Vol. 85, No. 3 (Jun., 1977), pp. 617-626

5. Lucian Croitoru, 2009, Adoptarea euro nu poate fi fortata, Interviu acordat publicatiei „Business Standard", in data de 30 iunie 2009, in Interviuri, www.bnro.ro

6. R. Mac Donald si I. Marsh, Exchange Rate Modeling, Kluwer Academic Publishers, London, 1999

7. MacDonald, R. (2000) Exchange rate behavior: are fundamentals important? Economic Journal, Vol. 109 Issue 459, p. F673-F691.

8. Frankel, Jeffrey şi Andrew Rose, 1995, „Empirical Research on Nominal Exchange Rates", Capitolul 33 in G. Grossman si K. Rogoff, editori, „Handbook of International Economics", Vol. 3, Elsvier Science B.V.

9. Frenkel, J.A., 1976, A monetary approach to exchange rate, in The Scandinavian Journal of Economics, pp.200-221

10. Jula Dorin, Econometrie, 2007, „Cursul de Modelare Macroeconomica", INCE; IPE

11. Schularick, M. and Bialluch, L.C. (2005) Are the CEE-4 currencies fundamentally undervalued? Deutsche Bank Research