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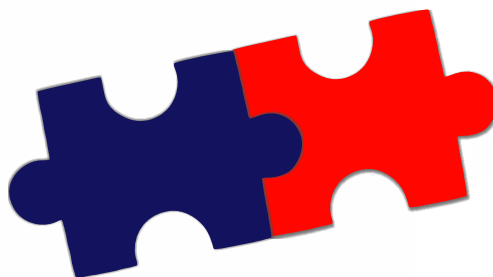**Years of the European**
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National Disparities in the European Union: Convergence or Divergence?

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Abstract

Deepening in the European Union (EU) integration process has enhanced the question of economic disparities at all levels. There is a profound differentiation among the EU member states in terms of economic development (the share of the five richest EU countries accounted for 67.7 per cent of total GDP, 61 per cent of all export volume, as well as 58.3 per cent of all inward FDI stock). The disparities among 276 NUTS-2 regions are much higher. In this paper we test the hypotheses of sigma, beta and club convergence presence using the official World Bank data for 2004-2014. The assessment has been based on min-max ratio, quartile and percentile ratio, coefficient of variation as well as Gini index. The goal of the paper is to assess the convergence within the EU, as well as within the EU and six EU-candidate countries. We pose significant problems for the theoretical assumptions of further integration process deepening especially at the expense of less developed Serbia, Montenegro, Macedonia, Turkey or even much poorer countries of the Eastern Partnership.

Keywords: European Union, Uneven Development, Convergence, Cross-country Growth

JEL Classification: O11, O47, F15, F47, E60

1. Introduction

Sustainability is particularly important in the development of integration associations, which suggests stability, the achievement of set goals, the ability to implement its commitments to the countries, creditors, population. Uneven development leads to the fact that the integration of the country, not only can overcome the action of the general laws of development of the world economy, but, on the contrary, fully obey them, which makes the group unstable.

So far, economic theory does not give a clear answer to these questions: How integration affects the dynamics of regional disparities and, on the other hand, how regional disparities affect the dynamics of integration? Theorists are divided into those who believe that integration enhances inter-regional and cross-country differences and support the theory of divergence, and those who believe that integration reduces these differences. Integration largely stimulates the problem of uneven development, but it is not the key to solving it. What they get for the integration association depends on the countries themselves – will they be a financial burden or the locomotive of development.

At the present stage of development of the European Union there is a profound differentiation among the member countries in socio-economic development. In terms of GDP per capita at

PPP, the leading countries and loosing countries differ in 5.6 times, the volume of exports per capita – in 54 times, the unemployment rate – in 5.29 times, the level of inward FDI per capita stock – in 220.9 times. Such unevenness inevitably leads to the formation of pockets of poverty, quality of human development decrease, the preservation of a significant level of unemployment, the growth of inter-regional conflicts, exacerbate social tensions. Avoiding excessive differentiation of the EU member countries in terms of socio-economic development, the maintenance of the necessary territorial and structural proportions in the economy are a condition for sustainable development of Europe.

The issue of uneven development has been actively studied by the means of different techniques: simple statistical approach, regression analysis (with cross-section and panel data), time series analysis etc. Kyjonková (2014) dealt with factors of economic development of regions in Central Europe and compared NUTS 2 regions by GDP per capita. Kulhánek (2014) using sigma and beta convergence stated that the EU-New member countries had converged to the EU-15 average. Burian and Brčák (2014) assessed the character of the convergence process in the European Union during the period 2002-2012 using cluster analysis and claimed that there was no permanent significant club convergence process in the EU. Battisti and Di Vaio (2008) applied a mixture regression approach to the β-convergence model for the EU-25 regions and concluded that excluding a small number of regions that behaved as outliers, only a few regions had shown an appreciable rate of convergence. The contradictory results may be explained by Kurt and Andreas (2008) who believe that the reduction of the income gap is a phenomenon among the nations, and not between regions within the EU. They considered whether there was a duplication of regional development trends in the EU: general convergence on the one hand, and spatial concentration (agglomeration), on the other, using a non-parametric analysis of the regional distribution of per capita income and regression analysis of regional differences in income for 1980-2000.

The EU controls have been active in the development of regional strategies for socio-economic development. However, non-uniformity in the development of the member countries continues to grow, and the problems of formation and implementation of regional development policies remain insufficiently studied in science and developed in practice.

2. Model and Data

The academic literature has suggested a number of different approaches to test the presence of convergence, ranging from simple statistical methods (assessment of the dynamics of the standard deviation) to the use of sophisticated econometric models. We test the presence of σ-convergence и absolute β-convergence between European countries (EU-28) after the widest enlargement of European Union in 2004. Our analysis is based on the World Bank data. The period covered is 2004-2014. The dependent variable is GDP per capita at PPP (constant 2011 international dollars).

The concept of σ-convergence assumes that income differentiation between economies (countries, regions, metropolitan areas) decreases over time. Sala-i-Matin (1996) measures the cross-sectional dispersion of income (σ) by sample variance of the log of income y_{it}

$$\sigma^2 = \frac{1}{N} \sum_{i=1}^{N} \left[\log(y_{it}) - \mu_t \right]^2 , \qquad (1)$$

where N is the number of countries, μ is the sample mean of $\log(y_{it})$.

In our analysis we use coefficient of variation which is given by:

$$CV = \sigma / \bar{y}, \tag{2}$$

Where σ is standard deviation of income and $\bar{y}$ is a mean income.

The σ-convergence takes place when the dispersion of real per capita income declines over time. The β-convergence means that less developed countries (with lower GDP per capita) tend to grow faster than more developed countries (with higher GDP per capita). We analyze β-convergence among EU-28 economies using ordinary least squares regression based on panel data (yearly GDP growth rates vs. GDP levels from the preceding year) as well as cross-sectional data (average annual GDP growth rates vs. GDP levels from the beginning of the period).

In the case of panel data, we use the specification from Vojinovic and Prochniak (2009):

$$\log y_{i,t} - \log y_{i,t-1} = \alpha + \beta \log y_{i,t-1} + \varepsilon_{i,t}, \tag{3}$$

where $\log y_{i,t}$ is the natural logarithm of GDP per capita at PPP in country i at time t, α is a constant and ε is the error term.

In the case of the cross-sectional data, we estimate regression equations of the form:

$$\log \sqrt[T]{\prod_{t=0}^{T} \frac{y_t}{y_{t-1}}} \times 100 = \alpha + \beta \log y_{t_0}, \tag{4}$$

where $\log y_0$ is the natural logarithm of GDP per capita at PPP in country i in the first year of the period, and T indicates the length of the period. Convergence occurs when $\beta < 0$, indicating that higher initial income level negatively affects the consequent growth rate. We analyze β-convergence for 2004-2014. Although different, the two concepts of convergence are related (Sala-i-Martin, 1996).

3. Results and Discussion

We need to identify the main statistical characteristics of GDP per capita at PPP levels in the EU countries, expressed in US dollars. The Table 1 shows main statistical indicators for 1995-2014 and includes the evolution of Gini index as well as σ-convergence coefficients, calculated as coefficients of variation for the respective data. The calculation is performed in two versions, when calculation includes Luxemburg (EU-28) and when not (EU-27). Luxemburg is the wealthiest country in the EU with GDP per capita more than twice as high as the mean income, therefore its inclusion may bring misleading results.

It can be seen that the EU maximum GDP per capita of Luxemburg or Netherlands has much lower growth, although the dynamics of a spasmodic character. The EU minimum GDP per capita of Bulgaria has risen to a much higher extent both for 1995-2014 and 2004-2014. Moreover, the data show much higher GDP per capita growth rates for new members of the EU from Central and Eastern Europe. Meanwhile the detailed analysis shows that during the financial crisis of 2008-2010 there was σ-divergence due to a sharp decline of GDP per capita in poor countries of Southern and Eastern Europe (Greece, Cyprus, Lithuania and Estonia). The evolution of Gini index confirmed the decrease of inequalities in GDP per capita in the EU between years 1995-2014.

Table 1: GDP per Capita at PPP (Constant 2011 International Dollars)

Country	1995	2000	2005	2008	2010	2014
Austria	33545	38623	40954	44037	42965	43908
Belgium	32361	36901	39495	41260	40606	40823
Bulgaria	8435	8946	12531	15720	15262	16363
Croatia	12543	15644	19420	21873	19989	20033
Cyprus	26445	30005	33592	35828	33747	29673
Czech Republic	19093	21003	25571	29128	28111	28715
Denmark	36670	41693	43919	45017	42997	42758
Estonia	11069	15298	22219	25300	22199	26612
Finland	27303	34517	38700	42122	39425	38535
France	30823	34773	36393	37502	36742	37214
Germany	33850	36979	37924	41229	40665	43602
Greece	21495	25111	29821	32158	29175	24372
Hungary	15137	17766	22190	23440	22150	23735
Ireland	26002	39837	47099	47908	44684	48431
Italy	32731	36073	37130	37475	35753	33039
Latvia	8146	10991	17235	21021	17983	22076
Lithuania	9229	12023	18273	23245	20782	25813
Luxembourg	64018	80732	87590	94197	90791	91408
Malta	20720	25841	25510	27872	27906	28822
Netherlands	35006	42013	43811	47463	45843	45691
Poland	11150	14640	16987	20117	21457	23976
Portugal	21975	26147	26744	27747	27393	26184
Romania	10272	10250	14275	18558	17355	19098
Slovak Republic	12876	15242	19490	24729	24504	26471
Slovenia	18245	22494	26683	30823	28388	28153
Spain	25630	30630	33377	34657	32976	31802
Sweden	31044	36816	41184	43421	42898	44034
United Kingdom	28513	32898	36851	37751	36164	38178
SD	12171	14805	14845	15021	14641	14434
Mean	23726	28353	31963	34700	33175	33911
EU average	26928	30276	32909	35053	34031	34771
CV	0.51	0.52	0.46	0.43	0.44	0.43
CV (EU-27)	0.42	0.41	0.34	0.27	0.30	0.29
Gini	0.2686	0.2660	0.2302	0.2071	0.2120	0.2011
Max/Min	7.85	9.02	6.99	5.99	5.95	5.59
Max/Min (EU-27)	4.50	4.70	3.76	3.05	3.00	2.96
Albania	3898	5165	7046	8643	9373	10136
Macedonia, FYR	7752	8712	9460	11102	11394	12287
Serbia	7167	7740	10568	12521	12300	12716
Turkey	11530	13011	15149	16458	16634	18869
Montenegro		9896	11195	14317	13785	14534
Bosnia and Herzegovina	1793	6225	7845	9336	9170	9490
CV (EU28+6)	0.61	0.62	0.56	0.52	0.53	0.51

Source: author's calculations, http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD

Figure 1 presents the dynamics of σ-convergence coefficients for 2004-2014.

Figure 1: σ-convergence of GDP Per Capita at PPP in the EU and the EU-Candidates Countries
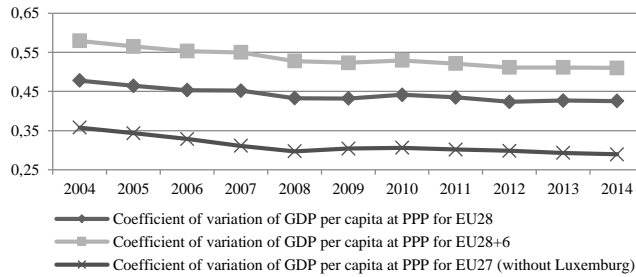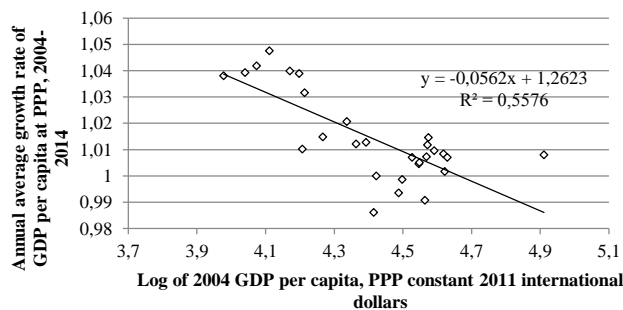

Source: author's calculations.

Drop-down trend of the coefficient of variation reflects the presence of σ-convergence and shows a decline in inequality between the EU countries and candidate counties although the later being much poorer than the average. Thus, the dynamics of variation indicators for the EU countries taking into account candidates' entry showed that the expansion will lead to a deterioration of development indicators, strengthening the divide within the EU. They will complement the list of recipient countries, not the donor countries, which will bring an additional burden on the overall budget. Moreover, Bulgaria and Romania have indicators similar to outside Turkey rather than the EU. The analysis of σ-convergence did not give a full picture of the development of the sample.

Figure 2 shows the relationship between the average annual growth rate of GDP per capita at PPP and the initial GDP per capita at PPP level, for 28 EU countries.

Figure 2: GDP Per Capita Growth Rate During 2004-2014 versus the 2004 GDP Per Capita Level

Source: author's calculations.

As we can see from the figure, there is a clear negative relationship between initial GDP per capita level and the growth rate. This confirms the absolute β-convergence.

Table 2 presents results of regression equations based on cross-section and panel data. The explained variable for cross-section data is the annual average growth rate of GDP per capita whereas the explanatory variable is the GDP per capita at PPP level in 2004. For panel data

we use the annual growth rate of GDP per capita at PPP and GDP per capita at PPP in the preceding year.

Table 2: Regression Results for *β*-Cconvergence within the EU Countries, 2004-2014

Indicator	Eq. 1	Eq. 2	Eq. 3	Eq. 4	Eq. 5	Eq. 6
Const	0.122** (0.041)	0.150** (0.03)	0.094** (0.000)	0.147** (0.034)	0.062** (0.011)	0.169** (0.029)
$\log y_{i,0}$	-0.026** (0.002)	-0.032** (0.002)	-0.020** (0.002)	-0.031** (0.007)	-0.011** (0.002)	-0.036** (0.002)
$(\log y_{i,t} - \log y_{i,t-1})_{-1}$					0.544** (0.031)	
R-squared	0.511	0.608	0.533	0.090		0.55
Within R-squared						
Sargan test					24.213 [0.990]	
AR(1)					-3.150 [0.001]	
AR(2)					-2.261 [0.024]	
St. error	0.0050	0.0046	0.0049	0.0170	0.0102	0.0046
N	28	27	34	280	252	22

Note: * and ** denote significance at 5% and 1% levels, respectively. Heteroskedasticity-robust standard errors are used. Source: author's calculations.

Eqs. (1)-(3) assess OLS model for economic growth and the log of per capita income in 2004 for EU-28, EU-27 and EU-28 plus six candidates countries, respectively. It is worth noting that the level of GDP per capita in the initial period of time is an important factor for economic growth in the EU – the hypothesis of absolute *β*-convergence is confirmed. The hypothesis of the presence of *β*-convergence of the EU countries, taking candidates into account is also confirmed. Although, there is a decrease in the rate of convergence growth to 2%.

The results based on panel data of 28 countries and presented in Eqs. (4)-(5), yield the same conclusion as the results based on cross-sectional data. We estimated Eq. (5) using difference GMM estimation proposed by Arellano and Bover (1995), and Blundell and Bond (1998). However, p-values of first and second-order serial correlation tests indicate that the model is not adequately specified. Panel regression confirms the existence of *β*-convergence. Our results confirm the fact that new EU member states converged at a higher rate than the process of convergence took place in the group of old EU members that is in line with Vojinovic and Prochniak (2009).

The results of the cluster analysis allowed us to classify countries into several groups with similar features. In this context, we compared cluster analysis results for 2004 and 2014. This comparison allows us to measure whether certain changes exist in defined clusters because changes in particular clusters can be interpreted as divergence or convergence tendencies (Burian and Brčák, 2014). A theoretical background of the analysis is based on Didenko (2008) and Everitt et al. (2011).

We conducted a hierarchical cluster analysis to determine the optimal number of clusters that was equal to four. Luxembourg was a pronounced leader, which was defined in a separate

cluster, so that the country was carried out of the analysis. Figure 3 shows results of a k-means analysis to consider the cluster compounds in 2004 and 2014 in terms of GDP per capita in constant PPP prices of 2011. The first cluster can be named as the "core of the EU", the second is the "old periphery" and the third one is the "new periphery".

Figure 3: The Results of a K-means Cluster Analysis for 2004 and 2014

2004		2014	
the core of the EU (11)	Ireland	Ireland	the core of the EU (10)
	Sweden	Sweden	
	Netherlands	Netherlands	
	United Kingdom	United Kingdom	
	France	France	
	Finland	Finland	
	Denmark	Denmark	
	Germany	Germany	
	Belgium	Belgium	
	Austria	Austria	
the old periphery (7)	Italy	Slovenia	the old periphery (10)
	Slovenia	Italy	
	Portugal	Portugal	
	Malta	Malta	
	Spain	Spain	
	Czech Republic	Czech Republic	
	Cyprus	Cyprus	
	Greece	Lithuania	
the new periphery (9)	Lithuania	Estonia	
	Estonia	Slovak Republic	
	Slovak Republic	Greece	the new periphery (7)
	Romania	Romania	
	Poland	Poland	
	Latvia	Latvia	
	Hungary	Hungary	
	Croatia	Croatia	
	Bulgaria	Bulgaria	

Source: author's calculations according to SPSS.

In the case of more intensive convergence, the distance among clusters should be declining over time. Generally, it is possible to claim that there is a convergence process in the EU. It should be noted that the clusters composition has not changed over the period, except for Italy and Greece, dropped from the second to the third and from the third to the fourth cluster, respectively. Lithuania, Estonia and Slovakia instead moved up from the bottom cluster to the so-called "old periphery". Thus, for each period not only the borders have changed, but also the clusters with a decreasing tendency in cluster distances among the EU. This fact confirms the hypothesis of the presence of the club convergence. We have also excluded from the analysis six countries for which GDP per capita was above 4/3 and below 2/3 of the EU average value in 2014 (34,771 PPP international 2011 dollars): Luxembourg, Ireland, Latvia, Croatia, Romania, and Bulgaria. The results of the OLS estimation for 2004-2014 are presented in Table 2 Eq. (6). The hypothesis of the presence of absolute β-convergence in the EU countries

(28-6) was also confirmed. This finding indicates the presence of convergence clubs as the bottom stays bottom.

4. Conclusion

The main aim of this paper was to produce the analysis of the convergence process among EU-28 and EU-candidate countries. We used Gini index, coefficient of variation as well as regression and cluster analysis of economic inequalities within the EU and between the EU-28 and EU-candidate countries. The analysis pointed out mostly decreasing disparities and convergence among the EU. We can state that the EU-candidate countries converge to the EU-28 average, but the convergence rate is lower than the speed of convergence of the EU member states as whole. The hypothesis of the presence of the club convergence within the EU was also confirmed. The uneven territorial development creates problems for decision-making system within the EU, which is guided by the principles of democracy. The EU, seeking to create and instill a European identity, to prevent a possible resuscitation of the national-state conflicts, cannot allow the conflict between rich and poor countries to escalate and it's possible transfer to the institutions of decision-making in the EU.

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