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CORPORATE TAX RATES IN THE EU: HARMONISATION AND COMPETITION FROM THE PERSPECTIVE OF CONVERGENCE ANALYSES*

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Abstract. Tax policy plays a key role in shaping the economic environment and the competitiveness of states within the common European market. Given the deepening economic integration within the EU, analysing tax system convergence is becoming increasingly important. This paper aims to analyse the development of tax rates in European Union countries, focusing on identifying long-term trends and assessing the degree of their convergence. The empirical part of the paper focuses on examining whether corporate tax rates are converging within the European Union, based on two analytical perspectives – Beta convergence and Sigma convergence. Regression analysis was used to test the hypothesis that member states with higher initial tax rates experienced a faster rate of reduction during the period 2013–2023 (Beta convergence). At the same time, the variability of tax rates among countries was examined using a trend analysis of the standard deviation to determine whether differences between countries are decreasing over time (Sigma convergence). The results of this study confirmed the existence of convergence in corporate tax rates within the European Union. Based on both Beta and Sigma convergence analyses, it can be concluded that differences between EU member states are gradually decreasing, indicating a partial trend toward harmonisation of tax policies in EU countries.

Keywords: corporate tax rates; tax harmonisation; effective tax rates; Beta convergence; Sigma convergence

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1. Introduction

Tax harmonisation and competition within the European Union are crucial in ensuring the smooth functioning of the single market and creating a level playing field for businesses across EU member states. The convergence of tax systems helps eliminate issues such as double taxation, tax evasion, and aggressive tax planning. This contributes to a fairer, more stable and transparent tax environment within the EU and increases the efficiency of tax collection, which is essential for the stability of public finances and the support of economic growth.

On the other hand, tax competition between member states can lead to lower tax rates to attract investment and boost employment. However, this phenomenon also risks fiscal stability, as it may result in lost tax revenues and disrupt market balance. Therefore, it is necessary to balance tax harmonisation, which ensures uniform rules, and tax competition, which promotes efficiency and innovation within national economies. Overall, tax

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harmonisation in the EU contributes to removing barriers to cross-border trade and investment, enhances the competitiveness of European companies and supports sustainable economic growth. At the same time, it requires respect for national sovereignty in tax policy and a sensitive approach to the differences between member state economies, to minimise negative impacts on individual countries and their fiscal capacity (Abidi & Taugourdeau, 2024; Martínez-Vázquez et al., 2024).

This study focuses on analysing the development of corporate tax rates in EU countries with the aim of assessing whether they are converging. Through convergence analyses, specifically Beta and Sigma convergence, we evaluate the dynamics of tax policies during the 2013–2023 period and identify whether differences between member states are decreasing over time. With this contribution, we aim to enrich the academic debate on the extent of tax system harmonisation in the EU and the impact of tax competition on the convergence of corporate taxation within the single market.

2. Theoretical Background

Tax harmonisation in the European Union (EU) represents one of the key issues of contemporary economic policy. Differences in corporate tax rates between member states can create distortions in the single market, encourage capital shifts to countries with lower tax burdens and threaten the tax revenues of countries with higher rates. This phenomenon, known as tax competition, can lead to the destabilisation of national tax bases (Dabla-Norris & Lima, 2023; Balasoiu, Chifu, & Oancea, 2023).

The debate on the need for harmonisation has intensified in recent years, focusing particularly on the extent to which the EU should be authorised to influence the tax policies of its member states. While high-tax countries prefer a more coordinated approach, some smaller or peripheral economies see tax competition as a legitimate tool to attract investment and stimulate economic growth (Feld & Heckemeyer, 2011; Delgado et al., 2014; Todorovic et al., 2024).

An important part of this discussion is the difference between nominal and effective tax rates. While the nominal rate is set by law, the effective tax rate (ETR) reflects the actual tax paid after deductions and exemptions. This difference plays a crucial role in the competitive positions of the countries and in the foreign decision-making of investors (Devereux et al., 2008; Wilde & Wilson, 2018; Konečná & Andrejovská, 2020; Andrejovska et al., 2024). Mutti and Ohrn (2019), Helcmanovská and Andrejovská (2021), Víghová et al. (2023, 2024) and Devereux et al. (2008) document a long-term downward trend in nominal rates due to globalisation and increasing competition. Feld and Heckemeyer (2011) show that smaller and peripheral countries, in particular, benefit from lower rates, thereby increasing their competitiveness. Heimberger (2021) also confirmed that active tax competition in the EU depends on country size and economic context.

Historically, efforts to harmonise began as early as the 1970s and 1980s, aiming to curb harmful tax competition and preserve the integrity of the single market. Delgado et al. (2014), based on an analysis of 27 member states, pointed to persistent differences in ETR (ranging from 10% to 35%) and the need for greater convergence.

Recently, major tax harmonisation measures have come into effect. As of February 1, 2024, the EU implemented a minimum effective tax rate of 15% for multinational corporations (European Commission, 2024), marking a significant step in the global effort for a fairer tax environment. Harmonisation of corporate taxation in the EU is a long-term effort to ensure fair competition conditions and minimise harmful tax competition, destabilising public finances and disrupting market balance in high-tax countries. Nevertheless, the harmonisation of direct taxes remains a politically sensitive issue, as member states wish to preserve their tax sovereignty.

Introducing a 15% minimum ETR (European Commission, 2024) represents a significant move toward a fairer tax environment. According to Johannesen (2022), implementing a global minimum tax could reduce profit shifting to tax havens, thereby strengthening fiscal stability (Garcia-Bernardo et al., 2021). In terms of the impact of the global minimum tax (GMT) at a 15% rate, which applies only to large multinational companies, it has been shown that partial GMT coverage leads to different tax competition equilibria between tax havens and other countries (Haufler & Kato, 2024). Delgado & Presno (2017) analyse tax convergence in the EU-15

from 1975 to 2011, finding that full convergence occurred mainly in the taxation of goods and services, where harmonisation is most advanced, while other tax types developed differently.

Bušovská (2014) confirms Beta convergence of tax systems in EU countries in the period 1965–2011, showing convergence of tax burdens and tax mixes (income, indirect and property taxes) across all current member states and those that joined later. These trends are driven by globalisation, tax competition, and aspirations of the countries to join the EU.

Regis, Cuestas, and Chen (2015), in their study of corporate tax rate convergence in Europe from 1980 to 2014 using Beta and Sigma convergence and cluster analysis, found that although overall convergence among all states did not occur, a phenomenon of "club convergence" was present, i.e., the formation of tax clusters with internal convergence. The log-t test identified three (later four) stable convergence clubs, each showing rate reductions at varying speeds. For example, "tax haven" countries (Cyprus, Ireland) reduced their rates the most, while high-tax countries (e.g., France) remained at higher levels. Sigma convergence confirmed declining variability within clubs, indicating internal convergence, while divergence between clubs persisted.

In summary, differences in corporate taxation affect not only investment behaviour but also the competitiveness of countries and the trajectory of their economic growth (Attard, 2023; Lopez-Garcia, 2024; Mikou, Vallet & Guivarch, 2024; Diller et al., 2025). Within the EU, further harmonisation remains a key challenge in pursuing a stable and fair single market.

3. Research Objective and Methodology

This paper empirically examines whether corporate tax rates are converging within the European Union, using two analytical perspectives, Beta convergence and Sigma convergence. Through regression analysis, we test whether member states with higher initial tax rates experienced a faster rate of reduction during the period 2013–2023 (Beta convergence). In parallel, we analyse the evolution of tax rate variability among countries using a trend analysis of the standard deviation to determine whether differences between countries are decreasing over time (Sigma convergence). From a research perspective, we focused on the following research question:

Research Question:

Is there convergence of corporate tax rates within the European Union in the context of harmonisation and tax competition, and what are the implications of this development for the effective functioning of the single market?

Methodological Approach for Beta and Sigma Convergence

Beta Convergence

This concept makes it possible to analyse whether EU countries with higher initial tax rates (both nominal and effective) in 2013 experienced a faster rate of reduction during the period 2013–2023. Based on this, we formulated the following hypotheses:

Hypothesis H1: There is Beta convergence of corporate tax rates (both nominal and effective) in the EU, meaning that countries with higher initial rates show a higher reduction rate in the subsequent period. The analysis was conducted using a simple regression analysis, where the average annual growth rate of the tax rate was explained by its initial level.

Calculation of the average annual growth rate:

$$g_i = \frac{1}{T} \times \ln\left(\frac{Y_{iT}}{Y_{i0}}\right)$$

Where:

- g_i is the average annual growth rate for country i.
- Y_{iT} is the value of the variable (e.g., tax rate, tax revenue) in the final year T.
- Y_{i0} is the initial value of the variable (in our research, in the year 2004).
- T is the number of years in the analysed period.

Regression Model for Beta Convergence:

$$g_i = \alpha + \beta \times \ln(Y_{i0}) + \varepsilon_i$$

Where:

- α is the intercept (constant), capturing the average growth when the logarithm of the initial value is zero.
- β is the Beta coefficient, expressing the relationship between the initial value of the variable Y_{i0} and the average annual growth rate. A negative β indicates convergence.
- $\ln(Y_{i0})$ is the natural logarithm of the initial value for country i .
- ε_i is the error term, capturing deviations not explained by the model.

Sigma Convergence

The concept of Sigma convergence involves monitoring the evolution of variability in a given indicator, in our case, effective (ETR) and nominal (NOM) corporate tax rates, among a group of countries over time. A decline in variability, represented by the standard deviation between countries, is interpreted as a sign of convergence.

In contrast to Beta convergence, which focuses on testing whether countries with lower initial levels of the indicator grow faster (i.e., converge toward the average), Sigma convergence evaluates the overall degree of dispersion of the observed indicator across the studied group over time. It is thus considered a stronger test of homogenisation between countries.

Following Delgado et al. (2014) and Heimberger (2021), as well as current legislative trends in EU corporate tax harmonisation (e.g., the introduction of a global minimum tax under Council Directive (EU) 2022/2523 of 14 December 2022 on ensuring a global minimum level of taxation for multinational enterprise groups and large domestic groups in the Union), we formulate the following research hypothesis:

Hypothesis H2: There is Sigma convergence of corporate tax rates (both effective and nominal) in the EU, meaning that variability between member states decreases over time.

In our analysis, we expressed Sigma convergence through the trend of the standard deviation of the logarithm of the observed indicator's value across EU member states each year. Logarithmic transformation is used for better statistical robustness and to eliminate potential asymmetries in the distribution of the indicator (Heimberger, 2021).

The formula for calculating the standard deviation in year t is as follows:

$$\sigma_t = \sqrt{\frac{1}{N} \sum_{i=1}^N (Y_{it} - \mu_t)^2}$$

Where:

- σ_t is the standard deviation in year t ,
- N is the number of countries in the analysed group,
- Y_{it} is the value of the variable (e.g., tax rate) for country i in period t ,
- μ_t is the average value of the variable in period t .

Interpretation:

- If σ_t decreases over time, convergence is occurring – differences between countries are shrinking.
- If σ_t increases, divergence is occurring – countries are moving further apart.

Analysis Procedure:

We performed the calculation for the period 2013–2023 for EU member states. In both cases, ETR and NOM, we applied a linear regression of the trend of σ_t on the time variable (year) to statistically verify the existence of a convergence trend.

Regression Model:

$$\sigma_t = \alpha + \beta \times Year + \varepsilon_t$$

The key parameter is the β coefficient, where a negative and statistically significant β confirms the existence of Sigma convergence. If the β coefficient is positive, we are observing divergence, i.e., differences between countries are increasing. If the β coefficient equals 0, there is no significant trend.

4. Convergence and Regression Analysis

Results of Beta Convergence – Nominal Tax Rate and Effective Tax Rate

Beta convergence is a key analytical tool used to examine whether countries with higher initial tax rates experience a faster decline in those rates over time, thereby gradually converging. Within the European Union, this analysis allows us to assess whether countries such as France, Belgium, or Germany, with historically higher corporate tax rates, have reduced their rates more quickly than countries like Ireland, Hungary, or Bulgaria, which have maintained low tax burdens over the long term.

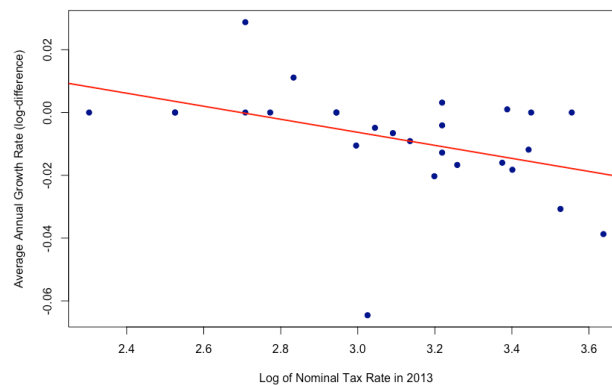


Figure 1. Beta convergence – Nominal Tax Rates (2013-2023)

Source: Own processing

The negative slope of the line depicting the relationship between the initial value of the logarithm of the nominal tax rate in 2013 and the average annual growth rate of that rate over the 2013–2023 period, expressed as a logarithmic difference (Figure 1), suggests that countries with higher initial rates (e.g., France, Belgium, Germany) tended to reduce their tax levels, while countries with lower rates grew more slowly or remained stable.

In the case of effective tax rates as well, we observe a negative slope of the regression line, which visually supports the Beta convergence hypothesis (Figure 2). This means that countries with higher effective rates (e.g., Germany, the Netherlands, Sweden) in 2013 saw a decrease in those rates during the observed period.

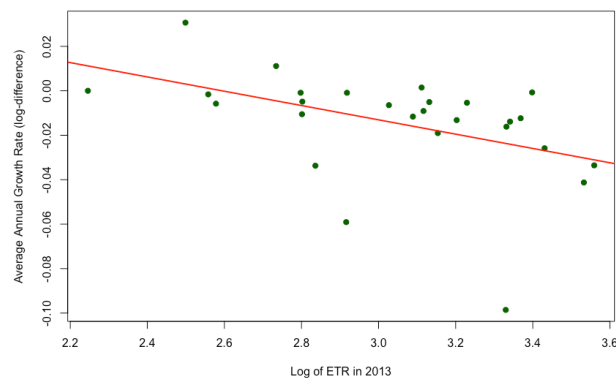


Figure 2. Beta convergence – Effective Tax Rates (2013-2023)

Source: Own processing

The result confirms the existence of Beta convergence in nominal tax rates, meaning that countries with higher rates in 2013 (e.g., France, Belgium, Germany) tended to reduce them over the following decade, thereby moving closer to the average. This negative correlation between the initial level and the subsequent growth of the tax rate indicates a narrowing of differences among member states. Regression analysis (Table 1) showed that the β coefficient = -0.02869 is statistically significant at the 5% level (p -value = 0.0268), with $R^2 = 0.205$, meaning that the initial nominal rate explains 20.5% of the variability in its growth.

This result also confirms the existence of Beta convergence in effective tax rates, indicating that countries with higher rates in 2013 (e.g., Germany, the Netherlands, Sweden) tended to reduce them in the following decade, approaching the average. This negative correlation between the initial level and the subsequent growth of the tax rate signals a convergence among member states. Regression analysis (Table 1) showed that the β coefficient = -0.03218 is statistically significant at the 5% level (p -value = 0.0179), with $R^2 = 0.204$, meaning that the initial effective rate explains 20.4% of the variability in its growth.

Table 1. Statistical Results of the Regression

Variable	Nominal rate	Effective rate
Dependent variable	$\log(\text{nom2023}/\text{nom2013}) / 10$ (average annual growth rate)	$\log(\text{etr2023}/\text{etr2013}) / 10$
Independent Variable	$\log(\text{nom2013})$	$\log(\text{etr2013})$
Coefficient β	-0.02869	-0.03218
p-value	0.0268 (statistically significant at the 5% level)	0.0179 (statistically significant at the 5% level)
$R^2 = 0.205$	0.205 (20.5% of the variability explained by the initial rate level)	0.204 (20.4% of the variability explained by the initial rate level)

Source: Own processing

Results of Sigma Convergence – Nominal and Effective Tax Rate

The declining trend of the standard deviation of the logarithm of nominal tax rates during the observed period indicates convergence in nominal rates (Figure 3).

The most significant fluctuation occurred in 2017, when the standard deviation increased sharply. This rise can be explained by sudden changes in rates in several countries (e.g., France, Hungary, Italy), which temporarily increased disparity. However, after this fluctuation, the dispersion began to decline again, and since 2019 there has been a steady decrease, culminating in very low values in the years 2021–2023.

Thus, Sigma convergence also occurs in nominal tax rates. Despite temporary fluctuations in the middle of the analysed period, the differences between member countries are decreasing. The negative slope of the trend line statistically supports this convergence.

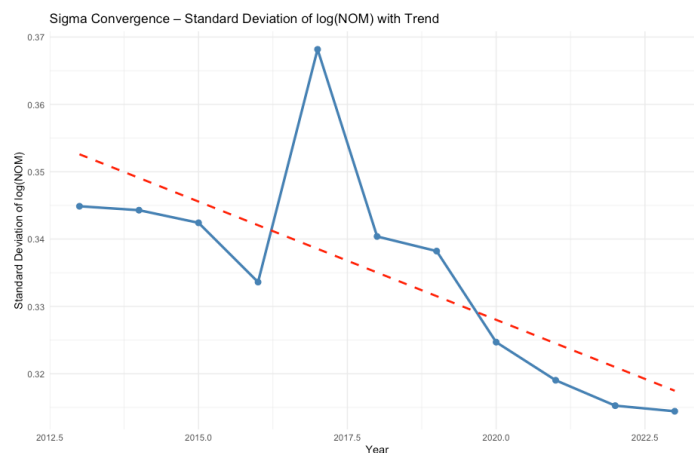


Figure 3. Sigma convergence – Nominal Tax Rates (2013-2023)

Source: Own processing

A negative and statistically significant coefficient indicates a reduction in differences in nominal rates among member countries. Although the dispersion temporarily increased in 2017–2018, likely due to major tax rate changes in some countries (e.g., Belgium, Latvia, France), the trend line confirms an overall converging development.

The trend line of the standard deviation of the logarithm of the effective tax rate among EU member states from 2013 to 2023 clearly shows a downward trend, indicating that differences in ETR between countries are decreasing over time (Figure 4).

While a slight fluctuation and increase in variability can be observed in 2017–2019, a more significant decline follows after 2020, culminating in the lowest level of dispersion in 2021–2022. The last observed year shows a slight increase, but it does not disrupt the overall convergence trend.

The observed development confirms the existence of Sigma convergence also in the area of ETR, i.e., the convergence of effective tax rates across EU member states. A statistically significant negative coefficient of the trend line (in the regression output) supports this conclusion. The regression of the standard deviation over time confirmed a negative trend, supporting the existence of Sigma convergence in effective tax rates.

Table 2. Regression Output for Nominal and Effective Tax Rates

Variable	Nominal rate	Effective rate
Coefficient	–0.00351	–0.00286
p-value:	0.01096 (statistically significant)	0.00065 (statistically highly significant)
R ²	53.1 %	66.7 %
adjusted R ²	47.9 %	63.7 %
F-statistic	10.19, p = 0.01096	22.05, p < 0.001

Source: Own processing

A negative and statistically significant coefficient for the variable "Year" indicates that the dispersion of effective tax rates among EU countries has been decreasing over time (Table 2). A high R² suggests that the time variable explains a substantial portion of the variation in dispersion (Table 2). This result strongly supports the hypothesis of Sigma convergence of effective tax rates in the EU.

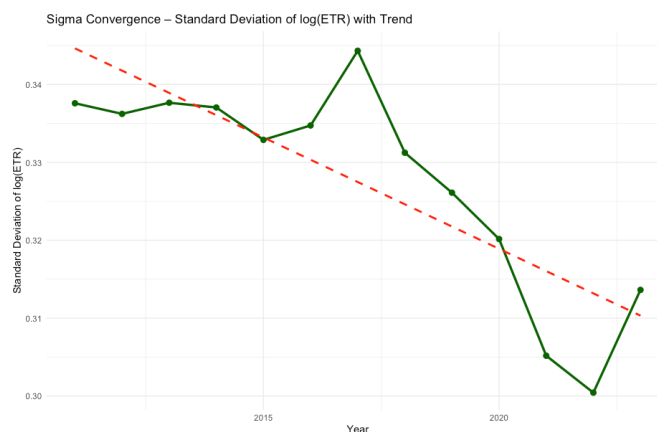


Figure 4. Sigma convergence – Effective Tax Rates (2013-2023)

Source: Own processing

The results of both types of convergence (σ -convergence and β -convergence) show that between 2013 and 2023, there was a gradual convergence of tax rates among EU member states. In the case of nominal tax rates (NOM), a clear downward trend in variability (σ -convergence) was recorded, and countries with higher initial rates tended to reduce their rates more rapidly (β -convergence). A similar trend was observed for effective tax rates (ETR), where convergence was even more pronounced, suggesting that statutory rates and tax burden on

businesses are becoming more aligned across countries. Among the converging countries, Belgium, France, Germany, and Italy stand out for implementing reforms during the period that reduced their tax rates.

On the other hand, some low-tax countries (e.g., Ireland, Hungary, Bulgaria) maintained their low rates steadily, thereby contributing to the overall reduction in variability within the EU, even though they did not directly converge toward the average. Some divergence occurred in 2017, when legislative changes in certain countries increased variability, but this effect was later offset in the following years.

The results indicate that both harmonisation and competition were simultaneously at play in the EU during the observed period. The harmonisation effect is visible in the results of Sigma convergence, which indicate that differences between countries are narrowing. However, tax competition continues to exist, as seen through Beta convergence, where countries with higher tax rates have lowered them under pressure to remain competitive.

The introduction of a 15% minimum effective tax rate in 2024 (in line with the OECD global agreement and the EU initiative) may strengthen this trend toward further harmonisation. In practice, however, competition still prevails over full harmonisation, mainly because member states retain significant tax sovereignty and use tax instruments as part of their economic policy.

5. Results and Discussion

The results of this study confirmed the existence of convergence in corporate tax rates within the European Union during the period 2013 to 2023. Based on both Beta and Sigma convergence analyses, we can conclude that differences among EU member states are gradually decreasing, indicating a partial trend toward the harmonisation of tax policies. Similar conclusions were presented by Delgado and Presno (2017), who, while acknowledging persistent differences, identified a trend of convergence, particularly in the area of goods and services taxation.

Hypothesis H1, which assumed the existence of Beta convergence, was confirmed for both nominal and effective corporate tax rates. For nominal rates, a statistically significant negative relationship was identified between their initial level in 2013 and their subsequent development. Countries with higher tax rates tended to reduce them more rapidly, thus approaching the average. A similar trend was confirmed for effective tax rates, suggesting that the actual tax burden on businesses also became more aligned across countries. These findings are consistent with Bušovská (2014), who identified a long-term trend of convergence in both the tax mix and overall tax burden, even among countries with different EU accession dates.

Hypothesis H2, assuming Sigma convergence, was also confirmed. For nominal tax rates, a long-term downward trend in variability (standard deviation) was observed, despite a slight fluctuation in 2017. In the case of effective rates, the decline in variability was even more significant, illustrating a stronger convergence in real tax burdens across member states. These results are also supported by the study of Regis, Cuestas, and Chen (2015), who identified “club convergence” using Beta and Sigma convergence methods, i.e., the formation of country clusters with internal convergence, but persistent divergence between those groups.

Among the converging countries, Belgium, France, Germany, and Italy can be identified, all of which implemented reforms during the observed period that led to lower tax rates. On the other hand, countries like Ireland, Hungary, and Bulgaria have long maintained low tax rates. While this does not directly contribute to convergence, it does help reduce overall variability in the EU. Similar country patterns were identified in Regis Cuestas and Chen (2015), where Ireland and Cyprus formed their own “tax clubs” characterised by steep rate reductions.

The findings suggest that two opposing forces, harmonisation and competition, operate simultaneously within the EU. Sigma convergence results point to a harmonising effect, with differences between countries diminishing. However, Beta convergence reflects ongoing tax competition, as countries with higher rates adjust their policies to remain competitive. Similarly, Haufler and Kato (2024) identified a tension between

harmonisation through the global minimum tax and the continued use of selective taxation, especially by tax havens.

The introduction of a 15% minimum effective tax rate in 2024, in line with OECD and EU initiatives, may represent a further step toward greater harmonisation. Nevertheless, competition between states still outweighs full harmonisation. Haufler and Kato (2024) point out that while countries are adopting new rules for large multinationals, they still preserve room for tax policy targeted at smaller entities, creating various equilibria between “havens” and other countries.

In conclusion, differences in corporate tax systems influence not only investment behaviour but also the competitiveness of the countries and their economic growth trajectories. Within the EU, the issue of further harmonisation remains a key challenge for achieving a stable and fair single market. In line with Delgado & Presno (2009), it can be concluded that fiscal coordination is a necessary condition for more successful integration, although national interests and tax sovereignty continue to pose complications.

Based on the analyses from 2013 to 2023, we can answer our research question affirmatively: corporate tax rate convergence is occurring within the European Union in terms of harmonisation and tax competition. The Beta and Sigma convergence results confirm that differences among member states are gradually diminishing, with countries with higher rates lowering them more quickly and effective tax burdens becoming more similar.

At the same time, it is clear that harmonisation efforts (e.g., the global minimum tax) coexist with ongoing tax competition, where some countries maintain low rates to attract investment. This combination affects the functioning of the single market, contributing to fairer business conditions, but persistent differences may slow fiscal integration. The results thus indicate that although convergence is happening, complete harmonisation is not yet a reality.

Conclusions

The results of the empirical analysis of corporate tax rates in EU member states for the years 2013–2023 confirmed that both nominal and effective rates have been converging over time. Negative and statistically significant coefficients in the β -convergence models showed that countries with above-average initial rates, particularly Belgium, France, Germany and Italy, reduced their rates more rapidly than low-tax countries such as Ireland, Hungary, and Bulgaria. Parallel σ -convergence analysis demonstrated a decline in rate variability across the Union, with a stronger effect observed for effective rates, indicating real convergence in corporate tax burdens.

These results suggest the simultaneous influence of harmonisation pressures and ongoing tax competition. From the perspective of the single market, the findings are twofold. Convergence supports a fairer and more transparent business environment, reducing profit-shifting incentives and aggressive tax planning. At the same time, persistent differences, especially in “low-tax peripheries”, slow the pace of fiscal integration and may create pressure for a renewed round of tax competition if harmonisation reforms proceed too slowly.

The conclusions of this paper thus confirm a positive answer to the research question: corporate tax rate convergence is occurring within the EU, but the process is partial and uneven. For EU legislation, further harmonisation steps should consider the persistent differences in member states' economic performance and fiscal priorities. Future research could extend the analysis to the post-pandemic years, assess the effectiveness of the new global minimum tax rules, and apply panel models with variables capturing structural factors (such as economic openness, innovation levels, and institutional quality) to explore better the motivations and constraints individual countries face when setting corporate tax policies.

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