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IS COMPETITIVENESS IN THE EUROPEAN UNION CONVERGING?

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Abstract

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The convergence process has for many decades captured the attention of economists and its importance has especially increased with deepening economic integration. A wide range of indicators is used in the professional literature to establish real and nominal convergence in the European Union, but national competitiveness is usually not among them, despite the fact that national competitiveness has in recent years been an important indicator of economic performance at the national level. Furthermore, converging competitiveness is a necessary precondition for further common development of the European Union. The aim of this contribution is to demonstrate whether the competitiveness of the EU countries is converging or not. Competitiveness is defined as the ability of a country to deliver beyond-GDP goals to its inhabitants and the indicator of outcome competitiveness is used for its evaluation. We apply methods of beta and sigma convergence and the results of both methods show that while the differences in competitiveness among the EU member states decreased in the period 2003–2012, it did so very slowly.

Keywords: outcome competitiveness, composite indicator, European Union, beta convergence, sigma convergence, homogeneity, regression

INTRODUCTION

The convergence process has been closely followed by economists for many decades. With deepening economic integration, the importance of convergence has especially increased. This is certainly true for the European Union, which currently represents the political and economic integration of 28 countries with different development levels. The importance of the convergence process in the European Union is stressed for example in Detken *et al.* (2004), Malý (2014) and by the ECB (2015). A wide range of indicators has been applied in the scientific literature to substantiate real and nominal convergence in the European Union. In particular, gross domestic product per capita and price levels are indicators often used to assess convergence or divergence in the European Union (for example Matkowski and Próchniak, 2004, Žďárek, 2011 and Dobrinski and Havlik, 2014). Other authors use different indicators to verify convergence in the EU, for example unemployment, productivity or unit labour cost (Estrada, *et al.*, 2012, Sondermann, 2012 and Bourgeot, 2013).

Since competitiveness has been such a closely studied indicator of economic performance in recent decades, it is essential to use this indicator to also test convergence within the European Union. According to Malý (2014), a converging tendency of competitiveness in the European Union is an important precondition for solving the Eurozone crisis. As Malý (2014) asserts, differences in competitiveness among member states have lead to macroeconomic imbalances inside the Eurozone and tended to promote different macroeconomic development in individual countries. Representatives of the European Union are also interested in enhancing the competitiveness of all EU member states as well as the European Union as a whole (we can find the goals concerning increasing competitiveness in the European Union in the Lisbon Strategy and also in the strategy

Europe 2020). Converging competitiveness among EU member states is a necessary precondition for the competitiveness growth of the EU as a whole.

If we want to verify whether the competitiveness of EU member states is converging or not, we first need to define what we mean by the "competitiveness" of a country. Despite the frequency with which this term is used in the scientific literature, we cannot find any consensus about its definition. In this paper we draw on the definition of competitiveness suggested by Aiginger *et al.* (2013, p. 1), who defined competitiveness as the "ability of a country to deliver beyond-GDP goals for its citizens". This approach to competitiveness is in accordance with the majority of the goals of the EU presented in the strategy Europe 2020. Besides smart growth, the European Union strove to reach sustainable and inclusive growth in this decade (sustainable growth covers indicators of environmental sustainability and inclusive growth means high employment and social cohesion in the EU member states; for further information see European Commission, 2010).

The main goal of this paper is to verify whether the competitiveness of EU countries is converging or not. Admittedly, the convergence process must be attended by competitiveness growth in the EU member states to ensure increasing competitiveness of the EU as a whole. So while the methodology proposed by Aiginger *et al.* (2013) is used for the competitiveness evaluation of EU economies, the original methodology is extended and a composite indicator of outcome competitiveness is constructed to verify whether competitiveness in the European Union is converging or in fact diverging. To identify convergence or divergence tendencies in the EU, the methods of beta and sigma convergence are used.

In the next section the methodology is introduced, the construction of the composite indicator is explained and the methods used for the convergence analysis are described. In the third section the results are presented, the composite indicator development is analysed and the beta and sigma convergence models are tested. The last two sections provide a discussion of the main results and a summary of the most important findings.

MATERIALS AND METHODS

Our choice of approach to national competitiveness draws on the goals specified in the strategy Europe 2020, specifically those of sustainable and inclusive growth. For this reason the approach proposed by Aiginger *et al.* (2013) was selected and hereinafter we use competitiveness as a synonym for outcome competitiveness. Based on Aiginger *et al.* (2013), outcome competitiveness is formed by three pillars: income, social and ecological. Each of these pillars covers several individual indicators, which were chosen on the basis of Aiginger *et al.* (2013) and adapted with respect to data availability. The income pillar consists of three individual indicators: net national income, net disposable income of households and final consumption expenditure. The second social pillar is composed of four individual indicators: the ratio of people at risk of poverty in the general population and in the population over 65 years (both after social transfers)[1], long-term unemployment (i.e. unemployment longer than 12 months) and youth unemployment (for the age group 15–24). The indicators of the ecological pillar evaluate environmental outcomes and cover two variables: resource productivity (which is the gross domestic product divided by domestic material consumption) and the ratio of renewable energy resources (defined as the ratio of renewable resources to total energy consumption). All individual indicators of outcome

I: *Individual indicators of outcome competitiveness*

Variable	Unit	Source
Net national income (NI)	thousand EUR per inhabitant	Ameco
Net disposable income of households (DI)	thousand EUR per inhabitant	Eurostat, Ameco
Final consumption expenditure (C)	thousand EUR per inhabitant	Ameco
People at risk of poverty (RoP)	percentage of total population	Eurostat
People at risk of poverty over 65 years (RoP65)	percentage of population in the age group 65+	Eurostat
Long-term unemployment (LU)	percentage of active population	Eurostat
Youth unemployment (YU)	percentage of population in the age group 15-24	Eurostat
Resource productivity (PROD)	EUR/kg	Eurostat
Energy from renewable resources (REN)	percentage of total energy consumption	Eurostat, World Bank

1 According to Eurostat, persons are at risk of poverty if their equivalised disposable income is below the risk-of-poverty threshold, which is set at 60 % of the national median equivalised disposable income after social transfers.

competitiveness, their units and sources are shown in Tab. I. All variables are available in an annual time series for the time period 2003–2012. Data before 2003 are not complete and thus we decided to start the analysis with the year 2003. Data after the year 2012 were not available for all the individual indicators at the time of conducting the analysis, so the year 2012 is our final year. We decided to use a shorter time series rather than imputing the missing data.

If we want to construct a composite indicator of outcome competitiveness, we must first usefully weight of the individual indicators. There exist several ways to achieve this. One can set equal weights, which usually means simplification or the use an expert opinion. This method, however, suffers from high degree of subjectivity. Thus we decided to use principal component analysis and factor analysis to estimate the weights of individual variables, as suggested by Temple and Johnson (1998) and Fagerberg *et al.* (2007). The methodology of weights estimation and the methodology of composite indicator construction is described in Nardo *et al.* (2005). The estimated weights of all nine individual indicators of outcome competitiveness are displayed in Tab. II.

Since all the variables are in different units, if we want to compute the composite indicator of outcome competitiveness, we first need to normalise the individual variables. Normalization will ensure that none of the indicators will outweigh the others. We used the min-max normalization method because, as mention for example by Rozmahel *et al.* (2013), it preserves the equal impact of all indicators, since after min-max normalisation all indicators have values between 0 and 1. All variables were normalised as a panel according to the following formula:

$$I_{qc}^{t} = \frac{x_{qc}^{t} - \min_{t\in T} \min_{c}(x_{q}^{t})}{\max_{t\in T} \max_{c}(x_{q}^{t}) - \min_{t\in T} \min_{c}(x_{q}^{t})}, \qquad (1)$$

where t is the year, c is the country and q is the indicator. In this modified version we do not use a minimum or maximum value for a specific year, but the minimum or maximum value for the whole dataset (i.e. panel) and thus the dynamic aspect is preserved (the dynamic aspect of the composite indicator, i.e. its comparability over time, is crucial if we want to use the indicator to verify a convergence or divergence tendency in the European Union). The final composite indicator of outcome competitiveness is computed as the weighted average of all the nine normalised variables. This can reach values from 0 to 1, where 0 would mean that a country was in a certain year the worst in all the variables of the composite indicator and, in contrast, a 1 would mean that a country was in a certain year the best in all the variables of the composite indicator. These extreme values were not achieved, however, so we can interpret the composite indicator values as follows: the nearer to 1 is a country's composite indicator, the more competitive is the country. Or alternatively, the increasing value of the composite indicator means the increasing competitiveness of a country. Importantly, our concept of competitiveness is as a relative term: we are assessing competitiveness for a fixed group of countries over a certain time period. Any change in the country group or the time period would require a recalculation of all the results.

The methods of beta and sigma convergence were used to verify whether competitiveness in the European Union is converging or not. The methodology of both these methods is based on neoclassical theory. The beta convergence concept is the older one; its fundamental ideas can be found in the work of Maddison (1982) or Baumol (1986). When beta convergence is shown, it means that initially poorer countries are growing faster, i.e. in our case beta convergence would mean that initially less competitive countries were enhancing their competitiveness more dynamically and thus catching up with initially more competitive economies. In this contribution we apply the extended beta convergence model as suggested for example Canova and Marcet (1995), Tondl (1999), Marelli (2004) or Marelli and Signorelli (2010). This model is based on panel data estimation of following regression equation:

$$\ln\left(\frac{y_{i,t}}{y_{i,t-1}}\right) = \alpha + \beta \cdot \ln\left(y_{i,t-1}\right) + \varepsilon_{i}, \qquad (2)$$

where $y_{i,t}$ is the variable in the country i and time t and $y_{i,t-1}$ is the variable in the country i and time $t-1$. If we get the parameter $\beta < 0$, then we can speak about a beta convergence of competitiveness among the selected economies; conversely, if the parameter is $\beta > 0$, it means the differences in competitiveness between selected countries are increasing, i.e. competitiveness in the European Union is diverging.

We also verify sigma convergence of competitiveness in the European Union because, as several professional studies have confirmed, beta convergence is a necessary, but not a sufficient condition for sigma convergence (Sala-i-Martin, 1996, Young *et al.*, 2008 and Slavík, 2007). Sigma convergence is defined as the decrease in variance of the logarithm of the selected indicator (i.e. competitiveness) between economies over time

II: *Estimated weights of individual variables*

Variable	NI	DI	C	RoP	RoP65	LU	YU	PROD	REN
Weight	0.12	0.12	0.12	0.11	0.10	0.10	0.10	0.10	0.13

Source: own calculations based on Eurostat, Ameco and World Bank data

(Slavík, 2007). Verification of the sigma convergence is based on the standard deviation (σ):

$$\sigma_t = \sqrt{\frac{1}{N}\sum_{i=1}^{N}\left(\ln y_{i,t} - \mu_t\right)^2}\,, \qquad (3)$$

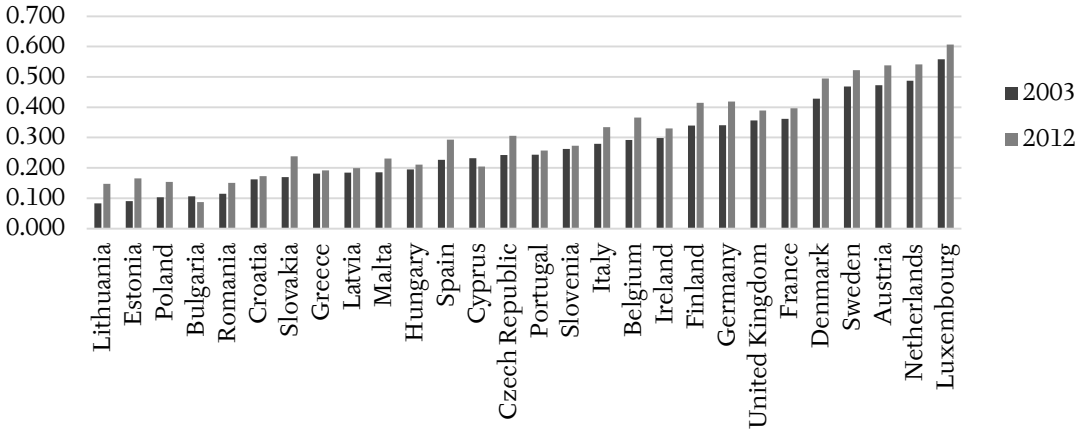
where N is the number of economies, t is the year and μ_t is the average of the variable (after calculating the logarithm) for the whole EU (Young *et al.*, 2008). If the standard deviation decreases, i.e. if $\sigma_t > \sigma_{t+1}$, we can speak about the occurrence of sigma convergence. In contrast, a result of $\sigma_t < \sigma_{t+1}$ points to a sigma divergence.

RESULTS

Before we analyse the convergence or divergence of outcome competitiveness in the European Union, we should examine the differences of the EU economies in the base year. In Fig. 1 we can see the composite indicator for all EU economies in the year 2003 and 2012. The countries are ranged according to the composite indicator value in 2003. In this year the least competitive economies were Lithuania, Estonia, Poland, Bulgaria and Romania. And these countries are still the least competitive economies in 2012, they have just interchanged their positions. With the exception of Bulgaria, their competitiveness in 2012 was higher than in the base year, but they did not climb above any other EU economies. Although we can observe a positive shift especially in the variables of the social pillar in these countries, all of them lag behind in the income pillar variables, which creates a barrier to them catching up. At the other end of our scale are the northern and the western European countries. These economies have a noticeable advantage in income pillar indicators and also higher resource productivity. If we compare the outcome competitiveness results in 2003 and 2012, we can see that competitiveness in almost all economies increased. The only exception is Bulgaria, as mentioned above, and Cyprus. But it does not seem that competitiveness in the initially less competitive economies is growing faster. Although competitiveness in some of them grew markedly (especially Estonia, Slovakia, Lithuania and the Czech Republic), in others the growth was insignificant. On the other hand, competitiveness growth in Germany, Finland, Denmark and Belgium was much more significant, which conversely indicates increasing heterogeneity in the European Union. To verify these tentative results we then applied the beta and the sigma convergence methods.

To verify beta convergence or beta divergence we need to estimate the equation (2), which requires a panel regression analysis. Accordingly, for the results of the Hausman test we chose the fixed effect model. Inter-annual growth between the year t and (t – 1) of the composite indicator is the dependent variable and the value of the indicator in the year (t – 1) represents the independent variable in this model. The results of the extended beta convergence model are given in Tab. III. In the first column we can see the results for the whole EU. Parameter beta is statistically significant on the 1 % significance level and is negative, which indicates beta convergence of competitiveness in the European Union. According to these results, the less competitive economies are indeed enhancing their competitiveness faster and thus are closing the gap on the more competitive countries of the European Union. But this convergence process seems to be very slow.

The next two columns show the results of the extended beta convergence model for old and new EU member states separately.[2] Beta



1: *The composite indicator of outcome competitiveness in the European Union*
Source: own calculations based on Eurostat, Ameco and World Bank data

2 Old member states are the 15 countries which entered the EU before the year 2004 (i.e. a reference to the EU-15); new member states are the 13 countries which entered the EU in 2004 and subsequently (i.e. a reference to the EU-13).

III: *Extended beta convergence model: panel regression results*

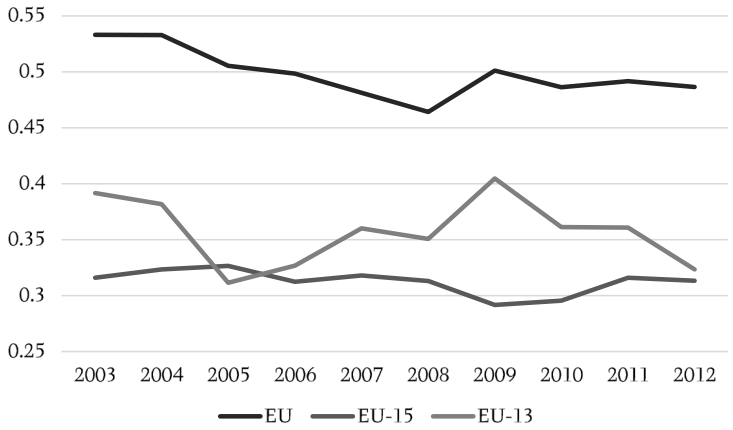
	EU	EU-15	EU-13
constant	–0.497***	–0.276***	–0.680***
	(0.061)	(–0,060)	(0.116)
y_t – 1	–0.382***	–0.289***	–0.403***
	(0.045)	(0.059)	(0.067)

Standard errors are in parentheses.
*, **, *** indicates significance at the 90 %, 95 % and 99 % level, respectively.
Source: own calculations based on Eurostat, Ameco and World Bank data

convergence was proven among the old as well as new member states. If we compare the beta parameter among these models, then the strongest relationship between competitiveness in the base year and interannual competitiveness growth can be observed in the EU-13. Conversely, the weakest relationship (i.e. the lowest beta parameter) is in the second model, which verified beta convergence among the old member states. The reason lies in the considerable dissimilarity of the EU-15 countries. While the competitiveness of the most competitive economies (especially those of the northern and western European countries) is increasing rapidly, competitiveness in southern European economies is not developing so dynamically. Were we to exclude the southern countries, the results would show a much stronger beta convergence process among the EU-11 countries (EU without Italy, Greece, Portugal and Spain).

To check the previous results of the beta convergence model, our final task is to apply the sigma convergence approach. We needed to analyse the standard deviation development to find out whether the differences among the EU economies is decreasing or increasing. The trend of the standard deviation for the outcome competitiveness indicator in the European Union, for both old and new member states in the time period 2003–2012, is shown on the Fig. 2. The highest standard deviation and thus the most significant heterogeneity is apparent across the whole EU. But in favour of sigma convergence attests, that the standard deviation is lower in the final year of the analysed time period than in the first. Although the standard deviation decreased just slightly (the absolute value of the decrease was about 0.04), the results confirm the sigma convergence of the outcome competitiveness in the European Union. The results could have been much more convincing, if there had not been the relatively robust growth in the standard deviation in 2009. This was caused primarily by the sharp decline in competitiveness in the Baltic countries and Poland. But the competitiveness of these countries increased in the following year and the standard deviation began to decrease again (the same is observable in the standard deviation development for the EU-13). In the final year 2012, the standard deviation is nonetheless still higher than in 2008.

If we look at the standard deviation development in the old and new member states separately, additional facts become clear. We get the lowest standard deviation among EU-15 countries, which points to the greater homogeneity in this group. In the group of new member states the standard deviation is much more volatile and was higher across almost the whole time period. The only exception is the year 2005, when the differences among the EU-13 economies decreased rapidly and also the heterogeneity of the whole EU was decreasing. In the final year of our analysis (2012) the standard deviation in EU-13 and EU-15 was almost equal, but there were still



2: *Sigma convergence model: standard deviation development*
Source: own calculations based on Eurostat, Ameco and World Bank data

considerable differences between these two groups. The homogeneity in the EU-15 and EU-13 was very similar in the year 2012, but there is still a huge gap in competitiveness between the old and new member states.

DISCUSSION

There is copious literature about convergence in the European Union and its importance for the further common development of the EU and especially the Eurozone. Different authors use different indicators to analyse the convergence process in the European Union. The results of these studies are quite ambiguous, however. The converging tendency in the European Union was not confirmed for example in Groll and van Roye (2011), Brunet (2013) or Barbosa and Alves (2011). Only a minority of existing studies apply competitiveness in their assessment of the convergence or divergence process in the EU countries.

According to Malý (2014), competitiveness in the European Union is not converging. Malý (2014) asserts that differences in competitiveness among the EU economies is in fact increasing, which should be perceived as a negative trend. Our results seem to indicate the opposite. It should be borne in mind, however, that competitiveness is a very specific indicator and one that must be handled very carefully. Choosing an appropriate definition of competitiveness is absolutely essential on the national level, as is choosing an appropriate competitiveness indicator. We identify the main problem of the analysis by Malý (2014) in the choice of the competitiveness indicator, since he used the Global Competitiveness Index for competitiveness evaluation.

The Global Competitiveness Index, created by the World Economic Forum for several decades, is undoubtedly a broadly accepted competitiveness measure. But it is not particularly suitable for a convergence analysis. For us, the problem lies in its construction, where approximately 72 % of all data included in the composite indicator are soft data coming from questionnaires (WEF, 2014). This means that these data are quite subjective and influenced by the prevailing social mood. The fact that this will vary means one should doubt the objective comparability of this composite indicator over time, which is however necessary for analysing convergence or divergence. The composite indicator of outcome competitiveness presented in this paper is in this respect much more suitable. While the Global Competitiveness Index is more comprehensive, since it covers more than 100 individual indicators, it is nonetheless not suitable for the convergence analysis.

CONCLUSION

The aim of this contribution has been to verify whether the competitiveness in the European Union is converging or not. When dealing with competitiveness at the national level, it is essential to choose a suitable approach to competitiveness. In this paper we have engaged in a convergence analysis of the competitiveness in the European Union and thus the approach to competitiveness should respect the goals and priorities of the EU set out for the decade in question. The goals of sustainable and inclusive growth can be approximated by the composite indicator of outcome competitiveness.

After calculating the composite indicator, we used the acquired data for the convergence analysis. Our data set has 280 observations (28 countries and a 10-year time period). These data were first tested for beta convergence. The results of the panel regression showed that competitiveness in the European Union is converging, i.e. the initially less competitive economies of the EU are increase their competitiveness more dynamically than the initially more competitive economies. While we can point to a catching-up process among the EU economies, it seems that this process is very slow. This conclusion is also proven by the sigma convergence results. When analysing the development of the standard deviation of the composite competitiveness indicator, we can see a decreasing tendency of variance. The standard deviation is decreasing over time (with a significant aberration in 2009), and thus the homogeneity of the European Union is increasing. But again, the process seems to be very sluggish. In particular, we found the income pillar to be a substantial barrier against faster convergence, where the differences between old and new (which joined EU in 2004 and subsequently) EU member states are considerable and are not decreasing over time.

According to our results, beta convergence as well as sigma convergence has been demonstrated. Thus we can conclude that competitiveness (in the meaning of outcome competitiveness as defined above) in the European Union is converging. The less competitive economies of the EU are increasing their competitiveness more dynamically, i.e. the differences in competitiveness between individual countries are decreasing, while the competitiveness of the EU as a whole is increasing. Only Bulgaria and Cyprus depart from this trend. Their competitiveness in 2012 was worse than in the first year of the analysed time period.

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