ANALYSIS OF CONVERGENCE WITHIN THE EUROPEAN UNION – SIGMA AND BETA CONVERGENCE

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Real convergence study began with the development of neoclassical models of growth and especially with the passage of econometric applications of these models. In this paper we present applications of indicators and patterns of convergence on the example of European Union member countries and some current economic impact assessments on European convergence process. This analysis is based on the estimated σ- and β convergence and on Markov chains. The study deals with the economic convergence of the European countries and especially the convergence of the EU countries, including Romania. In the end of the study presents several economic scenarios for a faster and easier exit from the current crisis in Romania.

Keywords: real convergence, σ-convergence, β-convergence, Markov chains.

JEL Classification: F15, C13, C15

Introduction

The convergence is an essential objective of the integration process of Romania in the European Union, minimizing gaps in the level of development that arise between Romania and the average of European Union.

There are two types of convergences: the Beta (β) and Sigma (σ) Convergence. 'Sigma' convergence measures the dispersion of real GDP per capita (in constant prices) between regions or countries based on standard deviation of the cross-section series (Barro 1992). When the standard deviation is falling (rising) over time, the differences of GDP per capita between regions or countries in absolute terms gradually decrease (increase) and convergence (divergence) is approached. If standard deviation does not show any clear tendency but instead, increases or decreases successively, then a mixed process of convergence and divergence is realized. A different way of measuring the 'sigma' convergence is to use the coefficient of variation which results by dividing the standard deviation with the mean of the sample. The coefficient of variation is a measure of relative variability and is expressed usually, as percentage and not via the units of data in which is referred. If the coefficient of variation decreases over time we have convergence otherwise we have divergence.

The 'beta' convergence of the neo-classical approach is obtained by a regression analysis estimating the growth of GDP per capita over a certain period of time in relation to its initial level. If the regression coefficient 'beta' has negative sign indicates that GDP per capita of countries with lower initial GDP per capita grow more rapidly than this of countries with higher

initial GDP per capita. The neo-classical theory presents two types of convergence: unconditional and conditional (Sala-i-Martin 1996). When all regions (or countries) converge to the same terminal point (steady-state point) the convergence is calling unconditional. In such a case, having considered that the economies do not differ significantly in terms of variables like the investment level, coefficient β is estimated without introducing structural variables. On the contrary, when the economies have different structures, it is assumed that they converge to a different steady state point. In this case convergence is calling conditional and both the coefficient β and the structural variables (influencing the level of growth of GDP per capita) are introduced in the model. According to the neo-classical model the query of why poor regions (or countries) grow faster than rich regions (or countries) can be answered by the diminishing returns to capital explanation.
A Markov chain is a multistage experiment consisting of a sequence of trials in which the state, or outcome, of each trial depends on the state of the trial that immediately precedes it. The goal in a typical problem involving Markov chain is to compute the probability that the system will be in a particular state at a specified time.
For a Markov chain with *m* states, the transition matrix *P* is the *m x n* matrix in which the entry p_{ij} is the probability of going from state *i* to state *j* in one step.

Convergence sigma and beta
A commonly used indicator for measuring convergence is the variation coefficient on the level of GDP/capita, denoted by σ. This indicator is used to measure Sigma convergence. It can be used to evaluate the real convergence level by measuring the dispersion of GDP/capita over a one year period, using for this purpose cross series (countries and regions). In this case, the relevance of the convergence indicator appears only when making comparisons.
In our study, we have used this indicator to measure and predict the real convergence level for all EU countries, specifically the group of EU27. Data series refers to the 1998-2007 period. The considered indicator concerning the GDP/capita variation coefficient of the EU countries shows a decrease during the entire period analyzed, from 1.6353 to 1.4835, fact that indicates the tendency of increasing convergence of the economies of the mentioned countries.
Besides Sigma indicator, expressed by the variation coefficient or standard deviation, there were numerous concerns within econometric research, a significant place being occupied by the Beta parameter estimation and interpretation of growth regression equation.
Beta indicator's values are increasing throughout the period 1999-2007, compared to 1998: they range from 1,043 to 1,358. This means that if in 1998 the indicator's GDP / capita would have increased by 1 unit, in 2007 it would have reached values of 1,358 or higher.
From 1998 to 2007, the Gini-Struck coefficient has decreasing values ranging from 0, 3207 to 0, 2909, which reveals that the indicators distribution is a relatively uniform one on all 27 EU countries.

Markov chain
Total crossing matrix between 1998 and 2007 is presented in the following table. We used nine stages for indicator GDP/inhabitants [1100-9900); [9900-18700); [18700-27500); [27500-36300); [36300-45100); [45100-53900); [53900-62700); [62700-71500); [71500-80300). All data are expressed in Euros. Based on this matrix we calculated the matrix of probability.
Probability vector is:

[1100-9900)	**[9900-18700)**	**[18700-27500)**	**[27500-36300)**	**[36300-45100)**	**[45100-53900)**	**[53900-62700)**	**[62700-71500)**	**[71500-80300)**
23.42	21.43	36.37	14.15	2.83	1.15	0.47	0.05	0.10

The forecast based on probability vector for the next three years (2008-2010) is as follows:

[1100-9900)	[9900-18700)	[18700-27500)	[27500-36300)	[36300-45100)	[45100-53900)	[53900-62700)	[62700-71500)	[71500-80300)
23.42	21.43	36.37	14.15	2.83	1.15	0.47	0.05	0.10
22.42	19.83	35.83	16.50	3.23	1.24	0.53	0.06	0.21
20.54	16.99	34.71	21.08	4.27	1.36	0.60	0.08	0.37

We can say there are increases the probability for higher stages, for example the last stage [71500-80300) increase from 0.10% in 2008 to 0.37% in 2010 and on the other hand the first stage [1100-9900) decreases from 23.42% in 2008 to 20.54% in 2010.

Conclusion

This paper has reviewed a number of methods and instruments developed for the analysis of economic and/or social inequalities and that can be used for examining disparities among EU27 countries.

One objective of the paper was to produce an update analysis of the convergence process and Markov change among EU countries. Another was to show that instruments vary significantly in terms of their specificities and qualities and that it is therefore important to be aware of their limits when measuring the extent and evolution of countries disparities within the EU. These results also underline that the analysis of convergence is in fact complex.

Finally, even if the analysis of countries disparities is conducted thoroughly, it says little about the effectiveness of EU Cohesion Policy. It is necessary to proceed to further analysis, notably by controlling other variables likely to affect the convergence process, as a proper econometric analysis would do.

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