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KEY TAX RATE DISPARITIES AND STRUCTURAL CHALLENGES OF EU FISCAL INTEGRATION

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НЕРІВНОМІРНІСТЬ КЛЮЧОВИХ ПОДАТКОВИХ СТАВОК І СТРУКТУРНІ ВИКЛИКИ ФІСКАЛЬНОЇ ІНТЕГРАЦІЇ ЄС

This paper examines how persistent differences in corporate, personal income, and VAT rates challenge the European Union's goal of deeper fiscal integration. These disparities sustain tax competition and create structural barriers that limit the EU's ability to balance fair internal market conditions with national fiscal sovereignty.

To test the degree of convergence or divergence, the study applies empirical benchmarking of top marginal tax rates for 27 countries, using Z-score standardization, k-means clustering, and the Elbow Method to define natural groupings and quantify structural patterns. This approach identified three stable clusters reflecting distinct fiscal profiles within the EU.

The analysis shows that while VAT rates display clear signs of convergence, direct taxes reveal meaningful divergence. Member states cluster into three main groups: high-tax welfare states combining higher corporate and personal rates with moderate VAT; mixed-model states with moderate corporate rates and heavier reliance on VAT; and low-tax regimes with competitive direct tax levels but VAT rates aligned with EU minimum standards. These results confirm that indirect taxation remains the most harmonized fiscal area, while national discretion over direct taxes sustains competitive differences.

The study uses publicly available rate data and focuses on statutory top marginal rates, which may not capture all effective tax incentives or policy shifts. Broader modelling including dynamic firm-level effects and new digital taxation trends could complement future research.

The results help EU policymakers, tax professionals, businesses, and researchers better understand where fiscal alignment works and where gaps remain, supporting informed debate on realistic harmonization scenarios and investment climate management.

By combining systematic rate benchmarking with quantitative cluster analysis in this context, the paper provides fresh empirical evidence that complements largely descriptive past research, offering clearer insight into the real structural challenges of EU fiscal integration.

У статті розглянуто, яким чином стійкі відмінності у рівнях корпоративного податку, податку на доходи фізичних осіб та податку на додану вартість (ПДВ) створюють виклики для реалізації мети Європейського Союзу щодо глибшої фіскальної інтеграції. Такі розбіжності підтримують податкову конкуренцію та формують структурні бар'єри, що обмежують спроможність ЄС забезпечувати баланс між рівними умовами внутрішнього ринку та збереженням фіскального суверенітету держав-членів.

Для оцінки рівня конвергенції чи дивергенції проведено емпіричне бенчмаркування граничних ставок для 27 країн із застосуванням стандартизації Z-оцінок, кластеризації методом k-середніх та методу «лікоть» для визначення природних групувань і кількісного вимірювання структурних закономірностей. У результаті виокремлено три стійкі кластери, що відображають характерні фіскальні профілі в межах ЄС.

Аналіз підтверджує, що ставки ПДВ демонструють ознаки конвергенції, тоді як прямі податки зберігають істотну дивергенцію. Держави-члени групуються у три типові класи: країни з високим рівнем оподаткування та розвиненими соціальними системами, які поєднують високі корпоративні та особисті ставки із помірним ПДВ; країни змішаного типу з помірними корпоративними ставками та більшою залежністю від ПДВ; а також держави з низьким рівнем прямих податків, але ставками ПДВ, що відповідають мінімальним стандартам ЄС. Отримані результати підтверджують, що саме непряме оподаткування залишається найбільш гармонізованою сферою, тоді як автономія держав у сфері прямих податків зберігає конкурентні відмінності.

Дослідження ґрунтується на відкритих даних про номінальні граничні ставки, що може не охоплювати усіх податкових пільг чи змін у політиці. Розширене моделювання з урахуванням динаміки на рівні підприємств та нових цифрових податкових інструментів може доповнити подальші дослідження.

Отримані висновки сприятимуть кращому розумінню актуального стану фіскального вирівнювання та наявних прогалин для політиків ЄС, бізнесу, податкових консультантів та дослідників, підтримуючи обґрунтовану дискусію щодо реалістичних сценаріїв гармонізації та управління інвестиційним кліматом.

Поєднання системного бенчмаркування ставок із кількісною кластеризацією забезпечує новий емпіричний доказ, що доповнює переважно описові попередні дослідження та дає чіткіше уявлення про реальні структурні виклики фіскальної інтеграції ЄС.

Keywords: *cluster analysis, convergence, divergence, EU, fiscal integration, fiscal model, tax disparities.*

Ключові слова: *кластерний аналіз, конвергенція, дивергенція, ЄС, фіскальна інтеграція, фіскальна модель, нерівномірність оподаткування.*

General statement of the problem and its connection with important scientific or practical tasks. Intensified economic integration and the growing dominance of digital business models continue to challenge the European Union's goal of achieving meaningful fiscal alignment. Despite decades of coordination, significant disparities in top marginal corporate tax rates, personal income taxes, and VAT rates persist across EU member states, sustaining competitive pressures that can undermine fair market conditions. These national differences reflect deeply rooted social models and economic structures, but they also enable strategic profit shifting and tax arbitrage, especially as new technologies and cross-border digital transactions grow more complex. This creates a pressing scientific and practical challenge: while policy instruments like minimum standards and directives have narrowed VAT variation, direct taxation remains fragmented, leaving gaps that complicate deeper integration. Many studies describe broad trends in tax harmonization but rarely provide consistent, up-to-date empirical evidence that clarifies where genuine convergence holds and where structural divergence endures. This lack of clear, comparative measurement limits the ability of policymakers to anticipate fiscal risks, shape resilient coordination frameworks, and respond effectively to shifting capital flows in an increasingly digitalized single market.

Analysis of recent studies and publications. There is a substantial body of research examining how key tax rate disparities and persistent structural barriers shape the feasibility of fiscal integration within the European Union. Scholars have explored the dynamics of national tax regimes, policy responses to globalization and digitalization, and the tensions between national sovereignty and collective EU fiscal frameworks.

Liapis, Rovolis, and Galanos assess whether the EU can achieve a common tax regime despite entrenched national differences. They use data from 1995–2009, applying regression and cluster analysis to identify tax burdens and groupings, finding clear clusters like high-burden Nordic states and low-burden Eastern members while highlighting the strategic outlier positions of financial hubs [1, pp. 104–106]. Yet, the study relies on pre-2009 data and remains descriptive without forecasting or scenario testing, limiting its practical policy relevance.

Guo analyzes the North–South divide in EU economic policy, focusing on how austerity measures during the debt crisis reflected contrasting welfare models and fiscal cultures. The paper shows how these deep structural divides fueled divergent approaches and hindered coordinated integration [2, p. 170]. However, the work stays mainly descriptive, lacking quantitative tests or modelling, and does not address new digital-era fiscal integration questions.

Mitsi explores the idea of a fiscal union's rationale, challenges, and possible pathways, stressing how deeper integration could stabilize the eurozone through shared borrowing and transfers. The paper weighs gradual versus radical routes and highlights treaty and sovereignty constraints [3, p. 2121]. Still, the discussion remains conceptual without fresh data analysis or tested scenarios, which weakens its evidence base.

Mihóková, Andrejovská, and Martinková compare corporate tax competitiveness in the EU from 2004–2014, showing how newer members sustain lower tax burdens to gain investment advantage while older states maintain higher rates. Using constant market shares and k-means clustering, they confirm enduring national differences despite harmonization efforts [4, pp. 605–606]. Nevertheless, the study's narrow corporate focus, older data window, and lack of broader fiscal dimensions limit its contribution to the full integration picture.

Cuenca García, Navarro Pabsdorf, and Mihi-Ramírez trace the history of EU tax harmonization, from early VAT directives to recent efforts curbing harmful tax competition. They highlight the push-pull between national sovereignty and the need for shared rules, concluding that progress remains cautious and partial [5, p. 50]. Yet, the paper stays descriptive and historical, without updated empirical tests or projections of likely convergence outcomes.

Ciak and Gruszczyńska examine the legal architecture governing EU tax systems, showing how directives shape VAT and excise duty alignment but leave direct taxes highly national. They stress that despite progress, uneven harmonization persists and complicates deeper union goals [6, pp. 63–65]. Nonetheless, the legalistic approach lacks fresh quantitative evidence or digital-era modelling, narrowing its predictive relevance.

Mileusnic uses text mining and qualitative coding of 160 documents to map shifts in EU fiscal integration from 2007–2022, identifying how crises like Brexit and COVID-19 spurred upward or stalled momentum. The study situates these shifts within neo(neo)functionalism and examines new instruments like SURE and NGEU [7, pp. 2973–2974]. Still, it leans heavily on discourse analysis without pairing findings with robust economic modelling or scenario forecasts.

Chen, Šimurina, and Solenički test how tax structures shape income inequality in the EU using regularized regression and advanced stacking. They show social contributions and income taxes help reduce inequality while government spending can worsen it, highlighting tax design's role in EU disparities [8, pp. 20–21].

Yet, their analysis rests mostly on correlations without strong causal modelling or simulation of harmonization effects, which limits its practical depth.

Pawlak reviews the evolution of EU-level fiscal powers, discussing the Monetary Union’s design, the Stability Pact, and crisis-response tools. The researcher argues progress toward deeper coordination depends on balancing oversight with national sovereignty [9, pp. 123–124]. Nevertheless, the analysis stays conceptual and lacks new empirical tests or scenario projections that could clarify policy impacts.

Onofrei, Vintilă, Chiricu, and Oprea examine how fiscal policy affects EU income distribution, using robust panel data to show that indirect taxes are regressive while institutional factors like education and governance play a role. They argue that fiscal levers alone cannot close inequality gaps [10, pp. 74–75]. Still, high correlation among variables and limited country-level simulations weaken the study’s value for concrete EU integration pathways.

Figueira and Espinoza develop a bargaining model for making an EU fiscal union politically acceptable, showing how North and South could negotiate trade-offs using targeted stabilizers instead of a single pooled system. They stress how crises can open windows for step-by-step advances [11, pp. 266–267]. However, the model remains purely theoretical, with no empirical stress testing or real-world scenario validation.

Oręziak analyzes the euro area’s incomplete fiscal union, discussing the potential for a separate budget and deeper federalism to strengthen crisis resilience. The author weighs proposals like turning the ESM into a European Monetary Fund and outlines the obstacles that remain [12, p. 96]. Yet, the paper is largely narrative and does not test quantitative effects or practical feasibility, which limits its predictive power.

Despite extensive scholarly attention, clear empirical tests combining cluster benchmarking with statistical evidence on corporate, personal income, and VAT rate convergence remain limited. The works reviewed underscore important theoretical and comparative insights yet show that deeper, quantifiable analysis is needed to clarify how national differences sustain tax competition. This literature gap substantiates the present paper's empirical cluster analysis and comparative tables, aiming to refine policy understanding of how structural disparities challenge EU fiscal harmonization.

Formulation of the objectives of the article (task statement). This article aims to assess the practical implementation of an integrative fiscal model within the EU by comparing key tax rates, measuring convergence and divergence patterns, and identifying structural challenges and policy implications for deeper fiscal harmonization.

Summary of the main research material. Table 1 examines whether an integrative fiscal model exists in practice within the European Union by analyzing the degree of convergence or divergence in three core tax dimensions: corporate, personal income, and value-added tax (VAT) rates across EU member states. Corporate taxation reveals partial alignment but clear limits to full harmonization. The average top marginal corporate tax rate of 21,30% indicates that most member states gravitate toward moderate corporate taxation that balances investment attractiveness and revenue needs. Notably, Austria (23,00%), Czech Republic (21,00%), Latvia (20,00%), and Estonia (20,00%) exemplify this central cluster. However, significant outliers persist. Hungary's 9,00% rate represents the EU's lowest, highlighting a deliberate strategy to attract foreign capital through tax competition.

At the other extreme, Malta levies a corporate tax of 35,00%, far above the EU mean. Such divergence is quantified by a standard deviation of 6,14, a coefficient of variation of 0,29, and an interquartile range (IQR) of 6,25, indicating that while half the member states cluster tightly, the overall spread remains substantial due to a few persistent outliers. This structural gap suggests that although the EU promotes fair competition, member states retain discretion over corporate tax policy, particularly to influence investment flows within the digital economy.

Table 1. Benchmarking EU member states' key tax rates: fiscal integration in focus

EU member state	Top marginal corporate tax rate, %	Top personal income tax rate, %	VAT rate, %
Austria	23,00	55,00	20,00
Belgium	25,00	60,20	21,00
Bulgaria	10,00	10,00	20,00
Croatia	18,00	32,00	25,00
Cyprus	12,50	46,50	19,00
Czech Republic	21,00	27,50	21,00
Denmark	22,00	55,90	25,00
Estonia	20,00	20,00	22,00
Finland	20,00	58,00	24,00
France	25,80	55,60	20,00
Germany	29,90	47,50	19,00
Greece	22,00	53,50	24,00
Hungary	9,00	33,50	27,00
Ireland	12,50	52,00	23,00
Italy	27,80	52,80	22,00
Latvia	20,00	31,40	21,00
Lithuania	15,00	39,00	21,00
Luxembourg	24,90	47,20	17,00
Malta	35,00	35,00	18,00
Netherlands	25,80	51,50	21,00
Norway	22,00	46,40	25,00
Poland	19,00	36,00	23,00
Portugal	31,50	58,20	23,00
Romania	16,00	10,00	19,00
Slovak Republic	21,00	35,00	20,00
Slovenia	22,00	61,10	22,00
Spain	25,00	45,00	21,00
Sweden	20,60	52,20	25,00
Minimum	9,00	10,00	17,00
Maximum	35,00	61,10	27,00
Range	26,00	51,10	10,00
Average (mean)	21,30	43,14	21,71
Median	21,00	46,85	21,00
Standard deviation	6,14	14,51	2,52
Percentage of standard deviation	28,82	33,63	11,63
Coefficient of variation	0,29	0,34	0,12
Interquartile range (IQR)	6,25	21,00	3,00

Source: elaborated by the authors based on [13]

Personal income taxation demonstrates even stronger divergence, reflecting deeply rooted national choices on social redistribution and welfare commitments. The average top marginal personal income tax rate stands at 43,14%, substantially higher than corporate rates, confirming the progressive nature of EU fiscal systems. Countries such as Belgium (60,20%), Finland (58,00%), and Portugal (58,20%) exemplify high-income tax policies that finance robust social protection. In contrast, Bulgaria and Romania maintain flat rates at 10,00%, demonstrating minimalist approaches aimed at simplicity and competitiveness. The range reaches 51,10 percentage points, with a standard deviation of 14,51 and a coefficient of variation of 0,34, the highest among the three tax types analyzed. The IQR of 21,00 shows that even the central half of EU states display significant variation. This distribution confirms that, despite efforts toward fiscal coordination, personal income tax systems remain firmly under national control, shaped by domestic social models, political cultures, and economic strategies.

Value-added tax (VAT) stands in clear contrast, offering robust evidence of genuine convergence. The average VAT rate across these states is 21,71%, with a median of 21,00%, reflecting tight clustering. Many countries, including Belgium (21,00%), the Netherlands (21,00%), and Spain (21,00%), maintain VAT rates within one to two percentage points of the mean. The outliers, Luxembourg at 17,00% and Hungary at 27,00%, remain exceptions rather than structural deviations. The range of only 10,00 percentage points, standard deviation of 2,52, and low coefficient of variation of 0,12 all confirm limited spread. The narrow IQR of 3,00 reinforces that the middle 50% of countries are tightly grouped. This degree of alignment stems directly from EU directives that prescribe minimum standard VAT rates and narrow the room for aggressive tax competition in this area. Such harmonization prevents distortions in the internal market and curbs the incentive for cross-border shopping based purely on VAT differentials – a key factor for the digital single market where cross-border transactions are common.

Taken together, the statistical evidence shows that VAT, as an indirect tax, is the most harmonized element within the EU's fiscal landscape. Direct taxes (both corporate and personal) continue to exhibit meaningful divergence, driven by national policy autonomy and competition for investment and skilled labor. The enduring variation in corporate tax rates, from Hungary's low to Malta's high, shows that states still exploit tax competition strategically, even under the pressures of digitalization. Meanwhile, the broad spread in personal income tax rates reflects different welfare traditions, demographic pressures, and the diverse fiscal capacities of member states.

The cluster analysis used k-means clustering, a widely applied method for identifying natural groupings within numerical datasets. First, all tax rate data (corporate, personal, VAT) were standardized using the Z-score method to ensure comparability of variables measured on different scales. To determine the optimal number of clusters, the Elbow Method was applied: by plotting within-cluster sum of squares (WCSS) for different values of *k* (from 1 to 10), the point where adding more clusters gave only marginal improvement was selected as the "elbow." This visual inflection suggested that 3 clusters offer a meaningful balance between interpretability and explanatory power (Table 2).

Table 2. Comparative cluster analysis of key tax rates in EU member states

Cluster	EU member states	Average corporate tax, %	Average personal tax, %	Average VAT rate, %
1	Austria, Belgium, France, Germany, Italy, Luxembourg, Netherlands, Portugal, Slovenia, Spain, Sweden	26,88	51,74	20,36
2	Croatia, Denmark, Finland, Greece, Hungary, Ireland, Norway, Poland	18,34	46,61	24,56
3	Bulgaria, Cyprus, Czech Republic, Estonia, Latvia, Lithuania, Malta, Romania, Slovak Republic	16,94	27,43	20,38

Source: elaborated by the authors

Cluster 1 gathers high-tax countries such as Belgium, Germany, and Sweden. These states sustain higher-than-average corporate rates (26,88%) and very high personal income tax rates (51,74%), combined with a moderate VAT.

This structure aligns with strong welfare traditions and well-developed public sectors.

Cluster 2 combines economies like Denmark and Finland with moderate corporate taxation (18,34%) but still robust personal taxes (46,61%) and a noticeably higher average VAT rate (24,56%). These states rely on indirect taxes more heavily to support social spending while remaining competitive for business.

Cluster 3 represents low-tax models, including Bulgaria, Estonia, and Romania, where average personal income taxes drop to 27,43% and corporate tax rates to 16,94% far below the EU mean. Despite their low direct taxes, their VAT rates hover around 20,38%, showing that even the lowest-tax group aligns with EU VAT minimums.

Conclusions and prospects for further research in this area. The findings demonstrate that the European Union's aspiration for a coherent fiscal model remains only partly fulfilled. The detailed benchmarking of top marginal corporate tax rates, personal income tax rates, and VAT rates shows a clear pattern: while indirect taxation displays strong convergence, direct taxes still reflect pronounced national disparities. The cluster analysis, underpinned by k-means grouping and validated through the Elbow Method, provides clear empirical value by revealing three robust fiscal clusters. These clusters highlight structural tax patterns (high-tax welfare states, moderate mixed models, and competitive low-tax regimes) each balancing fiscal needs, social commitments, and investment strategies in distinct ways.

The main value added of this study lies in quantifying where harmonization holds and where divergence persists. The narrow spread and low variation in VAT rates confirm the effectiveness of EU-level directives in preventing excessive tax competition in indirect taxation, which is essential for the functioning of the single market in the digital era. In contrast, the sustained differences in corporate and personal income taxation illustrate how member states maintain flexibility to adapt tax policy to local economic priorities and competitive pressures. This strategic variation raises important policy implications: deeper fiscal integration will require addressing the tension between tax competition and fair internal market conditions without undermining member states' fiscal sovereignty.

Future research should build on these cluster results by modelling how changing economic conditions, demographic shifts, and new digital tax rules might impact convergence trends. Further exploration of how tax incentives interact with digital capital flows could help refine practical pathways for a more balanced, resilient EU fiscal integration model in an increasingly interconnected global economy.

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