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Trends in Convergence in EU. Differences between EU-10 and EU-15*

Lucian-Liviu Albu**

Abstract

Early, the convergence theory was suggestively expressed in the Solow model. This can be shown in line with the fact that while economic development is advancing (expressed by the income per capita growth), on long run there is a general convergence process among countries. Generally, empirical evidences from the EU history have confirmed this process. Intuitively, some authors could consider that current crisis seems to affect convergence in EU. Contrary, how our analysis demonstrated, on long run the convergence process is not essentially altered. Depending on evaluation methodology, indicators used, and periods considered, the results of studies on convergence are often ambiguous. Despite a negative impact of actual crisis on growth rate, by using the Lorenz curve model and its derived Gini coefficients or variation coefficient, our study shows for the period of last decade a significant convergence in EU, in matter of GDP per capita. However, differences in matter of convergence still exist inside of groups of countries. Thus, generally while in EU-10 (last adhered countries to EU) is manifesting a strong convergence, in EU-15 (old members of EU) a significant trend of divergence was demonstrated. Moreover, besides GDP per capita, the convergence process is evaluated in case of other macroeconomic variables, like the export and import per capita, FDI per capita, etc.

In specialised literature last time emerged some studies trying to estimate the so-called structural convergence. In our study, based on empirical evidences in spatial distribution of GDP per capita in EU we estimated a model to describe and simulate structural changes concomitantly with the general process of economic development. Using a set of adequate convergence indicators, we analysed the convergence process during last decade both at the EU level (EU-27), but also inside of the group EU-10 and inside of the group EU-15. As general conclusion, at the EU level a general tendency of structural convergence was demonstrated. However, between the two groups of countries, there were some different trends in matter of structural convergence.

Keywords: real convergence, structural convergence, Lorenz curve, Gini coefficient

JEL Classification: C31, E27, J21, O11, O47

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1. Introduction

Convergence can be viewed as follows: while economic development is advancing there is a general process of convergence between countries. According to some studies trying to estimate the so-called structural convergence, generally, it is expected that the convergence in EU in terms of per capita income to be followed by structural convergence. The structural convergence even could be viewed as foundation of the convergence in matter of GDP per capita. Based on empirical data regarding the spatial distribution of GDP per capita in EU we estimated a model to describe and simulate structural changes concomitantly with a general economic development process. Moreover, using a set of some adequate indicators, we analyse the real convergence and structural convergence at the EU level, but also distinctively inside Eastern group and inside Western group.

2. Empirical evidences

The explanation of structural changes during the economic growth process still relies only on empirical findings, not resulting clear whether and at what values will stabilize the variables represented by share in total employment in primary sector (agriculture, forestry, fishing) secondary sector (industry and construction) and tertiary sector (services). A first simulation of the dynamics of long-term economic structure can be achieved by using a theoretical model, starting from a consistent set of empirical data. The model requires the existence of some limit values, to which the trajectories will converge in the long run. Advancing in the economic development is expressed by per capita income growth.

As empirical evidences there are, we are presenting in Figure 1 the spatial distribution of GDP per inhabitant in PPS (Purchasing Power Standard) in EU, y (as gap from EU average level = 100) in 2000 and in 2012, LO being the longitude (on its left side relating to the origin, 0 meridian, the Western longitude, as it is marked usually on geographical maps, was changed in negative values), and LA – latitude.



Source: Own calculations based on EUROSTAT data

Figure 1.

In Figure 1 we excluded from the graphical representation the two small island states (Malta and Cyprus) and Luxembourg due to its high level of GDP per inhabitant (244% in 2000 and 280% in 2011, comparing to the EU average level). We can see on the EU stylised map an

increasing tendency which is going from Eastern European countries (blue colours on the right side of the map) toward Western countries (red colours on the left side of the map).

In order to estimate changes in economic structure, we used a model in which the share of employment in agriculture in total employment, na, and respectively the share of employment in services in total employment, ns, as functions of GDP per capita, y, are expressed by the following relationships:

$$na(y) = (k1^*y + k2) / (k3^*y + k4)$$
(1)

$$ns(y) = k5*y / (k6 + y)$$
(2)

where k1,..., k6 are parameters.

Thus the resulting equation for the share of employment in industry in total employment, ni, is as follows:

$$ni(y) = 1 - \{ [(k1*y + k2) / (k3*y + k4)] + [k5*y / (k6 + y)] \}$$
(3)

To simulate the model in case of EU, we used EUROSTAT data for all member countries in the period 2000-2011. The results of simulation model (this time excluding only Luxembourg) are presented in Figure 2 (where share of the three sectors in total employment is in percents and GDP per capita is in thousand PPS).



Source: Own calculations based on EUROSTAT data

Figure 2.

The simulation model demonstrates a general process of structural convergence in EU during the analysed period, as the economic development process progresses. Discrepancies among countries can now be interpreted not only as differences between levels of income per capita, but also as the structural differences (structural gap). Also, there is a strong positive impact of the share of services in total employment on GDP per inhabitant (correlation coefficient = +0.816), but a negative impact of the share of agriculture (correlation coefficient = -0.699) and respectively of industry (correlation coefficient = -0.580).

3. Impact of crisis and discrepancies between groups of countries

In order to evaluate convergence process in EU during last decade we used some concentration indicators, such as Lorenz curve, its attached Gini coefficients, and variation coefficient. In Table 1 and in Figure 3 our estimates for variation coefficient and the average level of GDP per capita in PPS, in the period 2000-2012, are presented.

| | Variation Coefficient | GDP per capita | | |
|------|-----------------------|----------------|--|--|
| Year | (%) | (PPS) | | |
| 2000 | 26.208 | 19356 | | |
| 2001 | 25.458 | 20072 | | |
| 2002 | 24.208 | 20736 | | |
| 2003 | 22.970 | 21032 | | |
| 2004 | 22.179 | 22001 | | |
| 2005 | 21.622 | 22855 | | |
| 2006 | 20.831 | 24053 | | |
| 2007 | 19.774 | 25393 | | |
| 2008 | 18.506 | 25426 | | |
| 2009 | 17.680 | 23878 | | |
| 2010 | 18.135 | 24875 | | |
| 2011 | 17.998 | 25544 | | |
| 2012 | 18.062 | 25.487 | | |

 Table 1. Convergence in GDP per inhabitant in EU, 2000-2012

Source: Own calculations based on EUROSTAT data

For instance, in 2011, Lorenz curve shows that 25% of the EU population (the poorest 14 countries with a GDP per capita less than 23000 PPS) have covered only 16.5% of total EU GDP and 20% of the EU population (the poorest 9 countries with a GDP per capita of less than 19400 PPS) have covered only 12.4% of the total EU GDP (Albu, 2012).

During considered period, we can see, as a general rule, a significant diminution in value of convergence indicators, which means a trend to higher concentration inside EU. Thus, between 2000 and 2012, variation coefficient decreased by 31.1%. At the same time, GDP per capita increased by 31.7%. However, during last part of the investigated period the impact of actual crisis was materialised in stopping the convergence process, which is reflected by higher values of convergence indicators in 2010-2012 than in 2009 (where the minimum level of the whole investigated period was registered).

Despite of a convergence process at the EU level, significant differences occur when we analyse convergence process inside certain groups of countries in EU. This is the case when EU (excluding the two island states, Cyprus and Malta) is splited into two groups of countries: old EU countries, members before the last wave of enlargement in 2004-2007, so-called EU-15 (Austria, Belgium, Denmark, Germany, Greece, Finland, France, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and UK) and the former communist

countries of Central and Eastern Europe, the so-called EU-10 group (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia).



Source: Own calculations based on EUROSTAT data

Figure 3.

Applying the same methodology as at the level of EU (EU-27), we estimated the values of convergence indicators for the two groups of countries in the period 2000-2012. The estimated results for variation coefficient and the average level of GDP per capita in PPS, in the period 2000-2012 are summarized in Table 2 and Figure 4 for EU-10 and respectively in Table 3 and Figure 5 for EU-15 (in Figure 5 the variation coefficient was multiplied by 4).

| | Variation Coefficient | GDP per capita | | |
|------|-----------------------|----------------|--|--|
| Year | (%) | (PPS) | | |
| 2000 | 25.582 | 8606 | | |
| 2001 | 23.963 | 9122 | | |
| 2002 | 23.202 | 9696 | | |
| 2003 | 21.106 | 10243 | | |
| 2004 | 19.809 | 11102 | | |
| 2005 | 19.478 | 11784 | | |
| 2006 | 18.528 | 12764 | | |
| 2007 | 16.915 | 14114 | | |
| 2008 | 14.766 | 14787 | | |
| 2009 | 15.091 | 14238 | | |
| 2010 | 15.451 | 14895 | | |
| 2011 | 14.443 | 15772 | | |
| 2012 | 13.938 | 15958 | | |

 Table 2. Convergence in GDP per inhabitant in EU-10, 2000-2012

Source: Own calculations based on EUROSTAT data

We can see a strong convergence process inside the EU-10 group, contrary to a divergence process inside the EU-15. Within EU-10 the actual crisis does not affect the convergence trend, but in EU-15 it provoked after 2009 a divergence tendency.

At the EU level, convergence tendency is suggestively reflected in the graph of Figure 6 (where $\Delta y UE10\%$ and $\Delta y UE15\%$ are percentage deviations from the EU average in both groups of countries). Between the two groups of countries we can see large differences in matter of GDP per capita. Thus, in 2000 this indicator for the EU-10 represented only 44.5% of the EU average, compared with 115.5% for the EU-15. However, in the last decade, there was a significant process of convergence between the two groups of countries, so that in 2012 the GDP per capita in the EU-10 has grown to represent 62.6% of EU average, compared to 109.5% for the EU-15.



Source: Own calculations based on EUROSTAT data

Figure 4.

 Table 3. Divergence in GDP per inhabitant in EU-15, 2000-2011

| Voor | Variation Coefficient | GDP per capita | | |
|------|-----------------------|----------------|--|--|
| 2000 | (70) | (11115) | | |
| 2000 | 0.033 | 22351 | | |
| 2001 | 6.377 | 23103 | | |
| 2002 | 6.855 | 23774 | | |
| 2003 | 6.441 | 23951 | | |
| 2004 | 7.071 | 24931 | | |
| 2005 | 7.353 | 25807 | | |
| 2006 | 6.842 | 27042 | | |
| 2007 | 6.611 | 28355 | | |
| 2008 | 6.350 | 28198 | | |
| 2009 | 6.255 | 26379 | | |
| 2010 | 8.032 | 27457 | | |
| 2011 | 8.727 | 28062 | | |
| 2012 | 9.188 | 27914 | | |

Source: Own calculations based on EUROSTAT data



Source: Own calculations based on EUROSTAT data

Figure 5.



Source: Own calculations based on EUROSTAT data

Figure 6.

4. Structural convergence

In order to evaluate structural convergence we used a similar methodology as in case of real convergence (expressed by dynamics of GDP per capita). In Table 4 there are presented the values of variation coefficient estimated for the share of services in employment, during the period 2000-2011.

First, we can see a higher degree of concentration inside UE-15 than inside UE-10, expressed by smaller values of the variation coefficient (more than double in UE-10 than in UE-15). Second, during the investigated period, it was a tendency of rapprochement between the two groups of countries, the gap in terms of the average share of services in employment comparing to the EU average level decreased significantly. Third, we can also note a strong correlation between the share of service sector growth and convergence for both groups of countries (correlation coefficient values between the average share of services and coefficient of variation, signifying the degree of concentration or degree of convergence in groups , was -0.891 for the EU-10 and -0.970 respectively for EU-15).

| Year | Variation Coefficient | | | ation Coefficient Share of services in employment | | |
|------|-----------------------|--------|-------|---|--------|--------|
| | EU-27 | EU-10 | EU-15 | EU-27 | EU-10 | EU-15 |
| 2000 | 13.961 | 18.057 | 6.896 | 65.396 | 45.582 | 70.644 |
| 2001 | 13.095 | 18.916 | 6.791 | 66.209 | 47.331 | 71.088 |
| 2002 | 12.210 | 14.577 | 6.736 | 67.298 | 49.694 | 71.680 |
| 2003 | 12.030 | 15.186 | 6.698 | 67.895 | 50.259 | 72.198 |
| 2004 | 11.736 | 13.078 | 6.561 | 68.495 | 51.126 | 72.722 |
| 2005 | 11.591 | 12.712 | 6.438 | 68.888 | 51.642 | 73.080 |
| 2006 | 11.239 | 11.926 | 6.275 | 69.328 | 52.564 | 73.433 |
| 2007 | 11.085 | 11.923 | 6.217 | 69.526 | 52.893 | 73.634 |
| 2008 | 10.839 | 11.482 | 5.966 | 69.896 | 53.175 | 74.060 |
| 2009 | 10.612 | 11.857 | 5.500 | 70.839 | 54.504 | 74.914 |
| 2010 | 10.442 | 12.471 | 5.263 | 71.509 | 55.275 | 75.539 |
| 2011 | 10.504 | 12.580 | 5.203 | 71.798 | 55.122 | 75.932 |

Table 4. Convergence in matter of services' share in employment in EU, 2000-2011 $-\frac{9}{2}$

Source: Own calculations based on EUROSTAT data

Moreover, we evaluated for the period 2000-2011 the convergence process in case of industry share in total employment and respectively in that of agriculture share in total employment. The results are different. Thus, at the EU-27, in first case a divergence process was registered in the considered period, but in the second case a convergence process was demonstrated.

The estimated results for the other two major sectors of the economy, industry and agriculture respectively, are synthetically presented in Tables 5 and 6.

| Year | Variation Coefficient | | | Share of industry in employment | | |
|------|-----------------------|--------|--------|---------------------------------|--------|--------|
| | EU-27 | EU-10 | EU-15 | EU-27 | EU-10 | EU-15 |
| 2000 | 14.662 | 13.772 | 15.798 | 26.082 | 28.547 | 25.432 |
| 2001 | 15.376 | 11.272 | 15.649 | 26.147 | 30.060 | 25.139 |
| 2002 | 15.765 | 8.770 | 16.018 | 25.866 | 30.727 | 24.660 |
| 2003 | 16.130 | 9.191 | 16.344 | 25.432 | 30.423 | 24.218 |
| 2004 | 16.915 | 8.024 | 16.741 | 25.212 | 30.960 | 23.817 |
| 2005 | 17.224 | 7.650 | 16.937 | 24.980 | 30.975 | 23.527 |
| 2006 | 17.499 | 6.445 | 16.874 | 24.886 | 31.411 | 23.291 |
| 2007 | 17.692 | 5.832 | 16.849 | 24.893 | 31.838 | 23.182 |
| 2008 | 17.692 | 5.469 | 16.418 | 24.677 | 32.110 | 22.830 |
| 2009 | 17.934 | 4.992 | 15.595 | 23.744 | 30.855 | 21.973 |
| 2010 | 18.506 | 6.196 | 15.894 | 23.054 | 29.833 | 21.375 |
| 2011 | 19.863 | 6.261 | 17.327 | 22.841 | 30.029 | 21.064 |

 Table 5. Convergence in matter of industry's share in employment in EU, 2000-2011

 - %

Source: Own calculations based on EUROSTAT data

| Year | Variation Coefficient | | | ariation Coefficient Share of agriculture in employn | | |
|------|-----------------------|--------|--------|--|--------|-------|
| | EU-27 | EU-10 | EU-15 | EU-27 | EU-10 | EU-15 |
| 2000 | 94.364 | 43.960 | 53.286 | 8.503 | 25.875 | 3.899 |
| 2001 | 90.241 | 52.152 | 54.187 | 7.638 | 22.639 | 3.757 |
| 2002 | 85.250 | 40.906 | 52.845 | 6.836 | 19.577 | 3.660 |
| 2003 | 85.685 | 45.753 | 52.004 | 6.667 | 19.286 | 3.584 |
| 2004 | 82.575 | 41.904 | 49.800 | 6.304 | 17.915 | 3.474 |
| 2005 | 82.310 | 43.678 | 48.199 | 6.127 | 17.393 | 3.385 |
| 2006 | 81.455 | 43.930 | 49.207 | 5.755 | 16.025 | 3.237 |
| 2007 | 80.409 | 46.561 | 47.692 | 5.568 | 15.267 | 3.170 |
| 2008 | 79.854 | 48.143 | 46.618 | 5.433 | 14.731 | 3.114 |
| 2009 | 79.957 | 49.947 | 47.219 | 5.419 | 14.652 | 3.112 |
| 2010 | 80.745 | 54.277 | 48.319 | 5.467 | 14.890 | 3.123 |
| 2011 | 82.186 | 55.113 | 48.920 | 5.365 | 14.868 | 3.005 |

Table 6. Convergence in matter of agriculture's share in employment in EU, 2000-2011 $_{-\%}$ -

Source: Own calculations based on EUROSTAT data

In the period 2000-2011, at the EU level has been a collapse in the share of the population employed in industry in total employment (from 26.1% to 22.8%) and as the proportion of people employed in agriculture in total employment (from 8.5% to 5.4%). However, in the EU-10 the share of employment in industry in total employment increased (+1.5 percentage points), unlike the EU-15 in which there was a decline (-4.4 percentage points).

At the EU level, there is still a very high degree of scattering in matter of the share of agriculture in employment, although over the period analysed there was some tendency to concentrate. Inside the EU-10 group of countries even has been a process of divergence in the period under review, although the share of agriculture has declined significantly (from 25.9% in 2000 to 14.9% in 2011).

Conclusions

During last decade inside EU a convergence trend was manifested. However, despite efforts still exist significant discrepancies among countries in matter of GDP per capita.

Between the two groups of countries, EU-10 and EU-15, we can see large differences in matter of GDP per capita. Thus, in 2000 this indicator for the EU-10 represented only 44.5% of the EU average, compared with 115.5% for the EU-15. However, in the last decade, there was a significant process of convergence between the two groups of countries, so that in 2012 the GDP per capita in the EU-10 has grown to represent 62.6% of EU average, compared to 109.5% for the EU-15.

The impact of actual crisis was to stopping the convergence process, which is reflected by higher values of the selected indicators (meaning a decrease in concentration inside EU) in 2010-2012 than in 2009.

Generally, in matter of GDP per capita it was a strong convergence process inside the EU-10, contrary to a divergence process inside the EU-15. In case of EU-10 the actual crisis does not affect the convergence trend, but in that of EU-15 it provoked after 2009 a divergence tendency.

At the EU level during last decade a general tendency of structural convergence was manifested. However, regarding the share of industry in employment, it was registered a divergence process. Between the two group of countries, EU-10, Eastern countries, and EU-15, Western countries, there were some different trends in matter of structural convergence. Thus, in case of the share of industry in employment, in Eastern group of countries it was a strong convergence process, but in Western group of countries a slight divergence. Contrary, in case of the share of agriculture in employment, in Eastern group it was a divergence process unlike a convergence process in Western group.

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