THE ISSUE OF CONVERGENCE: NEW EMPIRICAL EVIDENCE FOR THE CENTRAL EASTERN EUROPE AREA.

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Abstract: This paper explores empirically the convergence path in selected Central Eastern European (CEE) economies. The empirical analysis uses per capita Gross Domestic Product (GDP) in Purchasing Power Parity (PPP) in constant prices of 2005 and covers the period 1980-2010. The empirical investigation relies on Nahar - Inder’s (2002) methodology in combination with the testing procedure of Bai - Perron (2003) to take into consideration the presence of possible structural breaks. The results demonstrate remaining disparities and support evidence in favor of catching up with EU-15 and the EU-27 averages only for three out of the ten examined economies.

Key words: catching up, structural breaks, CEE countries

JEL Classification: C32, C33, O47, O52

1. Introduction

The interest on convergence in per capita income across different economies is a long lasting issue in the empirical literature. This interest grew as the theory of growth evolved and, to some extent, was enhanced by the debate between the supporters of the neoclassical growth model (Solow 1956) and those of the “new” endogenous growth models. This debate still holds strong in recent times and emerges through a considerable body of the international relevant literature. Solow (1956) supported that, under certain assumptions, per capita output converges either to the steady-state of every individual country or to a common steady-state irrespective of the individual country’s initial output. Later, the opposite ‘new’ endogenous growth models (Romer 1986; Lucas 1988), underlined the lack of any tendency among income levels of countries to converge if some of the neoclassical assumptions are relaxed. Following these theoretical paths, a widespread conception derives and supports that disparities in growth rates create great differences in welfare, either across countries or within a specific group of countries. These differences have motivated the researchers to examine continuous and deeper this subject.

Despite the fact that there is a significant number of empirical investigations oriented to convergence debate, rather little attention has been paid to the CEE economies, this being justified by the fact that larger data sets have become available only in recent years. This data limitation allowed the researchers to use relatively traditional analysis such as cross section analysis and to a lower degree time series analysis, in order to confirm the existence of beta and sigma convergence. For instance, Kocenda et al. (2006) and Ingianni and Zdarek (2009) found evidence of beta convergence within the new EU members but also towards the old EU members. Therefore, the relevant research efforts on economic convergence used data samples comprising, in most of the cases,
only, a rather limited number of countries from the CEE area compared to EU either in national or in regional level (see Baldwin et al. 1997; Bjorksten 2000; Doyle et al. 2001; Fidrmuc and Korhonen 2004; Kutan and Yigit 2004; Figuet and Nenovskyy 2006; El Ouardighi and Somun-Kapetanovic 2007, 2009; Bonetto et al. 2009; Del Bo et al. 2010; Raileanu Szeles and Marinescu 2010); while, some other studies focused on the process of economic growth in CEE countries (Estrin et al. 2001; Kocenda 2001; Dawson and Hubbard, 2004; Dritsakis, 2004; Janicki and Wunnava, 2004; Kominek, 2004), only a small number among them have investigated the convergence process, mainly for the post-1950 period and also the catching up time as, for instance, Wagner and Hlouskova (2002) examined convergence with EU countries in a historical perspective and estimated that it will take three or four decades for the accession economies to catch up with the EU-15. Considering that the relevant empirical evidence isn’t still able to clearly argue on whether and under which circumstances convergence is noticed, the present investigation contributes by providing new and more reliable evidence based on a well documented empirical methodology (Nahar and Inder 2002), which further incorporates the possibility of structural breaks.

It is widely acknowledged that the CEE economies were heavily influenced during the last decades due to several events that took place in this area such as the German reunion, the breakup of Yugoslavia and the change of the political scheme that Soviet Union brought about. In addition, the increased nationalism in this area affected their relations of this area with the international community. A fact of major importance during the past decades has been the increasing disparities are observed in productivity levels among European countries. Beginning from the 1950s, right after the World War II, European productivity signed a soaring growth until 1973 with the lower rates observed at the Eastern part. After 1973 and until 1989, productivity in Europe was in general decelerating. The political change, from communism to open market economies increased the divergence between the CEE economies and the rest of the Europe as well as within the CEE area, probably due to the productivity slowdown. However, since 1992, there has appeared a resume in productivity which spurred the convergence process again (Rosenberg 2000; Cunado and Perez de Garcia 2006). In this context, European Union (EU) created certain conditions in order to benefit from the competitive advantages of the CEE economies and support their EU accession by taking legal and institutional reforms. Their geographical position itself primes advantages in the level of supply chains in comparison to other emerging economies. Moreover, the EU financial support to the CEE area improved the infrastructure of the region, this being an important prerequisite in order to equally participate in global market transactions. Finally, the human capital of the region is possibly itself a motive to attract FDIs, especially in cases when the multinationals aim at finding an emerging market as a new base. CEE presents competitive advantages over the other emerging markets with BRICS being the most important competitor. Actually, the location of the area which provides logistical facilities, the EU cohesion and structural funds directed to the area to strengthen infrastructure, the human capital as an important determinant of attracting FDI inflows etc. However, according to Cavenaile and Dubois (2011), there is still much to be done as far as it concerns the income convergence of the CEE economies to that of the Western Europe.
In this study, we attempt to detect income catching up effects between a sample of CEE economies and both the EU-15 and EU-27 averages. This comparison is important since the Maastricht criteria in 1992, that were reinforced in 1996 with the Stability Growth Pact (3% of GDP for budget deficit and 60% of GDP for public debt), were decided based on the development level of the EU-15 economies; however, this level is rather lower nowadays given the EU enlargements of 2004 and 2007 and hence these nominal criteria set at Maastricht have to be reexamined. Moreover, Vojinovic and Prochniak (2009) confirm beta and sigma convergence for the period after the mid nineties for the ten new entrants in EU, in 2004, while, during the first years of the 1990s their findings supported lack of convergence or divergence. Their main conclusion was that although the income gap reduced, it keeps on being significant.

This research effort, in the context of the empirical analysis, uses PPP per capita GDP, in constant prices of 2005 and, covers the period 1980-2010. The observed heterogeneity in the CEE area with respect to the growth rates of the individual economies as well as the observed disparities in the catch up processes with EU, further motivated us. To this direction, we distinguish two sub-groups of economies, the Balkans group and a second group for the rest of the CEE economies, aiming at detecting, in a more efficient way, possibly different patterns in the catch up process towards EU-15 and EU-27. A further contribution of this study might be the use of an advanced testing procedure, suggested by Nahar and Inder (2002), which permits non stationary processes to converge in combination with the testing procedure of Bai-Perron (2003) to take into consideration the presence of possible structural breaks.

The outline of the paper is structured as follows: Section 2 provides the background of the adopted empirical methodology and Section 3 presents the data set used. Section 4 illustrates the results of the empirical analysis. Finally, section 5 offers a summary and conclusions.

2. Methodological Issues

When testing empirically for convergence, taking into consideration its definitions, a number of different tests have been applied. This study employs the testing procedure suggested by Nahar and Inder (2002) augmented to take into account the possibility of structural breaks. Actually, it examines in the differentials of the per capita GDP from both the EU-15 and EU-27 averages, for a sample of CEE economies during the period 1980-2010.


The employed method examines convergence as a movement of a set of countries with similar characteristics towards a leader by constructing a time trend function. It is known that when time trend is removed, the time series turn stationary and time independent (Nelson and Plosser 1982). The adopted testing procedure relaxes the restrictions of stationarity and allows for non stationary converging processes compared to the traditionally used stationarity tests. Nahar and Inder (2002) further supported that this test provides more reliable results in the case of catching up for a set of countries towards a country or leader. Also, they doubted that stationarity is a prerequisite condition of catching up.
Assuming that technical change is stable over the examined sample and setting as $\eta_{it}$ the natural logarithm of the per capita GDP for any $t \in \{1, 2, \ldots, N\}$ economy and in every time period $t \in \{1, 2, \ldots, T\}$, according to the neoclassical growth model, for economy $t$ it is implied that:

$$
\lim_{\tau \to \infty} E_{\tau} (\eta_{it+\tau} - \alpha_{t+\tau}) = \mu_t \tag{1}
$$

where $\alpha_{t+\tau}$ is the common trend parameter for a group of countries, $\mu_t$ is balanced growth path of economy $t$. The $\mu_t$ parameter is non zero except from the case of countries with similar characteristics, where relation (1) expresses absolute convergence as below:

$$
\lim_{\tau \to \infty} E_{\tau} (\eta_{it+\tau} - \alpha_{t+\tau}) = 0 \tag{2}
$$

According to relation (2), the long run average of the difference $\eta_{it+\tau} - \alpha_{t+\tau}$ should converge to zero through time. As far as it concerns the definition of the leader, it could be either a single country or a group of countries with the best per capita economic performance.

Denoting by $d_{it}$ the per capita output gap, the following relation is derived:

$$
d_{it} = \eta_{it} - \bar{\eta}_{i,t} \tag{3}
$$

where $\bar{\eta}_{i,t}$ represents the average steady state of the leading group. Therefore, catching up effect is observed when this gap is reduced, heads towards zero and the rate of its change turns positive as in relation (4):

$$
\frac{\partial}{\partial t} d_{it} > 0 \tag{4}
$$

Next, combing equations (2) and (3) we derive the following relation:

$$
\lim_{\tau \to \infty} E_{\tau} (d_{it}) = 0 \tag{5}
$$

since $d_{it+\tau} > 0$ and its rate of change are positive with $d_{it+\tau} \to 0$ as $\tau \to \infty$. In order to determine $\frac{\partial}{\partial t} d_{it}$, the parameter $d_{it}$ is expressed as a time polynomial:

$$
d_{it} = f(t) + u_{it} \tag{6}
$$

The open form of equation (6) is analyzed:

$$
d_{it} = \theta_0 + \theta_1 t + \theta_2 t^2 + \theta_3 t^3 + \cdots + \theta_k t^k + u_{it} \tag{7}
$$

where $\theta_0, \theta_1, \theta_2, \theta_3, \ldots, \theta_k$ are the coefficients of the trend variables of the polynomial and $u_{it}$ is the disturbance term. The time polynomial is estimated using Ordinary Least Squares (OLS) and its length is specified by means of Akaike Information Criterion (AIC).

As it was mentioned above, for testing catching up effects the rate of change in $d_{it}$ should be positive. Considering equations (4) and (7) we obtain:

$$
\frac{1}{T} \sum_{t=1}^{T} \frac{\partial}{\partial t} d_{it} = \theta_1 + \theta_2 n_2 + \theta_3 n_3 + \cdots + \theta_k n_k + \theta_k n_k = r' \theta \tag{8}
$$

where $n_k$ is defined as follows:
The below pair of the tested hypotheses is examined by performing a Wald test:

\[ H_0: r' \theta \leq 0 \sim \text{no catching up} \]
\[ H_1: r' \theta > 0 \sim \text{catching up} \]

1.2. The Bai-Perron multiple structural break approach (2003)

This approach accounts for multiple structural break points through three different types of tests.

In particular, the double maximum tests (Udmax and WDmax) are performed in order to define the existence of at least one structural break along with a group of SupF(I+1/1) for the amount of possible breaks to be defined. The tested hypothesis for the ultimate sequential test of SupF(I+1/1) are

\[ H_0 = 1 \text{ break point} \]
\[ H_1 = 1 + 1 \text{ break points} \]

This procedure is based on the following model

\[ y_t = d_j z_t^j + b x_t^j + u_t \]  (10)

Where \( y_t \) stands for the independent variable, \( z_t^j \) is the intercept term, \( x_t^j \) is the dependent variable and \( u_t \) is the disturbance term. Additionally, the \( d_j \) and the \( b \) represent the coefficients of the relative terms. The above model holds for \( m \) breaks (\( m+1 \) regimes), \( t = T_{j-1} + 1 \ldots T_j, \ j = 1, \ldots, m + 1 \). The terms \( T_1, \ldots, T_m \) represent the break points.

3. Data

The data sample originates from the World Bank’s database\(^1\) and comprises ten selected CEE economies: Albania, Bulgaria, Estonia, Greece, Hungary, Latvia, Moldova, Romania, Slovak Republic and Turkey. The time series analysis uses per capita GDP series, expressed in PPP, in US Dollars and in constant prices of 2005. According to Maddison (2001, 2005), the usage of an indicator expressed in PPP is more adequate for studies on convergence and growth since it permits comparisons in an international level. The empirical analysis runs from 1980 to 2010 using two benchmarks, namely the EU-15 and the EU-27 averages. It should be mentioned that the relevant indicator for the Slovak Republic is available only after 1984; and that, our decision to limit the data set to ten only among the total of CEE countries is justified by the fact that only these particular countries do provide a sufficiently large number of observations that permits econometric inference.

\(^1\) World Development Indicators (WDI) is the primary World Bank database for development data from officially-recognized international sources.
Figure 1: GDP per capita – Benchmarks EU-15 & EU-27

Figure 1 above, illustrates the per capita GDP series of all the examined economies as well as the average GDP per capita of the EU-15 and that of the EU-27. It is easily noticed that all the CEE countries present obvious income disparities and that they all move below both the EU-15 and EU-27 averages over the whole time period span. According to the figure, Greece and, to a lower degree, the Slovak Republic move closer to the EU averages while Albania and Moldova are placed last presenting the lowest levels. Furthermore, we notice also that the catching up process of these countries, and especially of the new entrants has been highly affected by the outbreak of the recent global economic crisis.

By the end of the central planning era in 1989, for the whole CEE area, a rapid slowdown of output is marked, whereas, by the middle of 1990’s, an increase in per capita output is noticed in all countries, being attributed to the undertaken of structural reforms and policy measures aiming at macroeconomic stabilization; the new economic environment attracted considerable Foreign Direct Investment inflows and helped effectively in the recovery of the internal investment and the boosting of productivity.

4. Empirical Results

This research effort applies the methodology of Nahar-Inder (2002) using a sample of ten CEE countries over the period 1980-2010. In the first step of the empirical analysis, we model the relative income per capita for every individual country, denoted by $d_t$, as a time polynomial according to equation (7). Furthermore, aiming at producing more reliable results, we extend the methodology by taking into account the possibility of structural breaks in the evolution of relative income. To this direction, in the first step, we apply the methodology of Bai and Perron (2003), which detects, endogenously, multiple significant structural breaks. The detected break points are further incorporated in model (7) as dummy variables. The optimal specification of the estimated, and augmented with dummies, models rely on AIC. The next step concerns the construction of the $r_k$ index which, combined with the estimated coefficients of the time polynomial, is tested by means of a Wald test in order to infer regarding the existence of catching up. Table 1, below, reports the order (t) of the time polynomials, the estimated average slopes, the values of the applied Wald tests accompanied with the respective probability values and finally, the dates of the detected structural breaks.
Based on the above presented results, evidence for catching up with the EU-15 average is supported only for two out of the ten countries, being the cases of Latvia and Turkey that, in particular, present average slopes nearly 1.03% and 0.82%, respectively. On the other hand, the results for Greece, Hungary, Romania and Slovak Republic reveal signals of no catching up. Starting from Greece, the year 1986 coincides generally with the stabilization program implemented by the Greek socialist government during the period 1985-1987. In addition, the second break point, detected in 2002, is close to the adoption of euro by Greece, in 2001. Hungary, Romania and Slovak Republic were strongly affected by the changes of the political regime starting from 1989 as well as due to the breakup of Yugoslavia. These facts influenced their economic performance and their catching up with the EU-15.

Moreover, the findings presented in Table 2, below, concern catching up effects with the EU-27 average. The evidence is similar to that with benchmark the EU-15 except from the case of Estonia for which there is further evidence of catching up. More particularly, the average slopes are found nearly 1.18% for Latvia, 0.49% for Turkey and 0.912% for Estonia; whereas, regarding the diverging countries, there is no such evidence for the Slovak Republic any more.

### Table 2: Results of Nahar - Inder Convergence Methodology - Benchmark: EU-27

<table>
<thead>
<tr>
<th>Countries</th>
<th>t</th>
<th>Average Slope</th>
<th>Wald test</th>
<th>p-value</th>
<th>Break dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albania</td>
<td>2</td>
<td>0.69542</td>
<td>1.3569</td>
<td>0.244</td>
<td>1989</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>2</td>
<td>0.063744</td>
<td>0.022361</td>
<td>0.881</td>
<td>1990</td>
</tr>
<tr>
<td>Estonia</td>
<td>2</td>
<td>0.9164</td>
<td>2.8192</td>
<td>0.093</td>
<td>1990</td>
</tr>
<tr>
<td>Greece</td>
<td>5</td>
<td>-0.21429545</td>
<td>6.2607</td>
<td>0.012</td>
<td>1986</td>
</tr>
<tr>
<td>Hungary</td>
<td>4</td>
<td>-0.7730728</td>
<td>17.911</td>
<td>0.000</td>
<td>1990</td>
</tr>
<tr>
<td>Latvia</td>
<td>2</td>
<td>1.18635</td>
<td>3.6393</td>
<td>0.056</td>
<td>1991</td>
</tr>
<tr>
<td>Moldova</td>
<td>2</td>
<td>0.72928</td>
<td>1.0088</td>
<td>0.315</td>
<td>1991</td>
</tr>
<tr>
<td>Romania</td>
<td>2</td>
<td>-0.66452</td>
<td>2.7793</td>
<td>0.095</td>
<td>1990</td>
</tr>
<tr>
<td>Slovak Rep.</td>
<td>3</td>
<td>0.0028</td>
<td>2.69E-05</td>
<td>0.996</td>
<td>1990</td>
</tr>
<tr>
<td>Turkey</td>
<td>4</td>
<td>0.49101</td>
<td>4.7299</td>
<td>0.030</td>
<td>1985</td>
</tr>
</tbody>
</table>

5. **Summary and Concluding Remarks**

This paper has investigated the issue of catching up in terms of GDP per capita between selected CEE countries and the respective EU-15 and EU-27 averages. The
empirical analysis has been performed for a sample of ten countries during the period 1980-2010. In the context of the econometric analysis, we applied the methodology of Nahar and Inder (2002) to investigate catching up effects, properly modified to take into account possible structural changes, being identified by means of the Bai–Perron (2003) testing procedure. The results revealed the existence of dissimilarities among the examined economies in the catching up process towards the EU averages.

Summing up our findings, evidence of catching up effects with EU is supported only for Estonia, Latvia and Turkey. On the other hand, statistically significant evidence for divergence is found for Greece, Hungary, Romania and Slovak Republic. The estimations of the break points coincide mainly with political changes in the region after 1989 as well as with the increase in the investment rate that promoted rapidly growth after 1993 and almost until 2002 when started its decrease.

Catching up does not occur accidentally and is a prerequisite to economic integration. The reduction of the per capita GDP and the rise of the income inequalities among the examined countries due to enlargements that followed one another in 2004 and in 2007 detained catching up process (El Ouardighi and Somun - Kapetanovic 2009). Our results have demonstrated these difficulties in catching up by revealing that three out of the ten examined economies catch up with the EU-27 and only 2 of them with the EU-15.

The first indications of development by the end of 1990s along with the stability after 2000, only helped towards reducing the disparities among Balkan countries; however, the relative income gap with the EU remains, in general, still significant. This tendency is possibly explained by the outbreak of the global crisis that has undoubtedly strengthened the social inequalities and influenced downwards the convergence process not only for the CEE countries but in general for countries that were part of this process. Obviously, the mitigation of the consequences of the current global recession, in terms of length and debt is highly associated with the reinforcement of the domestic demand, the efficient restructuring of the debt and the reorientation of the trade flows towards the EU, conditional on an effective maintenance of their competitive advantages. There is an obvious necessity for supporting the CEE area through adopting a common and development oriented policy where cooperation and reforms, unquestionably, should be part of it.

References


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