

Measurement and Evaluation of the Real Economic Convergence of the V4 Countries with the European Union

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Abstract

Socio-economic factors play a key role in the development of a society, the status of which is a means to measure and assess the tendencies and the degree of economic convergence or divergence. On the whole it can be said that this is a natural and continuous process that requires permanent engagement and which, subject to certain factors, occurs at different speeds. A key factor that affects the dynamics of these processes is geographical area. This is the case for the Visegrad (V4) countries within Central Europe. The development of this region has over many years been influenced by similar economic, cultural, geopolitical, natural and ethnic interests that have been intertwined through historical developments, power interests and the strong common desire to see their economies converge with those of Western Europe. The aim of the study presented in this article is to measure and evaluate the real level of economic convergence of the Visegrad countries eleven years after joining the European Union. This is achieved by the means of β - and σ - convergence using regression analyses for the monitored periods 2004-2014, 2004-2008 and 2008-2014.

Keywords: European Union, growth disparities, real economic convergence, optimal growth, steady state, Visegrad Group.

Introduction

The Visegrad region forms an integral part of Central Europe and was conceived as a modern entity and an active member of the advanced structures of Western Europe. This is amplified and reflected in the historical-cultural needs on both sides. This process was compounded by the fall of the Iron Curtain and is fully reflected in the countries joint accession to the European Union (Filipova and Gilbert 2011). In terms of its genesis and connotations, the region has shown strong internal conviction and motivation to move

forward, which is visible in the growing strength and importance of Central Europe as it goes through different stages of development (Schreier 2015). On 1 May 2004, the European Union officially admitted ten new member states, the largest single enlargement in its history, bringing the total number of member states to twenty-five (Weiner and Diez 2009). The eastward expansion of the European Union saw the incorporation of economies with large disparities in terms of living standards and economic characteristics (Domonkos et al. 2015).

Reducing these disparities and narrowing the gaps between the V4 countries themselves, as well as between the V4 countries and the original members of the European Union, has become an urgent topic of discussion with regards to further growth and progress. The economic situation in the V4 countries during the examined period 2004-2014 was influenced by the interaction of a number of external and internal factors. Some of the most important factors were the initial structure of the economies, the intensity of investment, infrastructure status, transformation strategy, which sought to strengthen macro- and socio-economic growth, combined with the efficiency of state governance and public administration in the implementation of reforms (Radvanský et al. 2016). The economic baseline in each of the Visegrad countries was very similar, but in many ways dominated by differences that were subsequently modelled by their individual ability to adapt to the new economic environment. This, together with a qualified and motivated labour force, was a potentially positive starting point for the successful integration into the international environment and new structures (Berend 2016). The examined countries had, in light of their common history and similar predispositions, and not only those of a socio-economic nature, due to the convergence process, similar attributes that did not stand in the way of common and individual strategies in the form of options for future action and direction.

Material and methods

In the European Union, a number of different groups gradually emerged with diverging opinions on the need, sustainability and success of the socio-economic convergence of member states. The differences between these groups lie in the time scale that convergence should be achieved, the macro- and microeconomic convergence criteria, and which form of convergence (nominal, real, structural) is the most important e.g. Buti, Martins and Turrini (2007), Marelli and Signorelli (2010), Deroose and Gaspar (2011), Katsikides and Hanappi (2016). Firstly, researchers, whose views have since been reflected in practice, suggested that the convergence of the economies before joining the Monetary Union was the only way to generate benefits without exceeding costs. The main thrust of this approach lay in socio-economic convergence. Once achieved, the integration process would be crowned with the introduction of the single currency. This approach is therefore often referred to as the coronation theory. This approach originated in the Council of Ministers in 1974 and is reflected in the European Commission directive on stability, growth and full employment. In 1989, at a summit in Madrid, the three phases for creating a monetary union were determined. The first phase began on 1 June 1990

with the drawing up of convergence programmes designed to improve the economic characteristics of the member states.

Furthermore, it was suggested that the convergence of the economies would create adequate conditions for eliminating currency fluctuations and their subsequent fixation (Barro and Alesina 2013). The promotion of the convergence criteria was to some extent connected with the speculative attacks on the currencies of the EU member states during the operation of the ERM (Exchange Rate Mechanism), which led to a currency crisis. The need to prepare adequately before entering was particularly promoted by the German Central Bank. A second group thought that setting convergence criteria was unnecessary and that the economies would gradually converge after joining the Monetary Union. In their opinion, the existence of the Monetary Union would naturally accelerate the convergence of the economies of the member states. The pioneer of this opinion was Professor Jeffrey A. Frankel from Harvard University. This approach is represented by the endogeneity hypothesis in an OCA (Optimum Currency Area), based on the pretext of improving individual performance criteria after joining the euro area. While most OCA studies are applied to independent countries, OCAs (e.g. Ishiyama's "The Theory of Optimum Currency Areas") may not correspond to national boundaries because of non-homogeneities within countries. As a result, the analysis among groups of countries is not always informative (Alesina, Barro and Tenreyro 2002). Moreover, there are also groups of researchers that work on the assumption that convergence prior to entering the euro area may be beneficial, but that it is not a precondition for its effective functioning. This opinion is maintained by the likes of Professor Paul De Grauwe (2014) of the London School of Economics, as well as Paulson and Mongelli (2008). According to them, convergence should not be a condition for EMU membership, since its significance lies in the reduction of costs associated with the loss of monetary policy and an increase in the benefits of euro area membership. Furthermore, countries should themselves determine the conditions under which their membership will be beneficial and set their own criteria for entry.

Convergence is a term that comes from the Latin word "convergere", meaning moving towards each other, while the opposite phenomenon is divergence i.e. an enlargement or deepening of differences. In the event that there are no significant changes, we talk about stagnation. Convergence is therefore a tendency for societies to evolve similarly in terms of their structures, processes and performances. Convergence occurs when the growth of poor or less developed economies is faster than that of wealthier ones i.e. the difference between two or more variables decreases over time, eventually becoming negligible or zero. Real convergence is based on a neoclassical approach, which is characterised by a market that is free and self-regulating, without state intervention. Approaches to convergence research can, from a theoretical point of view, be divided into two groups. Firstly, those that examine the convergence of GDP, and secondly, those that examine the convergence of price or income per capita, specifically the concepts of β - and σ -

convergence¹. When there is a negative relationship between the growth rate of income per capita and an initial level of income during a test period, we talk about β - convergence (Sala-i-Martin, 1996). In other words, β - convergence occurs when poor economies grow faster than wealthier ones. Under this approach, a variety of estimation methods can be used. One of the most popular methods for estimating β - convergence is the least squares method:

$$\frac{1}{T} \cdot \log\left(\frac{y_{iT}}{y_{i,0}}\right) = \alpha - \beta \cdot \log(y_{i,0}) + \varepsilon_i \quad (1)$$

where the left side of the equation represents the average output growth per capita in the period from 0 to T (T is the number of years/researched periods). This average growth is dependent on the initial level of product $\log(y_{i,t_0})$. Index i indicates the observed region. Based on the assumption that all regions have the same steady state α and the time period is sufficiently long, then $\beta = 1$, while all regions are achieving identical product per person. In reality, the β coefficient indicates how much of a difference to the steady state the regions on average were able to eliminate. The secondary approach is a regression analysis statistical model called the fixed effects model:

$$\log\left(\frac{y_{iT}}{y_{i,T-k}}\right) = \alpha_i - \beta \cdot \log(y_{i,T-k}) + \varepsilon_i \quad (2)$$

where the left side of the equation reflects relative growth in period $T-k$ to T (k denotes a shift to the previous period and index i is the observed region). This relative growth is dependent on the past level of product $\log(y_{i,T-k})$. The third least squares method approach shows an average income growth at the time t_0 to t_0+T , depending on the initial level of income $\log(y_{i,t_0})$. In this case, the β coefficient measures the value of the decline in growth rate of the product as its level increases by 1%. The higher the value of this ratio (see (3)), the faster the convergence process is:

$$\frac{1}{T} \cdot \log\left(\frac{y_{i,t_0+T}}{y_{i,t_0}}\right) = \alpha \cdot \left(\frac{1-e^{-\beta \cdot T}}{T}\right) \cdot \log(y_{i,t_0}) + \varepsilon_{i,t_0,t_0+T} \quad (3)$$

¹ β - convergence occurs when poor economies grow faster than wealthy ones, while σ - convergence refers to a reduction in the dispersion of levels of income across economies. The convergence models used for this study are based on the initial Barro and Balassa-Samuelson convergence effect, whereby the distortion in purchasing power parity results from international differences in relative productivity between the tradeable and non-tradeable goods sector.

In addition, a distinction is made between absolute (unconditioned) and conditional convergence. Absolute convergence refers to a situation where regions converge to the same steady state, whereby economies that are more remote (at the beginning of researched period) from this steady state tend to grow faster. Conditional convergence refers to a situation where regions converge towards different steady states. (In this case, it may also happen that regions do not converge at all. Under these circumstances, it is therefore necessary to include models of other explanatory variables that could help to explain the differences in the steady states e.g. savings interest rate, type of economic policy, level of technology, etc. However, a problem may occur in the quantification of these variables.)

With regards to the speed of the convergence, reference is often made to the term half-life (Radius needed), which expresses the time it will take to eliminate half the original gaps between regions. The half-life is derived from the term $e^{-\beta \cdot T}$ as follows:

$$e^{-\beta \cdot T} = \frac{1}{2} \quad (4)$$

where β is the estimated coefficient of convergence. The shorter it takes to eliminate this gap, the faster the convergence process is. In cases where there is a need to approximate the average income per capita in real wages, the following equation is used:

$$\ln\left(\frac{w_{i,T}}{w_{i,T-k}}\right) = \alpha_i - \beta \cdot \ln(w_{i,T-k}) + \varepsilon_i \quad (5)$$

where w is the average real wage, α_i is the layered constant for a region i , β is the coefficient of convergence and ε_i is a random component. The whole equation expresses the relative growth of average real wages at $T-k$ up to T depending on their past level $\ln(w_{i,T-k})$. During σ - convergence we measure whether the variance of income per capita over time between groups of economies is decreasing. Sample variance can be calculated based on the relationship:

$$\sigma_t^2 = \frac{1}{N} \sum_{i=1}^N [\log(y_{it}) - \mu_t]^2 \quad (6)$$

where μ_t is the sample mean $\log(y_{it})$ and σ_t is the standard deviation. Moreover, the coefficient of variation can be used as an alternative:

$$CV = \frac{\sigma_t}{\mu_t} \quad (7)$$

Sala-i-Martin (1996) explains that there is a relationship between the aforementioned types of convergence and concludes that β - convergence is a necessary but not sufficient condition for σ -convergence. Additionally, when σ - convergence is established, it is very likely that β - convergence is also be present, as well as being a necessary condition for it.

This research is part of KEGA No. 018EU-4/2014 European Marketing – Factors and Determinants of the Single European Market (monograph with multimedia support), VEGA No. 1/0178/14 Common Consumer Policy of the EU and its Application in the Slovak Republic and the Impact on Consumer Education, and VEGA No. 1/0224/15 Consumer Behaviour and Individual Consumption in Periods of Unemployment and Relative Deprivation in the Population: Implications for Decision-making Bodies and Businesses. The purpose is to measure and evaluate the real economic convergence of gross domestic product (GDP) expressed in purchasing power standards (PPS) and comparative price levels (CPL) based on the models of Barro (2004), Sala-i-Martin and Balassa (1964), in particular those focusing on β - and σ - convergence. The measured β - convergence equation used in this research originates from the following equation:

$$\frac{1}{T} \cdot \log\left(\frac{y_{i,T}}{y_{i,0}}\right) \quad (8)$$

where t_0 and t_0+T represent average growth, dependent on an initial level of y_{i,t_0} , and T represents the number of years in the monitored period. The assumption is also made that there is a steady state during β - convergence. During σ - convergence the focus is on

detecting possible catching-up processes as a reduction of the disparities among the V4 countries over time. The following equation is used to measure σ - convergence:

$$\sigma_t = \sqrt{\left(\frac{1}{N-1}\right) \sum_{i=1}^N (R_{it} - \bar{R}_t)^2} \quad (9)$$

where $R_{it} = Y_t - Y_t^b$ variance expresses the degree of variation of the values compared to the average or the convergence difference of the selected countries and the benchmark European Union market. $\bar{R}_t$ represents the mean of the difference in the selected period, while n is the number of observation years - periods. The σ parameter is positive and full integration is achieved when σ reaches zero. It is affected by outliers and by the variable measurement of unit. For smaller samples of countries, the denominator is replaced with $(n-1)$ instead of n , while the principle is to express an original dispersion at *time period t1* over a newer dispersion of countries at *time period t2* (Barro 2004).

Results and Discussion

In this section the research results have been combined with Eurostat data in order to measure and evaluate the real convergence of the Visegrad countries with the developed economies in the West during the period 2004-2014 against that of the EU average. The reason for this is that the efforts of the V4 countries lie in convergence and alignment with these countries and structures, while the EU average provides a basis for objective results because it represents a representative sample that is both mature, due to the continued efforts towards pro-European integration, and realistic in terms of measurement as it represents the steady state to which the converging countries are seeking to get closer to. The Visegrad countries form a perfect sample set due to the degree of homogeneity between them in terms of characteristics, values, socio-economic factors, history, culture and location. On this basis, the following research hypotheses were formulated and applied to all models:

HA0: The V4 countries have not converged with the EU during the selected time period and based on the measured unit.

HA1: The V4 countries have converged with the EU during the selected time period and based on the measured unit.

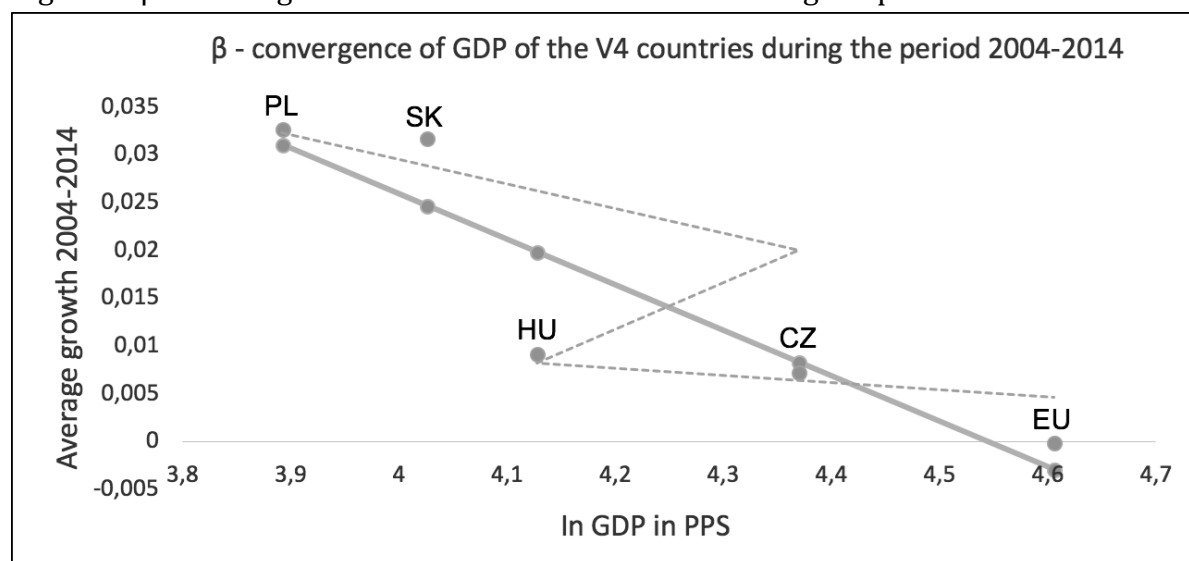
The following table 1 shows the regression outputs that are required for the analysis of the real convergence of the V4 countries. Regression equations for each model were estimated using the least squares method. The table is logically divided into three parts (time periods) during which the V4 countries diverge from or converge with the European Union. In the first model, β - convergence of gross domestic product per capita expressed in PPS is analysed in the V4 countries against that of the European Union for the entire period 2004-2014, in the second model for the period 2004-2008, and in the last model for the period 2008-2014. This makes it possible to cover the whole-time period, including the financial crisis. It is important to note that the economic crisis of 2008 (in the US), and from 2009 onwards in Europe, did not manifest itself in Eastern Europe

during the measured period. The factors that resulted in the crisis have been the focus of many studies and have been broadly discussed by, for example, Brown (2011), Crespo (2012), Blunden (2013), Mishkin (2013), Bruun (2014), Ringe (2015), Mishkin (2015) and Minkenberg (2015). Analyses of this topic show common characteristics, as they all underline the simultaneous development of more than one crisis factor, while the evolution of the GDP growth indicator captures the differences in periods both before and after the year 2009 (Páleník, et al., 2015).

Real β - convergence of GDP in the V4 countries

In the first model, the V4 countries converged with the EU. The regression coefficient R^2 is high (80.62%) and the estimates for the regression coefficients are statistically significant (p-value of less than 5%), which indicates β - convergence (the null hypothesis is rejected, therefore the compliance coefficients of the regression line go to zero). Poland and Slovakia are above the regression line, which means that in the period 2004-2014 they grew faster than their GDP when compared with the other countries. In contrast, Hungary and the Czech Republic saw significantly lower increases in GDP, with Hungary performing particularly badly, as indicated by the distance from the regression line, i.e. economic growth should have been more than it actually was.

Figure 1: β - convergence of GDP of the V4 countries during the period 2004-2014



Source: Author's calculations, Eurostat data

In the second model, for the period 2004-2008, the convergence of the GDP of the V4 countries with the EU could not be proved. The regression coefficient R^2 is low (37.38%) and the estimates for the regression coefficients are not statistically significant (p-value is greater than 5%), which does not indicate β - convergence. Slovakia is situated above the regression line, which means that in the period it grew faster than its GDP when compared to the other countries. The Czech Republic is on the regression line, which means that it grew in line with its level of GDP. In contrast, Hungary and Poland saw significantly lower increases, with Hungary performing particularly badly, as indicated by

the distance from the regression line, i.e. economic growth should have been more than it actually was.

Tab. 1: Real convergence of GDP in PPS in different time periods

Regression equation for GDP	Time period	Slope parameter	p-value	R ²	Evaluation
$y = -0.047x + 0.2163$	2004-2014	-0.047	0.038	80.62	β - convergence
$y = -0.055x + 0.2540$	2004-2008	-0.055	0.273	37.38	β - divergence
$y = -0.054x + 0.4832$	2008-2014	-0.054	0.042	79.43	β - convergence

Source: Author's calculations, Eurostat data

In the third model, for the period 2008-2014, the V4 countries converged with the EU. The regression coefficient R² is high (79.43%) and the estimates for the regression coefficients are statistically significant (p-value of less than 5%), which indicates β - convergence (the null hypothesis is rejected, therefore the compliance coefficients of the regression line go to zero). Poland is above the regression line, which means that in the period it grew faster than its GDP when compared with the other countries. The Czech Republic is on the regression line, which means that it grew in line with its level of GDP. In contrast, Hungary and Slovakia saw significantly lower increases, with Hungary once again performing particularly badly, as indicated by the distance from the regression line, i.e. economic growth should have been more than it actually was.

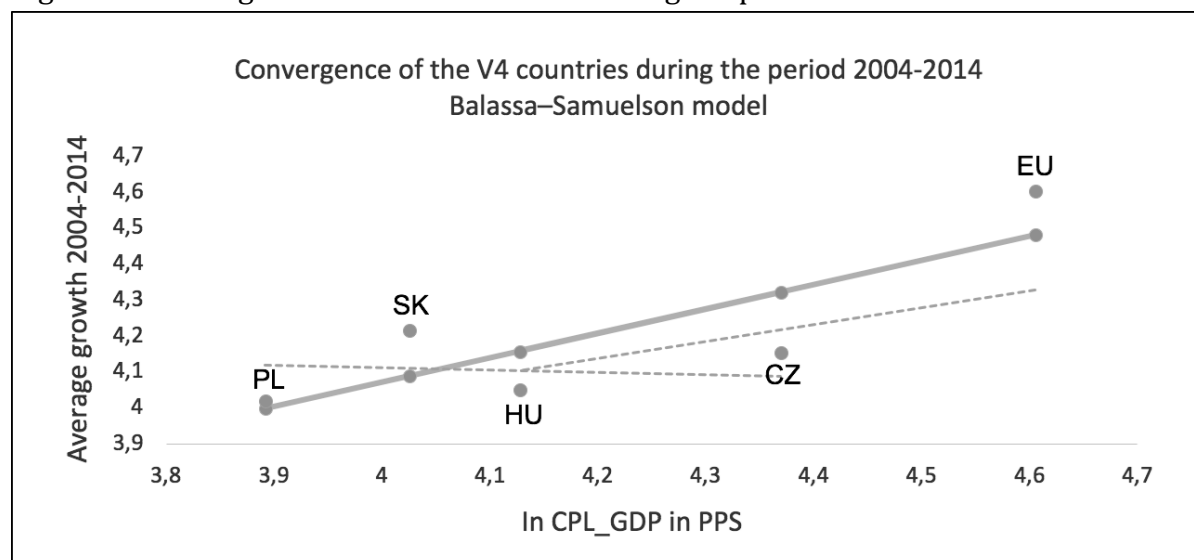
Combined models of nominal and real convergence

In addition to the real convergence of GDP per capita expressed in PPS, there is also nominal convergence represented by the convergence of comparative price levels (CPL). In the combined models that follow for the periods 2004-2014, 2004-2008 and 2008-2014, an analysis is made of nominal and real convergence, whereby faster growth in real GDP in the less developed countries in comparison to the developed ones is primarily the result of faster convergence in labour force productivity and its subsequent influence on gross domestic product per capita expressed in PPS in relation to the price levels in the V4 countries against that of the European Union.

In the first model, for the period 2004-2014, the relationship of the price level to GDP expressed in PPS for the V4 countries was measured against that of the European Union. A positive dependence and connection between real and nominal convergence could not be proven because the correlation coefficient is high (82.13%) and the regression coefficient of determination is relatively high (67.69% > 50%), although the p-value is greater than 5% (in this case 8.8%). Despite the slightly higher p-value, it is clear that there is a very close relationship between the nominal and real variables, which is a positive slope parameter. A look at the distance of the V4 countries from the regression line shows that Hungary and the Czech Republic are located below the regression curve, which means that during the period their price levels did not correspond to the economic level of their economies (prices in these countries were higher than the performance of

the economy). In contrast, Poland is on the regression line, which means that its price level corresponds to the performance of the economy. Slovakia and the EU average are slightly above the regression line.

Figure 2: Convergence of the V4 countries during the period 2004-2014



Source: Author's calculations, Eurostat data

The second model, for the period 2004-2008, clearly shows a positive dependence and a connection between the real and nominal convergence of the V4 countries and the EU. The correlation coefficient is extremely high (91.13%), and the regression coefficient of determination (83.50%) and the p-value are statistically significant. When compared to the measurements obtained under the previous period, the dependence of the researched variables increased. Slovakia is on the regression line, which means there is an equilibrium (steady state) between price levels and GDP. Poland is this time slightly above the regression line, with the position of Hungary and the Czech Republic remaining unchanged.

Tab. 2: Nominal and real convergence of GDP and CPL in different time periods

Regression equation	Time period	Slope parameter	p-value	R ²	Correlation coefficient	Convergence
$CPL = 0.6769GDP + 1.3642$	2004-2014	0.6769	0.0881	67.69	82.13	no
$CPL = 0.5053GDP + 2.2114$	2004-2008	0.5053	0.0299	83.5	91.13	yes
$CPL = 0.8932GDP + 0.3854$	2008-2014	0.8932	0.0383	80.68	89.82	yes

Source: Author's calculations, Eurostat data

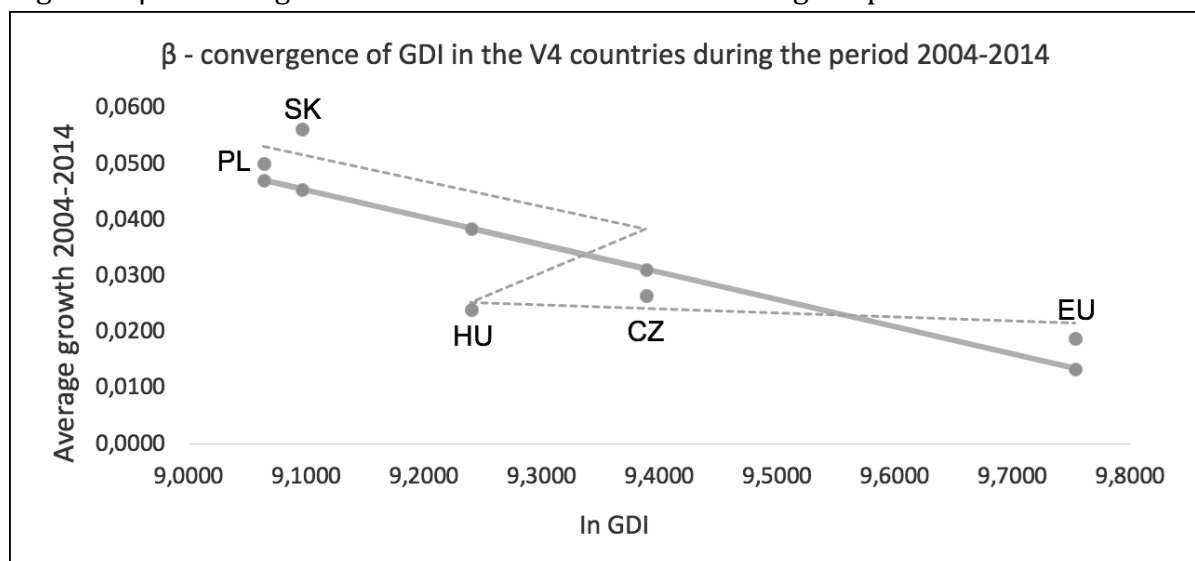
On this basis it can be concluded that after joining the European Union the price level in Slovakia compared to the other V4 countries stabilized and matched the performance of the economy, and that the remaining V4 countries flourished, showing a positive trend, albeit with minor deviations, towards meeting the price convergence criteria corresponding to the EU average. Another aspect is that the convergence of price levels stabilised in individual V4 countries after joining the European Union because those countries complied with the requirements of price convergence and at the same time, caught up with older member states.

In the third model, for the period 2008-2014, it was also possible to clearly demonstrate a positive dependence and a connection between the real and nominal convergence of the V4 countries to the EU. The correlation coefficient (89.82%) and regression coefficient of determination (80.86%) are extremely high and the p-value is statistically significant. When compared to the measurements for the previous period, the dependence of the researched variables was slightly reduced. Slovakia again achieved steady state, as the only V4 country closest to the EU average. The position of Poland and the Czech Republic in terms of their position relative to the regression line remains unchanged, only the measured value changed. However, the position of Hungary at the beginning of 2008 significantly improved, this time located only slightly below the regression line.

The measurements prove there is a link (positive relationship) between nominal and real convergence. If a comparison is made of the individual periods, it is evident that the dependence of the researched nominal values decreased slightly compared to the previous periods, whilst the nominal convergence only took place on the basis of the strengthening of domestic nominal rates (with exception to Slovakia, which had the Euro from 2009 onwards). The most significant convergence of the V4 countries with the European Union occurred during the period 2004-2008. The similar pattern of convergence can be explained by the fact that the V4 countries lie in close geographical proximity to each other, share a common history and have significant trade links.

Real β - convergence of GDI in the V4 countries

In this part, the convergence of the V4 countries and the European Union during the period 2004-2014 is not analysed from the macro-economic perspective. Gross domestic product and other economic indicators are mostly used to determine real convergence, but they do not tell us a lot about the real situation in ordinary households. On the basis of this argument, the most plausible and most commonly used indicator to determine social convergence was therefore applied, namely the measure of the real living standards of households (used by institutions such as National Banks, Eurostat and OECD), specifically the gross disposable income (GDI) of households (real adjusted gross disposable income of households per capita), which overestimates regional differences in income because it does not take into account the impact of taxes.

Figure 3: β - convergence of GDI in the V4 countries during the period 2004-2014

Source: Author's calculations, Eurostat data

In the first model, for the period 2004-2014, the convergence of living standards of the V4 countries with the EU was proven. The regression coefficient R^2 is statistically significant (64.75%) as is the coefficient of determination (80.47%). Although the estimates of the regression coefficients exceed the threshold of 5% as a whole, the regression analysis itself shows that three out of the four V4 countries successfully converged with the EU with regards to standards of living. Poland managed to achieve steady state (on the regression line), Slovakia grew at a rate faster than the standard of living model estimate, the Czech Republic approached steady state (located just below the regression line), with Hungary showing the lowest potential convergence among the V4 countries with the EU.

Tab. 3: Real convergence of GDI in different time periods

Regression equation for GDI	Time period	Slope parameter	p-value	R^2	Evaluation
$y = -0.048x + 0.4853$	2004-2014	-0.048	0.1	64.75	β - convergence
$y = -0.055x + 0.5626$	2004-2008	-0.055	0.34	29.84	β - divergence
$y = -0.046x + 0.4724$	2008-2014	-0.046	0.065	72.98	β - convergence

Source: Author's calculations, Eurostat data

In the second model, for the period 2004-2008, the convergence of the standards of living of the V4 countries with the EU could not be clearly proven. The regression coefficient R^2 is low (29.84%). This is due to the estimates for the regression coefficients not being statistically significant (p-value is considerably higher than 5%), which clearly indicates a lack of β - convergence. On an individual level, as in the previous case, only Poland converged. Hungary and the Czech Republic are in the lower range of the x-axis and Slovakia is significantly above the regression line.

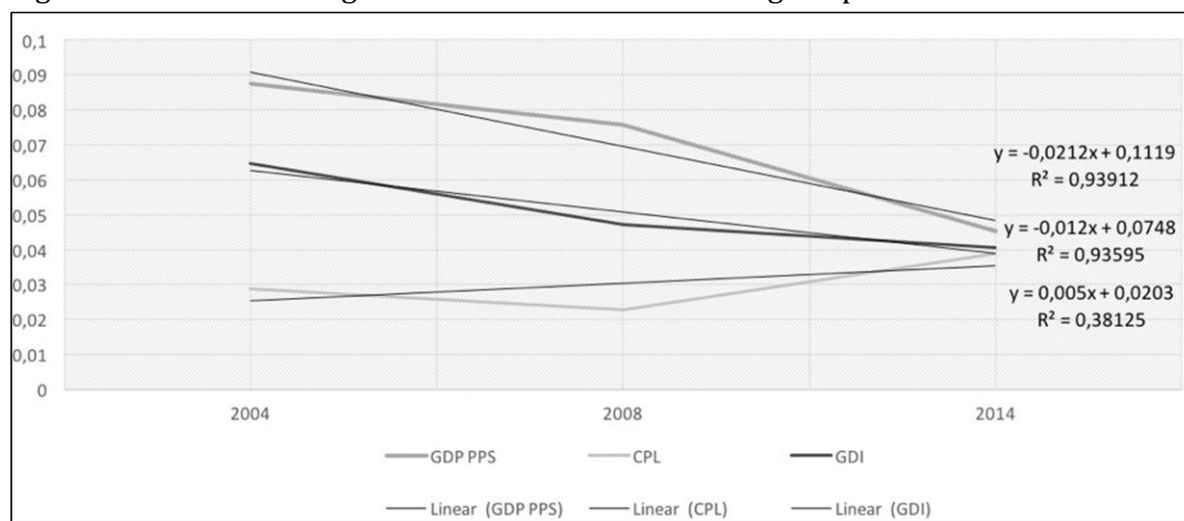
In the third model, for the period 2008-2014, the V4 countries converged with the EU. The regression coefficient R^2 (72.98%) and the coefficient of determination (85.43%) are high

and the estimates for the regression coefficients are statistically significant (despite a slight 0.015% cross the border), which indicates β - convergence (i.e. the null hypothesis is rejected, therefore the compliance coefficients of the regression line go to zero). Slovakia is slightly above the regression line (as is Poland, which grew slower than Slovakia), which means that in this period it grew faster than the level of living standards and was close to steady state. In contrast, Hungary grew less, which means that at the determined level of standard of living it should have grown more. On the whole, during the researched period, the V4 countries converged with the European Union, with Slovakia and the Czech Republic converging the most.

Real σ - convergence in the V4 countries

In the last model, an analysis is performed of σ - convergence by measuring the standard deviation indicators based on natural logarithms in relation to the level of real GDP in PPS of the V4 countries against that of European Union. This is done in an effort to partially, respectively completely, reduce the variation (reduction of variance of logarithms) in the level of GDP among the countries researched and over the time period. Real σ - convergence is indicated by a reduction in the variation coefficient during the observed period and is paired with the expectation of similar levels of growth in all countries.

Figure 4: Real σ - convergence of the V4 countries during the period 2004-2014



Source: Author's calculations, Eurostat data

A visible change (decrease/negative slope) can be observed as a result of the reduction in asymmetries between the countries. As can be seen in Figure 4, in the period 2004-2014, σ - convergence only occurred in the V4 countries with regards to GDP and GDI, whilst σ - convergence of the price levels was not confirmed. When it comes to future macro-economic development, according to Karol Morvay, a broadly similar trend can be expected to that in previous years, i.e. similar levels of macro-economic stability and stable rates of economic growth. However, it should be noted that the set of positive development phenomena since joining the EU, with exception to the crisis period, cannot be of a permanent character.

Tab. 4: Real σ - convergence of GDP, CPL, GDI and household income in different time periods

	Country				σ
GDP in PPS	SK	PL	CZ	HU	
2004	1.7482	1.6902	1.8976	1.7924	0.0877
2008	1.8573	1.7324	1.9085	1.7993	0.0758
2014	1.8865	1.8388	1.9294	1.8325	0.0453
CPL					
2004	1.7404	1.7267	1.7443	1.7931	0.029
2008	1.8445	1.8407	1.8882	1.842	0.0229
2014	1.8235	1.7388	1.8014	1.7574	0.039
GDI					
2004	3.9503	3.9364	4.0773	4.0127	0.0646
2008	4.1066	4.0345	4.1302	4.0427	0.0472
2014	4.1946	4.1538	4.2064	4.1173	0.0406

Source: Author's calculations, Eurostat data

Conclusion

The research presented shows that the V4 countries have converged and still are converging with the European Union on a macro-economic level. Convergence on the economic level combined with political decisions have naturally had an impact on the living standards of households, thereby having a noticeable effect on reducing the disparities among the V4 members. Based on the obtained data and research, it is possible to state that the second wave of pro-European transformation since 2004 has been the most successful in the Czech Republic (subsequently Slovakia, Poland and Hungary), which has long demonstrated admirable macro-economic development, particularly in terms of price levels. In contrast, the slowest transformation was observed in Hungary, which is the only member of the Visegrad group to have chosen a gradual transformation process. In the period 2004-2008, the V4 countries converged with the European Union. For the crisis period 2008-2012, β - and σ - convergence could not be clearly demonstrated for the V4 as a whole (only on an individual basis), however, convergence has been clearly happening again since 2012.

Slovakia, as well as the other transitional V4 countries, experienced a continual increase in the number of seasonal and temporary cross-border workers prior to 2008, which may, among other factors, be attributed to the opening up of the European labour market (Menbere, 2015), while differences in productivity in the EU are the main determinants of cross-border prosperity levels (Schwab, et al., 2015). For the period 2004-2014, σ - convergence was successfully proven. The reason for applying σ - convergence was to better capture the course of the convergence among the V4 group with the European Union with regards to GDP and GDI (as the real living standards of households), which are the most indicative and commonly used macro-economic indicators, and CPL. Furthermore, a positive correlation was shown to exist between nominal (comparative price level) and real (GDP per capita) convergence during the period 2004-2008 for all

members of the Visegrad group, as well as during the period 2004-2014 for the majority of the Visegrad group, the exception being Hungary, whose economy failed to grow continuously throughout the monitored period at a pace that matched its economic level.

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