Convergence examinations in the European Union

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Abstract

In this paper I examine the issue of convergence and divergence within the enlarged European Union both at national and regional level in the aspect of the GDP per capita (PPS). My objective is to find and point out evidence on sigma- and beta-convergence in an empirical way among the member states and regions under the period of 1995-2006. Using descriptive statistic methods in my examinations I prove the sigma- and absolute beta-convergence hypothesis, which were coined by Barro and Sala-i-Martin and refer to the negative correlation between the initial levels of real GDP per capita and its average yearly growth rate without conditioning. Those countries with lower GDP per capita perform higher growth rate than those countries with the higher one, just because they are poorer. Although the dispersion in income is higher at regional level because of the territorial disparities the standard deviation is lower. Despite of it the convergence is much more conspicouos at national level, certainly.

Key words: convergence, divergence, regional growth, European Union, disparities

JEL Classification: R11

1. Introduction

The European Integration is one of the most successful, operating and competitive regional integration being sustained for a long time. Today's EU, with 27 Member States and a population of close to 500 million people, is much safer, more prosperous, stronger and more influential than the original European Economic Community of 50 years ago, with its 6 members and population of less than 200 million. Now, the EU, a community of values based on peace and freedom, democracy and the rule of law, as well as tolerance and solidarity is the world's largest economic zone. The wider internal market and new economic opportunities have increased Europeans' prosperity and competitiveness. Due to the effects of enlargements and across its proceeds the relatively homogenic Union has became more heterogenic as regards the economy. Differences in income, yield and stage of development have increased and became more significant.

Europe does not show a single view as far as its economies are concerned:

- Developed welfare countries and their societies *(traditionally West-Europe, euro area)*
- Cohesion, so called *„catching-up"* countries *(earlier the mediterranean countries, then the eastern-central European countries respectively, the EU-10))*
- The most backward countries as regards the development *(Bulgaria, Romania, the candidate countries and the potential candidate countries respectively and those country groups enjoying the EU membership perspective: West-Balkan, post-soviet area)*

Thus the differences in development within the enlarged Union are significant *(particularly after the enlargements in 2004 and 2007).* Only Cyper's and Slovenia's GDP per capita excesses the 90% of the whole union average among the new member states, the values of other eastern-central European countries, Bulgaria, Romania and Portugalia *(of the „old" member states)* are below that.

Table 1: GDP per capita (PPS) frequencies in the EU-27

Income categories	1995		2006		Average (1995-2006)	
	EU-10 + BG, RO	EU-15	EU-10 + BG, RO	EU-15	EU-10 + BG, RO	EU-15
y<=10000	8	0	2	0	6	0
10000<y<=20000	4	14	8	1	6	3
20000<y<=30000	0	1	2	11	0	11
30000<y<=40000	0	0	0	2	0	0
40000<y	0	0	0	1	0	1
∑	27		27		27	

Source: Author's calculations based on Eurostat.

According to data of Eurostat about the GDP per capita in Purchasing Power Standard *(EU-27 = 100):*

- None of the new member sates reaches and excesses the average of the EU-27, only Poland and Latvia odd half of it, the previous with 53,6%, the latter with 57,8%. Compared to the year of accession this value remained constant in Cyper, in Slovenia it has increased up to 5%. In 2004 Latvia performs 45,7% of the average, Lithuania 50,5% and Poland 50,6%. The biggest average change can be shown in the Balticum area (13%) and in Slovakia compared to the average of the EU-27. Only in Hungary and Malta can be observed decrease.
- Due to the enlargement in 2007 Bulgaria and Romania became the most underdeveloped countries of the EU-27. Bulgaria reaches only 38% of the EU average, Romania 40,5%, while Luxemburg remains the most developed country with 276,7%, unchanged. Thereby the difference in income and development in case of Bulgaria is more than sevenfold, in case of Romania it is almost as many.

Table 2: GDP per capita (PPS) frequencies in the EU-27 at NUTS II level

Income categories	1995		2006		Average (1995-2006)	
	EU-10 + BG, RO	EU-15	EU-10 + BG, RO	EU-15	EU-10 + BG, RO	EU-15
y<=10000	41	11	21	0	37	0
10000<y<=20000	7	170	28	46	16	103
20000<y<=30000	0	26	3	137	2	101
30000<y<=40000	0	3	2	31	0	10
40000<y	0	1	0	6	0	3
∑	258		274		272	

Source: Author's calculations based on Eurostat.

At regional level *(NUTS II)* disparities in state of development occur more significant: the 28 least developed regions of the EU *(below 50% of the EU average of GDP per capita)* consists of those eastern-central European countries that became members of the EU in 2004. In addition by the accession of Bulgaria and Romania this means around 15% of the whole NUTS II regions of the EU in 2007. The least developed region is Nord-Est (Romania) with

its GDP per capita; reaches only one quarter of the EU average *(24,2%, 5430 euro),* while in the most developed region it is more than triple of the average *(302,7%, 67798 euro),* the difference is more than tenfold; at current prices counted it is thirty-fivefold {1}.

2. Literature review

For the last 50 years there has been widespread discussion about the economic consequences of the European integration. The basic questions are: is economic integration growth enhancing? Are the rich getting richer and the poor getting poorer, or will the income levels of the EU member countries converge as a consequence of integration {2}. The literature differentiates *'exogenous and endogenous growth model'*. From the late 1950s to the mid-1980s the simple Solow-Swan *'exogenous growth model'* dominated the literature {3}. According to the neoclassical theory, the economy converges towards a *'steady state'* due to diminishing returns to investment in psychal capital. In a competitive environment, regional labour and capital mobility leads to factor price convergence and thus also to the convergence of regions within a country. Assuming a constant population, the long-run growth rate is solely determined by the rate of technological change, which is assumed to be exogenous. As the growth rate is therefore independant of any economic behaviour, economic policy changes will only have a temporary effect on economic activity. According to the neoclassical growth theory, the European integration should not have a lasting effect on growth rates. However, the income levels should converge perfectly. In the 1980s the so called *'endogenous growth theory'* revolutionized the literature on economic growth. According to that theory technology that was formerly considered to be a public good and exogenous now became endogenous. Romer's concept {4} is that enterprises have an incentive to invest in research, as the development of new technologies assures them of the posession of temporary monopoly power. In the 1990s began spreading those views and studies which deal with the regional dimensions of economic growth comparing the EU member states with those developed countries similar to it. According to Vanhoudt[1] {5} regional integration has no impact on long-term growth rate, against the alternative model based on endogenous growth theory. He did not find evidence of a significant long-run growth rate associated either with EU membership or with length of membership. Henrekson[2] {6} found opposite of it. Williamson[3] {7} claims that national development creates increasing regional disparities in the early stages of development, while later on, development leads to regional convergence. Those effects that cause disparities can be neutralised by external intervention.

Although convergence and catching-up are synonymous concepts, do not mean one and the same. According to Halmai {8} both are defined as concepts with negative sign, catching-up means the distance needed to carry out, convergence in turn expresses the extent of the progress. So catching-up means process while convergence the velocity of it. Consequently in case of narrower residual deviation will be bigger the extent of catching-up while increase in

[1] He carried out panel data regressions on 23 OECD countries to check whether EU membership had a positive effect on growth compared to developed countries which have not joined the EU.

[2] His results support the hypothesis that regional integration in Europe can have significant growth effects and suggest that further regional integration my be growth enhancing in the long-run.

[3] This main argument behind Williamson's finding is that in a catching-up country there are a few growth pole regions in which capital and skilled workers are concentrated. As a consequence of a faster rise in productivity, growth accelerates in these regions, which leads to increasing regional disparities. At later stages, as higher factor costs or diseconomies of agglomeration emerge in the growth pole regions, capital is likely to move to other regions with lower capital per worker. This, together with knowledge spillover effects, may enhance the reallocation of productive factors across sectors and regions, which leads to spatial convergence.

reducing the difference it will be lower. The literature differentiates nominal *(price-, interest level)*, real *(GDP per capita, productivity)* and structural *(e.g. employees in industry sector)* convergence.

According to the literature three types of convergence are basically differentiated within the concept of real convergence {9}; {10}:

- **Sigma-convergence** :
  - compares differences in development between two dates
  - the dispersion of values *(standard deviation)* of the examined variable *(GDP per capita)* decreases around the average value by time
  - its disadvantage that the st. deviation may decrease then if values -originally near to the average- get even nearer to it while those values most far from the average remain unchanged
  - the econometric form of σ-convergence:

$$s_t = \sqrt{\sum_{i=1}^{197}\left(\frac{Y_{it}}{Y_t}\cdot 100 - 100\right)^2 \frac{P_{it}}{P_t}} \qquad (1)$$

- **absolute (or unconditional) beta-convergence**:
  - dynamic method which examines growth rates
  - the whole income *(GDP per capita)* values converge to the same steady state
  - because in those countries and/or regions with lower income level growth rate is much faster than in those countries with the higher one
  - the examined territorial units differ only in the initial capital stock and income level
  - the econometric form of absolute β-convergence:

$$\log(y_{i,t}) = \alpha + (1-\beta)\cdot \log(y_{i,t-1}) + \mu_{i,t} \qquad (2)$$

- **conditional beta-convergence**:
  - the economy of all regions converges to an own state value
  - however, there is not an identical, common equalised state value for all of the regions
  - allows equalisation within and divergence across the regions
  - the econometric form of conditional beta-convergence:

$$\left(\frac{1}{t}\right)\log[y(t)/y(0)] = c - (1-e^{-\beta t})/t \cdot \log\ y(0) + S\gamma + u(t) \qquad (3)$$

$$\begin{array}{c} \sigma\text{-convergence} \Rightarrow f(\beta\text{-convergence}) \\ \beta\text{-convergence} \not\Rightarrow f(\sigma\text{-convergence}) \end{array} \qquad (4)$$

For the existence of sigma-convergence beta-convergence is a necessary *(but not sufficient)* condition, but beta-convergence can be even without sigma-convergence *(the less developed territorial units grow faster than the more advanced, but the differences still remain among income levels).*

3. Convergence examinations[4]

My assumption is that those countries and/or regions with relatively lower GDP per capita produce relatively higher growth rate than those with the higher one and vica versa. Thus they gradually *'catch-up'* with the developed countries and/or regions of the EU. Basing on the term *'ß-convergence'* which was coined by Barro and Sala-i-Martin, they assessed that *'ß-convergence'* refers to the negative correlation between the initial levels of real GDP per capita and its average yearly growth rate either after conditioning for certain control variables or without conditioning. They introduce the complementary concept of *'σ-convergence'* which refers to the decrease of the dipersion of real GDP per capita across economic units through time {10}.

The econometric form of Barro and Sala-i-Martin's neoclassical β-convergence:

$$\frac{1}{T}\ln\frac{(Y_{i,t})}{(Y_{i,t-T})} = \alpha + \ln Y_{i,t-T}\frac{(1 - e\beta t)}{T} + \varepsilon i,t - T \qquad (5)$$

3.1. Sigma-convergence examination:

Using descriptive statistics *(mean, standard deviation, relative st. deviation, covariance etc.)* I give an attempt to point out σ-convergence *(according to the neoclassical theory).*

$$\sigma = \sqrt{\frac{1}{n}\sum_{j=1}^{k} f_j (x_j - \bar{x})^2}$$

$$V = \frac{\sigma}{\bar{x}} \qquad (6)$$

[4] This study is confined to the examination of the sigma- and absolut beta-convergence within the concept of real convergence.

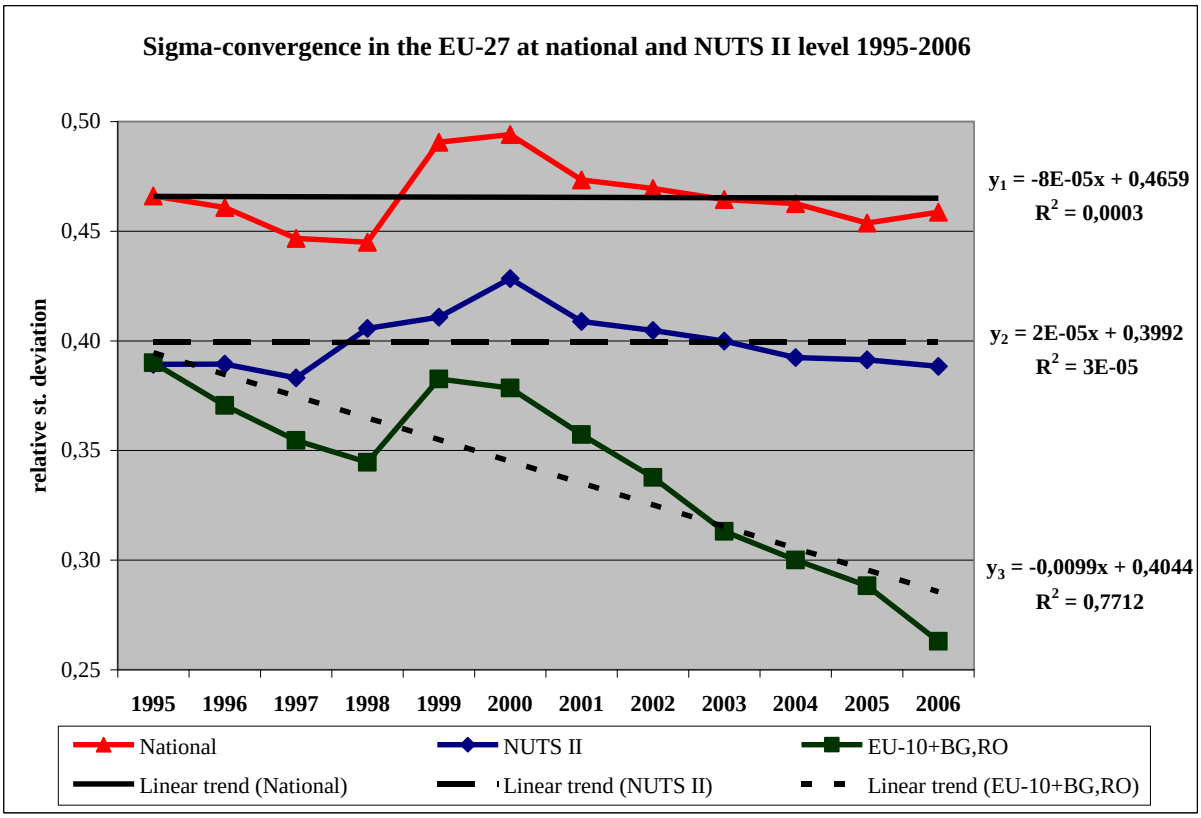

Chart 1

Source: Author's calculations based on Eurostat.

Under the period of 1995-2006 we can see the evidence of σ-convergence both at national and regional level two times and also divergence at one time: between 1995-1997 and 1998 a fall of dispersion in incomes and then after 2000 up to 2005 and 2006. From 1998 to 2000 inequalities in income have markedly grown among the nations and regions with a peak in 2000. Only afterwards can be observed a remarkable jump to the initial level of st. deviation. According to the linear trend the relative st. deviation shows stagnant values in both cases. Before drawing any far-reaching conclusions, exogen and other key factors also have to be taken into account that might have had influence on growth and development like conjunctural cycles, trends in the worldmarket and –economy or the pre-accession funds and instruments before 2004 for the eastern-central-european countries and their net beneficiary position after that even as the domestic economy and the effects of economic policies. Nevertheless the higher the inequalities in income at regional level are the lower are the values of the relative st. deviation. Because of the low value of the determination coefficient the results can be tackled with conditions. Also have to be mentioned that solely within the new member states can be observed notable decrease of dispersion in income *(from the initial value of 0,39 down to 0,26)* with a significant determination coefficient *(R^2 = 0,7712)*.

3.2. Beta-convergence examination:

In order to define ß-convergence have to count the whole annual change in GDP *(geometrical mean; $\sum x_G$)* then correlate it with the initial GDP per capita *(PPS)* value.

$$\bar{x}_G = \sqrt[n]{\prod_{j=1}^{k} x_j^{f_j}} \tag{7}$$

$$r = \frac{C_{xy}}{\sigma_x \sigma_y} = \frac{\sum d_x d_y}{\sqrt{\Sigma d_x^2 \Sigma d_y^2}} \tag{8}$$

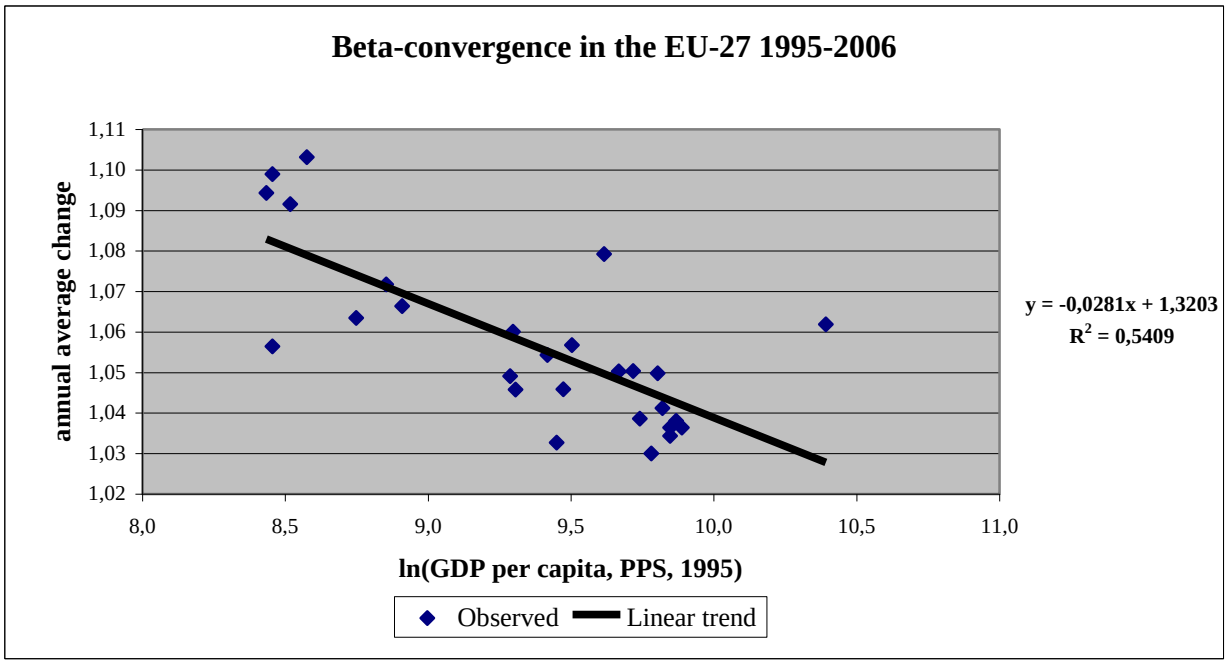

Chart 2

Source: Author's calculations based on Eurostat.

The existence of β-convergence can be proved at national level under the period of 1995-2006. As σ-convergence was pointed out and proved both at national and regional level we assumpt that β-convergence can also be observed as neccessary condition for the existence of σ-convergence according to the neoclassical theory. Thus the lower the GDP per capita is at the early stage the higher is the annual growth rate adequately and vica versa, respectively. The value of the correlation coefficient refers to a strong relationship between the two factors *(r = -0,7354)*. Because of the relatively low values of the determination coefficient the given results can be tackled carefully.

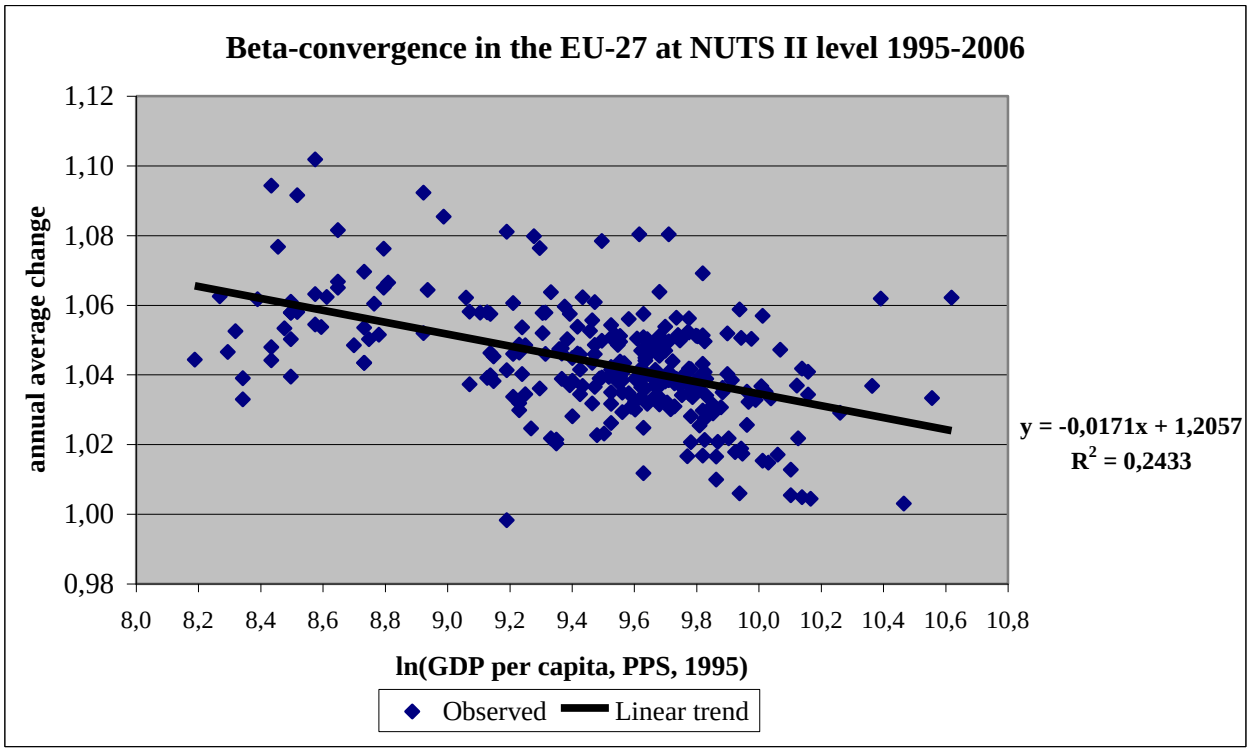

Chart 3

Source: Author's calculations based on Eurostat.

In case of regional level β-convergence can also be evinced but not in that extent like at national level. The cause behind it is probably the high value of dispersion in income levels and the fact that most of the observed phaenomena do not concentrate around the mean. The relatively low value of the correlation coefficient *(r = -0,4476)* and determination coefficient also allow us to draw that conclusion that the existence of β-convergence can not be accepted unconditionally. So in this aspect we can assess that the evidence of β-convergence is not properly significant at regional level contrary to the national level but the negative sign refers to the existence of it.

4. Conclusions

In this study my main objective was to give an overview about the concepts of convergence and catch-up process *(according to the neoclassical theory)* in theoretically and empirical way in the enlarged European Union both at national and regional level. One of the main conlusions is that the convergence and/or *„catch-up"* process do not come forward automatically and occur in the aspects of spatial and time. Using descriptive statistic methods my objective was to evince the existence of σ- and β-convergence under the period of 1995-2006 in the examined territorial units. I carried out that both σ- and β-convergence can be observed but in different extents. At national level predominates β-convergence rather than at regional level as regards its extent. The cause of it can be properly that across the regions the differences in income levels have grown by time despite the decrease in relative st. deviation of income levels within the regions. Also have to keep in mind that the given results can not be accepted without conditions and reflect only one factor *(GDP per capita, PPS)*. In reality -

as it mentioned- many factors have influence on growth and development of an economy. However, this study can be the base and/or subject of further research.

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