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Real convergence in Europe: a cluster analysis

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Abstract

In this paper we analyse real convergence in GDP per worker in the EU member states. The aim is to test whether there is evidence of club convergence in the EU, i.e. divergence in GDP per worker. Evidence in favour of cluster or club convergence may be an indication of significant productivity divergences between countries, which may also explain the current turmoil in the euro zone. The results show evidence of different economic growth rates within Europe, which also converge to different steady states, implying divergence in the EU-14. Within the EU-14 member states we observe two convergence clubs, which are not related to the fact that some countries belong to the euro area. Furthermore, Eastern European countries are also divided in two clubs, with a more direct effect of belonging to the euro zone in the composition of the clubs.

Keywords: cluster, real convergence, economic integration, euro.

JEL classification: C32, C33, O47

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1. Introduction

The existence of real convergence within the European Union (EU) member states is of paramount importance in the process of economic integration, providing a mechanism to achieve economic and social cohesion amongst countries. In fact, the reduction of income inequality across its members has long been a declared objective of the EU, and policies aimed to promote economic convergence were set out in 1975 through the Structural Funds, and in 1993 through the Cohesion Funds. The idea that European integration through macroeconomic policy convergence and greater capital mobility will cause convergence in income growth rates motivated the implementation of those policies aimed to promote cohesion.

Boldrin and Canova (2001) suggest that EU regional and structural policies have mostly redistributed income and have had little effect in fostering economic growth and the desired convergence of income levels across countries. This divergence view stands at odds with the neoclassical growth theory (Solow, 1956; Mankiw et al., 1992). According to this theory, the growth rate of capital per worker of countries with a lower initial capital endowment tends to be greater than countries with an initial higher capital stock. Thus, countries with different initial capital stocks tend to converge in terms of income per worker, over time. This hypothesis is known as *absolute convergence.* The empirical evidence on the absolute convergence hypothesis is mixed. Baumol (1986) and the World Bank (1993), amongst others, point to the fact that this process is hardly observed in practice. In contrast, Barro and Sala-i-Martin (1991) concluded in favour of absolute but slow convergence in Europe. There is generally more evidence in favour of the convergence hypothesis when country heterogeneity is taken into account and, in particular, when the assumption of similar parameters between countries is relaxed, implying different steady states (Barro and Sala-i-Martin, 1995). Only after controlling for different economic conditions, can one observe the negative relationship between initial income per worker and economic growth. This hypothesis is known as conditional convergence.

The consensus at the introduction of the euro was that the internal EU market with free mobility of goods, capital, and labour would ensure sustainable growth and economic convergence in the euro area, even though cross-country structural differences prevailed at the beginning. This view also suggested that under economic and monetary integration, the preconditions for the convergence theories are more likely to be met. A number of studies have analysed the existence of convergence in the EU and the euro zone. The results to date are far from conclusive. De la Fuente (2003) finds only mild evidence in favour of convergence, due to the different labour market institutions and investment ratios, whereas Salinas-Jiménez et al. (2006) find some evidence in favour of convergence trends, due to human and physical capital accumulation. In a recent contribution, Crespo-Cuaresma et al. (2008) point to the fact that being a EU member state increases integration and has positive and lasting effects on economic convergence.

As the new and future EU members are much poorer than the old members, the prospect of further enlargement of the EU may jeopardise the achievement of real convergence. It is also worth mentioning that the process of convergence of Eastern European countries with Western European countries has special features which are different from other process of economic and political integration: First, all Eastern

European countries have been in transition from planned to market economies, at the same time as an intense process of integration with the west; second, this group of countries belong to the common European market and, according to the neoclassical model of economic growth, the process of economic integration may have accelerated real convergence with the west. This is due to the elimination of barriers to the mobility of production factors. The latter elimination, arguably, would help to equalise those production factors' productivities.

One of the consequences of the process of economic integration is that Eastern European countries have adopted the EU standards in terms of economic policies, institutions and economic governance. For instance, these countries have had to adopt multilateral agreements, such as Stability and Growth Pact, which establishes a number of fiscal policy rules. Thus, Padoa-Shioppa (2003) highlights the fact that Eastern European countries have had to keep two process of convergence; real income and structural convergence. These processes are of course related.

Additionally, by means of participating in the process of European economic integration, this group of countries, sooner or later, will join the euro zone, once the Maastricht criteria are fulfilled (ECB, 2003). This situation implies, then, that not only the countries involved will have to face the process of real convergence, but also those countries which are EU member states, will have to fulfil nominal convergence. Lein et al. (2008) have analysed whether real convergence has been driving nominal convergence in the new EU Member States. These authors concluded that openness has had a negative impact and productivity a positive one on price level convergence with respect to the Euro area.

In this paper we analyse the process of real economic convergence in Europe, focusing on the real economy, using as a proxy the gross domestic product per worker. In contrast to Lein et al. (2008) the aim is to test whether there has been club convergence. That is, our primary question is: are EU countries converging to a single steady state or are they clustering around different states? The possibility of club convergence within the EU may raise issues in terms of differences in competitiveness, linked to the lack of structural reforms, which may yield significant instabilities within the EU. These instabilities may also affect the stability of the euro currency, as we have seen in the 2008-2011 financial and sovereign debt crisis.

The remainder of the paper is organised as follows; the next section presents the cluster methodology proposed by Phillips and Sul (2007, 2009) to test for club convergence within the EU-14. Section 3 discusses the empirical results. The last section concludes.

2. Methodology: convergence and cluster tests

The hypothesis of conditional convergence implies that real convergence depends upon the economic conditions of the country, but it does not depend upon initial income per worker. Nevertheless, the initial income per worker may have an effect on the country's economic growth path. Thus, regardless of the fact that two countries might share similar evolutions of fundamental variables and long term growth rate, they may not converge to the same steady state if they do not have similar initial incomes per worker. This is known as the *club convergence* hypothesis. According to the latter, if two countries start the process of economic convergence with different incomes per worker, they will hit different steady states. In order words, given a threshold of income per worker, countries with an income per worker below the threshold will convergence to a different steady state than those countries with an income per worker above the threshold. This hypothesis, then, implies that those countries with lower income per worker will form a club with a lower long term income per capita than those countries with higher initial income per worker.

This does not contradict the fact that countries with different initial income per worker may converge to the same steady state as richer countries, if the former countries get involved in structural reforms. In the case of the EU, club convergence refers to the possibility that Southern and Eastern European countries may have sluggish economic growth, diminishing their possibilities of catching up with the rest of the countries, the latter achieving a higher steady state.

The time series approach to convergence study can be found in the seminal papers by Carlino and Mills (1993) and Bernard and Durlauf (1995, 1996). These authors have developed the concept of stochastic convergence, based upon the stationarity properties of the variables under analysis. Thus, two non-stationary variables converge if there is a cointegrating relationship between them. In other words, two non-stationary series convergence if they share the same stochastic trend.

This definition of convergence can be empirically tested by means of time series econometric techniques. However, as pointed out by Phillips and Sul (2009), traditional convergence tests are inadequate when technology is heterogeneous across countries and the speed of convergence is time-varying. To account for temporal transitional heterogeneity, Phillips and Sul (2007, 2009) introduced cross-sectional and time series heterogeneity in the parameters of a neoclassical growth model. The starting point of the test is a simple factor model:

$$X_{it} = \delta_i \mu_t + \varepsilon_{it} \qquad (1)$$

where δ_i measures the idiosyncratic distance between some common factor μ_t and the systematic part of X_{it}. This model seeks to capture the evolution on the country specific X_{it} in relation to μ_t by means of its two idiosyncratic elements, that is, the systematic element δ_i and the error ε_{it}. Phillips and Sul (2007) modified this initial model by allowing the systematic idiosyncratic element to evolve over time, thereby accommodating heterogeneous agent behaviour and evolution within that behaviour by means of a time-varying factor-loading coefficient, δ_{it}. Furthermore, they allow δ_{it} to have a random component, which absorbs ε_{it} in (1) and allows for possible convergence behaviour in δ_{it} over time in relation to the common factor μ_t. The new model has the following time varying representation:

$$X_{it} = \delta_{it} \mu_t \qquad (2)$$

The time varying representation in (2) can be used to separate common from idiosyncratic components in the traditional decomposition of panel data:

$$X_{it} = g_{it} + a_{it} \qquad (3)$$

where g_{it} embodies systematic components, including permanent components that give rise to cross section dependence, and a_{it} represents transitory component. The transformation of (3) to the form of (2) is given by:

$$X_{it} = \left(\frac{g_{it} + a_{it}}{\mu_t} \right) \mu_t = \delta_{it} \mu_t \qquad (4)$$

for all *i* and *t*. In this way, X_{it} is decomposed in a single common component μ_t and a idiosyncratic one δ_{it}, both of which are time-varying.

The simple econometric representation in (2) can be used to analyze growth convergence by testing whether the factor loadings δ_{it} converge. Phillips and Sul (2009) proposed a modification of the neoclassical growth model so that technological growth rates differ across and over time and are endogenously determined. To account for temporal and transitional heterogeneity, Phillips and Sul (2009) introduced time-heterogeneous technology by allowing technological progress, A_{it}, to follow a path of the form $A_{it} = A_{i0}\exp(x_{it}t)$. Under this heterogeneous technology the individual transition path of log per capita real income, $\log y_{it}$, evolves as:

$$\log y_{it} = \log \tilde{y}_i^* + \log A_{i0} + \left[\log \tilde{y}_{i0} - \log \tilde{y}_i^*\right] e^{-\beta_{it} t} + x_{it} \qquad (5)$$

where $\log \tilde{y}_{i0}$ and $\log \tilde{y}_i^*$ denote initial and steady-state levels of effective log per capita real income and β_{it} is a time-varying speed of adjustment.

Equation (5) can be expressed in the form (2):

$$\log y_{it} = \log \tilde{y}_i^* + \log A_{i0} + \left[\log \tilde{y}_{i0} - \log \tilde{y}_i^*\right] e^{-\beta_{it} t} + x_{it} = a_{it} + x_{it} = \delta_{it}\mu_t \qquad (6)$$

where x_{it} is presumed to have some elements that are common across countries so that countries share a common growth component, μ_t. This common component can represent commonly available world technology such as the industrial and scientific revolutions and internet technology. Thus, the dynamic factor formulation $\delta_{it}\mu_t$ involves the growth component μ_t that is common across countries and individual transition factors δ_{it} which measures the transition path of an economy to a common steady-state growth path determined by μ_t. During transition, δ_{it} depends on the speed of convergence parameter β_{it}, the rate of technological progress parameter x_{it}

and the initial technical endowment and steady state levels through the parameter a_{it} (Phillips and Sul, 2009, p. 1158).

Phillips and Sul (2007) proposed modelling the transition elements δ_{it} by the construction of a relative measure of the transition coefficients:

$$h_{it} = \frac{X_{it}}{\frac{1}{N}\sum_{i=1}^{N} X_{it}} = \frac{\delta_{it}}{\frac{1}{N}\sum_{i=1}^{N} \delta_{it}} \qquad (7)$$

This measures the loading coefficient δ_{it} in relation to the panel. The variable h_{it} is called the relative transition path, and traces out an individual trajectory for each *i* relative to the panel average. So, h_{it} measures region *i*'s relative departure from the common steady-state growth path μ_t. When there is a common limiting transition behaviour across regions, we have $h_{it} = h_t$ across *i*, and when there is ultimate growth convergence then $h_{it} \to 1$ for all *i* as $t \to \infty$.

Next, Phillips and Sul (2007) construct the cross-sectional mean square transition differential H_1/H_t where:

$$H_t = \frac{1}{N}\sum_{i=1}^{N}\left(\hat{h}_{it} - 1\right)^2 \qquad (8)$$

and measures the distance of the panel from the common limit.

To formulate a null hypothesis of growth convergence, the authors proposed a semiparametric model for the time-varying behaviour of δ_{it} as follows:

$$\delta_{it} = \delta_i + \sigma_i \xi_{it} L(t)^{-1} t^{-\alpha} \qquad (9)$$

where δ_i is fixed, $\sigma_i > 0$, ξ_{it} is i.i.d (0,1) across *i* but weakly dependent on *t*[1], and L*(t)* is a slowly varying function for which *L(t)* tends to infinity as t also goes to infinity.

[1] These conditions imply that the stochastic component declines asymptotically so that the trend vanishes and each coefficient converges to δ_i.

Following Phillips and Sul (2007) the *L(t)* function is assumed to be *log t.* ξ_{it} introduces time-varying and region-specific components to the model. The size of α determines the behaviour (convergence or divergence) of δ_{it} . This formulation ensures convergence of the parameter of interest for all $\alpha \geq 0$, which is the null hypothesis of interest since $\delta_{it} = \delta_i$ as $t \to \infty$. Furthermore, if this hypothesis holds and $\delta_i = \delta_j$ for $i \neq j$, the specification in (9) still allows for transitional periods in which $\delta_{it} \neq \delta_{jt}$, thereby incorporating the interesting possibility of transitional heterogeneity or even transitional divergence across *i.* Thus, the null hypothesis of convergence can be written as:

$$H_0 : \delta_{it} = \delta \; and \; \alpha \geq 0 \qquad (10)$$

and the alternative:

$$H_A : \delta_{it} = \delta \; for \; all \; i \; with \; \alpha < 0 \qquad (11)$$

or

$$H_A : \delta_{it} \neq \delta \qquad (12)$$

The alternative hypothesis includes divergence, as in (11) and (12), but can also consider club convergence. For example, if there are two convergent clubs, the alternative is:

$$H_A : \delta_{it} \to \begin{cases} \delta_1 \; and \; \alpha \geq 0, if \; i \in G_1 \\ \delta_2 \; and \; \alpha \geq 0, if \; i \in G_2 \end{cases} \qquad (13)$$

where G stand for a specific club.

Phillips and Sul (2007) show that these hypotheses can be statistically tested by means of the following 'log t' regression model:

$$\log(H_1/H_t) - 2\log(\log(t)) = a + b\log t + u_t \qquad (14)$$

for t=[rT], [rT]+1,…, T with some r > 0. Phillips and Sul (2007) suggest r=0.3 based on their simulation experiments.

The key parameter of the convergence test, *b*, is related with α. Indeed, Phillips and Sul (2007) showed that the fitted value of log t is $\hat{b} = 2\hat{\alpha}$ where $\hat{\alpha}$ is the estimated value of α under the null. In this method, rejection of the null for the whole panel does not imply that there is not convergence, since it is possible to test, by means of an algorithm, whether there are clubs/clusters of convergence. Hence, it is possible to test the hypothesis of convergence for different group of countries, and identify commonalities within a panel of countries.

The regression test of convergence in (14) is made up of three stages (Phillips and Sul, 2007, p.1788). In the first step, the cross-sectional variance (H_1/H_t) ratio is constructed, and then in the second step the conventional robust t statistic, $t_{\hat{b}}$, for the coefficient $\hat{b}$ is computed using (14). Finally, in the third step, an autocorrelation and heteroskedasticity robust one-side t test of the inequality null hypothesis $\alpha \geq 0$ is applied using the estimated coefficient $\hat{b}$ and HAC standard errors. At the 5 percent level, the null hypothesis of convergence is rejected if the statistic has a value below -1.65.

However, the novel aspect of this approach is that convergence patterns within groups can be examined using the log t regressions, i.e. the existence of club convergence and then clustering. This fact is particularly relevant since the rejection of the null of convergence does not necessarily imply divergence, since different scenarios can be met, such as separate points of equilibrium or steady-state growth paths, as well as convergence clusters and divergent regions in the full panel.

The convergence approach by Phillips and Sul (2007) has a number of clear advantages. First, it is a test for relative convergence as it measures convergence to some cross-sectional average in contrast to the concept of level convergence analyzed by Bernard and Durlauf (1996). Second, this approach outperforms the standard panel unit root tests since in the latter case $X_{it} - X_{jt}$ may retain nonstationary characteristics even though the convergence condition holds, i.e. panel unit root test may classify the difference between gradually converging series as non-stationary. As a further problem, a mixture of stationary and non-stationary series in the panel may bias the results. Moreover, test results are sometimes not particularly robust. In contrast, the Phillips and Sul (2007) test does not depend on particular assumption concerning trend stationarity or stochastic nonstationarity of the variables to be tested.

3. Empirical results

In this paper we analyse the convergence of GDP PPP adjusted in 1990 US dollars per worker convergence in the following countries; Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Holland, Poland, Portugal, Romania, Slovak Republic, Spain, Sweden and the United Kingdom. We use annual data from 1980 to 2009 for Western Europe and from 1990 to 2009 for Eastern Europe. Data come from the World Bank.

In order to analyse if the convergence process of our pool of countries is homogeneous or, on the contrary, the countries form clubs of convergence, we apply the Phillips and Sul (2007, 2009) methodology. According to this methodology, groups of countries may converge to a steady state which is common to all the countries of the group but different to other groups of countries. As previously mentioned, this approach is based on a nonlinear and time varying factor model, which incorporates the possibility of transitory heterogeneity and even transitory divergence. Furthermore, the order of integration of the variables is not relevant in applying this methodology. Interestingly, this method also allows us to distinguish convergence clubs.

Table 1 shows the results of the cluster analysis for the 24 target countries, for the sample 1990-2009. To obtain the results we have followed Phillips and Sul's (2007) algorithm. This implies four steps. In the first step the series in the panel are sorted out according to the amount of the last third period income.

The second step consists of selecting the k highest individuals in the panel to form the subgroup G_k for some $2 \leq k < N$. The log t regression is run and the convergence test statistics $t_k = t(G_k)$ calculated. The core group size k* is chosen according to the criterion:

$$k^* = \operatorname{argmax}_k \{t_k\} \, \textit{subject to} \min\{t_k\} > -1.65$$

In the third step the data is sieved for new club members. This implies to add one country at a time to core primary group with k* members and run the log t-test again.

Table 1

Cluster analysis. Sample 1990-2009

	1st club analysis	
	b coefficient	t statistic
constant	-2.850	-7.228
log t	0.386	2.364

First cluster: Bulgaria, Estonia, Greece, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic and Slovenia

Test to know whether the rest of countries form a cluster:

	b coefficient	t statistic
constant	0.171	0.469
log t	-0.641	-4.253

Since the $t < -1.65$ the analysis needs to be repeated

	2nd club analysis	
	b coefficient	t statistic
constant	-1.391	-5.577
log t	0.122	1.177

Second cluster: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Italy, Ireland, Holland, Portugal, Spain, Sweden and the United Kingdom.

The new country is included in the convergence club if the associated t-statistic is greater then the criterion c*. Finally, in the fourth step new cluster are searched for. A second group of countries is formed from those for which the sieve condition failed in step 3. The log t-test is run to see if this group satisfies the convergence test. If so, it is possible to conclude that there are two convergence club groups. If not, steps 1 to 3 are repeated to see if the second group can itself be subdivided in to convergence clubs. If there is no k in step 2 for which $t_k > -1.65$, the remaining countries have divergent behaviour.

According to the results in table 1, we find a first cluster consisting of Bulgaria, Estonia, Greece, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic and Slovenia. That is, all Eastern European countries plus Greece. Surprisingly, Greece's GDP per worker converges with Eastern Europe rather than with the EU-14. The second cluster is formed by the Western economies minus Greece. These results highlight that, during the process of economic integration, countries from Eastern Europe have converge to their own steady state, which is different from that of the rest of the EU. These results give support to the idea that, despite notable improvements, gaps in terms of income per worker relative to the euro area remain large in the Eastern European countries (Borys, et al., 2008). This suggests that the challenges of real convergence will remain relevant for these countries even in the medium and long term.

Phillips and Sul's (2007) procedure, allows us a first classification of countries with more homogenous features in terms convergence. This does not prevent us from finding subclusters within clusters, implying different steady state within groups. To do this, we divide the panel in two groups of countries. The first one consists of Eastern European countries, and the second consists of the remainder. Despite the fact that Greece appears in the Eastern European countries in the previous analysis, we have include this countries in the Western group since it is not a transition economy, and we are interested in analysing its behaviour in relation with the rest of the member states, and with those with whom shares the euro. Also, we have left the Czech Republic in the Eastern European group of countries, given that GDP per worker data is not available before 1980.

Table 2

Cluster analysis. Sample 1980-2009		
	1st club analysis	
	b coefficient	t statistic
constant	-4.236	-8.111
log t	0.578	3.136
1st cluster: Finland, Ireland, Italy, Portugal, Spain and Sweden		
Test for the remainder countries forming a club:		
	b coefficient	t statistic
constant	0.102	0.702
log t	-0.748	-14.553
Since t < -1.65 the process needs to be repeated		
	2nd club analysis	
	b coefficient	t statistic
constant	-3.324	-3.530
log t	0.694	2.088
2nd cluster: Austria, Belgium, Denmark, France, Germany, Holland and the United Kingdom		

Table 2 displays the results of the EU-14 cluster analysis. The sample is 1980-2009. From these results it is possible to highlight that there is evidence of two groups. However, the results do not pinpoint the traditional division into Northern Europe and Southern Europe. Although the first cluster includes Southern European countries, it also includes Northern countries such as Finland and Sweden. The second cluster consists of Germany, France and the United Kingdom, along with those countries with strong links with Germany. In addition, belonging to the euro zone does not determine the cluster and convergence to a common steady state. For instance, Sweden belongs to the first cluster, and Denmark along with the United Kingdom, belong to the second. Rather, these clusters seem to be related with the divergence in competitiveness has suggested by De Grauwe (2008). According to this author some countries as Portugal, Spain and Italy amongst others have suffered an important loss of price competiveness which may be linked to different national policies. Finally, Greece is not in either of the two clusters and therefore follows a divergence path.

Table 3 shows the results of the cluster analysis for Eastern Europe for 1990-2009. Here we also find two clusters. The first one consists of Bulgaria, Latvia, Lithuania, Poland, Romania and Hungary. In the second one we find the Czech Republic, Slovak Republic, Slovenia and Estonia. It seems that, with this group of countries, belonging to the euro zone determines the clusters. The three countries which are part of the euro zone appear in the same cluster.

Table 3

Cluster analysis. Sample 1990-2009		
	1st club analysis	
	b coefficient	t statistic
constant	-1.159	-5.262
log t	0.076	0.860
First cluster: Bulgaria, Latvia, Lithuania, Poland, Romania and Hungary		
Test for the remainder countries forming a club:		
	2nd club analysis	
	b coefficient	t statistic
constant	-7.797	-3.695
log t	1.873	2.198
Since t > -1.65 the remaining countries form a convergence club		
2nd cluster: Czech Republic, Estonia, Slovak Republic and Slovenia		

Figure 1 presents the transition curves the for four clusters.[2] These transition curves depict the transitional dynamics of each cluster. Under the assumption of overall convergence for the full sample of countries, the relative transition parameters should converge to one. In the presence of club convergence, the relative transition parameters of each club converge to different constants. As is clear, the four cluster present different steady states in terms of per capita income. The transition curves show that, from mid-nineties, countries in cluster two have slowly converged to the cluster formed by Germany, France and the United Kingdom (inter alia). However, this transition was broken in 2008 and, as a consequence of the financial turmoil, European countries in cluster 1 and 2 diverge. As regards Eastern countries (clusters 3 and 4), there is no evidence of convergence within EU-14 countries, neither within them. These results have two important implications. First, convergence within EU-14 is overall modest. This lack of convergence may reflect macroeconomic imbalances within these countries that may partly explain the current euro crisis. Second, the fact that Eastern European countries do not show any signal of convergence casts doubt on the sustainability of a future enlarged common currency area including less advanced economies as well as the inability of Maastricht criteria to promote real convergence.

[2] Cluster 1 and cluster 2 corresponds respectively to cluster 1 and 2 in Table 2. Cluster 3 and 4 corresponds respectively to cluster 1 and 2 in Table 2.

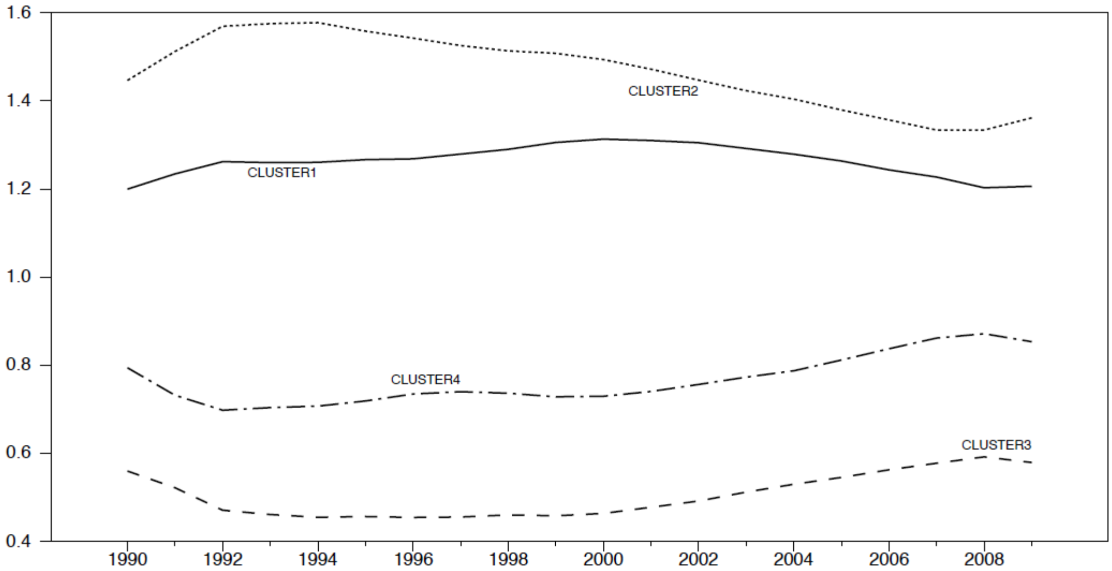

Figure 1: transition curves for the clusters

4. Conclusions

In this paper we have analysed the hypothesis of income per capita convergence within the EU. This analysis is of crucial importance, since the EU now consists of a large number of countries with different levels of productivity and economic growth.

By means of applying club convergence techniques, we find that there are strong divergences in terms of income per capita within the EU; first, we have the Central and Eastern European countries plus Greece, forming a group of convergence. Interestingly, Greece appears to behave more similarly to the economies in transition group. Second, after repeating the analysis for western and eastern EU countries, we find that there is neither clear subdivision between southern and northern countries, nor between euro and non-euro countries. In addition, Greece appears not to belong to either of the clusters, within the west. Finally, for Eastern European countries, it seems that belonging to the euro zone determines the cluster that these countries belong to. It seems that for Eastern European countries, the process of transition to market economies, along with the desire to belong to the EU and euro zone, has had the anticipated effect.

Our results point out the necessity of deep structural reforms within the EU, in order to increase the level of convergence amongst its Member States.

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