Simulation Model for Foreign Trade During the Crisis in Romania

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The paper proposes to analyze the evolution of foreign trade during the crisis in Romania. The evolution of foreign trade is analyzed using a simulation model. The period of analysis is 2006-2014. The data source is Eurostat and National Bank of Romania. Also, based on these data, we propose an econometric model which can be developed using different scenarios and forecasting of evolution of foreign trade. In period of economic recession, protectionist sentiments against imports competing with domestic products tend to rise. The same phenomenon was manifested in Romania. Thus, our study started from this consideration. Using econometric model we made scenarios predictions and the results are similar to the real values.

Keywords: balance of payments, financial crises, international trade, simulation
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1. Introduction

The analysis uses macroeconomic indicators of foreign trade: export (X), import(M), foreign debt (DE), annuity (SDE), direct foreign investment (ISD), current account balance (SCC), foreign exchange reserves (REZ), exchange rate (CURS) and GDP (PIB). First, the analysis establishes correlations between these variables. Based on these correlations we established main influences. We considered only those variables between the correlation was strong or medium intensity. Initial data were seasonally adjusted.

2. Methodology

The analysis is based on the theory of multiple linear regression.

It is therefore necessary to consider the influence of multiple factors, especially factors with significant influence on the characteristic investigated.

Dependence of resultative variable (Y) and factorial variables, $X_j,\ j=\overline{1,m}$ can be formalized as follows:

$$\boldsymbol{Y} = f(\boldsymbol{X}_1, \boldsymbol{X}_2, \ldots, \boldsymbol{X}_k) + \varepsilon \qquad (1)$$

This is the generic model of multifactorial regression.

Among these models, the linear model allows the easiest application, which makes it to be the most use features multiple regression model:

$$y_{x_1,x_2,\ldots x_k} = a_0 + a_1 \cdot x_1 + a_2 \cdot x_2 + \ldots + a_k \cdot x_k . \qquad [2]$$

Parameters $a_0, a_1, \ldots\ldots, a_k$ obtained similar linear regression unifactorial by the method of least squares, solving the system of normal equations:

$$\begin{cases} n \cdot a_0 + a_1 \cdot \sum x_{1i} + \ldots + a_1 \cdot \sum x_{1i} + \ldots + a_k \cdot \sum x_{ki} = \sum y_i \\ a_0 \cdot \sum x_{1i} + a_1 \cdot \sum x_{1i}^2 + \ldots + a_1 \cdot \sum x_{1i} \cdot x_{1i} + \ldots + a_k \cdot \sum x_{1i} \cdot x_{ki} = \sum x_{1i} \cdot y_i \\ a_0 \cdot \sum x_{2i} + a_1 \cdot \sum x_{1i} \cdot x_{2i} + \ldots + a_1 \cdot \sum x_{2i} \cdot x_{1i} + \ldots a_k \cdot \sum x_{2i} \cdot x_{ki} = \sum x_{2i} \cdot y_i \\ \ldots\ldots\ldots\ldots \\ a_0 \cdot \sum x_{ki} + a_1 \cdot \sum x_{1i} \cdot x_{ki} + \ldots + a_1 \cdot \sum x_{1i} \cdot x_{ki} + \ldots + a_k \cdot \sum x_{ki}^2 = \sum x_{ki} \cdot y_i . \end{cases}$$

[3]

Parameter a_0 - unregistered model captures the influence;

Parameters $a_1, a_2, \ldots\ldots, a_k$ Variables are associated slopes Xj and are called partial regression coefficients. They show how many units resultative variable changes when one variable Xj factor changes by one unit and the other independent variables are held constant.

The parameter values $a_0, a_1, \ldots\ldots, a_k$ obtained by solving the above system (system of k equations with k unknown) specific form of the function is determined by multiple regression and then investigated the theoretical values of the feature.

When applying multiple regression models, multicollinearity problem may occur, so factorial variables are in a strong mutual dependency, which induces problems in interpreting the multifactorial model.

3. The model

The first step of the analysis is to determine the correlation coefficients between the variables.

The correlation matrix is:

	PIB	*EXP*	*IMP*	*SCC*	*REZ.INT.*	*DE*	*SDE*	*ISD.NET*	*CURS*
PIB (mld.euro)	1								
EXP (mld.euro)	0,34	1							
IMP (mld.euro)	0,39	0,78	1						
SCC (mld.euro)	-0,40	0,54	0,11	1					
REZ.INT.(mld.euro)	0,27	0,85	0,50	0,57	1				
DE (mld.euro)	0,25	0,86	0,43	0,64	0,96	1			
SDE (mld.euro)	0,31	0,89	0,55	0,56	0,73	0,83	1		
ISD.NET (mld.euro)	0,39	-0,60	-0,26	-0,90	-0,68	-0,69	-0,53	1	
CURS (lei/euro)	0,20	0,80	0,31	0,68	0,89	0,97	0,83	-0,67	1

The main measurements are:

$$\begin{cases} REZ = f(X) \\ M = f(X) \\ DE = f(X, REZ) \\ ISD = f(SCC, REZ, DE, SDE) \\ CURS = f(DE, X, REZ, ISD) \\ PIB = f(X, M, SCC, ISD) \end{cases}$$

[4]

After determining regression equations we obtained:

$$\begin{cases} REZ = 11.154 + 2.205 * X \\ (Sig\ F = 1.54262E - 09) \\ M = 6{,}545 + 0.5625 * X \\ (Sig\ F = 2.35E - 07) \\ DE = -46.7012 + 1.33946 * X + 2.962 * REZ \\ (Sig\ F = 4.01E - 17) \\ SDE = 5.8226 + 0.20856 * DE + 1.143073 * X - 0.6671 * REZ \\ (sig\ F = 1.49E - 13) \\ ISD = 7.07264 - 0.4658 * SCC - 0.3328 * REZ + 0.0646 * DE + 0.0381 * SDE \\ (Sig\ F = 3.05E - 11) \\ CURS = 3.57 + 0.0346 * DE - 0.0432 * X - 0.0465 * REZ - 0.00065 * SDE + 0.00084 * ISD \\ (Sig\ F = 2.2907E - 20) \\ PIB = 7.4436 + 4.0532 * X - 1.7977 * M - 0.7169 * SCC + 1.507 * ISD \\ (Sig\ F = 4.08E - 07) \end{cases} \quad [5]$$

If Sig F is equal to or less than $\alpha = 0.05$, we decide to reject the null hypothesis. If Sig.F is greater than 0.05, decide acceptance the null hypothesis. In all our cases Sig f are smaller than $\alpha = 0.05$, which entitles us to reject the null hypothesis and accept that there is a significant relationship between mathematics and statistical performance.

4. Scenarios[4]

- first scenario is one in which intoduce as exogenous variable export. So, if X = 12.766 (the value of 2014Q2), the model gives us the following values: CURS=4.18; M=13.72; PIB=33.19; REZ=39.3; SCC=1.001; SDE=12.3. In all these cases, the error between the theoretical and real values is 5%. This result is another reason for accepting statistical model.
- following scenario is one in which the trade balance is zero. If X=M=12.766 (2014Q2) obtain PIB=35.07 and CURS=4.18.
- the third scenario is when the exchange rate is exogenous variable (CURS=4.5). In this case X=15.30; M=15.15; PIB=40,25 and SCC=1.004. This means that at an exchange rate of 4.5, the trade balance are about equal to zero, GDP increases and the current account balance is positive.

5. Conclusions

Our model is a tool for decision makers. We believe that based on this model can be established economic parameter values for foreign trade. For exemple, a higher exchange rate (4.5 lei/euro) means the trade balance is balanced. The model can be developed by introducing new variables. The model can take into account a much greater period of time. We recommend that the analysis be at the quarter given the seasonality of the phenomena studied.

[4] In developing the scenarios we used EUREKA program.

Reference

[1]. Andrei, Tudorel: *Statistică şi econometrie.* Bucureşti, Editura Economică, 2003
[2]. Andrei, Tudorel şi Stancu, Stelian: *Statistică – teorie şi aplicaţii.* Bucureşti, Editura All, 1995
[3]. Begu, Liviu-Stelian: *Statistică internaţională.* Ediţia a doua. Bucureşti, Editura ASE, 2004
[4]. Jaba, Elisabeta: *Statistică.* Ediţia a III-a revizuită şi adăugită. Bucureşti, Editura Economică, 2002
[5]. Jakobiak, François: *L' intelligence économique.* Paris, Éditions d'Organisation, 2004
[6]. Korka, Mihai, Begu, Liviu-Stelian şi Tuşa, Erika: *Bazele statisticii pentru economişti.* Două volume. Bucureşti, Editura Tribuna Economică, 2002
[7]. Korka, Mihai şi Tuşa, Erika: *Statistică pentru afaceri internaţionale – International Business Statistics.* Ediţia a doua. Bucureşti, Editura ASE, 2004
[8]. Mitruţ, Constantin, Şerban, Dana şi Mitruţ, Cristina-Andreea: *Statistics for Business Administration.* Bucureşti, Editura ASE, 2003
[9]. Newbold, Paul, Carlson, William L., Thorne, Betty: Statistics for Business and Economics. Ediţia a şasea. Pearson Prentice Hall, Pearson Education, Inc., 2007
[10]. Păun, Vasile: *Competitivitate prin informaţie.* Bucureşti, Editura Paideia, 2006
[11]. Tuşa, Erika: *Statistics for Economists.* Bucureşti, Editura ASE, 2005
[12]. Voineagu, Vergil, Furtună, Felix, Voineagu, Mariana-Elena, Ştefănescu, Codrin: *Analiza factorială a fenomenelor social-economice în profil teritorial.* Bucureşti, Editura Aramis, 2002

[13]. http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/
[14]. www.bnr.ro