Real Convergence in the Euro Area: Mirage or Reality?

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Abstract

The aim of this paper is to study the convergence patterns in the European Union and the Euro Area between 2000 and 2019 by means of the absolute and conditional β- and σ-convergence, considering cohesion not opposite but complementary to competitiveness. By estimating cross-sectional regressions, we have found evidence favouring the absolute β-convergence for the Eurozone (19) and the European Union, illustrating that the initially poorer members experienced higher GDP per capita growth rates than the developed economies. The average catching-up speed recorded between 2000 and 2019 in the European Union was 2.5%, while in the Eurozone (19), it was 2.3%. Based on panel data and seemingly unrelated regressions, we have illustrated that improvement in the competitiveness of Member States by promoting investment, trade openness, high levels of labour productivity, education and the implication of citizens in society positively influenced the GDP per capita growth rates between 2000 and 2019. Finally, the estimation of σ-convergence based on the standard deviation led us to conclude that income gaps narrowed across the European Union and the Eurozone (19) between 2000 and 2019, having, in contrast, an upward trend among the early adopters of the euro. The original elements of the paper derive from the comparative analysis of convergence in the Euro Area and the European Union and the study of the economic growth process from the perspective of competitiveness-related variables. In this respect, the study emphasizes the role of human capital in generating prosperity gains at the Community level.

1. INTRODUCTION

One of the most complex challenges for the European Union is to find the appropriate balance between two seemingly contradictory objectives: cohesion and competitiveness. Cohesion is a fundamental pillar of the Community, which was promoted by the European policymakers from the early stages of the regional integration process. By contrast, competition is a key element

of the single market, which determines economic operators to focus on their comparative and competitive advantages and to act as major international players. Given the challenges that occurred in the European Union, cohesion and competitiveness are no longer antagonistic but rather complementary. In this respect, decision-makers can enhance competitiveness by implementing favourable measures in the fields of R&D, education, labour market, also positively influencing aggregate wealth in this manner. The aim of this paper is to comparatively study the convergence patterns in the European Union and the Eurozone between 2000 and 2019 by taking into consideration the methodological instruments developed: absolute and conditional β-convergence and σ-convergence. Particularly, estimations were done for three groups of countries: 1) the European Union - comprising all twenty-eight Member States; b) Eurozone members (19); and the Eurozone (12) or the early adopters. Although real convergence has been a largely debated topic both in government chancelleries and academic forums, we have tried to contribute to the empirical literature by examining the European Union's landscape from multiple perspectives. On one hand, absolute β-convergence was complemented by the conditional framework and subsequently by σ-convergence. On the other hand, the methodology was applied for multiple groups of countries to confirm the convergence/divergence patterns. Moreover, the main objective for the empirical analysis was not only to capture the evolution in the Eurozone, but also among the early adopters of the euro (Eurozone – 12). By applying simple cross-sectional regressions to determine absolute β-convergence in Eurozone (19), we have found evidence in favour of the neoclassical growth model assumptions, as the initially poorer members from Central and Eastern Europe (CEE) experienced higher GDP per capita compared to the wealthy early adopters. The average catching-up speed identified for the Eurozone (19) was 2.3% between 2000 and 2019, confirming the 2% law of convergence. In the second part of our paper, we have tried to study conditional β-convergence and the main determinants of growth in the Euro Zone, also from the perspective of Member States' competitiveness. By applying panel regressions, we have illustrated that variables that are representative of a country's competitive position, such as investment, trade openness, labour productivity, education and governance, positively influenced the convergence process in the European Union and the Eurozone between 2000 and 2019. Absolute and conditional β-convergence was complemented by the analysis of σ-convergence, which suggested that income differentials across the Eurozone members, particularly among early adopters, increased after 2009 as a result of the global financial crisis. The study contributes to the recent literature in the field of real convergence with the complementary focus on cohesion and competitiveness. In this respect, we have tried to capture the influence of competitiveness-related variables on the economic growth process, also having a multidimensional approach to the convergence process, given the methodological strategy and the groups of countries taken into consideration. The paper is structured as follows: the second chapter reviews the literature in the field of real convergence, with a focus on the European Union; the third chapter describes the objectives of the empirical study, the methodology and the data, while the following section contains a description of the results; lastly, we have summarized the findings of the paper, while also illustrating the main limitations and suggesting future directions of study.

2. THEORETICAL BACKGROUND

The advancement from a customs union to an economic and monetary union and the enlargement of the European Union from six to twenty-eight members was accompanied by a rise of empirical studies addressing the topic of economic convergence. In this respect, researchers tried to determine if the European Union can assure economic, social and territorial cohesion across countries and regions and the perspectives of the poorer new members to narrow income gaps compared to the developed Western countries. Although analysts have not reached a consensus regarding the scope, definition, indicators or main determinants of convergence, almost all empirical studies that focused on the European Union and/or the Eurozone have as a starting point the economic growth theory. Starting with the neoclassical growth model (Solow, 1956), the explanations for the economic growth process underlined the influence of capital and labour, together with the technological progress, as an exogenously determining factor. In addition to the neoclassical growth model, which failed to explain the causes of income polarization across economies and the incapacity of poorer countries to catch up, analysts such as Lucas (1987) and Romer (1986, 1989) tried to explain the economic growth process based on endogenously determining factors. The new theory, known as the endogenous growth model, brought to the fore the role of human capital, know-how and R&D. In contrast with the neoclassical growth model, which assumes that less developed economies experience higher growth rates than the developed economies as a result of the decreasing returns to capital, the new theories include the possibility that the former group members remain poor, while the latter continue their growth path and exceed their state of equilibrium. Moreover, recent research also takes into account competitiveness as a key factor in generating prosperity gains. For example, Bilan et al. (2020) consider that R&D and the particularly increasing intellectual potential of the labour force through formal and informal activities represent a crucial factor for competitiveness in the European Union. A potential solution to increase the productivity and skills of the labour force would be to strengthen the relationship between business and academic environments, also promoting the convergence between education and labour market requirements (Dima & Ghinea, 2016). Moreover, to meet the needs of the domestic market and increase mobility in the labour market, another potential solution would be to promote the internalization of higher education (Dima & Vasilache, 2016).

The introduction of the single currency has triggered a debate in the political and academic environment regarding the capacity of the Eurozone to assure economic growth and prosperity for all its members. Consequently, the number of empirical studies addressing the topic of economic growth-convergence has significantly risen, researchers being interested in studying the possibility to find the perfect balance between the interests of the twenty-eight Member States, cohesion and competitiveness. Representative studies in this respect were conducted by Diaz del Hoyo et al. (2017), Gros (2018), Franks et al. (2018), Aiyar et al. (2017), Marelli et al. (2019) and Boltho (2020). Moreover, with the subsequent waves of enlargement of the European Union and the accession of some of the CEE countries to the Euro Area, analysts were particularly interested in studying the performance of this group of countries in respect to the Community's average or the Old Member States. Analysts such as Matkowski & Próchniak (2007), Rapacki & Próchniak (2009), Stanišić (2012), Dobrinsky (2013), Dobrinsky & Havlik

(2014), Matkowski et al. (2016), Alcidi et al. (2018) and Rapacki & Próchniak (2019) examined the real convergence at the level of the European Union, identifying evidence in favour of the "iron law of convergence" (Barro, 2012). In this respect, researchers empirically demonstrated that the European Union experiences an average catching-up speed of 2%, but there is evidence that the new Member States from the CEE record even higher growth rates (Dobrinsky, 2013; Dobrinsky & Havlik, 2014; Rapacki & Próchniak, 2019). Generally, researchers tend to agree that in spite of the initial high expectations that accompanied the adoption of the euro, the performance of the Member States in the field of economic growth and convergence is rather modest (Diaz del Hoyo et al., 2017; Boltho, 2020). For example, Diaz del Hoyo et al. (2017) demonstrated that the Member States outside the Eurozone and those that adopted the common currency after 2002 experienced better economic performances than the early adopters. At the same time, experts illustrated that the Eurozone had not made significant progress in terms of real convergence between 1999 and 2016, as some countries still experienced income gap widenings compared to the Community's average. Similar conclusions were reached by Boltho (2020), who compared the performance of the CEE countries that adopted the single currency with those from Southern Europe. By focusing on the living standards, competitiveness, governance framework, trade and financial integration, Boltho (2020) illustrated that the new members performed significantly better than the Southern Members, catching up towards the level of the developed countries from Northern Europe. Suciu et al. (2021) have studied the performance of the new euro Member States, concluding that the efforts to adopt the single currency have positively contributed to convergence, competitiveness and long-term economic growth. In the same line, Gros (2018) studied real convergence in the euro and non-euro countries, illustrating that the new Member States continued their convergence process after joining the Eurozone. In addition to Diaz del Hoyo et al. (2017), Gros (2018) noticed that the progress achieved by the new members was not influenced by the Eurozone membership. Also focusing on the performance of the Eurozone, Aiyar et al. (2017) illustrated that lower-income countries recorded higher growth rates than the developed ones between 1960 and 1992. At the same time, β-convergence was accompanied by σ-convergence, so that divergences between the Eurozone (12) decreased at a steady pace until 1992. By contrast, Aiyar et al. noticed that the convergence speed slowed down after adopting the Maastricht Treaty, identifying even divergent trends. Similarly, to Diaz del Hoyo et al. (2017) and Boltho (2020), Aiyar et al. noticed that the new Member States that joined the Eurozone made significant progress so income gaps have considerably narrowed. Franks et al. (2018) concluded that the convergence speed was higher in the Eurozone compared to the EU (28) between 1993 and 2015, pointing out that although income convergence is not a necessary condition for the proper functioning of the economic and monetary union, it has been and will remain a key objective of the European Union, which can also strengthen the unity of the euro economies.

According to Christodoulakis (2009), despite the convergence process, which took place in the European Economic Community in the 1980s and early 1990s, the introduction of the euro took place under unfavourable circumstances of widening divergences among the early adopters. From the perspective of Dyson (2007), the low performance of the initial adopters of the euro, especially in terms of GDP and employment, calls into question the incentives for the states that have not yet joined the Eurozone to aim for inclusion in this club. By studying income convergence in the Eurozone (12) between 2000 and 2014, Kalemli-Özcan (2019) did not find

robust evidence favouring absolute β-convergence, but a partial correlation between the initial level of GDP per capita and subsequent growth rates, after checking for structural variables. By contrast, the analysis found evidence for regional convergence among the early adopters of the euro, both under the absolute and conditional frameworks. Coutinho & Turrini (2020) concluded that the early adopters of the euro experienced rather divergent paths before the financial crisis, given the heterogeneity of the component countries in terms of GDP per capita and the lack of convergence in the field of productivity. Chapsa et al. (2019) have also studied absolute and conditional convergence in the EU (15) between 1995 and 2012, comparing the performance of Southern Members with that of Northern European countries. The analysts concluded that investment was an important catalyst of economic growth in both subgroups, while inflation and government consumption negatively influenced the catching-up process. By focusing on the economic performance of the Eurozone Members, Ferreiro et al. (2017) found evidence in favour of a convergence process among countries for variables such as employment creation, public balance and Gini coefficient, but divergent trends in the field of real GDP per capita. Moreover, Grigorescu et al. (2020) illustrated that the global financial crisis had a significant impact on the convergence/divergence patterns, increasing heterogeneity among countries. Similar conclusions were reached by Correia & Martins (2019). They illustrated that the members most affected by the crisis (Greece, Ireland, Portugal, Spain and Cyprus) have diverged from the Eurozone's averages, mainly in the fields of net international investment position, private and public debt and unemployment rates.

In the same line, Marelli et al. (2019) identified divergences in the Eurozone between 1995 and 2016, the β coefficient being positive. Extending the sample by considering the European Union, Marelli et al. identified a convergence rate of about 4%, mainly reflecting the high performance of the group of new Member States. According to analysts, Eurozone membership did not influence the results of the study. Moreover, the analysts identified asymmetric trends in the Eurozone by sub-period, concluding that convergence rates between component states have declined mainly since 2008, given the negative effects of the financial and sovereign debt crises, which have particularly affected the peripheral members of the group. Similarly, Boltho (2020) illustrated that the new members from CEE achieved remarkable progress both in the field of income convergence, gradually catching up to the level of Western developed countries, and also in terms of competitiveness and institutional quality. Similarly, Bernardelli et al. (2021) illustrated that promoting economic freedom and strengthening the governance framework had a positive influence on economic growth in the European Union. However, the impact was not stable over time. According to Bernardelli et al. (2021), European policymakers should limit their intervention in the market, rather promoting competition between economic players, mainly to enhance the economic recovery after the Covid-19 pandemic. By considering the heterogeneity of technological processes, Cieślik & Wciślik (2020) tried to determine if the CEE members were converging towards the income level of the Old Members (EU-15) between 1995 and 2017. In contrast with the results obtained by using β- and σ-convergence, Cieslik & Wcislik (2020) did not find robust evidence in favour of the convergence hypothesis for the whole sample, illustrating that the CEE countries seem to converge towards their state of equilibrium. At the same time, the Old Members experience rather divergent trends.

From another perspective, Madzík et al. (2015) studied the relationship between the competitiveness of economies and the standard of living of citizens, demonstrating the existence of a strong and positive relationship between the two indicators. Madzík et al. (2015) identified eight groups of countries with similar characteristics regarding national competitiveness or standard of living. In this regard, analysts examined the individual performances of the countries included in the same cluster, highlighting a trend of specialization in a particular field. According to research by Madzík et al. (2015), Estonia is the leader in labour market efficiency, and the Czech Republic in the area of business sophistication. Also referring to the competitiveness of Member States, Sánchez-López et al. (2019) illustrated that trade globalization and technological development contributed to reducing inequalities, as measured by the Gini index. From the perspective of Dauderstädt (2014), productivity will be the main determinant of convergence, which will increase income without jeopardizing competitiveness. In the private sector, productivity may be enhanced by investment and structural changes that consider the competitive advantages of companies. Similarly, Balcarová (2016) showed interest in the evolution of convergence in the field of competitiveness, but taking into consideration the objectives of the Europe 2020 Strategy, which were structured into three main categories: income, social and ecological dimension. The analyst concluded that the least competitive economies in 2003 (Lithuania, Estonia, Poland, Bulgaria and Romania) remained at the bottom of the rankings in 2012. Although these countries have improved their social dimension, they failed to make significant progress in terms of income, lagging behind the developed states of Western Europe. Estimating the β-convergence indicator, the least competitive economies in the initial analysis year managed to make progress during the analysed period, although the convergence rates were still low. Analysing the results reached by analysts who focused exclusively on the income level (Vojinović et al., 2009; Rapacki & Próchniak, 2009) compared to those revealed by Balcarová (2016), it can be concluded that the progress achieved in terms of GDP per capita by the new members was not accompanied to the same extent by the advance in terms of competitiveness.

It should be emphasized that the banking sector has played an important role in this process (Belás et al., 2012; Belas et al., 2014).

To sum up, the empirical studies addressing the topic of real convergence are vast and complex, considering different timespans, indicators, methodologies, geographical areas and subgroups of countries. Although a consensus among researchers is difficult to reach, recent studies generally emphasize the progress of the new members from CEE and the capacity of the Economic and Monetary Union to harmonize the interest of the component countries. By contrast, certain voices argue that the progress of the new members was accompanied by modest economic performances across the old Member States, particularly in the Eurozone. These evolutions might jeopardize the stability of the Eurozone in the long run, threatening the accession perspectives of other countries. Another important conclusion that results from the review of the relevant literature, starting with the economic growth theories, is that technology, R&D and human capital play an important role in generating prosperity gains.

3. RESEARCH OBJECTIVE, METHODOLOGY AND DATA

The aim of this paper is to study the convergence process in the European Union and particularly in the Eurozone between 2000 and 2019, trying to answer the question of whether the common currency can guarantee prosperity and cohesion among its members. To capture the economic landscape of the Euro Area, we have used the methodology proposed by Barro & Sala-i-Martin (1992): absolute and conditional β- and σ-convergence. Absolute β-convergence studies the relationship between the initial level of income and the subsequent growth rates. If the relationship between variables is negative (β < 0), there is evidence favouring convergence. Based on this instrument, we have initially tried to determine if the initially poorer economies experience higher GDP growth rates than developed countries. In addition, we have examined conditional β-convergence, which takes into consideration the differences between economies and the possibility to reach different states of equilibrium. By controlling the differences between economies, conditional β-convergence also allows the study of the economic growth determinants. In this respect, we have tried to examine the influence of competitiveness-related variables on the catching-up process, having a complementary perspective on cohesion and competitiveness. We have estimated an empirical model based on panel regressions and using seemingly unrelated regressions by including variables related to the level of investment, trade and education, the performances of the labour market and governance-related indicators. The analysis of β-convergence was complemented by another instrument developed by Barro & Sala-i-Martin (1992): σ-convergence to examine if income differentials between economies diminish over time. To capture the European economic landscape, β- and σ-convergence were computed for three clusters of countries: a) European Union (28); b) Eurozone (19) (comprising the early adopters, Cyprus, Estonia, Latvia, Lithuania, Malta, Slovakia and Slovenia); c) Euro Zone (12), which comprises the initial adopters of euro and Greece). The data were obtained from Eurostat and World Bank databases and envisaged the period from 2000 to 2019. We have selected this timeframe based on the data available for all variables. On the one hand, we have chosen 2000 as the first year of analysis to avoid the potential distortion of data, given the political, economic and social crisis that took place in the ex-communist countries in CEE at the end of the 20th century. On the other hand, we have captured an interval of relative stability (except for the global financial crisis, which had the highest magnitude in Europe in 2009).

We have proposed the following hypotheses:

H1: The process of income convergence took place in the European Union and the Eurozone (19) between 2000 and 2019, given the negative relationship between the initial level of GDP per capita and the subsequent growth rates.

H2: The CEE group experienced higher growth rates than the Community's average between 2000 and 2019.

H3: The catching-up speed in the European Union and the Eurozone (19) was about 2%.

H4: Investment and trade openness had a favourable influence on the annual GDP per capita growth rates in the European Union and the Eurozone.

H5: Human capital catalysed the economic growth between 2000 and 2019 in the European Union and the Eurozone, representing a key factor of competitiveness.

H6: Income disparities within the European Union and the Eurozone (19) had a downward trend between 2000 and 2019.

In the first section of the paper, we tried to study the absolute β-convergence in the European Union and the Eurozone, using cross-sectional regressions and the ordinary least squares method. The independent variable was represented by the initial level of income of the countries, while the dependent variable aimed at the average growth rate between 2000 and 2019. If a_1< 1, we may conclude that the initially poorer economies experienced higher growth rates than developed countries. The equation was computed as follows:

$$\frac{1}{T} ln[\frac{y_{i,t}}{y_{i,0}}] = a + a_1 ln(y_{i,o}) + \varepsilon_i \tag{1}$$

$y_{i,0}$ = GDP per capita of the economy "i" in 2000

$y_{i,t}$ = GDP per capita of the economy "i" in 2019

T = time interval

ε_i = error term

Based on the coefficient a_1 resulted in the first equation, we have determined the convergence speed, as follows:

$$\beta = -\frac{1}{T} ln(1 + a_1 T) \tag{2}$$

In the scope of conditional β-convergence, estimated on panel data, T=1.

In order to determine the number of years that are necessary to reach halfway towards the state of equilibrium, we have used the equation below:

$$t* = ln0.5/\beta \tag{3}$$

The analysis of the absolute β-convergence was complemented by the conditional framework. The model includes, besides the lagged value of GDP per capita, macroeconomic, social and governance-related variables. The equations were estimated based on panel data and using seemingly unrelated regressions in order to account for heteroscedasticity and correlations between errors. The model comprises as explanatory variables the gross fixed capital formation (% of GDP), the volume of trade (sum of exports and imports as % of GDP), the real labour productivity, the percentage of the labour force with advanced education and the early leavers from education and training, and an indicator referring to the governance framework (voice and accountability). The regression was computed as follows:

$$\Delta lny_{i,t} = a + a_1 ln(y_{i,t-1}) + a_2(GFCF) + a_3(Trade) + a_4(RLP) + a_5(LFAE) \\ + a_6(Early\ leavers) + a_7(Voice) + \varepsilon_{i,t} \tag{4}$$

$\Delta lny_{i,t}$ = annual GDP per capita growth rate

σ-convergence has been calculated taking into consideration the standard deviation of data sets. The indicator has been computed as follows:

$$\sigma_t = \sqrt{(\frac{1}{N}) \sum_{i=1}^{N} [log(y_{i,t}) - log(\mu_t)]^2} \tag{5}$$

σ_t = standard deviation of the data set

$y_{i,t}$ = GDP per capita of the economy "i" in year "t"

μ_t = average GDP per capita in the European Union in year "t"

Table 1 presents the variables included in the panel regression estimation based on equation 4. Given the difficulty to determine all factors that influence the economic process and the methodological limits to include a side set of explanatory variables (mainly due to multicollinearity), we have tried to select factors that are representative for multiple dimensions, including competitiveness: macroeconomic framework, labour market, education and governance. We have considered the labour productivity and the level of education of the labour force as key indicators of a country's competitiveness in the field of human capital. The definition and the expected influence of the explanatory variable are presented in Table 1:

Tab. 1 – Variables, definitions and sources. Source: own research

Variable	Definition	Source	Expected sign
GDP per capita (lagged value)	GDP per capita at market prices (PPS per capita)	Eurostat (2021)	Negative
Gross fixed capital formation	Gross fixed capital formation (% of GDP)	World Bank (2021)	Positive
Trade	Sum of exports and imports of goods and services (% of GDP)	World Bank (2021)	Positive
Real labour productivity	Real labour productivity per person employed (2010=100)	Eurostat (2021)	Positive
Labour force with advanced education	Labour force with advanced education (% of the total working-age population with advanced education)	World Bank (2021)	Positive
Early leavers	Early leavers from education and training (% of population aged 19 to 24 years)	Eurostat (2021)	Negative
Voice and accountability	Part of the Worldwide Governance Indicators	World Bank (2021)	Positive

4. RESULTS AND DISCUSSION

4.1 Absolute β-convergence

Figure 1 illustrates the results of absolute β-convergence, computed based on equation 1, for Eurozone (19) between 2000 and 2019. The inverse relationship between the initial level of income of the Member States and the average growth rates, reflected by the negative slope of the trend line, confirms our first hypothesis. The main winners of the catching-up process were the Baltic States, which experienced average growth rates above 5.5%. Slovakia had an average growth rate of 4.3%, while Slovenia 2.8%. Consequently, we confirm our second hypothesis, that the CEE group experienced higher growth rates than the Community's average. In the group of the new members, the lowest growth rate was experienced by Cyprus between 2000 and 2019, reaching 2%. Similarly, the early adopters of the euro experienced growth rates that reached on average 2%, except for Ireland and Luxembourg. The two developed economies are calling

into question the neoclassical growth model assumptions, experiencing growth rates above the Euro Zone's average (Ireland 4.1% and Luxembourg 2.7%). The success of these countries can be judged from the perspective of the new growth theories, which explain the high growth rates of the developed countries due to the increase in productivity, enhanced R&D and labour force capabilities. At the bottom of the ranking dropped Greece and Italy, with average GDP per capita growth rates of about 2%.
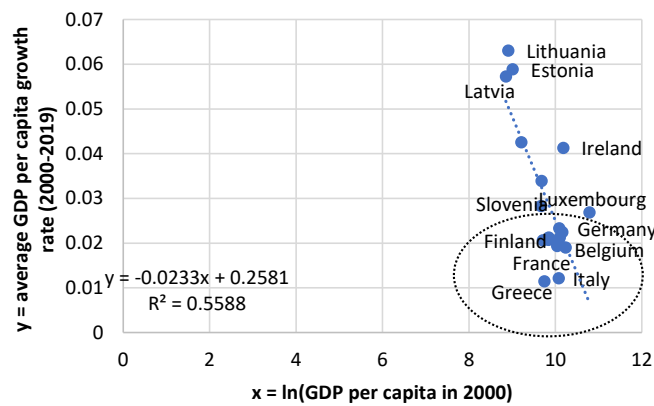

Fig. 1 – (Absolute) β-convergence in the Eurozone (19). Source: own research

The graphical representation is complemented by the presentation of the regression output for the absolute β-convergence in Table 1. Given the coefficients obtained in the first equation, we have determined the convergence speed and the number of years which are necessary to reach the halfway point towards equilibrium, taking into consideration equations 2 and 3. The β-convergence hypothesis is confirmed for both the European Union (28) and extended Eurozone (19), the convergence speed reaching 2.5% in the case of the former and 2.3% for the latter. Based on these percentages, the European Union needs almost 28 years to reach the halfway point towards equilibrium, while the Eurozone (19) needs 29 years. By contrast, as the graphical representation suggested, the relationship between variables was positive in the Eurozone (12). These results are in line with the previous studies, which confirm the 2% law of convergence (Barro & Sala-i-Martin, 1992). By contrast, as the graphical representation suggested, the relationship between variables was positive in the Eurozone (12). The values of the determination coefficient confirm that the initial level of income explains in a high proportion the average growth rates, except for the estimation conducted for the early adopters of the euro.

Tab. 2 – Absolute β-convergence. Source: own research

Dependent variable: Average GDP per capita growth rate (2000-2019)			
Method: Ordinary least squares (OLS)			
Group	European Union	Eurozone (19)	Eurozone (12)
No. obs.	28	19	12

a	0.2720* (0.0318) (8.5517)	0.2580* (0.0493) (5.2278)	-0.0914 (0.0791) (-1.1547)
GDP per capita in 2000	-0.0247* (0.0032) (-7.5469)	-0.0233* (0.0050) (-4.6330)	0.0112 (0.0078) (1.4276)
R²	0.6865	0.5580	0.1643
Adjusted R²	0.6745	0.5320	0.0862
Prob. (F-statistic)	0.0000	0.0000	0.0000
β (convergence speed)	2.5%	2.3%	N/A
t*	27.7	29.4	N/A

Note: standard errors and t-statistics in parentheses. * - p-value < 1%, ** - p-value < 5%<; a - intercept

4.2 Conditional β-convergence

The empirical study is complemented by the analysis of the conditional β-convergence, with the purpose of capturing the economic growth determinants and bringing a complementary perspective between cohesion and competitiveness. As already mentioned, conditional β-convergence takes into consideration the structural differences between economies under the assumption that they will not necessarily reach the same level of equilibrium. To study the convergence patterns, the differences among economies are controlled by including macroeconomic, social and institutional determinants. We have used seemingly unrelated regressions to manage the heteroscedasticity and correlation between errors, which are frequent in the empirical studies of economic growth based on panel regressions.

The results confirm the convergence hypothesis, given the negative relationship between the lagged values of GDP per capita and the annual growth rates. In spite of the results obtained under the absolute framework, which rather suggested divergence among early adopters, the estimation of the conditional β-convergence led us to different conclusions, resulting in a high catching-up rate of 9%. In fact, the convergence speed, based on the coefficient value of the lagged value of GDP per capita, is higher for all groups under the conditional framework than the absolute one. Consequently, the empirical analysis confirms that the macroeconomic environment, together with competitiveness and governance, has a defining role in promoting economic growth and convergence. All explanatory variables have the expected sign for all three estimations, illustrating that investment and trade catalysed the economic growth rates in the European Union and the Euro Area. Another conclusion drawn from the analysis is that the increase in labour force competitiveness based on productivity represented a major source of prosperity between 2000 and 2019. Moreover, the results emphasize the role of human capital as a key factor in generating economic growth and illustrate the need to continue the efforts to reduce the number of early leaving from education and training. Although not statistically significant in all estimations, the empirical model illustrates that the governance framework, particularly the active involvement of citizens and the freedom of expression, enhanced the catching-up process in the Economic and Monetary Union. The values of the determination coefficient suggest that the model explains in a proportion of about 62% the variation of the

dependent variable in the case of the Eurozone (19). By contrast, the determination coefficient is about 0.51 for the estimates calculated for the European Union. Moreover, the values of the Durbin-Watson test, which is about 2, confirm that there is no first-order correlation between errors.

Tab. 3 – Conditional β-convergence. Source: own research

Dependent variable: Annual GDP per capita growth rate (2001-2019)			
Method: Generalized least squares (GLS) - seemingly unrelated regressions (SUR)			
Group	European Union	Eurozone (19)	Eurozone (12)
No. obs./ Variable	476	323	204
a	-0.0762 (0.0918) (-0.8303)	-0.0449 (0.03866) (-1.161)	-0.3555** (0.1602) (-2.2182)
GDP per capita (-1)	-0.0730* (0.0048) (-17.2849)	-0.0653* (0.0039) (-16.7351)	-0.0863* (0.0130) (-6.6189)
Gross fixed capital formation	0.0417* (0.0048) (8.6240)	0.04874* (0.0044) (10.9656)	0.0099 (0.0061) (1.6296)
Trade	0.1003* (0.0100) (9.9819)	0.0190* (0.0018) (10.956)	0.0342* (0.0054) (6.2743)
Real labour productivity	0.0891* (0.0102) (8.7298)	0.1028* (0.0098) (10.3967)	0.2270* (0.0332) (6.8326)
Labour force with advanced education	0.0289 (0.0199) (1.4505)	0.2795* (0.0394) (7.0907)	0.2647* (0.0746) (3.5454)
Early leavers from education	-0.0036 (0.0022) (-0.3763)	-0.0076* (0.0017) (-4.4431)	-0.0044 (0.0034) (-1.3105)
Voice & accountability	0.0396* (0.0046) (8.4559)	0.0359* (0.0048) (7.3882)	0.0330* (0.0077) (4.2655)
Prob (F-statistic)	0.0000	0.0000	0.0000
R²	0.5137	0.6299	0.3245
Adjusted R²	0.5064	0.6217	0.3003
Durbin-Watson stat	2.0105	2.0151	1.8287
Convergence speed (β)	7.6%	6.8%	9%

Note: robust standard errors and t-statistics in parentheses. * - p-value < 1%, ** - p-value < 5%, *** - p-value < 10%, a - constant

To ascertain if the model follows the classical linear regression model assumptions, we have applied a number of tests. We have initially tested the linear regression model assumptions by looking if there is multicollinearity among repressors. By using the variation influence factors test, we have obtained in all cases values below 5. Consequently, we have concluded that there is no high correlation between explanatory variables that might bias the estimations. Subsequently, we have checked if the residuals are homoscedastic and not correlated. The results obtained using the histogram indicate that residuals are homoscedastic (Prob.>5%). Moreover, we have applied the cross-section dependence test to confirm that there is no correlation between errors. Also, in this case, we have accepted the null hypothesis, which presumes that residuals are not correlated between cross-sections.

4.3 σ-convergence

To determine if the European Union and the Euro Area have got closer to the desideratum of cohesion, the analysis of absolute and conditional β-convergence has been complemented by σ-convergence, trying to answer the question if income disparities had a downward trend or, by contrast, were amplified by the successive crises. Based on time-series data, we estimated the standard deviation of each data set. The results suggest that σ-convergence had a downward trend (from 0.42 in 2000 to 0.29 in 2019) within the European Union. Similarly, the Eurozone (19) experienced a narrowing of the income gaps among its Members by 22%. The analysis of the dynamics of the standard deviation for the early adopters indicates a narrowing by 10% of the income gaps. However, as reflected by the graphical representation, favourable trends occurred before 2009. Subsequently, the income differentials increased among Eurozone (12) members. Another finding is that income disparities significantly widened after 2014, being mainly determined by the economic and tax imbalances experienced by some of the early adopters. Overall, we have concluded that β-convergence was complemented by σ-convergence in the European Union and the Eurozone (19), so we have accepted the sixth hypothesis of the study.
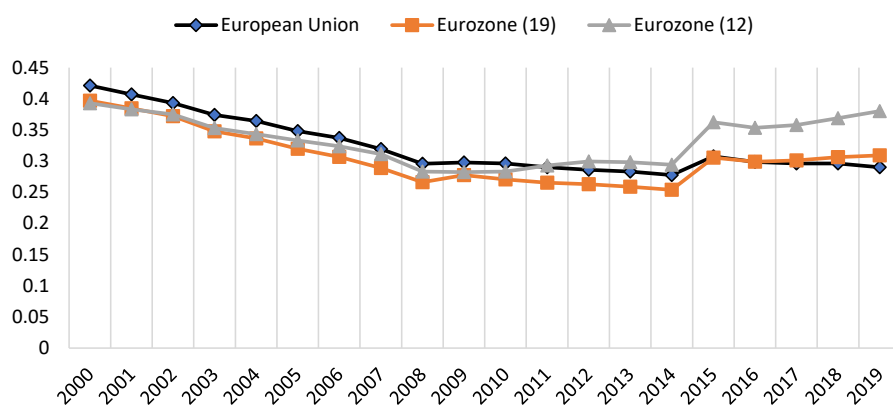

Fig. 2 – σ-convergence in the European Union, Eurozone (19) and (12). Source: own research

The paper brings additional evidence in favour of the "iron law of convergence" of 2% (Barro, 2012) for the European Union and the Eurozone (19). Consequently, our results are in line with the studies of Barro & Sala-i-Martin (1992), who illustrated that the economies would tend towards the state of equilibrium with a universal speed of 2% per year. Moreover, as previously demonstrated by Diaz del Hoyo et al. (2017), Marelli et al. (2019) and Boltho (2020), the euro new members from CEE experienced higher GDP per capita growth rates compared to early adopters. In line with the results of Kalemli-Özcan (2019) and Marelli et al. (2019), we did not find evidence in favour of the absolute β-convergence in the Eurozone (12), given the positive relationship between the initial level of the GDP per capita and the average growth rates between 2000 and 2019. Moreover, as reflected by σ-convergence, the income gaps widened after the global financial crisis among the early adopters of the euro. As far as the conditional β-convergence is concerned, the empirical study confirms the positive influence of investment in enhancing economic growth, as illustrated in the studies conducted by Próchniak (2011), Stanišić (2012), and Marelli et al. (2019). Moreover, our findings suggest that trade openness, measured as the volume of exports and imports (% of GDP), is an important catalyser of economic growth (Dobrinsky & Havlik, 2014; Rapacki & Próchniak, 2019; Marelli et al., 2019). At the same time, the research illustrates that labour productivity had a positive influence on the economic growth process (Dobrinsky & Havlik, 2014). The research also emphasizes the role of human capital, as a competitive factor, in enhancing economic growth. Similar conclusions were reached by Boltho (2020), who highlighted the role of human capital in capitalizing on the benefits associated with economic integration.

5. CONCLUSIONS

The aim of this paper was to study the convergence patterns in the European Union, in general, and the Eurozone, in particular, by conducting a comparative analysis of the evolutions that occurred between 2000 and 2019 based on the absolute and conditional β- and σ-convergence. By applying cross-sectional regressions, we found evidence favouring the absolute β-convergence for the European Union and the Eurozone (19). The catching-up speed identified in the European Union was 2.5%, while in the Eurozone, it was 2.3%. By contrast, the convergence hypothesis was rejected for the early adopters of the euro, where the relationship between the initial level of income and the average growth rates was positive and weak. In addition to the absolute dimension, the conditional β-convergence allowed us to study the main factors that influence the economic growth process, emphasizing the role of investment and trade openness in generating prosperity gains. One of the elements of originality of the paper derives from the complementary perspective on cohesion and competitiveness. In this respect, the analysis of the conditional β-convergence emphasized the role of human capital as a strategic element of competitiveness in enhancing the catching-up process. Consequently, the increase in labour force productivity and education had a major contribution to the GDP per capita growth rates between 2000 and 2019. Moreover, the empirical study confirms that the efforts of the European Community to reduce early school leaving, as part of the Europe 2020 Strategy, were also reflected in the GDP per capita growth rates. Overall, the main conclusion that can be drawn is that the European decision-makers should focus more than ever on human capital as a primary competitive factor in

generating prosperity gains. This finding should also be interpreted in the light of the Covid-19 pandemic, which significantly affected the job and education opportunities, undermining one of the main pillars of the common market – the free movement of workers.

Another objective of the paper was to determine whether income disparities narrowed among the European Union and the Eurozone members between 2000 and 2019. The evolution of the standard deviation suggests that β-convergence has been accompanied by a narrowing of the income gaps in both the European Union and the Eurozone (19). However, the divergent trends identified among the early adopters of the euro might call into question the stability of the Economic and Monetary Union. Given the complexity of the process, the main limitations of the study are related to the short period of time under review and the limited set of variables taken into consideration in the study of the conditional β-convergence. Consequently, to validate the results, the empirical research may be extended by taking into consideration the influence of another set of explanatory variables, also representative for the macroeconomic, competitiveness and governance framework. Another future direction of study regards the impact of the Covid-19 pandemic on the performance of the Member States, looking at the economic growth, on the one hand, and at the competitiveness key indicators, on the other hand.

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