## TESTING CONVERGENCE AND DIVERGENCE AMONG EU MEMBER STATES

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#### Abstract

Convergence is considered to be a fundamental element of the current economic literature and at the same time of the macroeconomic system concentrating upon distribution of the revenues among states and upon the polarity and differences that characterize the modern economies. Relating convergence to economic growth is considered to be an extremely debated subject that determines a series of interpretations. The existence of convergence throughout the economies was tested in order to establish the validity of the modern theories of economic growth. Also testing the speed of convergence between different economies is regarded as a key indicator of the economic growth models. This study aims to investigate the current degree of convergence between different member states of European Union using different models and determine the main factors that conduct economies to converge or on the contrary to diverge one another and the channels used.

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#### 1. Introduction

An extremely debated subject among the recent macroeconomic theories is the one regarding the main arguments that raise the high interest of economists in analyzing the convergence process between different economies. In order to find a pertinent explanation for this phenomena one should take into consideration two important definitions of this controversial topic. The first one was developed by Barro<sup>1</sup>in his famous work:" The property regarding convergence is developed from the neoclassical models of economic growth. The economies that register less relative levels of capita/worker tend to register more increased growth rates or more increased return rates." A similar view is expressed by Malinvaud<sup>2</sup> in 1998: "States or regions with different levels of output/capita, developing in a stable environment and relaying on the same technology, should experience convergence tendencies: the dispersion in what concerns the output/capita should reduce over time and poor countries should grow faster than the rich ones".

#### 2. The concept of convergence

The concept of convergence is analyzed by many authors<sup>3</sup> from two points of view: as an *economic process* and also as a *statistic* one. As an economic process the concept of convergence is highly related to the issues, whether the process of economic growth of a certain economy register multiple steady states or in a stochastic context, multiple invariant measures. If we were to attribute a mathematical definition to the mentioned statement we could summarize it as follows:

### (1) $\lim_{k \to \infty} \mu(g_{i,t+k} S_{i,t}, \theta, \rho)$ does not depend on $S_{i,t}$ .

where  $g_{t,t}$  is considered the growth rate of an economy i at the time t,  $S_{t,t}$  denotes the levels of human and phisical capital,  $\theta$  is the element denoting technology,  $\rho$  is regarded as a symbol of the preferences and u is considered a probability measure.

In order to establish a connection between this equation and the economic growth models we could simplify it according to the following hypothesis: we consider population to be 1, there is no technological progress, the capital stock depreciation is 100% and the saving rate is constant. In these conditions the evolution of the capital stock for a certain economy can be determined as follows:

(2)  $k_{t+1} = sf(k_t)$ 

<sup>&</sup>lt;sup>1</sup> Barro, R., (1997), "Determinants of Economic Growth," Cambridge: MIT Press, p.2

<sup>&</sup>lt;sup>2</sup> Malinvaud, E., (1998), "Macroeconomic Theory, volume B: Economic Growth and Short- Run Equilibrium", Amsterdam: North Holland, p.776

<sup>&</sup>lt;sup>3</sup> See Durlauf Steven (2003)," *The Convergence Hypothesis After 10 Years*", available on: http://www.clmeconomia.jccm.es/pdfclm/durlauf\_i.pdf

In what concerns the second approach, and namely the statistic one, the first papers that concentrate upon this aspect were the ones developed by Barro (1991)<sup>4</sup>, Barro and Sala-i-Martin (1992)<sup>5</sup> and Mankiw, Romer, and Weil (1992)<sup>6</sup> that investigated the convergence process between different economies. These models analyzed the convergence process by using as a key point the relationship between the level of GDP/capita as a dependent variable and the initial level of GDP/capita, the technological progress, the population growth rate and the saving rate of human and physical capital as explanatory variables. Following this trend, the concept of convergence may be analyzed also by relating it to the business cycles convergence or to the consumer behavior convergence. For a more clearly understanding of the complexity of this concept and an objective approach consistent with the recent trends it is necessary to establish some criteria in order to be able to classify the most appealing theories regarding this aspect. Such a classification is proposed by Islam that distinguishes between the following dichotomies when it comes to convergence process:<sup>7</sup>

(a) Convergence within an economy vs. convergence across economies;

(b) Convergence in terms of growth rate vs. convergence in terms of income

level;

- (c) Sigma convergence vs. Beta convergence;
- (d) Unconditional (absolute) convergence vs. conditional convergence;
- (e) Global convergence vs. local or club-convergence;
- (f) Income-convergence vs. TFP (total factor productivity)-convergence;
- (g) Deterministic convergence vs. stochastic convergence.

<sup>&</sup>lt;sup>4</sup> Barro J. Robert, Sala-I-Martin Xavier, Blanchard Jean Olivier, Hall E. Robert (1991), " Convergence *Across States and Regions*", Brookings Papers on Economic Activity, No. 1, p. 107-182

<sup>&</sup>lt;sup>5</sup> Barro, R. J. and Sala-i-Martin, X. (1992), "*Convergence*", The Journal of Political Economy. 100 (2),p. 223-251

<sup>&</sup>lt;sup>6</sup> Mankiw, N. G. Romer D. and Weil, D. N. (1992), "A contribution to the Empirics of Economic Growth", Quarterly Journal of Economics. 107, p.407-437

<sup>&</sup>lt;sup>7</sup> Nazrul Islam (2003), " What have we learnt from the convergence debate", Journal of Economic Surveys, Vol. 17, No. 3

#### 3. From transition to economic growth

The process of transition of the economies represents a historical landmark, and its analysis is very complex due to the fact that implies not only changes in what concerns the economic structures, but even more important profound changes in what concerns the political and social relationships that are considered determinant factors regarding its multi-dimensionality aspect. If we were to appeal at a common concept that determines the experiences of different economies in achieving their primary objective, and namely the welfare of the population, that would be economic growth. It has been over two decades since the transition process began to gain power, first in Central Europe between 1989-1990 and later expanding to the east. If we were to analyze the average of growth rates of GDP/capita between 1992 and 2011the extreme values of this interval are registered in 1992 with a minimum value of -2% and in 2007 with a maximum value of 4,92%, the year before the trigger of the current economic crises in European Union. Even though the annual averages of GDP/capita are constantly decreasing, in 2011, only three countries registered negative trends in what concerns the analyzed indicator and namely Greece, Ireland and Portugal the rest of EU members, recording positive trends and values close to zero. The European Union is still in the catching-up phase of the values of growth rates registered before the recession. In what concerns the last semester in 2011 only Austria, Belgium, Germany, Malta, Poland, Slovakia and Sweden manage to counterbalance de loss of GDP/capita during 2008-2011. Greece did not manage to get out of the recession while Denmark, Italy, Ireland, Portugal, Slovenia and Spain manage to recover but only few percents of this mentioned indicator.8

	Year/Country	1992	2004	2007	2011
1	Austria	2	3	4	3
2	Belgium	2	3	3	2
3	Bulgaria	-7	7	6	2
4	Cyprus	9	4	5	0
5	Czech Republic	-1	5	7	2
6	Denmark	2	2	2	1
7	Estonia		6	7	8

Table no. 1- The growth of GDP/capita in EU member states

<sup>&</sup>lt;sup>8</sup> EEAG (2012), *"The EEAG Report on the European Economy"*, Macroeconomic Outlook, CESifo, Munich 2012, p. 17–55.

8	France	1	3	2	2
9	Greece	1	4	3	-7
10	Hungary	-3	5	0	2
11	Ireland		5	5	-1
12	Italy	1	2	2	0
13	Latvia	-32	9	10	5
14	Luxembourg	2	4	7	2
15	Malta	5	-1	4	2
16	Netherlands	2	2	7	1
17	Portugal	1	2	2	-2
18	Poland	3	5	7	4
19	Slovenia	-5	4	7	0
20	Slovakia	-7	5	10	3
21	Spain	1	3	3	1
22	Sweden	-1	4	3	4
23	Romania	-9	8	6	0
24	Finland	-3	4	5	3
25	Great Britain	0	3	3	1
26	Lithuania	-21	7	10	6
27	Germania	2	1	3	3
28	EU average	-2	4	4,92	1,74

<sup>So</sup>urce:http://books.google.ro/books?hl=ro&lr=&id=DfU15\_U1VcoC&oi=fnd&pg=PA3&dq=HAV RYLYSHYN+RECOVERY+AND+GROWTH+IN+TRANSITION&ots=\_g8xemZ9\_V&sig=YqN KO50mIyumzX4cz7UO9E2j6GA&redir\_esc=y

#### 4. Data and methodology

When it comes to study the degree of convergence between different economies, the question that raise the interest of the economiest and not only, is the one reffering to the period of time needed for an economy to converge towards the average of the group it is part of. This issues may also be applied to the analysis of the real convergence process for the new member states of European Union that joined this structure in 2004 and 2007 and are in the situation of having adopted euro or on the path of achieving this important goal. The first problem one may face when studing convergence across EU is the period of time needed for the new member states to approach the average level of GDP/capita of the European Union. Taking into consideration the initial level of GDP/capita ( $Y_2$ ) of every economy from EU12 and comparing it with the average level of EU27 ( $Y_{27}$ ) will try to estimate

using a deterministic approach, the period of time needed to equalise the metioned indicators. This harmonization in what concerns the level of GDP/capita will occur in a resonable period of time only in the situation where the new member states will register higher trends of growth rates  $(r_i)$  than the ones registerd by the entire member states of EU 27( $r_{E27}$ ). This phenoma is generally known as absolute convergence. This concept is not a knew one, and it has been used even in the famous neo-clasical growth model developed by Solow.<sup>9</sup> Empirical studies that have been elaborated much later, claim absolute convergence hypothesis only in some economies, namely between those one with similar characteristics or otherwise defined by a high degree of homogeneity, a concept known in the literature as convergence clubs.<sup>10</sup> The controversity upon this subject may be found in works like the one developed by Mankiw et al. (1992)<sup>11</sup>or Coulombe şi Day (1999)<sup>12</sup>. In order to estimare the time period nedeed to achieve convergence we start from two simple relationships used o express de GDP/capita at initial level and also using average growth rates, equation also used by Aurel Iancu, in his study entitled Real Convergence<sup>13</sup>:

$$Y_{tR} = Y_t (1+r_t)^t \tag{1}$$

$$Y_{tE} = Y_{UE} \left(1 + r_{UE}\right)^t \tag{2}$$

The process of achieving convergence is taking place in the moment when these two equation are becoming equal:

$$Y_{tR} = Y_t (1 + r_t)^{\epsilon} = Y_{tE} = Y_{UE} (1 + r_{UE})^{\epsilon}$$
(3)

After the logarithm of the terms we may determine the time period nedeed for an economy to achieve convergence in what concerns the GDP/capita as follows:

$$t = \frac{\log Y_{tE} - \log Y_{tR}}{\log(1 + r_t) - \log(1 + r_{27})}$$
(4)

 <sup>&</sup>lt;sup>9</sup> Solow, R. (1956), "A contribution to the theory of economic growth", Quarterly Journal of Economics
<sup>10</sup> Chatterji, M. (1992) "Convergence clubs and endogenous growth", Oxford Review of Economic Policy, 8(4), p. 57–69.

<sup>&</sup>lt;sup>11</sup> Ibidem 6.

<sup>&</sup>lt;sup>12</sup> Coulombe, S. and Day, K. M. (1999), "*Economic Growth and Regional Income Disparities in Canada and the Northern United States*", Canadian Public Policy. 25 (2), p.155-178.

<sup>&</sup>lt;sup>13</sup> Iancu Aurel (2009)- "Real convergence" National Institute of Economic Research, p.15-18

The source of the data included in the estimation is Worldbank. This source is also used for the average growth rates of GDP/capita of the new members states. All data are annualy and are between 2004-2012.

# 5. Estimating the time period for achieving convergence for the new EU members

Taking as starting point the presented formulas we will try to determine the number of years needeed for the new member states of EU and few of them already members of EMU to achieve the average of EU in what concerns GDP/capita.

PIB/CAPITA (constant 2005 international \$)	Value	PIB/CAPITA (constant 2005 international \$)	value	Average growth rates in EU (2004-2011)*
GDP/CAPITA initial EU (2004)	24600	GDP/CAPITA initial Romania (2004)	8965,47355	1,33 (%)
GDP/CAPITA initial EU (2004	24600	GDP/CAPITA initial Bulgaria (2004)	9170,45602	1,33 (%)
GDP/CAPITA initial EU (2004	24600	GDP/CAPITA initial Poland (2004)	13297,1393	1,33 (%)
GDP/CAPITA initial EU (2004	24600	GDP/CAPITA initial Hungary (2004)	16294,8365	1,33 (%)
GDP/CAPITA initial EU (2004)	24600	GDP/CAPITA initial Czech Republic 2004)	19958,0324	1,33 (%)
GDP/CAPITA initial EU (2004	24600	GDP/CAPITA initial Latvia (2004)	11727,7915	1,33 (%)
GDP/CAPITA initial EU (2004	24600	GDP/CAPITA initial Lithuania (2004)	13088,1042	1,33 (%)
GDP/CAPITA initial EU (2004	24600	GDP/CAPITA initial Slovakia(2004)	15178,3846	1,33 (%)
GDP/CAPITA initial EU (2004	24600	GDP/CAPITA initial Slovenia (2004)	22610,2203	1,33 (%)
GDP/CAPITA initial EU (2004	24600	GDP/CAPITA initial Estonia (2004)	15166,0975	1,33 (%)
GDP/CAPITA initial EU (2004	24600	GDP/CAPITA initial Malta (2004)	20405,1298	1,33 (%)
GDP/CAPITA initial EU (2004	24600	GDP/CAPITA initial Cyprus (2004)	24061,9144	1,33 (%)

Tabel no.2-	Evolution of GDP/ca	pita in EU and	the new member states

Source: Authors calculations based on World Bank data. Date of calculations 06.03.2013.

\* The average growth rates of GDP/capita during 2004-2011 at EU level

Country	The number of year t nedeed to achieve convergence for the new member states using different growth rates					
	R1	R2	R3	R4	R5	R6
Average rates**	2%	3%	4%	5%	6%	7%
Romania	153	62	39	28	22	19
Bulgaria	150	61	38	28	22	18
Poland	93	38	24	17	14	11
Hungary	62	25	16	11	9	8
Czech Republic	31	13	8	6	5	4
Latvia	112	45	28	21	16	14
Lithuania	95	39	24	18	14	12
Slovakia	73	30	19	14	11	9
Slovenia	13	5	3	2	2	2
Estonia	74	30	19	14	11	9
Malta	28	11	7	5	4	3
Cyprus	3	2	0,8 months	0,6 months	0,4 months	0,4 months

Tabel no.3- Estimating the number of year t nedded to achieve convergence for the new member states using different growth rates

Source: Authors calculations based on World Bank data. Date of calculations 06.03.2013.

\*\* For the six growth rates (2%,3%,4%,5%,6%,7%) for the new members states they are between the range of 2004-2011.

The results differ considering the research method used to estimate the annual growth rates. The literature in the field uses a multitude of models in order to analyze the impact of adherence to the EU upon the speed of convergence within emerging economies.<sup>14</sup> Analyzing the obtained data we may admit that at an average growth rate of 2%/year the country that would achieve most rapidly the optimal level of convergence of EU, supposing that it would maintain its growth rate at a level of 1,33%/year would be Cyprus in a period of 3 years, followed by Slovenia in 13 years and Malta in 28 years. At the opposite pole taking into consideration the same growth rates would be Romania and Bulgaria regarding the alignment in what concerns the GDP/capita with a period of time ranging between 153 years and 150 years from achieving EU average. Based upon the same rationing at an

<sup>&</sup>lt;sup>14</sup> Quah Danny, (1993)," *Empirical Cross-Section Dynamics in the Economic Growth*," European Economic Review, 37, p.426–434.

average growth rate of 7%/year for the new member states and maintaining the same range for the EU at a level of 1,33%/year, the differences in what concerns the number of years needed to achieve convergence would reduce dramatically for all the states. In this case Cyprus, Slovenia, Malta or Estonia will maintain their leading positions with small intervals ranging between 4 months for Cyprus to 9 years for Estonia. Romania along with Bulgaria are still at the back of the list with 19 and 18 years needed to achieve GDP/capita convergence.

#### 5. Conclusions

Last accession rounds from 2004 with 10 new states and 2007 with other two ones, were only the first step towards ensuring a sustenable convergence across economies. In order to achieve this goal the mentioned economies will have to pay more attention to the macroeconomic indicators, namely the ones required by the Maastricht criteria but even more importantly to the ones relating to the real convergence namely the level of GDP/capita, openess of the economy or structure of industry by sectors. Secondly these states, unlike their predecessors will have to face the effects of the recent economic crises that modified the structure of the economies across all the world. Furtheremore, in order to achieve convergence and in the end economic growth, economies should direct their strategies towards innovation and competivness considered the engines of the growth process.

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