

STOCHASTIC MODELING OF THE MACROECONOMIC AGGREGATES – STUDY CASE: ROMANIAN ECONOMIC RELATIONS

*Professor PhD Liviu-Stelian Begu, Academy of Economic Studies, Bucharest;
liviubegu@yahoo.co.uk*

*Lecturer PhD Alina Cretu, Academy of Economic Studies, Bucharest
Teaching Assistant PhD Student Adriana Alexandru, Academy of Economic Studies, Bucharest*

ABSTRACT: The paper is analyzing the main tendencies in the Romanian economy after 1990, trying to identify, which variables are influencing on long term the process of accession to EU. Statistical analysis, nonparametric tests, regression analysis and particularly analysis of the main (principal) factor, applied for a system of aggregate measures, can determine clusters of ex-communist countries and allows us to establish the gap between Romania and other ex-communist countries. The paper is also developing possible scenarios for the Romanian economy. The study case is about the evolution of the main economic indicators for external relations for Romania in 1996-2006. The evolution is based on balance of payments and the major economic aggregates. The results shows us that the Romanian economy is not yet in order but some indicators are very good for a market economy.

Keywords: factorial analysis, balance of payments, cluster of countries, external relations

JEL Codes: F19, L14

Introduction

International business environment tried to adopt and integrate Romania after 1990. Romanian evolutions after 1990 were a democratic one characterized by powerful economic, financial, political and social crisis. This paper aim is to suggest a coherent statistical aggregate measures system developed according to EUROSTAT whose purpose makes the Romanian economy changes evaluated and to compare them to the other candidate's changes.

Methods

This paper results are based on the factorial analysis, analysis of the main components, cluster analysis, stochastic relations modeling. The main method used, analysis of the main factor aimed to create clusters of ex communist countries using the system of measures according to EUROSTAT. Analysis of the main components is a technique used to reduce the size of the phenomenon. It allows the presentation according to axes called main components: linear restrictions o maximal variance of the initial variables. The main components are scaled according to the variance magnitude and are not correlated taken 2 by 2.

The steps of the methods are:

- Identifying the main components equivalent with identifying the following problem:

$$\begin{cases} \max_{A \in M_{(n \times n)}} \sigma^2(w_i) \\ SR : w = A^T \cdot x \end{cases}$$

It can be proved that the matrix A is the own vectors of the covariance matrix X

- Holding the directions with the largest variability
 - Reducing the initial variable space
- Applications of this method are the selection of the influence variable, obtaining aggregate measures and facilitating the graphical displaying.
- This paper is also using the statistical system of Indicators proposed by EUROSTAT.
- Applying this method we can classify the ex-communist countries according to the identified dependencies and their relative position compared to the EU. We can also obtain complex indicators used in order to characterize the macroeconomic evolutions. Primary indicators used have characterized: the monetary market, the real sector, the labor market, public finances, external sector, balance of payments indicators and life quality indicators.
- The system of indicators according to EUROSTAT used to compare the ex-communist countries' evolution was:
- Demographic indicators as population size by gender and age classes, living new born, deceases, child mortality, cause of decease, interregional migration
 - Macroeconomic accounts: Gross Added Value, salaries, investment level
 - Employment measures: occupied population, number of employees, population within the age of work, number of unemployed people, unemployed people per gender and age classes, overall unemployment rate and unemployment rate per gender, age classes, long term unemployment
 - Energy indicators: production level per sources of energy, electricity production per sources, gas production, coal production, gross capacity in function, oil refineries, electricity consumption per sectors
 - Agriculture: use of land, vegetal production, per surface and as total volume, animal production, milk production, labor force, gross added value in agriculture
 - Transportation: routes size, train route size, nb o vehicles, nb. Of passengers per transportation means, ships cargo, air transport, inter-regional flows of goods, river transport, accidents
 - Research and development: occupied population, expenditure level, licenses
 - Tourism: total number, places, tourists and number of nights for hotel accommodation, motels, hostels, camping, holiday houses, pensions
 - Industry
 - Dwellings: dwellings, equipments, finished dwellings

Main results

Primary indicators have been replaced by aggregated indicators, with a variance of 86.36% taken from the initial space, and well conditioned covariance matrix. The main components identified were: *the level of economic development, economic evolution and investment.*

The clusters of countries resulting from the analysis were:

- Poland
- Check Republic, Slovenia
- Latvia, Estonia, Lithuania
- Bulgaria, Slovakia
- Romania

We have also determined that the evolutions of the macroeconomic variables in Romania were influenced by factors expressing different politics to approach the transition and preparation process for the accession to EU. The main influence factors over the Romanian economic evolution were:

- till 1994: monetary measures did not really change the economy, in spite of the fact that Romania disposed of large amount of foreign funds left by the communist regime

- between 1994 and 1996 political factors have had a huge influence over the economic policies and the State budget supported and covered all the economic losses. The state owned banks were forced to finance extensive economic policies
- between 1997 and 1999 in spite of the severe reform measures the channel of macroeconomic losses were only partially closed. Important reforms were made: end of price liberalization, measures to increase the banking system efficiency, increase of the privatization rate and also the GDP reduction
- from the year 2000 the Romanian economy has started to prepare for the accession to EU by adopting a large part of the European AQUIS.

The data analyses, the elements and factors of influence for the accession and for the gap between the ex-communist countries show that the tendency of the main macroeconomic measures for Romania are slightly increasing in the last period inducing a small economic increase. If this increase will continue we hope to permanently diminish the difference between Romania and the ex-communist countries that have already acceded to EU.

Possible scenarios for Romania are:

1. if the average annual economic increase for Romania be small, around 4,5% supposing that the ex-communist countries already a part of EU will have constant growth rates eliminating the gap between Romania and Hungary would be impossible. Reaching Poland and Slovakia level will be possible in 29 and 16 years, respectively.

2. if the average annual economic increase will be in Romania at a medium level of around 6% supposing that the ex-communist countries already a part of EU will have constant growth rates eliminating the gap between Romania and Hungary would be possible in a century, reaching Slovakia level would be possible in 11 years

3. with an annual increase of 7% we could reach Hungary in 50 years, Poland and Slovakia in 9 years.

Study case

The analysis of the evolution of Romania's latest external economic relations has the purpose of completing the image of the economic state, as well as drawing a possible trajectory of hers. The study emphasizes the main transactions with the exterior, which are pointed out in the country's balance of payments.

First of all, we can determine the weight of every post in the total returns (PX) and the weight of every post in the total payments (PM) of the current account [1].

$$PX = \frac{x_j}{X} \cdot 100 \quad ; \quad PM = \frac{m_j}{M} \cdot 100. \quad [1] \quad \left| \right.$$

The post "goods and services" has the biggest weight in the current account, every year. This post represents the accomplished exports and imports that, thus the commercial balance. We can notice the bigger weight that the payments index has as opposed to the returns index, which shows the negative balance account of the commercial balance and implicitly of the current account.

Another indicator is **the contribution of a post to the general unbalance (Dj)**, which is calculated according to relation (the index can be used when both subtractions have the same sign)[2]:

$$D_j = \frac{X_j - m_j}{X - M} \cdot 100 = \frac{S_j}{S} \cdot 100. [2]$$

In this case, the index for the “goods and services” post is bigger than 100%, which means that this unbalance is partially counteracted by that of the transfers that has a sign counter to the balance account of the current account and has not been calculated.

By reporting the current account to the gross domestic product (GDP) we obtain another important index used for estimating the economic situation, after a time, **the weight of the balance account of the current account in the gross domestic product (PSCC)[3]** :

$$PSCC = \frac{X^{cc} - M^{cc}}{PIB} \cdot 100. [3]$$

We can notice that, outwards the year 1999, every year the index surpasses the -5% threshold, which can be a communication cord for the governmental decision-making factors. Anyway, there is a good side, in the sense that the index has known, in an absolute value, a decrease over the whole period.

If instead of the subtraction in the index above we totalized the accomplished exports and imports, we would obtain **the relative significance of international trade in goods and services (GDE)[4]** of a country, or the international “ventilation” of the gross domestic product of that country:

$$GDE = \frac{X + M}{PIB} \cdot 100 [4]$$

In regards to the evolution of this index, we can estimate that it is a positive one for the country, keeping in mind that the index shows the way in which foreign trade takes part in the accomplishment of the gross domestic product. The increase is significant in 2002, although we must not forget that the imports have had a more rapid evolution rather than the exports, which reduces the favorable signification of the index’s evolution. Also, the index shows that the destination for consumption of the gross domestic product has decreased internally.

The evolution in dynamics of the ratio between returns and payments is calculated with the help of **the index of the percentage coverage of payments by incomes (IGA)[5]** .

$$IGA = \frac{GA_1}{GA_0} = \frac{X_1}{M_1} \cdot \frac{X_0}{M_0} = \frac{X_1}{M_1} \cdot \frac{M_0}{X_0} = \frac{X_1}{X_0} \cdot \frac{M_0}{M_1} = \frac{I_{V0}^A}{I_{V0}^M}. [5]$$

The results shows us that the Romanian economy is not yet in order but some indicators are very good for a market economy. Also, the external economic relations of Romania could be better but there are private aspects in economy and this stop the external relations for the moment.

Bibliography:

1. Abdi, H., *Introduction a un traitement statistiques des donnees experimentale*, Grenoble, 1987
2. Armstrong, H. W., *Convergence among regions of European Union, 1950 – 1990*, in The Journal of RSAI, 74, 1995
3. Bartholew, D. J., *The foundations of factorial analysis*, Biometrika, 71, 1986

4. Begu, L.S., *International Statistics*, , Ed. ASE, Bucuresti, 2003;
5. Begu, L. S., *Statistics and software*, Ed. Clauet, 1999
6. Boudon, R., Lazarfled, P., *L'Analyse empiriques de la causalite*, Mouton, Paris, 1969
7. Harman, H. H., *Modern factorial Analysis*, University of Chicago Press, Chicago, 1967
8. Jollife, I. T., *Principal component analyses*, Springer, Berlin, 1986
9. * * * *System of National Accounts*, United Nations, 1993