PROCEEDINGS OF THE JOINT INTERNATIONAL WORKSHOP SUSTAINABLE INVESTMENTS, INDUSTRIAL POLICY AND GROWTH

Coordinators: Simona MOAGĂR-POLADIAN,
Alina-Cerasela AVRAM

Bucharest, 2025
ISBN: ISBN 978-973-0-43262-6.

ISBN: ISBN 978-973-0-43262-6.

During the scientific event "JOINT INTERNATIONAL WORKSHOP SUSTAINABLE INVESTMENTS, INDUSTRIAL POLICY AND GROWTH", organized by the Institute for World Economy of the Romanian Academy together with the Bulgarian Academy of Sciences, Economic Research Institute, which took place on 20 June 2025 at the Institute for World Economy in Bucharest, the following authors presented their papers: Daniela BOBEVA, Simona MOAGĂR-POLADIAN, Iana PALIOVA, Andrei RĂDULESCU, Virginia ZHELYAZKOVA, George-Cornel DUMITRESCU, Eduard MARINOV, Alina-Cerasela AVRAM, Mariana ȚĂRANU, Claudia Gabriela BAICU, Iulia Monica OEHLER-ȘINCAI, Georgeta ILIE, Andreea – Emanuela DRĂGOI, Mădălina TOCAN, Oana CHINDRIȘ-VĂSIOIU, Paul CALANTER, Ion-Matei Dumitrescu.

Table of Contents

Daniela BOBEVA[1]

POLITICAL ECONOMY OF JOINING THE EURO AREA (LESSONS LEARNED)

***Abstract**: Countries with fixed exchange rate regimes seem to be more interested in joining the euro area than those with their own monetary policies. Bulgaria is the last country with fixed exchange rate regimes that has now been allowed to join after twenty-three years of trying. The aim of this article is to examine the main challenges of joining the euro area in the context of changes in procedures, the interpretation of criteria and the relationship between nominal and real convergence. The study concludes that the new framework for joining the euro area is highly discretionary, more tolerant of higher inflation, debt and public deficit. All this, coupled with the weaknesses of the euro area, makes the path to the euro area for other countries difficult to motivate, and Euroscepticism is gaining popularity along with populism.*
***Keywords**: Economic and Monetary Union; Euro Adoption, Nominal and Real Convergence*
***JEL:** E42; E50; E52*

1. Introduction

There is a fundamental difference between non-euro area countries with fixed exchange rate regimes and those with independent monetary policies. Non-euro area countries are more motivated because they do not use the important instruments of monetary policy and do not essentially conduct an independent monetary policy. Countries with independent monetary policies have "something to lose" – their sovereignty. Bulgaria is the last EU Member State with a fixed exchange rate regime to join the euro area in early 2026, after twenty-three years of attempts that began as early as the EU accession negotiation process in 2000, when the country declared its desire to join the EU and the euro area simultaneously, motivated by the fixed exchange rate to the euro and its sustainable maintenance, as well as a prudent fiscal policy. The question is why it took Bulgaria so long despite the political consensus to join the euro area and the high degree of sustainable macroeconomic and currency stability.

[1] *Prof. Dr. Daniela Bobeva, International Economics Department, Economic Research Institute at the Bulgarian Academy of Sciences: bobeva.daniela@gmail.com.*

During these years, the euro area has changed – it has become more numerous, more heterogeneous, and time has tested its ability to achieve its mandate and to truly be an example of successful monetary policy. The attractiveness of the euro area itself for countries outside it is low, which is demonstrated by the reluctance of countries, for which fulfilling the accession criteria is not a problem, to include quick accession in their priorities. In the public and academic debate in Bulgaria and in other non-euro area countries, the question of benefits and risks remains central. Now the main problem is the desire and motivation of the countries for membership rather than the selectivity and conditionality for their admission.

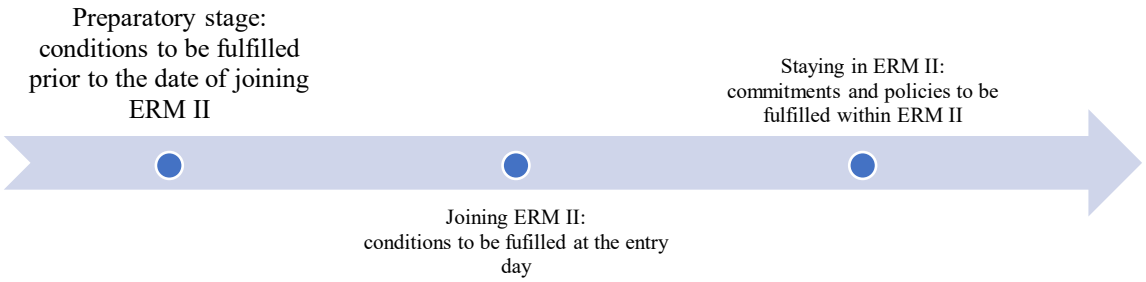
In this study, we focus on three main reasons for the difficulties of joining the euro area in current conditions: changes in the process itself, changes in the interpretation of the criteria leading to its increasingly discretionary nature, and the contradiction between nominal and real convergence. Bulgaria's experience in the process makes it possible to answer these research questions.

2. The changing procedures and criteria for joining the euro area

The construction of euro-area entry criteria is based on the fundamental principles of macroeconomic stability and equal treatment of applicants. The core Maastricht criteria have numerical expression which gives the applicant countries the security to be equally treated when applying. Altering both the procedure and the interpretation of the criteria has led to changes that make the accession process more discretionary and euro area membership less attractive. These changes include the essence of European Exchange Rate Mechanism (ERM II), the conversion of numerical criteria into non-numerical ones and the greater tolerance for high debt and looser fiscal policy.

One of the most important criteria for joining the euro area is the participation of the national currency in ERM II. Although up till then the EU legislation did not provide for criteria and restrictions for the access of national currencies to ERM II, in 2020 the two countries with strong aspirations for euro-area membership – Bulgaria and Croatia – were requested to accept quite severe conditions to fulfil this convergence criterion. The process has become more complicated and now includes three stages (Figure 1).

Figure 1. ERM II stages before joining the euro area



Unlike the previous accession of national currencies to the mechanism, with requirements set for the policy to be conducted after joining the mechanism, the new approach already sets conditions to be fulfilled before joining the mechanism. Compliance with these conditions is subject to ongoing reports and a final assessment by the European Central bank (ECB) and the European Commission (EC).

In the cases of Bulgaria and Croatia, the commitments concerned areas such as: a) supervision of the non-banking sector; b) insolvency framework; c) anti-money laundering framework; d) governance of state-owned enterprises and others.

An essential part of the preliminary preparation phase was the Asset Quality Review (AQR) of the banks selected and conducted by the ECB, applying its methodology. The process itself involved risks for the system, insofar as revealing weaknesses in some of the banks assessed could raise doubts about their soundness. In the case of Bulgaria, the outcome of the AQR led to a request for capitalisation of a private bank with public funds. In the case of Croatia, mergers and acquisitions followed in the banking system.

Another novelty in the process, in addition to the fulfilment of the so-called "preconditions", is the mandatory accession of the country to the Banking Union in the form of "close cooperation". The ECB also selects the banks it will directly supervise. Thus, the loss of supervision and control over a country's own banking system as a condition for joining ERM II is a significant loss of national sovereignty that countries with a derogation must accept if they wish to join the euro area.

The participation in "close cooperation" is essentially not directly related to the currency mechanism itself and the maintenance of currency stability within +/-15% deviation from the exchange rate to the euro. In this sense, the currency mechanism is no longer a pure currency mechanism. On the other hand, data for the last fifteen years for countries with a derogation show that the fluctuation of their currencies is consistently within the ERM II fluctuation band, even though they are not formally in it.

The changes in ERM II are inspired by the extension of the ECB's functions to banking supervision within the Banking Union and the ambition to extend the supervisory functions to subsidiaries of banking groups in countries with a derogation. The aim is to test the stability of the banking system before entering ERM II and the euro area. For this purpose, the currency mechanism is used not only as a "gateway" to the currency area, but also as a gateway to the banking systems of the countries with a derogation.

Another substantial change in the process of joining the euro area is the assessment of the nominal convergence criteria. The changes concern inflation and fiscal criteria. As Darvas, Z. (2010) pointed out, the choice of ECB and EC to exclude some countries' inflation from the calculation of reference inflation gives them a tool to define different values of the reference rate. In doing so, the automatism in the assessment of the inflation criteria is replaced by discretion. Doubts about this have arisen with the last convergence reports (2022, 2024). If the principle enshrined in the Treaty and the practice before the implementation of the concept of countries "statistically atypical in the calculation of the reference value" were applied, then Croatia would not have met the inflation criterion. Since 2010 the inflation reference rate for Croatia has been much higher than that calculated from the three best performers, higher than the average inflation in the EU, and in only four of the ten convergence reports inflation is below the ECB's target level of 2%. Tolerating higher inflation at entry into the euro area could create risks for overall inflation in the euro area.

Euro area accession and membership are now more tolerant of high debt and fiscal deficits in candidate countries. Croatia entered the euro area on 1 January 2023 with a large public debt of over 60% of GDP (79.8% in 2021), provided that this ratio decreases at a "satisfactory pace". Over the past years, Croatia has managed to reduce its debt to 63% of GDP for 2023 still above the 60% reference level (Eurostat, 2025).

3. The contradiction between nominal and real convergence

Data for the last sixteen years show different macroeconomic performance of countries outside the euro area with respect to nominal convergence assessment criteria (Tables 1, 2, 3 and 4).

Table 1. Inflation criteria

	2008	2010	2012	2013	2014	2016	2018	2020	2022	2024
Bulgaria	NO	NO	YES	YES	YES	YES	YES	YES	NO	NO
Czechia	NO	YES	YES	YES	YES	YES	NO	YES	NO	NO
Hungary	NO	NO	NO	YES	YES	YES	YES	NO	NO	NO
Romania	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO
Poland	NO	NO	NO	YES	YES	YES	YES	YES	NO	NO

Table 2. Government deficit to GDP

	2008	2010	2012	2013	2014	2016	2018	2020	2022	2024
Bulgaria	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES
Czechia	NO	NO	NO	NO	YES	YES	YES	YES	YES	NO
Hungary	NO	NO	NO	YES	YES	YES	YES	YES	YES	NO
Romania	YES	NO	NO	YES	YES	YES	YES	NO	NO	NO
Poland	NO	NO	YES	YES	YES	YES	YES	YES	YES	NO

Table 3. Government debt to GDP

	2008	2010	2012	2013	2014	2016	2018	2020	2022	2024
Bulgaria	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Czechia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hungary	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Romania	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NO
Poland	Yes	NO	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NO

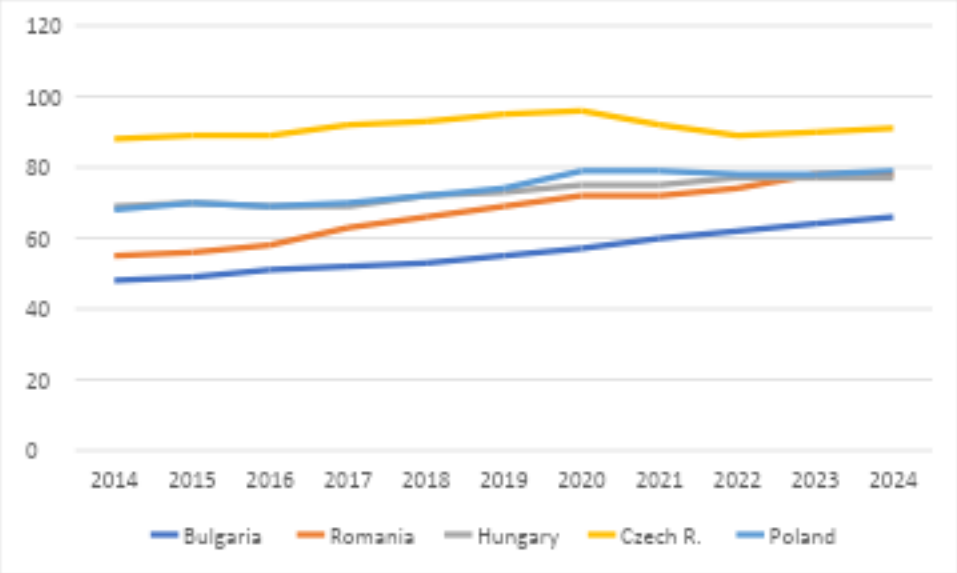
Table 4. Long-term interest rate

	2007	2008	2010	2012	2013	2014	2016	2018	2020	2022	2024
Bulgaria	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES
Czechia	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES
Hungary	NO	NO	NO	NO	NO	YES	YES	YES	YES	NO	NO
Romania	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO
Poland	YES	YES	NO	YES	YES	YES	YES	NO	YES	NO	NO

If we calculate the cases of criteria fulfilment in all 10 years under the four criteria according to the relevant convergence reports out of a total of 40 cases, the worst performer is Hungary, which does not meet the criteria in 27 times, followed by Romania 23, Poland 14, Czechia 9 and Bulgaria 6. If the criteria for nominal convergence are the main indicator of macroeconomic stability, Bulgaria is the best performer, and Romania the second worst performer. Contrary to the fundamental economic principles and the understanding of the Economic and Monetary Union that a high degree of macroeconomic stability creates conditions for a high degree

of real convergence, Romania has become the best performer in terms of real convergence in the last decade, while Bulgaria has performed the worst (Figure2).

Figure 2. Gross domestic product per capita (EU=100)



Source: Eurostat

Some other studies (Bobeva, 2021) also confirm the conclusion that achieving high growth in real convergence is accompanied by failure to meet the criteria for nominal convergence. This puts countries that want to quickly catch up with high GDP per capita in a situation where they could be tempted by an unstable macroeconomic policy that distances them from euro area membership. In the case of Bulgaria, the country "sacrifices" real convergence to achieve nominal convergence with a restrictive fiscal policy because of the currency board as the strictest form of fixed exchange rate regimes. The loss of the currency board as an anchor of macroeconomic stability creates risks of losing fiscal discipline upon entering the euro area. If, however, the analyses of the relationship between nominal and real convergence are correct, the euro-area membership will accelerate real convergence, and it remains to be seen whether this will not be at the cost of accumulating macroeconomic imbalances.

4. Conclusion

The two recent crises in the countries with a derogation are a kind of a test of the sustainability of these economies and their macroeconomic stability in the context of nominal convergence criteria. Due to the flexibility in the assessment of the criteria, their achievement

largely depends on the intentions of the countries to adopt the euro and of those in the euro area to welcome them.

Many and important policy tools might be lost by the other non-euro area countries that decide to join the euro area – apart from their own monetary policy, sovereignty over the supervision of the banking system (even before entering the euro area at the stage of ERM II). The assessment of the criteria might be largely discretionary. Under these conditions and the risks in the euro area itself, it will be increasingly difficult to argue the benefits of joining. Adhering to strict macroeconomic stability in the conditions of global uncertainty will be a challenge, and as the experience of Bulgaria and other countries shows, a rather generous fiscal policy pushes up real convergence. In the conditions of growing populism, solving this political puzzle will depend on the degree to which the argument for being in the core, rather than on the periphery of the EU, is articulated.

References

Bauerle Danzman, S. and Meunier, S. (2021). *The Big Screen: Mapping the Diffusion of Foreign Investment Screening Mechanisms* (August 28, 2021). Available at SSRN: https://ssrn.com/abstract=3913248 or http://dx.doi.org/10.2139/ssrn.3913248.

Bobeva D., Nominal, Structural and Real Convergence of the EU Candidate Countries' Economies. *Journal of Central Banking Theory and Practice*, Vol.10, 3, 2021

Eurostat (2025). General government debt statistics. Available at: https://ec.europa.eu/eurostat/databrowser/view/gov_10dd_ggd/default/table?lang=en&category=gov.gov_gfs10.gov_10dd.gov_10dd_sgd

Zsolt Darvas, Discretion lets Croatia in the euro area in 2023, but leaves Bulgaria out, SEER: *Journal for Labour and Social Affairs in Eastern Europe* Vol. 25, No. 2, Fair taxation and the Euro (2022), pp. 183-194

Simona MOAGĂR-POLADIAN[2]

ROMANIA'S ROADMAP TO THE EUROZONE: MAIN BENEFITS OF EURO ADOPTION, DRAWBACKS, AND CONCERNS

***Abstract**: Romania's trajectory toward Eurozone accession reveals a striking duality: while the country has achieved rapid real convergence with European Union living standards, it continues to lag behind in meeting the nominal convergence criteria (European Commission, 2020; Eurostat, 2024). This study explores the gap between these two dimensions, arguing that Romania's pattern illustrates an asymmetrical form of integration — one where social and economic convergence have advanced faster than institutional and fiscal alignment (Pop & Ionescu, 2021; Stoian & Diaconu, 2020). Using a mixed-method approach that combines policy analysis and macroeconomic indicators, the research traces the evolution of Romania's Euro adoption roadmap, assessing both the achievements and limitations of its convergence process (Banca Națională a României, 2024; World Bank, 2023). The findings indicate that although rising wages, investment inflows, and improved purchasing power have narrowed the standard of living gap with Western Europe, persistent fiscal deficits, inflation volatility, and non-participation in the Exchange Rate Mechanism (ERM II) continue to hinder full Eurozone readiness (European Commission, 2018; Isărescu, 2022). The paper concludes a paradox that redefines the traditional understanding of convergence within the European Union.*

***Keywords:** Euro adoption; real and nominal convergence; monetary integration; Romania; economic development; Eurozone enlargement.*

***JEL Classification:** E42; F36; O11; O52*

1. Introduction

Since joining the European Union (EU) in 2007, Romania has been legally committed to adopting the common European currency. Yet, nearly two decades later, the country remains outside the Eurozone *(European Commission, 2020)*. This continuing postponement has become a defining feature of Romania's economic trajectory — one marked by notable improvements in

[2] *Prof. Dr. Habil Simona MOAGĂR-POLADIAN, Institute for World Economy, Romanian Academy, smpoladian1@gmail.com, ORCID 0000-0002-0930-1729.*

living standards but ongoing challenges in institutional and fiscal convergence *(Darvas & Wolff, 2014)*. While most European policymakers view Euro adoption as the logical conclusion of integration, Romania's experience challenges this assumption by demonstrating that real convergence can advance independently of monetary union *(Stoian & Diaconu, 2020)*.

Over the past decade, Romania has recorded some of the fastest rates of income growth and wage expansion within the EU, accompanied by gains in purchasing power and reductions in poverty *(World Bank, 2023; Eurostat, 2024)*. However, this progress in real indicators contrasts sharply with the stagnation of nominal convergence, as evidenced by recurrent fiscal deficits, rising public debt, and sustained inflationary pressures *(Pop & Ionescu, 2021; Banca Națională a României, 2024)*. The divergence between these two dimensions — real and nominal — reveals the complex nature of Romania's integration process and raises important questions about the interaction between economic development and institutional readiness.

This paper examines Romania's evolving position within the framework of dual convergence. It aims to identify the mechanisms that have allowed real economic advancement despite nominal non-compliance and to evaluate the long-term implications of this imbalance for Eurozone accession *(European Commission, 2018)*. By combining historical, economic, and policy perspectives, the study contributes to the broader debate on how post-transition economies can sustain growth and credibility outside the single currency, while laying the groundwork for eventual monetary integration based on both real and nominal alignment.

2. Literature review

The debate on Eurozone enlargement has evolved from a narrow focus on nominal convergence to a broader understanding of how institutional capacity and socioeconomic factors shape monetary readiness. Early analyses of the European Monetary Union emphasized that adherence to the Maastricht criteria—low inflation, fiscal discipline, debt sustainability, and exchange rate stability—was the essential prerequisite for entry *(Darvas & Wolff, 2014; European Commission, 2020)*. However, subsequent research has demonstrated that these nominal indicators alone do not ensure the structural and institutional resilience required for sustainable integration, particularly for post-transition economies *(Pop & Ionescu, 2021; Stoian & Diaconu, 2020)*.

In the case of Central and Eastern European countries, the literature increasingly differentiates between real convergence, referring to improvements in productivity, income, and living standards, and nominal convergence, referring to compliance with macroeconomic stability criteria *(Stoian & Diaconu, 2020; World Bank, 2023)*. Several scholars argue that while nominal convergence can be achieved through short-term fiscal adjustments, real convergence requires long-term institutional reforms, investment in human capital, and innovation *(Isărescu, 2022; Banca Națională a României, 2024)*. This uneven pace of progress often produces a phenomenon

of dual convergence, where social and economic development advances more rapidly than fiscal and monetary discipline.

Recent contributions by Poladian (2023) emphasize that Romania's economic trajectory should be understood within this dual framework. Her analysis argues that while Romania has achieved visible progress in living standards and wage growth through foreign investment and EU cohesion policies, it continues to struggle with the credibility of its fiscal governance and policy consistency. According to Poladian, the country's challenge lies not in the lack of economic capacity but in the misalignment between institutional readiness and political commitment to reform.

3. Methodology

This study employs a **mixed-method approach** to capture the dual nature of Romania's convergence — the contrast between real progress in living standards and nominal underperformance in meeting Eurozone criteria *(Poladian, 2023; Pop & Ionescu, 2021)*.

The **qualitative component** involves an interpretive analysis of policy documents, convergence reports, and national strategies issued by the European Commission and the National Bank of Romania *(European Commission, 2018; Banca Națională a României, 2024)*. This allows for the identification of institutional and governance factors underlying Romania's delayed Euro adoption.

The **quantitative component** analyzes key macroeconomic indicators—GDP per capita, inflation, public debt, and budget deficit—using data from *Eurostat (2024)*, the *National Institute of Statistics (2024)*, and the *World Bank (2023)*. By comparing trends from 2007 to 2025, the study assesses whether real convergence has advanced independently of nominal alignment.

The analysis is guided by two research questions:

1. What structural and policy factors have sustained Romania's progress in real convergence despite repeated failures in nominal compliance?
2. How does this imbalance affect the country's readiness and credibility for Eurozone accession?

4. Results and Discussions

Romania's path toward the Eurozone has been repeatedly delayed due to a persistent combination of institutional indecision and economic inconsistency. The analysis of the National Euro Commission's 2018 strategic document and subsequent policy developments revealed that, despite optimistic projections, the country's convergence remained largely aspirational rather than operational.

By 2019, official evaluations already indicated that Romania's progress was slower than expected. The European Commission's Convergence Report (June 2020), based on 2019 data, explicitly concluded that Romania met none of the four nominal convergence criteria required for Eurozone accession. The evaluation highlighted the following deficiencies:

- Price stability (inflation): Not met, as domestic inflation exceeded the European reference value.
- Sound public finances (deficit and debt): Not met, with Romania placed under the excessive deficit procedure.
- Exchange rate stability: Not met, since the leu was not yet part of the Exchange Rate Mechanism (ERM II).
- Long-term interest rates: Not met, reflecting market volatility and risk perceptions.

These results demonstrate that the confidence of earlier strategies was undermined by persistent structural gaps and weak fiscal governance. Despite notable improvements in living standards, Romania's failure to meet any of the nominal criteria underscored the fragility of its convergence process.

The evidence shows that Romania's delay in joining the Euro area is not merely a political choice but the outcome of incomplete economic readiness. The country's future integration will depend on sustained fiscal discipline, price stability, and credible institutional reforms capable of aligning national policies with the long-term objectives of the European monetary framework.
Romania's increasing gap from Euro adoption stems from a convergence of structural, fiscal, and political factors, the most significant being its repeated failure to comply with the Maastricht convergence criteria. These shortcomings have been reinforced by domestic political instability and a series of adverse economic developments over the past decade.

One of the most persistent challenges is Romania's chronic budget deficit, reflecting limited fiscal discipline and the inability to align public finances with European standards. Since 2019, the deficit has consistently exceeded the 3 percent ceiling established by the Stability and Growth Pact. In 2019, the fiscal shortfall already surpassed this threshold, and during 2020–2021, the situation deteriorated further as pandemic-related spending caused the deficit to reach unprecedented levels. This development placed Romania under the Excessive Deficit Procedure (EDP) of the EU.

As of 2025, the country remains under this procedure, which represents a significant legal and economic barrier, since no state can join the Euro area while subject to corrective fiscal supervision. Current projections continue to indicate deficits well above the permissible limit, with estimates reaching approximately –9.3 percent of gross domestic product. The persistent inability

to consolidate public finances has thus become a central obstacle preventing Romania from fulfilling one of the fundamental requirements for Eurozone accession.

A second area of concern relates to the rapid growth of public debt, which directly challenges the Maastricht criterion requiring that government debt remain below 60 percent of gross domestic product. Although Romania's debt level has historically been moderate compared with other EU members, it has followed a steadily upward trajectory in recent years. In 2019, public debt stood at approximately 35 percent of gross domestic product, but by 2020 it had risen sharply to around 48.9 percent as a result of pandemic-related fiscal measures. The trend continued, reaching 54.8 percent by December 2024.

While Romania has not yet breached the formal 60 percent threshold, the pace of debt accumulation signals a growing vulnerability in public finances. This trajectory raises concerns about long-term fiscal sustainability, limits future policy flexibility, and places additional pressure on the country's ability to achieve the stability required for Eurozone accession.

Another critical area of non-compliance concerns inflation volatility and the failure to meet the price stability criterion established by the Maastricht framework. According to this requirement, a country's average inflation rate—measured by the Harmonised Index of Consumer Prices—must not exceed by more than 1.5 percentage points the average rate of the three best-performing EU Member States.

In Romania's case, inflation has remained persistently high and volatile, particularly since 2021. The annual average inflation rate reached 3.8 percent in 2019, increased to 5.1 percent in 2021, and surged to 13.8 percent in 2022 amid global price shocks and domestic market pressures. Although inflation began to moderate thereafter, it remained elevated at 10.4 percent in 2023 and 5.6 percent in 2024. As of May 2025, the year-on-year rate stands at approximately 5.45 percent. This sustained inflationary environment keeps Romania well above the reference threshold for price stability, indicating limited success in achieving one of the fundamental conditions for Eurozone convergence. Persistent inflation undermines purchasing power, complicates fiscal planning, and diminishes investor confidence—factors that collectively delay the country's progress toward monetary integration.

A further obstacle to Euro adoption is Romania's non-participation in the ERM II, which constitutes a fundamental prerequisite for joining the Euro area. The Maastricht framework requires each candidate country to participate in ERM II for at least two consecutive years without experiencing severe exchange rate tensions, maintaining the national currency within a fluctuation band of plus or minus fifteen percent around a central parity rate against the euro.

In practice, Romania has never entered the mechanism. Although successive governments have announced political intentions and indicative timelines—such as a potential entry by 2026—no formal application has been submitted. This ongoing hesitation reflects persistent concerns about

macroeconomic stability, particularly in relation to the high fiscal deficit and volatile inflation, which would make it difficult to sustain a stable exchange rate within the required margins.

The absence of ERM II participation represents a critical procedural and economic barrier. Without completing this mandatory "waiting period," the technical and legal process of Euro adoption cannot begin. Consequently, Romania's non-entry underscores broader structural vulnerabilities and a continued lack of policy coordination necessary for achieving monetary stability and long-term convergence.

So, we may say we've distanced ourselves from the Eurozone, but what about the standard of living?

The postponement of Euro adoption has not necessarily resulted in a deterioration of living standards in Romania. On the contrary, the country has experienced a gradual but notable improvement in economic welfare, although this progress has unfolded under circumstances quite different from those initially envisioned within the framework of monetary integration. Economic convergence, once expected to accelerate through Eurozone membership, has instead occurred largely outside it, driven by domestic growth dynamics, labor market adjustments, and external investment flows.

In terms of gross domestic product per capita measured in purchasing power parity, Romania has recorded significant advances over the past decade. Around 2014, Romania's GDP per capita represented approximately 50 to 55 percent of the EU average, positioning it among the less developed Member States. By contrast, in 2023, this indicator had risen to nearly 77 percent of the European average, reflecting substantial real convergence.

This upward trajectory indicates that Romanians today can afford a greater quantity and quality of goods and services than was possible a decade ago. While not directly attributable to Eurozone integration, these improvements demonstrate that economic and social convergence with the EU can advance even in the absence of a common currency, provided that domestic reforms and investment remain consistent. Over the past twenty-five years, Romania has experienced substantial wage growth, reflecting both economic expansion and labor market adjustments. During this period, average salaries have increased more than twenty-two times, marking one of the most significant upward trends among EU Member States. In October 2024, the average net monthly wage rose by approximately 12.3 percent, reaching nearly 5,300 lei. By April 2025, the average gross monthly salary stood at around 9,415 lei, confirming a continuing trajectory of income growth.

Although persistent inflation has partially eroded real wage gains, the overall purchasing power of Romanian households has improved markedly compared with previous decades. Higher nominal and real wages have enhanced the population's ability to meet everyday consumption needs, reduce financial vulnerability, and engage more actively in discretionary spending. This

evolution underscores a broader pattern of social and economic convergence, even in the absence of Eurozone membership.

Romania has registered consistent progress in real economic convergence with the EU average between 2006 and 2023, but also reveals persistent regional disparities. While the national average increased from 38 percent to 78 percent of the EU average, the pace of growth varied substantially across regions. The Bucharest–Ilfov region remains the country's undisputed economic leader, reaching 190 percent of the EU average in 2023 and acting as the primary engine of national growth. In contrast, the North-East continues to lag behind, achieving only 47 percent of the EU average, which underscores the uneven distribution of development and investment opportunities. Regions such as the West, Centre, and North-West show strong convergence, reflecting the positive effects of industrial diversification and foreign investment. Meanwhile, South-Muntenia, South-East, and Oltenia demonstrate moderate but steady improvements, largely supported by European funding and infrastructure projects. Overall, the regional data suggest that Romania's integration process has been marked by both substantial national progress and widening intra-country inequality, emphasizing the need for targeted regional policies to ensure balanced and inclusive convergence.

5. Conclusions

The study set out to examine the main factors behind Romania's repeated postponement of Euro adoption and to assess the relationship between delayed monetary integration and advanced living standards. The findings reveal that Romania's persistent divergence from the Eurozone roadmap is primarily the result of structural fiscal imbalances, institutional fragility, and unreliable policy implementation. Despite political declarations of intent, the country continues to distance of the Maastricht convergence criteria, with chronic budget deficits, rising public debt, record inflation of the more recent peak, and the absence of participation in the ERM II serving as major obstructions.

The research also addressed the second question—how these delays have affected economic convergence and citizens' welfare. The results suggest that while non-adoption of the euro has not hindered improvements in living standards, such progress has occurred through alternative channels, including foreign investment, wage growth, and the broader effects of EU integration. Economic convergence has therefore advanced in real terms but without the institutional discipline and credibility that Eurozone membership could have reinforced.

However, this study has several limitations. The analysis relied primarily on macroeconomic indicators and secondary data, without incorporating survey-based or behavioral evidence on public perceptions of Euro adoption. Additionally, the research does not model potential future scenarios under varying fiscal or monetary policies.

Future research should expand by employing econometric modeling and cross-country comparisons to evaluate the potential outcomes of Romania's entry under different policy assumptions. Further investigation into the social and political dimensions of Euro adoption could also provide valuable insight into the balance between economic readiness and public trust. In sum, Romania's path to the Eurozone remains possible but contingent on restoring fiscal discipline, strengthening institutions, and aligning real and nominal convergence with sustainable development goals.

Acknowledgment

The author wishes to express sincere appreciation to the colleagues who provided valuable feedback throughout the preparation of this study.

References

Banca Națională a României. (2024). Raport anual 2023. București: BNR.

Darvas, Z., & Wolff, G. B. (2014). Should non-Euro area countries join the single currency? Bruegel Policy Contribution, 2014/05, 1–14.

European Commission. (2018). Romania's Eurozone path: Strategic assessment report. Brussels: European Commission.

European Commission. (2020). Convergence Report 2020. Brussels: Directorate-General for Economic and Financial Affairs.

Eurostat. (2024). Regional GDP and income statistics – Database. Retrieved from https://ec.europa.eu/eurostat

Isărescu, M. (2022). Romania's monetary policy challenges on the road to Euro adoption. National Bank of Romania Working Paper Series, No. 18.

National Institute of Statistics. (2024). Romania in Figures – Statistical Yearbook 2024. Bucharest: INS

Poladian, S. (2023). *Romania's Economic Convergence and Eurozone Readiness: Between Nominal Criteria and Real Progress*. Bucharest: Romanian Academy Publishing.

Pop, L., & Ionescu, D. (2021). Fiscal consolidation and sustainable convergence in emerging EU economies. Romanian Journal of Economic Forecasting, 24(3), 45–61.

Stoian, A., & Diaconu, M. (2020). Institutional quality and readiness for the Eurozone: Evidence from Central and Eastern Europe. Eastern European Economics, 58(6), 491–511.

World Bank. (2023). World Development Indicators: Romania Country Data. Washington, DC: World Bank.

Iana PALIOVA[3]

MEDIUM-TERM FISCAL-STRUCTURAL PLANS: BULGARIA AND ROMANIA CASES

Abstract

For the first time in September 2024, the Member States of the European Union (EU) presented a national medium-term fiscal-structural plan aligned with the new EU economic governance framework from 2024. Romania sent its plan to the European Commission in late October 2024, while Bulgaria presented it in February 2025 due to the appointment of a new government after the extraordinary parliamentary election. Bulgaria has fulfilled the Maastricht criteria during its participation in the Exchange Rate Mechanism (ERM II) as a prerequisite for the euro area membership. On 8 July 2025, the European Parliament and the EU Economic and Financial Affairs Council confirmed Bulgaria as the 21st member of the euro area starting on January 1st, 2026. Romania is still in the excessive deficit procedure, struggling with the effects of a continued expansionary fiscal policy. In this regard, the study discusses fiscal perspectives for Bulgaria and Romania aligned with their macroeconomic assumptions in the medium-term fiscal-structural plans. It examines the performance of the Maastricht criteria and how the net nationally financed primary budget expenditure, fiscal deficit, and government debt as key fiscal indicators for assessment of the fiscal policy are projected for the 2025-2028 period. The study assesses whether their level is moving towards sustainable levels to achieve the medium-term objectives aligned with the requirements of the Stability and Growth Pact.

Keywords: *Fiscal policy, European integration, Government policy*

JEL: *H 68, F15, Q57*

1. Introduction

After the COVID-19 pandemic crisis, the European Commission (EC) introduced the Next Generation EU (NGEU) initiative focused on financial support to Member States through the Recovery and Resilience Facility to restore and boost growth and restore the sustainability of the public finances. At the same time, the European Commission proposed a reform of the economic governance framework in the EU, with an emphasis on the predictability of public spending for debt sustainability and economic growth, to address issues related to the coordination and monitoring of the EU economic policy over the next decade. On 26 April 2023, the EC presented legislative proposals to implement a comprehensive reform of the fiscal rules through a proposal to amend the regulations for the implementation of the Growth and Stability Pact on the

[3] *Iana Paliova, Ph.D., Associate Professor, Economic Research Institute at the Bulgarian Academy of Sciences and Public Finance Consultant of the International Monetary Fund, ipaliova@abv.bg, ORCID ID 0009-0000-1657-4410.*

strengthening of budgetary surveillance and the coordination of economic policies.[4] On 30 April 2024, the European Parliament and the Council adopted the new legislation reforming the EU fiscal rules.[5] For the first time in September 2024, most of the Member States presented their national medium-term fiscal-structural plans (MTFSP).

2. The implementation of the Maastricht criteria by Bulgaria and Romania

Bulgaria

Bulgaria is one of the Member States with a high degree and sustainability of the fulfilment of the economic convergence criteria throughout the period of its membership in the EU. The Maastricht criteria are fully covered in five of the convergence reports: 2012, 2014, 2016, 2018, and 2025. The government debt criterion is fulfilled according to all ten convergence reports, the budget balance is within the criterion according to nine convergence reports, the long-term interest rate criterion is also covered in nine reports, and the inflation criterion – in five.[6] The GDP per capita[7] convergence is 66% of the EU average for 2024. Bulgaria's general government deficit increased to 3% of GDP in 2024, and is expected to stay at the same level in 2025-26. Government debt of Bulgaria is the second lowest in the EU, amounting to 24.1% of GDP at the end of 2024. In April 2025, the 12-month average rate of HICP inflation in Bulgaria stood at 2.7%, i.e., just below the reference value of 2.8%.[8] As regards the exchange rate criterion, the Bulgarian lev participated in ERM II in the two-year reference period from 20 May 2023 to 19 May 2025. Over the reference period, the lev did not exhibit any deviation from the central rate of 1.95583 levs per euro. Long-term interest rates in Bulgaria stood at 3.9%, on average, over the reference period from May 2024 to April 2025 and were therefore below the 5.1% reference value for the interest rate convergence criterion.[9]

Romania

[4] European Commission COM (2023) 240 final. Proposal to amend Regulation (EC) No. 1466/97 on the strengthening of supervision over the state of the budget and the coordination of economic policies.

[5] Official website of Council of the EU, https://www.consilium.europa.eu/en/press/press-releases/2024/04/29/economic-governance-review-council-adopts-reform-of-fiscal-rules/

[6] Bobeva D. (2025). Bulgaria's readiness to join the eurozone. In: Annual Report 2025: "Economic Development and Policies in Bulgaria 2025: Assessments and Expectations", Economic Research Institute at BAS, 2025 (in Bulgarian)

[7] Bulgaria's GDP per capita 66% of EU average in 2024.

[8] The reference value is based on the three best performing Member States in terms of price stability, i.e. Ireland (1.2%), Finland (1.3%) and Italy (1.4%), taking their average inflation over the past 12 months and adding 1.5 percentage points.

[9] Official site of the European Commission, 2024 European semester: Country reports, Bulgaria, https://economy-finance.ec.europa.eu/publications/2024-european-semester-country-reports_e

Romania's GDP per capita[10] convergence is 78% of the EU average for 2024, surpassing Bulgaria by 12 p.p. However, Romania is listed among Member States at fiscal risk of being affected by macroeconomic imbalances. Romania has been subject to an excessive deficit procedure since April 2020. In light of the deep contraction in economic activity linked to the COVID-19 pandemic, in 2021, the deadline for the correction of the deficit was expanded until 2024. In 2023, all sub-components of the Council Recommendation addressed to Romania in 2021 were missed by a significant margin. The headline deficit was significantly higher (6.5% of GDP vs 4.4% of GDP in the Council Recommendation), the structural effort was much lower than recommended, and growth in net expenditure was much higher than recommended. Therefore, on 26 July 2024, the Council adopted a decision on the absence of effective action.[11] Romania faces vulnerabilities related to external accounts, mainly linked to large and increasing government deficits, while significant price and cost pressures have intensified, and policy action has been weak.[12]

Table 1. Comparison of the fulfilment of the Maastricht criteria by Bulgaria and Romania for 2024

	Reference value	Bulgaria	Romania
HICP (as of end 2024, for last 12th month period)	2.5*	2.1	5.8
Fiscal balance at the end of 2024 (% of GDP)	-3.0	-3.0	-9.3
Government debt at the end of 2024 (% of GDP)	60	24.1	54.8
Exchange rate	A standard fluctuation band of +/- 15%	The Bulgarian lev observes a central rate of 1.95583 to the euro	An average of 4.97 to the euro (moderate fluctuations) **
Long-term interest rates	5.1	3.9	6.8

Source: Eurostat and ECB databases.

**/ The average of the 12-month average inflation rates in Lithuania (0.9), Finland (1.0), and Italy (1.1) plus 1.5 percentage points. ** The Romanian leu (RON) is not part of the ERM II.*

3. The medium-term fiscal-structural plans in the context of the new EU fiscal rules

[10] Bulgaria's GDP per capita 66% of EU average in 2024.

[11] OJ L, 1.8.2024, ELI: https://eur-lex.europa.eu/eli/dec/2024/2130/oj.

[12] Official site of the European Commission, 2024 European semester: Country reports, Romania, https://economy-finance.ec.europa.eu/publications/2024-european-semester-country-reports_e

The medium-term fiscal structural plan of the EU member states is a cornerstone of the new economic governance framework. It replaces the Convergence Programme (or the Stability Programme for the eurozone member states) and the National Reform Programme, which member states were required to send to the European Commission by the end of April every year. The MTFSP covers a period of four or seven years, depending on the normal length of the legislative cycle of the country concerned and whether the Member State needs more time to adjust to the reference levels of fiscal balance and government debt. In 2024, the European Council and Parliament approved changes in the preventive and corrective clauses of the Stability and Growth Pact and on the requirements for the budgetary frameworks of the Member States.

The new economic governance framework introduces two new indicators, *"net nationally financed primary expenditure"* and "*growth of net primary expenditure financed at national level*", as key indicators for assessment of the predictability of public expenditure and stability of fiscal deficit and government debt below reference levels as Maastricht fiscal criteria. The indicator is not affected by automatic stabilisers and other fluctuations that are outside the direct control of the Government.

The growth path of the *"net nationally financed primary expenditure"* should allow the fiscal deficit and consolidated debt to achieve their Maastricht reference levels in the medium term. The maximum growth rate of net expenditure is calculated according to a specific formula defined by the EC and presented in the Debt Sustainability Monitor 2023 published in March 2024.[13]

Box.1 The new EU Governance Framework (2024)

The *preventive clause* in the Regulation (EU) 2024/1263 on the effective coordination of economic policy and on multilateral budgetary surveillance is linked to the MTSFP. The medium term is defined as the ten-year period after the end of the adjustment period.

The corrective clause in the Regulation (EU) 2024/1264 for the countries with a fiscal deficit above 3% of GDP is defined as net expenditure growth, with a minimum annual improvement in the structural balance of at least 0.5% of GDP.

The changes in the Directive (EU) 2024/1265 focus mainly on achieving consistency with the new preventive clause and strengthening the multi-annual perspective of national budgetary planning.

Net nationally financed primary expenditures are equal to General Government expenditure net of interest expenditure, discretionary revenue measures, EU financed expenditure fully covered by revenue form EU funds, national expenditure on co-financing of the EU projects, cyclical elements of unemployment benefit expenditure, as well as one-off, and other temporary measures.

Growth of net primary expenditure financed at the national level =

[13] Official website of the European Commission. Debt Sustainability Monitor 2023, https://economy-finance.ec.europa.eu/publications/debt-sustainability-monitor-2023_en

potential GDP growth + GDP deflator – required change in structural primary balance/primary expenditure ratio to GDP.

The structural primary balance is the cyclically adjusted General Government budget balance net of interest expenditure, one-off and other temporary measures.

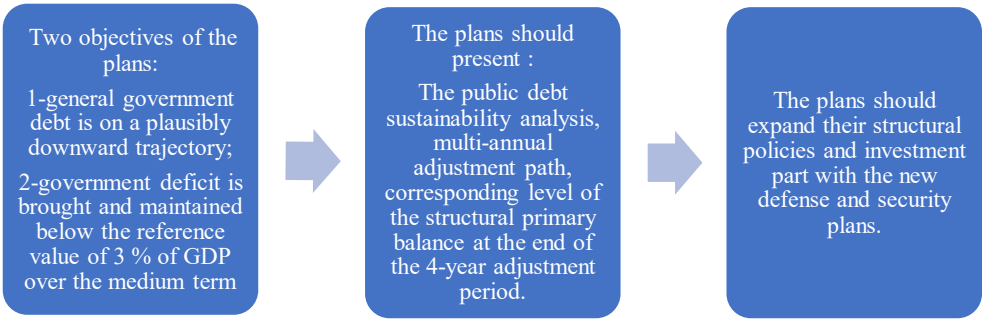
The fiscal deficit (ESA 2010) should be below the reference level of 3% of GDP in the medium term for Member States in the excessive deficit procedure (EDP).

The consolidated government debt should be below the reference level of 60% of GDP. It would be triggered by deviations from the net expenditure path for Member States with government debt above 60% of GDP.

Source: European Commission (2024)

The European Council endorses the reference trajectory of growth of *net nationally financed primary expenditures* in the MTFSP. The reference trajectory is also consistent with the deficit benchmark, the debt sustainability safeguard, and the deficit resilience safeguard. The reference trajectory is risk-based and ensures that, by the end of the fiscal adjustment period and in the absence of further budgetary measures beyond the adjustment period, general government debt is on a plausibly downward trajectory or stays at prudent levels over the medium term, and the general government deficit is brought below 3% of GDP and is maintained below that reference value over the medium term.

Figure 1. The objectives of the medium-term fiscal structural plans



Source: Own representation.

The amendments also include provisions related to strengthening the independent fiscal institutions and broadening accountability requirements. The changes in the EU fiscal legislation also requires amendments to national legislation of the member states by the end of 2025.

3. Macroeconomic assumptions and Fiscal perspectives of Bulgaria and Romania in the MTFSP

Romania submitted its medium-term fiscal-structural plan in late October 2024, while Bulgaria, delaying it to February 2025 due to parliamentary elections in late 2024, followed by the appointment of a new government in January 2025. Bulgaria's MTFSP is for the 2025-2028 period, while Romania's one for the 2025-2031 period. Bulgaria presented its MTFSP together with a request for extraordinary convergence reports from the European Commission and the European Bank with an assessment of the country's readiness to join the eurozone from January 1, 2026. Romania presented a seven-year MTFSP as the country has been in the excessive deficit procedure for years and needed the maximum period for its adjustment trajectory. Both MTSFPs have been prepared based on technical requirements and in a dialogue with the European Commission.

3.1. Macroeconomic assumptions

During 2025 - 2028, the potential GDP growth rate of Bulgaria is set to decrease from 2.8% to 2.4%. The contribution of total factor productivity (TFP) is set to decrease over the projection horizon from 1.6 p.p. in 2024 to 1.4 p.p. in 2028. The contribution of capital to potential growth is expected to increase between 0.8–1.0 p.p., while the contribution of labour to potential growth to gradually decline but remain positive.

In 2025, the real growth of Romania is expected to be supported by resilient private consumption and an acceleration of private investment, both helped by more accommodative financial conditions. In the 2027 – 2028 period, Romania's potential GDP growth is expected to be driven by capital deepening and growth in TFP. The potential GDP growth is expected to further decelerate to 2% by 2031, following the envisaged fiscal consolidation process.

The depletion of the positive effect of investments under the National Recovery and Resilience Plan will have an impact on the growth in both countries after the end of 2026.

Bulgaria's annual inflation rate decreased to 2.2% in 2024 (from 8.6% in 2023). The inflation was primarily driven by rising costs for food and non-alcoholic beverages, alcoholic beverages and tobacco, and education. Romania displayed the highest inflation rate (consumer price index) of 5.6% in the EU for 2024 (10.4% for 2023). Prices accelerated for both food and non-food products, while the cost of services remained high. Following the growth path of the net nationally financed primary expenditure for Romania, the inflation rate is expected to decelerate to 5% in 2028 and 4.5% in 2031.

Table 2. Potential GDP and GDP deflator in the national MTFSP (in percent)

a) Bulgaria

	2024	2025	2026	2027	2028
Potential GDP growth (%)	2.5	2.8	2.6	2.5	2.4
GDP deflator (%)	6.4	3.9	2.6	2.3	2.1

b) Romania

	2024	2025	2026	2027	2028	2029	2030	2031	Average over the period of validity of the plan 2025–2028	Average over the adjustment period 2025–2031
Potential GDP growth (%)	2.7	2.7	2.5	2.4	2.2	2.1	2.0	2.0	2.4	2.3
GDP deflator (%)	7.2	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.8	4.7

Source: MTSFP of Bulgaria and Romania

3.2. Growth of the net nationally financed primary budget expenditure

Bulgaria

Bulgaria's net nationally financed primary expenditure increased by 11.2% in 2024 and by 6.2% in 2025, before gradually declining to 4.0% at the end of the plan. On average, over the 2025–2028 period, the net expenditure growth is 4.9%. In January 2024, the gross wages grew by 13.9%, while the minimum wage increased by 19.6% on a yearly basis. The country needs to limit wage bidding and gradually decrease nominal wage growth to the average historical rate of around 8-9%. Expenditure on public pensions and salaries is set to continue to increase, but at a slower pace, especially for pensions. The EU absorption rate is at a low level of 67% contracted and 36% paid. Bulgaria received only one tranche (€1.3 billion) from the Recovery and Resilience Mechanism, while the second tranche of € 0.7 billion is still frozen. After extraordinary elections in late 2024, the newly appointed government presented a modified plan to the European Commission in April 2025, while the Parliament was working on the legislative amendments. In

June, the European Commission approved the revised plan of €6.17 billion in grants, and covers 50 reforms and 51 investments.

Romania

Romania's net expenditure growth is 14.3% in 2024, which led to a large deficit of 9.3% of GDP for 2024. The plan commits to average net expenditure growth of 4.8% over the years 2025–2028. In addition, Romania commits to a set of reforms and investments with the view to extending the adjustment period to 7 years (2025–2031), over which the average net expenditure growth is planned to be 4.4%.

Table 3. Net nationally financed primary expenditure

a) Bulgaria

Commitments		2023	2024	2025	2026	2027	2028
Net nationally financed primary expenditure	growth rate	X	11.2	6.2	4.9	4.4	4.0
cumulative growth rate		X		18.1	23.9	29.3	34.6

a) Romania

	2025	2026	2027	2028	2029	2030	2031	Average 2025–2028	Average 2025–2031
Maximum net expenditure growth (annual, %)	6.1	5.7	5.3	5.0	4.8	4.7	4.5	5.5	5.2

Source: MTSFP of Bulgaria and Romania

Box 2. The reference trajectory in the national MTFSP for Romania

To frame the dialogue leading to the submission of national medium-term fiscal-structural plans, on 21 June 2024, the Commission sent, according to Article 9 of Regulation (EU) 2024/1263, the reference trajectory to Romania.

The Commission engaged in a technical dialogue between July and October 2024. The dialogue focused on the net expenditure path envisaged by Romania and its underlying assumptions, and on the envisaged set of reform and investment commitments underpinning Romania's request for an extended adjustment period.

The Commission published the reference trajectory on 25 October 2024. The reference trajectory of Romania sets out that, based on the Commission's assumptions underpinning the prior guidance transmitted in June 2024 and

assuming a 7-year adjustment period, net expenditure should not grow by more than the values set up for every year. This corresponds to average net expenditure growth of 5.2% over the adjustment period (2025–2031) and of 5.5% over the period 2025–2028.

Source: Council Recommendation (C/2025/647) of 21 January 2025 endorsing the national medium-term fiscal-structural plan of Romania

If the committed net expenditure path in the plan and the underlying assumptions materialise, general government debt would, according to the plan, increase from 52.2% of GDP in 2024 to 62.6% of GDP in 2029, before declining to 61.4% of GDP in 2031. Based on the plan's net expenditure path and assumptions, the general government deficit would decline to 2.5% of GDP in 2031, the first year when it would be below 3% of GDP.

In Romania, the government spending on personnel and goods and services, and slower revenue growth is due to weaker economic activity. Public investment as a share of GDP is expected to rise significantly, reflecting ambitious targets for both nationally and EU-funded investment projects. A fiscal consolidation package amounting to about 1.2% of GDP includes spending cuts, generated through measures to streamline public administration and tighter eligibility conditions for public servants to benefit from holiday vouchers and food allowances, and new measures in revenues amounting to 0.9% of GDP. Romania plans a fiscal consolidation package - about 1.2% of GDP spending cuts for public administration and 0.9% of GDP new measures in revenues. Multiannual budget planning for investments and R&D is envisaged as a critical measure to help it reach its 2% R&D investment target by 2027.

Romania's updated National Recovery and Resilience Plan is worth €28.5 billion, of which €13.6 billion is in grants and €14.9 billion is in loans. For the implementation of the National and Resilience Plan, Romania received two pre-financing tranches of €3.79 billion from the Recovery and Resilience Mechanism: a tranche of €1.85 billion related to the grant component, and €1.94 billion from the loan component, but its next tranches are also under question due to some remarks from the European Commission. In October 2024, the European Commission endorsed a positive preliminary assessment of the six targets and 62 out of 68 milestones linked to Romania's third payment request for €2 billion (net of pre-financing). The Commission found that six milestones have not been fulfilled at this stage. This concerns reforms of the governance of state-owned enterprises, as well as investments in transport, and a reform of the tax regime for microenterprises.

3.3. Structural primary balance

The technical information of the European Commission for Bulgaria recommends that, in order to comply with the applicable fiscal rules over an adjustment period of 4 years, and based on the Commission's assumptions, the structural primary balance should amount to at least 2.1% of GDP at the end of the adjustment period in the scenario without the deficit resilience safeguard.

For information, considering also the deficit resilience safeguard, the structural primary balance would amount to at least 0.9% of GDP at the end of the adjustment period. However, the deficit resilience safeguard is not a requirement for Bulgaria.

The adjustment of the primary structural balance envisaged in the MTSFP for Romania is 1%. The structural primary balance was – 4.4% of GDP in the prior guidance transmitted to Romania in June 2024 and is – 5.3% of GDP in the plan.

Table 4. Structural primary balance

a) Bulgaria

	2024	2025	2026	2027	2028
Net lending/borrowing (% of GDP)	-3.0	-3.0	-2.9	-2.9	-2.9
Structural balance (% of GDP)	-3.1	-3.0	-3.0	-3.0	-2.9
Structural primary balance (% of GDP)	-2.5	-2.3	-2.1	-2.0	-1.8
Gross debt (% of GDP)	24.2	25.8	27.4	29.1	30.8
Change in gross debt (%)	1.4	1.5	1.6	1.7	1.7

a) Romania

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2041
Net lending/borrowing (% of GDP)	- 6.5	- 7.9	- 7.0	- 6.4	- 5.7	- 5.0	- 4.2	- 3.4	- 2.5	- 1.6
Structural primary balance (% of GDP)	- 4.1	- 5.3	- 4.3	- 3.3	- 2.3	- 1.3	- 0.3	0.7	1.7	
Change in structural primary balance (pps.)	n.a.	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Government debt (% of GDP)	48.9	52.2	55.7	58.5	60.6	62.0	62.6	62.4	61.4	47.9

Source: MTSFP of Bulgaria and Romania

3.4. Government debt

For Bulgaria general government debt of 24.2% of GDP for 2024 was the second lowest in the EU, while Romania's general government debt was 54.8% of GDP for 2024.

Although Bulgaria's government debt remains low compared to other EU member states, if the net expenditure path committed to in MTFSP and the underlying assumptions materialise, general government debt will increase by 6.6 p.p. at the end of 2028 compared to 2024. Consistent fiscal consolidation is needed to avoid passing the debt burden to future generations amid adverse demographic trends in the country.

According to the MTFSP, with the growth rate of net nationally financed expenditures, the debt ratio for Romania is expected to increase to 62% of GDP at the end of 2028. Romania's government debt is envisaged to increase to 62.6% of GDP in 2029, and then to decline gradually to 47.9% of GDP by 2041. The high fiscal deficit is planned to decrease slowly, from 5% of GDP in 2025 to 2.5% of GDP in 2031.

Conclusion

Both Bulgaria and Romania have their own economic reforms and fiscal challenges as EU Member States. The countries managed to become together full members of the Schengen area on 1st January 2025, following the lifting of the land border control, but their path to the euro area is different. Many Bulgarian governments' efforts in the implementation of the economic reforms and strong fiscal discipline over the years of the EU membership resulted in the approval of Bulgaria as the 21st member of the euro area starting on January 1st, 2026. Romania faces macroeconomic imbalances and vulnerabilities in external accounts, mainly related to fiscal expansion policy with large and increasing government deficits. Significant price and cost pressures have intensified, and policy action has been weak. The implementation of fiscal consolidation measures to achieve the medium-term fiscal-structural plans targets and governance structural reforms are critical for both countries, including enhancing administrative capacity and transparency, fighting corruption, and making state-owned enterprises more efficient.

References

Bobeva D. (2025). Bulgaria's readiness to join the eurozone. In: Annual Report 2025: "Economic Development and Policies in Bulgaria 2025: Assessments and Expectations", Economic Research Institute at BAS, 2025 (in Bulgarian).

Bulgaria's Ministry of Finance (2025). Medium-term fiscal plan for 2025-2028, Sofia.

European Central Bank (ECB) database, https://data.ecb.europa.eu/.

European Commission (2024a). Debt Sustainability Monitor 2023, https://economy-finance.ec.europa.eu/publications/debt-sustainability-monitor-2023_en.

European Commission (2024b). EU Autumn 2024 Economic Forecast: A gradual rebound in an adverse environment, Institutional Paper 296, November.

Eurostat database, https://ec.europa.eu/eurostat/data/database.

National Statistical Institute (NSI), Bulgaria, NSI database, https://www.nsi.bg/en.

Official Journal of the European Union (2024). Council Directive (EU) 2024/1265 amending Directive 2011/85/EU.

Official site of the European Commission, European semester country reports 2024, https://economy-finance.ec.europa.eu/publications/2024-european-semester-country-reports_e.

Regulation (EU) 2024/1263 of the European Parliament and of the Council of 29 April 2024 on the effective coordination of economic policy and on multilateral budgetary surveillance and repealing Council Regulation (EC) No 1466/97 lays down the preventive arm of the SGP.

Regulation (EU) 2024/1264 amending Regulation 1467/1997 on speeding up and clarifying the implementation of the excessive deficit procedure.

Romania's Medium-term fiscal plan for 2025-2031, https://economy-finance.ec.europa.eu/economic-and-fiscal-governance/stability-and-growth-pact/preventive-arm/national-medium-term-fiscal-structural-plans_en.

Andrei RĂDULESCU[14]

THE EUROPEAN ECONOMIC CONVERGENCE OF POLAND

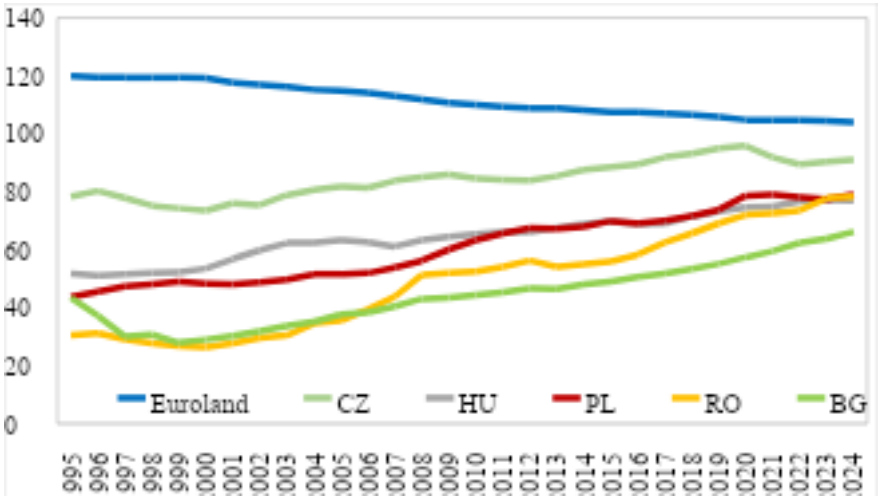
***Abstract**: The economic convergence of Poland towards the EU average represents a successful story and a reference in the history of European economic integration. The Polish economy grew by an average annual pace of 3.8% from 2003 (the year before the EU integration) to 2024, a rate almost three times higher than the EU average. GDP/capita at PPS almost doubled during 2003-2024, to 79% of the EU average. These positive evolutions were determined by the forces of the EU integration process. In this paper we focus on the analysis of the macroeconomic developments in Poland since the EU integration. Standard econometric tools are applied and the databases of Eurostat and International Monetary Fund are used in order to estimate the annual pace of the potential output in Poland in comparative analysis with the EU average. According to the results of the econometric estimates the gap in terms of annual rate of potential output Poland – EU stood above two percentage points from 2003 to 2020, as the Polish economy presented a stronger resilience during the Great Financial Crisis and the coronavirus pandemic compared to the EU average. However, the annual rate of potential output in Poland deteriorated since the outbreak of the crisis in Ukraine, to below 3% in 2024, the lowest level since the beginning of the 1990s. In this context, additional structural reforms are needed to be implemented in Poland in order to change the recent trend in terms of annual pace of potential GDP, from downward to upward.*
***Keywords**: production factors, Poland, economic convergence*
***JEL:** C10, E32, O47, O52*

1. Introduction

Poland joined the European Union on 1st of May 2004, in the first wave of the enlargement towards the East, also known as the Big Bank phenomenon. The economic convergence of Poland towards the EU average was successful, GDP/capita (PPS – Purchasing Power Standards) rose from less than 50% in 2003 to almost 80% in 2024, according to the Eurostat (2025) database, reflected in Figure 1.

[14] *Senior Researcher, Ph.D,. Institute for World Economy, Romanian Academy, iemradulescu@gmail.com*

Figure 1. GDP/capita at PPS (% of the EU average)



Source: representation of the author based on the database of Eurostat (2025)

This evolution was supported by the mechanisms of the EU integration process and by the policy-mix implemented in Poland over the past decades.

From the perspective of the dimension of the nominal GDP in 2024 Poland was the sixth largest economy of the European Union (up from the 10th place in 2003) and the largest in Central and Eastern Europe. The forecasts of the International Monetary Fund (2025) indicate the increase of the nominal GDP of Poland from USD 909bn in 2024 to over USD 1tn in 2026 and over USD 1.3tn in 2030.

However, more than 20 years since integrating the European Union the European economic convergence of Poland is not fully attained. The gaps between Poland and the EU continue high, while the risk of divergence in the future are on the upside unless the structural reforms are accelerated. These reforms are needed in order to address the structural challenges the Polish economy is confronted with at present: public finance, decarbonization, productivity, and demographics.

In this paper standard econometric tools are implemented and the databases of Eurostat (2025) and International Monetary Fund (2025) are used in order to assess the macroeconomic performance of Poland during the period 2000 – 2024. The results of our econometric analysis show a downward trend for the annual rate of the potential output since the outbreak of the coronavirus pandemic.

The rest of the paper has the following structure: next chapter focuses on the literature review on the economic convergence of Poland towards the EU average; chapter three briefly

presents the methodology; the results are analysed in the fourth chapter; the main conclusions are drawn in the last chapter.

2. Literature Review

The macroeconomic developments in Poland over the past decades, with a focus on the positive impact of European integration were analysed either by Polish experts, or international organizations.

Among the main aspects supporting the economic performance of Poland over the past decades there can be mentioned the orientation of the society to democracy and open markets after the end of communism, the consensus to join the European Union, and the quality of the economic policy (Piatkowski, 2019).

The foundation of the economic convergence of Poland towards the EU average after the fall of communism was laid by the set of structural reforms implemented by Balcerowicz, in order to ensure a fast transition from a centrally planned economy towards a market economy. These reforms focused on stabilization, liberalization and institutional change (Dorn, 2014).

The Balcerowicz Plan included important structural measures: the liberalization of prices and of the domestic trade, a balanced policy mix (focused on fiscal responsibility, restrictive monetary policy, and tight income policy), liberalization of foreign trade, privatization, and restructuring of the banking and social security systems (Garland, 2015).

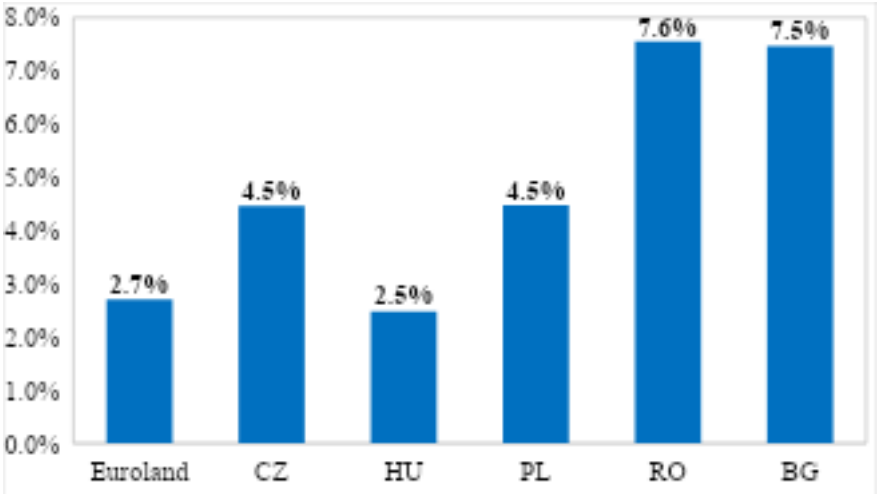
The reforms were characterized by continuity in the past decades, this aspect contributing to the Polish economic miracle (Lehman, 2012).

Following the EU integration the economic development of Poland was also supported by the strong inflows of EU funds, mainly structural funds and agriculture, with a cumulated volume of EUR 246bn during 2004 – 2023 (National Institute of Statistics of Poland, 2024).

The country contributed EUR 84bn to the EU budget. Therefore, Poland received more than EUR 160bn during the interval 2004 – 2023, being the country with the highest net entry of EU funds in the European Union.

The continuity of the structural reforms and the strong inflows of EU funds determined the significant increase of the capital stock in Poland over the past decades. The capital stock rose by an average annual rate of 4.5% during 2000 – 2024, a similar rate as in Czechia, but higher than in Hungary (2.5%) and Euroland (2.7%) (Eurostat, 2025), as can be noticed in the following chart.

Figure 2. Capital stock – CAGR (compound annual growth rate) during 2000 - 2024



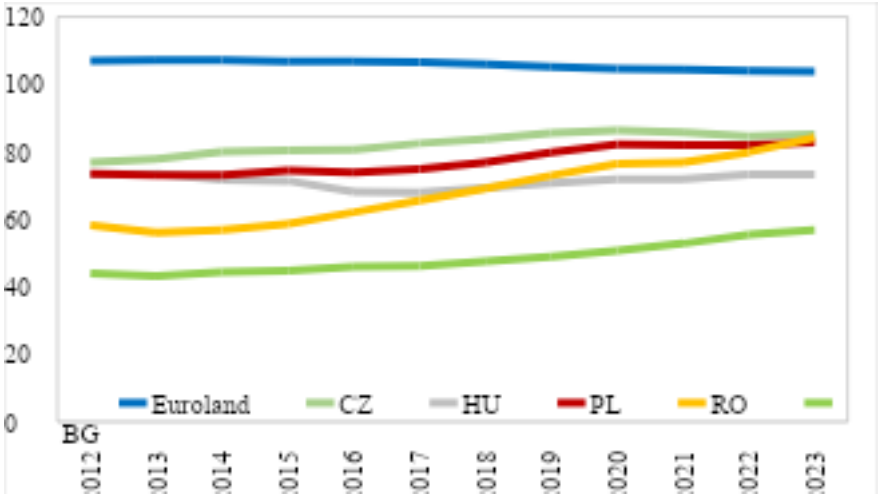
Source: representation of the author based on the database of Eurostat (2025)

We emphasize the fact that Poland avoided recession during the Great Financial Crisis, as the economic policy measures implemented during the pre-crisis cycle did not lead to the accumulation of imbalances. This, in turn, allowed the policy-makers to implement countercyclical policies following the outbreak of the worst global economic and financial crisis since the end of the World War II (International Monetary Fund, 2012).

On the other hand, several studies have recently pointed out the structural challenges the economy of Poland is confronted with at present, including the deterioration of the competitive advantages, given: the increase of the minimum wages, the increasing shortage of workers (especially qualified), the high level of the energy prices, and the regulatory burden (ING, 2025). In this context, several reforms are needed in the future, including those necessary for the improvement of labour productivity, and for a smart industrial strategy, including through the balanced incorporation of technological progress and labour market flexibility (World Bank, 2024).

In this context we underline the fact that labour productivity per hour worked in Poland (at PPS – Purchasing Power Standards) stood at 82.7% of the EU average in 2023, below the level in Romania, the second largest economy in Central and Eastern Europe, with a nominal dimension of around EUR 350bn in 2024 (Eurostat, 2025).

Figure 3. Labor productivity per hour worked (PPS) (EU average = 100)



Source: representation of the author based on the database of Eurostat (2025)

3. Methodology

In this paper standard econometric tools are applied and the databases of Eurostat (2025) and International Monetary Fund (2025) are used in order to assess the macroeconomic performance of Poland in the period 2000 – 2024.

The Cobb-Douglas production function is employed to estimate the annual pace of the potential output and the contribution of the production factors to the annual pace of the potential GDP for the largest economy in Central and Eastern Europe over the past 25 years.

This econometric method is expressed by the following relation:

$$Y = L^{\alpha} \times K^{1-\alpha} \times MFP \quad (1)$$

in which Y, L, K, MFP and α represent the output, the labour factor, the capital factor, the multifactor productivity, and the elasticity of output with respect to labour. For this elasticity we considered a level of 0.65 (D'Auria, et al. 2010).

By applying the logarithms, the relation (1) is transformed into the following relation:

$$Y_t = \alpha \times L_t + (1 - \alpha) \times K_t + MFP_t \quad (2)$$

The structural components (the trends) for the labour factor and for the multifactor productivity were estimated through the implementation of the Hodrick-Prescott filter, also a common method used in the econometric analysis, synthetized by the following relation:

$$\textbf{Min} \sum_{t=1}^{T} (\ln Y_t - \ln Y_t^*)^2 + \lambda \sum_{t=2}^{T-1} ((\ln Y_{t+1}^* - \ln Y_t^*) - (\ln Y_t^* - \ln Y_{t-1}^*))^2 \quad \textbf{(3)}$$

in which Yt, Yt* and λ represent the macroeconomic indicator, its trend, and the smoothness parameter, for which we considered a value of 100, as we worked with annual data.
In order to estimate the labour factor, we considered the following relation:

L = labour force x participation rate e x (1-unemployment rate) x number of worked hours (4)

For the capital factor the perpetuity method was implemented:

$$\mathbf{K_t = K_{t-1} \times (1-d) + GFCF_t} \quad \textbf{(5)}$$

in which K_t represents the capital stock from the year t, d the depreciation ratio, and $GFCF_t$ the gross fixed capital formation of year t.

In this paper we considered the capital stock of Poland for the year 1995 (Derbyshire, et al. 2010). Furthermore, a standard depreciation ratio of 5% was considered.

In order to estimate the multifactor productivity, the following relation was applied:

$$\mathbf{MFP_t = Y_t - \alpha \times L_t - (1- \alpha) \times K_t.} \quad \textbf{(6)}$$

Last, but not least, the annual pace of the potential output was estimated based on the following relation:

$$\mathbf{Y_t^* = \alpha \times L_t^* + (1 - \alpha) \times K_t + MFP_t^*,} \quad \textbf{(7)}$$

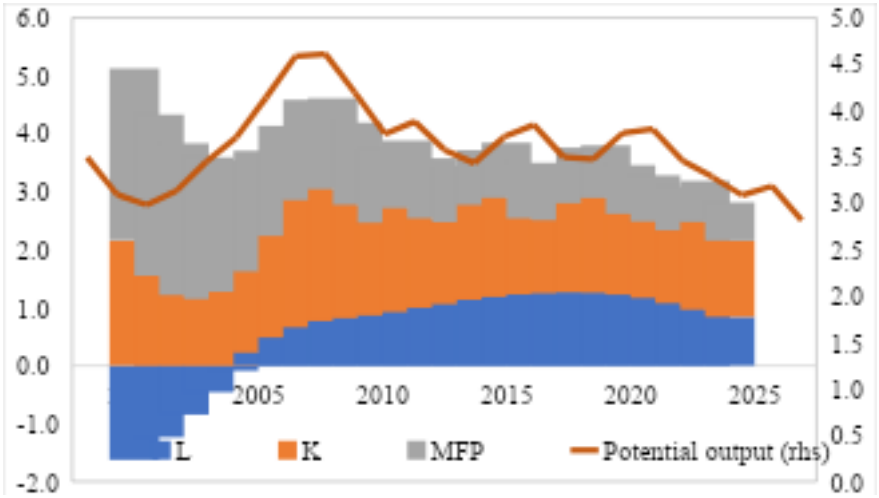
where Y_t^*, L_t^* and TFP_t^* are the trend components for the annual rates of output, labour factor, and multifactor productivity.

4. Research Results

According to the results of the econometric estimates, the annual rate of the potential output in Poland presented a downward trend in recent years, from 3.8% in 2019 (the year before the outbreak of the coronavirus pandemic) to 2.8% in 2024. This is a record low level, at least for the period under analysis (2000 – 2024), as can be noticed in Figure 4.

The deceleration of the annual pace of the potential GDP in Poland since the outbreak of the coronavirus pandemic was mainly determined by the deterioration of the contribution of the labour factor, from 1.3pps in 2019 to 0.8pps in 2024, the minimum since 2009, as reflected in the Figure 4. At the same time, the contribution of the capital factor to the annual pace of the potential output in Poland diminished from 1.6pps in 2019 to 1.3pps in 2024, the minimum since 2017. Last, but not least, the contribution of the multifactor productivity to the annual pace of the potential GDP in Poland decreased from 0.9pps in 2019 to 0.7pps in 2024, a record low level.

Figure 4. Contribution of the production factors to the annual rate of potential output in Poland (pps)



Source: representation of the author based on the results of the econometric analysis, using the database of Eurostat (2025)

On the other hand, we point out that since 2005 the production factors (capital, labour, and multifactor productivity) had a positive contribution to the annual pace of the potential output. In our view this reflects the positive impact of the integration of Poland into the European Union. In fact, the annual rate of the potential output grew from 3.1% in 2003 (the year before the EU integration) to a record high level of 4.6% in 2007 and 2008, as can be noticed in the Figure 4. Furthermore, according to the results of our econometric estimates the capital factor has had

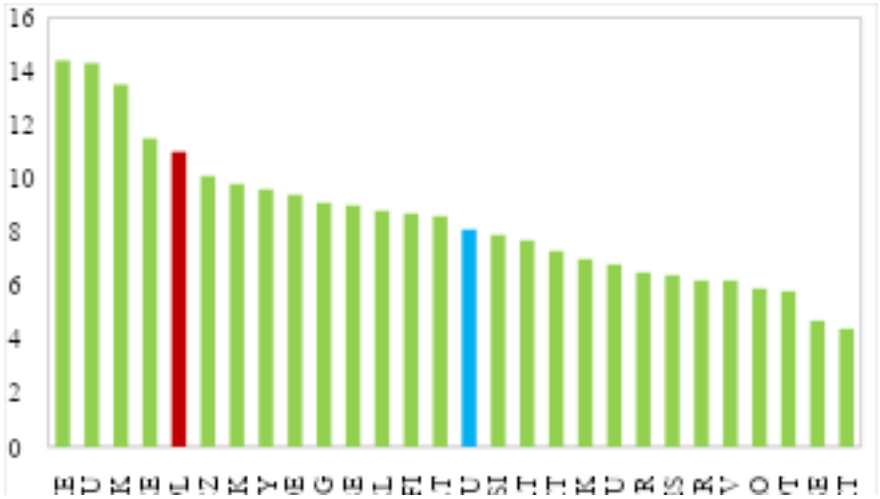
the most important contribution to the annual pace of the potential output in Poland over the past decades, an evolution determined by the huge capital inflows (including EU funds), but also by the development of the capital markets.

Last, but not least, the downward trend for the annual pace of the potential output and for the contribution of the production factors to the annual pace of the potential output in Poland in recent years expresses the fact that the growth and development model over the past decades reached its maturity.

In other words, Poland needs to implement new structural reforms in order to ensure the continuity of the European economic convergence process in the coming years and next decade. These reforms should be focused on the incorporation of technological progress, higher investments in research and development in order to generate talent, improving the quality of regulation, accelerating the decarbonization, and addressing the ageing of the population.

In this respect, we point out that Poland is the sixth largest economy of the European Union, but the fifth in terms of emissions of CO2 per capita, as can be noticed in Figure 5.

Figure 5. Emissions per capita in EU member countries (tonnes CO2 eq)



Source: representation of the author based on the database of Eurostat (2025)

5. Conclusions

According to the results of our econometric analysis the annual rate of the potential output presented a downward trend in Poland since the outbreak of the coronavirus pandemic, the worst health crisis in the world in more than 100 years.

This evolution was determined by the generalised deterioration of the contribution of all production factors, which confirms the maturity of the Polish growth and development model over the past decades.

At the end of this paper we point out that further research should focus on estimating the impact of the reforms (several scenarios) needed to address the above-mentioned challenges on the annual pace of the potential GDP in Poland.

Last, but not least, the macroeconomic research in the future should also address the distance between Poland and Euroland, the main component of the European Union, with a contribution of around 85% in the GDP of the region.

References

D'Auria, F., Denis, C., Havik, K., MC Morrow, K., Planas, C., Raciborski, R., Roger, W. and Rossia, A. (2010). The production function methodology for calculating potential growth rates and output gaps. *ECFIN Economic Paper, No. 420, European Commission.* Available at http://ec.europa.eu/economy_finance/publications/economic_paper/2010/ecp420_en.htm

Derbyshire, J., Gardiner, B. and Waights, S. (2010). Estimating the capital stock for the NUTS2 regions of the EU-27, *European Union Regional Policy, 1*. Available at http://ec.europa.eu/regional_policy/sources/docgener/work/2011_01_capital_stock.pdf

Dorn, J. (2014). Leszek Balcerowicz Transformed Poland through an Embrace of Economic Freedom. Available at https://www.cato.org/commentary/leszek-balcerowicz-transformed-poland-through-embrace-economic-freedom

Eurostat (2025). Database available at https://ec.europa.eu/eurostat/web/main/data/database

Garland, E. (2015). REFLECTIONS ON THE BALCEROWICZ PLAN, *Zeszyty Naukowe PWSZ w Płocku Nauki Ekonomiczne, t. XXI*. Available at http://bazekon.icm.edu.pl/bazekon/element/bwmeta1.element.ekon-element-000171368281

Hodrick, R. and Prescott, E. C. (1997). Postwar U.S. Business Cycles: An Empirical Investigation. *Journal of Money, Credit and Banking*, 29 (1), pp. 1-16.

ING (2025). Engines of Polish economic growth: Concerns and postulates of businesses. Available at https://think.ing.com/reports/engines-of-polish-economic-growth-concerns-and-postulates-of-businesses/

International Monetary Fund (2012). IMF E-library, Chapter 12. Poland: A Beacon of Resilience in Europe. Available at https://www.elibrary.imf.org/display/book/9781616353810/ch012.xml

International Monetary Fund (2025). World Economic Outlook Database. Available at https://www.imf.org/en/Publications/WEO/weo-database/2025/april/select-country-group

Lehman, H. (2012). The Polish Growth Miracle: Outcome of Persistent Reform Efforts. *IZA Policy Paper No. 40*. Available at https://www.iza.org/publications/pp/40/the-polish-growth-miracle-outcome-of-persistent-reform-efforts

National Institute of Statistics of Poland (2024). 20 years together. Poland in the European Union. Available at https://stat.gov.pl/en/topics/other-studies/other-aggregated-studies/20-years-together-poland-in-the-european-union,37,1.html

Piatkowski, M. (2019). Europe's Growth Champion. Insights from the Economic Rise of Poland. *Oxford University Press*. Available at https://global.oup.com/academic/product/europes-growth-champion-9780198839613?lang=en&cc=cn

World Bank (2024). Boosting Productivity, Maintaining Inclusion Are Key to Raising Poland's Competitiveness and Advancing EU Convergence. Available at https://www.worldbank.org/en/news/press-release/2024/09/24/boosting-productivity-maintaining-inclusion-are-key-to-raising-poland-s-competitiveness-and-advancing-eu-convergence

Virginia ZHELYAZKOVA[15]

THE CIRCULAR ECONOMY IN BULGARIA AND ROMANIA: A COMPARATIVE STUDY IN THE EU CONTEXT[16]

Abstract

The paper presents a comparative analysis of the circular economy (CE) performance of Bulgaria and Romania within the broader framework of European Union (EU) policy and monitoring mechanisms. Drawing on data from the EU Circular Economy Monitoring Framework, the study evaluates the progress of the two countries across key indicators. The aim is to identify patterns of convergence or divergence between Bulgaria and Romania, and to contextualize their trajectories within the overall progress of the EU towards a CE. The analysis offers insights into how both countries are advancing in relation to EU targets. The findings contribute to a clearer understanding of the integration of CE indicators in newer EU Member States and their alignment with EU sustainability objectives.

Keywords: *circular economy, waste management, circular economy use rate*

JEL: *O44, Q20*

1. Introduction

The circular economy (CE) is a strategic priority of the European Union (EU), aiming to decouple economic growth from resource use through waste reduction, recycling, and more efficient production. Bulgaria and Romania, as newer EU Member States, face specific challenges in aligning with CE goals due to legacy infrastructure and lower investment capacity.

This paper aims to assess the CE performance of Bulgaria and Romania through five key indicators, identifying convergence trends and informing future policy directions. The results are meant to inform policy alignment, regional cooperation, and further research on circular transitions in Southeast Europe.

---

[15] *Professor Virginia Zhelyazkova DSc (Econ.), Ph.D., Economic Research Institute at the Bulgarian Academy of Sciences, and University of Insurance and Finance, Sofia, v.zhelyazkova@iki.bas.bg, vzhelyazkova@uzf.bg, virginia.zhelyazkova@gmail.com*

[16] *This research is done within the research project "Circular Economy in the European Union and its Implementation in Bulgaria", part of the scientific research program of the Economic Research Institute at the Bulgarian Academy of Sciences.*

2. Literature Review and Conceptual Framework

The CE has gained prominence in both academic and policy discourses as an alternative to the traditional linear economic model of "take-make-dispose." While the concept traces its intellectual origins to ecological economics, industrial ecology, and systems thinking (Boulding, 1966; Pearce & Turner, 1990), its practical application has been largely shaped by EU strategies and directives in recent years. The CE paradigm is increasingly viewed not only as a response to environmental degradation but also as a lever for enhancing resource security, innovation, and competitiveness (Korhonen et al., 2018).

Scholarly literature identifies multiple dimensions of the CE, including material efficiency, waste minimization, closed-loop production systems, and sustainable consumption. Kirchherr et al. (2017), in their widely cited meta-analysis, emphasize that the CE remains an "umbrella concept," encompassing diverse practices and goals across sectors and governance levels. A growing body of empirical research has sought to operationalize CE progress through indicators such as the circular material use rate, waste generation per capita, and the rate of recycling and recovery (Camacho-Otero et al., 2018). In this context, the EU Circular Economy Monitoring Framework provides a standardized and policy-relevant set of indicators for assessing national performance.

Comparative studies on CE implementation in the EU are still limited but expanding. Several authors have noted that newer Member States tend to lag behind older ones in circularity indicators, often due to structural constraints, legacy pollution, or underdeveloped waste management systems (European Environment Agency [EEA], 2022). At the same time, examples from Central and Eastern Europe demonstrate that targeted interventions and access to EU funds can accelerate progress (Ghisellini et al., 2016).

For Bulgaria and Romania specifically, there are reasons to suggest a shared path dependency rooted in their post-socialist transitions, characterized also as in other countries of the EU, by delayed environmental policy reform and uneven infrastructure development. Nonetheless, both countries have incorporated CE objectives into their national strategies and benefit from EU structural support. The lack of detailed comparative analyses between the two countries on CE outcomes creates a research gap that this paper seeks to address.

The conceptual framework adopted here views CE performance as a multidimensional construct operationalized through selected indicators from the EU monitoring system. By focusing on quantitative, comparable metrics, this study aims to identify patterns of alignment and divergence without delving into institutional or regulatory analysis. The indicators serve not only as performance benchmarks but also as tools for policy monitoring and public accountability.

3. Methodology and Data Sources

This study applies a comparative, indicator-based methodology to assess the CE performance of Bulgaria and Romania using harmonized data from the EU Circular Economy Monitoring Framework for the period 2015–2023 to capture recent trends. Both absolute values and relative EU rankings were considered to contextualize performance. The selection of indicators was based on their policy relevance and data availability for both countries.

The approach is descriptive and benchmarking-oriented. It does not attempt to isolate policy effects or causal drivers but rather aims to highlight trends, gaps, and comparative progress.

4. Results: Comparative Performance of Bulgaria and Romania

4.1 Resource Productivity

Resource productivity remains low in both Bulgaria and Romania compared to the EU average. In 2022, Bulgaria reported 0.58 EUR/kg, while Romania reached 0.74 EUR/kg—both far below the EU-27 average of 2.30 EUR/kg. Romania's upward trend suggests some improvement in decoupling growth from resource use, whereas Bulgaria's progress has stalled since 2020. Both countries' reliance on material-intensive sectors explains the low figures and underscores the need for innovation-driven productivity gains.

4.2 Circular Material Use Rate

The circular material use rate (CMUR) is among the weakest areas for both countries. Bulgaria's CMUR was 2.6% in 2022, and Romania's fell to 1.4%, significantly below the EU average of 11.5%. These values reflect persistent challenges in recycling, secondary raw material integration, and market development. Without systemic changes in material flows, infrastructure, and policy, both countries remain far from circularity benchmarks.

4.3 Municipal Waste Generation and Recycling

Municipal waste per capita in 2022 was 435 kg in Bulgaria and 399 kg in Romania, below the EU average but potentially reflecting underreporting and lower consumption. Recycling rates differ more starkly: Bulgaria reached 34.5% (up from 22% in 2015), while Romania stagnated at 12.1%. Bulgaria shows gradual progress due to infrastructure investments, but both countries are far from the EU's 55% recycling target for 2025 and face continued overreliance on landfilling.

4.4 Trade in Secondary Raw Materials

Bulgaria and Romania participate modestly in EU circular trade, mainly exporting low-value recyclables such as metals and paper. Bulgaria exported around 1.05 million tonnes in 2022, and Romania slightly more, but domestic reprocessing remains limited. Weak internal markets and

a lack of high-value recycling infrastructure reduce the economic returns of secondary raw materials trade and hinder material loop closure.

4.5 Private Investment and Employment in Circular Activities

Circular sectors employ 1.4% of the workforce in Bulgaria and 1.6% in Romania, with both countries below the EU average. Investment remains low (0.11% and 0.13% of GDP, respectively), concentrated in compliance-driven waste management rather than high-value innovation.

CE activities are present but not yet transformative. Stronger policy support and market incentives are needed to scale up circular jobs and value creation.

5. Discussion of Results

The comparative analysis of CE indicators for Bulgaria and Romania reveals a mixed and asymmetric picture of progress within the shared context of EU policy goals and measurement frameworks. While both countries remain below the EU average across all core indicators, the patterns of convergence and divergence suggest differing dynamics in their respective CE transitions.

A key finding is the divergent trajectory in resource productivity, where Romania has consistently outperformed Bulgaria since 2018. This reflects Romania's relatively stronger decoupling of GDP growth from material use, possibly linked to sectoral shifts, improved efficiencies in manufacturing, and more favorable investment absorption. Bulgaria, by contrast, has seen only marginal gains, with material-intensive sectors continuing to dominate its economic structure. This suggests that despite common regional characteristics, progress in resource efficiency is uneven and contingent on national development strategies.

The comparison of the CMUR presents a more uniform challenge. Both countries perform well below the EU average, with CMU rates hovering below 3%. Romania's temporary progress between 2016 and 2018 has since reversed, while Bulgaria's figures show stagnation. This indicates deep structural barriers to developing functioning secondary raw material markets and reintegrating waste into productive use. The lack of circular supply chains, insufficient incentives for recycled content, and the persistence of linear production models appear to be shared constraints.

In the area of municipal waste management, Bulgaria has made notable progress, steadily increasing its recycling rate, albeit from a low base. Romania, however, remains largely stagnant, with recycling levels far from EU targets. The divergence in performance may be linked to differences in the implementation of EU-funded waste infrastructure, regulatory enforcement, and public awareness campaigns. Bulgaria's experience demonstrates that infrastructure investment

combined with regulatory pressure can yield measurable results, though continued acceleration is required.

Regarding trade in secondary raw materials, both countries are modest players in EU circular material flows. Their participation is primarily in low-value-added segments, such as metal and paper scrap, with limited domestic processing capacity. These findings suggest that circular trade remains an underdeveloped opportunity, constrained by market thinness, technical limitations, and policy fragmentation. Without strategic investment in domestic reprocessing industries and stronger demand for recycled materials, participation in circular trade will remain extractive rather than value-generating.

Finally, the indicators on investment and employment in CE sectors point to an early-stage economic transition. Romania slightly outpaces Bulgaria in both employment share and investment intensity, but both countries lag behind more advanced EU members in terms of circular innovation and value creation. The dominance of waste management and repair in CE employment structures indicates that the circular transition is not yet embedded across broader industrial sectors.

Taken together, the results confirm that both countries are in the foundational phase of their CE transitions, with partial progress in waste management and resource efficiency but limited integration across economic structures. The asymmetries between the two—Romania's slightly better resource productivity and employment, Bulgaria's stronger recycling performance—highlight the importance of tailored national strategies within a common EU framework.

The findings also reaffirm the importance of maintaining indicator-based monitoring at national and regional levels, not only to benchmark performance but to identify sectoral gaps, track policy effectiveness, and support evidence-based circularity planning. In both countries, improving circularity will require multi-level efforts—combining technical upgrades, behavioral change, regulatory strengthening, and market development—to close the gap with EU targets.

6. Conclusion and Policy Implications

This study has examined the CE performance of Bulgaria and Romania through a comparative lens, using harmonized indicators from Eurostat. The findings highlight both shared challenges and divergent trajectories in key areas of CE.

Overall, both countries lag significantly behind the EU average across most indicators, suggesting that the circular transition remains in its early stages. Romania has shown comparatively stronger performance in resource productivity and employment in circular sectors, whereas Bulgaria has made more tangible progress in municipal waste recycling. However, in critical areas such as circular material use rate and domestic integration of secondary raw materials, both countries face structural and systemic barriers.

The analysis underscores the need for a multi-faceted policy approach to accelerate the CE transition in Bulgaria and Romania:

1. Boosting circular innovation and investment: both countries must leverage EU funding instruments, including the Recovery and Resilience Facility and the Just Transition Fund, to support innovation in product design, reuse systems, industrial symbiosis, and digital CE solutions (EEA, 2022; European Commission, 2020a).
2. Strengthening waste governance and market integration: while infrastructure development is necessary, it must be complemented by stricter enforcement of waste sorting, landfill reduction, and extended producer responsibility schemes (Ghisellini et al., 2016).
3. Developing domestic markets for secondary raw materials: enhancing the demand and use of recycled content in manufacturing—through green public procurement, eco-labeling, and recycled-content mandates—can create economic incentives for circular business models.
4. Improving data quality and regional benchmarking: national statistical authorities should improve the quality and coverage of CE data to better inform local policy and allow for intra-regional benchmarking and learning.
5. Promoting public engagement and behavioural change: citizen participation remains a key determinant of CE success, especially in waste prevention, reuse, and recycling. Awareness campaigns, educational programs, and community-led initiatives can significantly complement top-down policies (Camacho-Otero et al., 2018).

In conclusion, while Bulgaria and Romania have made initial steps toward a CE, more ambitious and integrated efforts are needed to align with EU goals and unlock the environmental and economic benefits of circularity. This comparative assessment provides a baseline for future monitoring and offers direction for evidence-based policy design tailored to national capacities and regional opportunities.[17]

References

Boulding, K. E. (1966). The economics of the coming spaceship Earth. In H. Jarrett (Ed.), *Environmental quality in a growing economy* (pp. 3–14). Johns Hopkins University Press.

Camacho-Otero, J., Boks, C., & Pettersen, I. N. (2018). Consumption in the circular economy: A literature review. *Sustainability, 10*(8), 2758. https://doi.org/10.3390/su10082758 [Accessed 7 June 2025].

European Commission. (2020). *A new Circular Economy Action Plan: For a cleaner and more competitive Europe* (COM/2020/98 final). Brussels: European Commission. [Accessed 2 May 2025 2025].

[17] *For stylistic refinement and grammar correction, large language models were used as editorial tools. All content development, analysis, and writing were carried out solely by the author.*

European Commission. (2023). *Monitoring framework for the circular economy: Updated indicators*. https://ec.europa.eu/eurostat/web/circular-economy [Accessed 5 July 2025].

European Environment Agency (EEA). (2022). *Circular economy in Europe: Developing the knowledge base*. EEA Report No. 2/2022. Circular economy in Europe — Developing the knowledge base | European Environment Agency's home page [Accessed 8 May 2025].

Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production, 114*, 11–32. https://doi.org/10.1016/j.jclepro.2015.09.007 [Accessed 6 May 2025].

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling, 127*, 221–232. https://doi.org/10.1016/j.resconrec.2017.09.005 [Accessed 25 July 2025].

Korhonen, J., Honkasalo, A., & Seppälä, J. (2018). Circular economy: The concept and its limitations. *Ecological Economics, 143*, 37–46. https://doi.org/10.1016/j.ecolecon.2017.06.041 [Accessed 20 July 2025].

Pearce, D. W., & Turner, R. K. (1990). *Economics of natural resources and the environment*. Harvester Wheatsheaf.

George-Cornel DUMITRESCU[18]

ARE ENVIRONMENTAL TAXES EFFECTIVE IN REDUCING GREENHOUSE GAS EMISSIONS? EVIDENCE FROM SEVEN EU MEMBER STATES

Abstract: *This paper examines the relationship between total environmental tax revenues (ETR) and greenhouse gas emissions (GHGi) in industrial processes and product use in seven European Union member states (Bulgaria, France, Germany, Hungary, Italy, Poland, and Romania), between 2005 and 2022. Using log-log ordinary least squares (OLS) and Prais-Winsten regression models that include lagged values, determine whether environmental taxation has a measurable impact on reducing greenhouse gas emissions. We identified a statistically significant negative relationship at a 95% confidence level in five out of the seven countries studied. France, Germany, and Italy exhibit robust models where a 1% increase in environmental tax revenues is associated with GHGi reductions ranging from 0.36% to 0.96% after three years. Diagnostic tests confirm that most models satisfy the linear regression assumptions of linearity, homoskedasticity, normality of residuals and lack of autocorrelation. In Bulgaria and Romania, the Prais-Winsten regression model was applied, yielding elasticities of -0.53 and -0.43, respectively, after one year. In Hungary and Poland, we did not find statistically significant relationships between the analysed indicators for reasons that require further investigation. The results for France, Germany, Italy, Bulgaria and Romania support the hypothesis that environmental taxation can lead to emissions reduction, the impact varying from one country to another. The identified heterogeneities suggest the importance of tailoring environmental fiscal policies within the EU member states that consider their national contexts.*

Keywords: *environment, taxation, emissions, Prais-Winsten regression, log-log OLS, sustainable development*

JEL: *C33, C51, H23, Q52*

1. Introduction

The European Union has an ambitious goal to REACH net-zero emissions by 2050 and, through the Green Deal, set an intermediary target to reduce greenhouse gas emissions by at least 55% by 2030. Environmental taxation is one of the instruments promoted by the EU to internalise environmental costs, incentivise cleaner production, and support the polluter-pays principle.

This research examines the impact of total environmental tax revenues (ETR) on greenhouse gas emissions in industrial processes and product use (GHG*i*) in selected European

[18] *Associate professor, Dr, George-Cornel Dumitrescu, The Institute for World Economy at the Romanian Academy: george.dumitrescu@iem.ro.*

Union countries —Bulgaria, France, Germany, Italy, Hungary, Poland, and Romania — using both quantitative trends and econometric analysis.

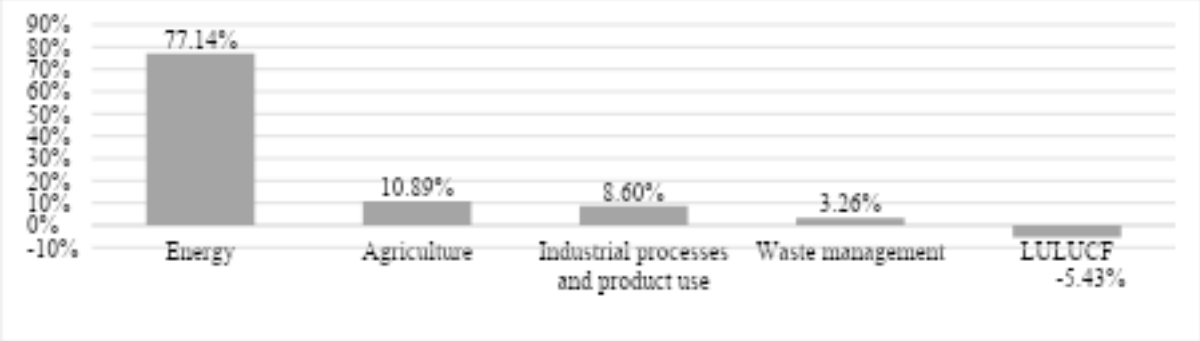
Greenhouse gas emissions in industrial processes and product use (Eurostat, 2025a) include data on carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3).

According to Eurostat (2025b), environmental tax revenue encompasses revenues by category of environmental taxes on energy, transport, and the sum of pollution and resource taxes.

The aim was to find a tool that measures the impact and determines how responsive GHG*i* are to tax changes.

The analysis is relevant because industrial processes and product use were the third-largest source of pollution in the EU in 2022 (Figure 1). Providing tailored measurement tools to evaluate the impact of environmental taxation on reducing greenhouse gas emissions helps policymakers to design effective policies to achieve the climate goals for 2030 and 2050, as assumed by the European Union.

Figure 1. The share of industrial processes and product use emissions in total EU greenhouse gas emissions (excluding LULUCF and memo items) in 2022

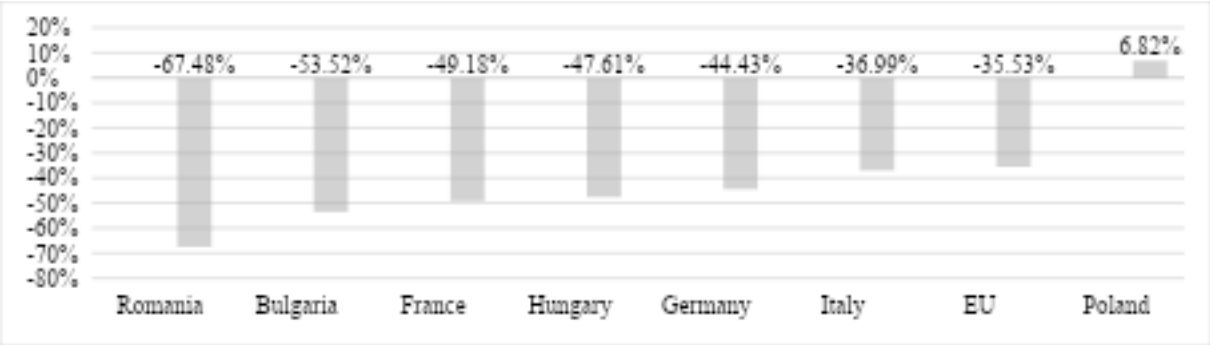


Source: Author, based on Eurostat 2025a.

The greatest polluter in the EU was the energy sector (77%), followed by Agriculture (11%).

Sector emissions decreased beyond the EU's 2030 intermediary target in Romania (an almost 70% decrease compared to the target of 55%), and Bulgaria was very close in 2022 (Figure 2).

Figure 2. Percentage change in GHG emissions in industrial processes and product use between 1990 and 2022



Source: Author, based on Eurostat 2025a.

Within the analysed time frame, Poland increased its emissions in industrial processes and product use by 7%.

2. Literature review

There is a significant body of literature on the relationship between environmental taxes and greenhouse gas emissions. The findings can be organised as follows:

2.1. A causal relationship between environmental taxes and emissions

Wolde-Rufael and Mulat-Weldemeskel (2021, 2022) found unidirectional negative causality running from environmental policy stringency to CO_2 emissions, thereby supporting the "green dividend" hypothesis, which suggests that improving environmental quality leads to lower CO_2 emissions. Likewise, the higher the revenue from total environmental taxes, the higher the reductions in CO_2 emissions. Both policy instruments were effective in reducing CO_2 emissions. Safi et al. (2021) argue that in both the short and long run, environmental taxes, R&D, and exports significantly reduce carbon emissions, whereas GDP and imports significantly enhance carbon emissions. Policies targeting environmental taxes, environmental R&D, exports, imports, and GDP have a significant impact on CO_2 emissions. Guo et al. (2023) demonstrated that environmental tax reform reduced the intensity of carbon emissions and total emissions from resource-based cities.

Tao et al. (2021) confirm that eco-innovation and environmental taxes play a significant role in carbon abatement as well as the presence of the environmental Kuznets curve (EKC) in seven emerging economies.The empirical evidence in both the short and long run confirmed a negative and significant effect of environmental taxes on carbon emissions and PM2.5. Non-renewable energy sources are contributing to environmental degradation in the targeted economies (Chien et al., 2021).

2.2. Evidence of environmental tax effectiveness in advanced economies

Doğan et al. (2022) demonstrated that environmental taxes decrease emissions for the G7 countries and confirmed that the marginal effects of environmental taxes on energy use and natural resources rents increase significantly with higher tax levels. Xie and Jamaani (2022) applied the Method of Moment Quantile Regression, which showed that renewable energy, green innovation, and environmental taxes significantly mitigate carbon emissions, while GDP causes a rise in CO_2 emissions in the G7 economies. Green technology, environmental taxes, and green energy have a negative association with CO_2 emissions in both the short run and long run. Thus, the empirical results confirm the contributing role of green technology, environmental taxes, and green energy in promoting a sustainable environment in the five sovereign Nordic countries (Sharif et al., 2023).

2.3. Company-level research

Du et al. (2024) attribute a significant reduction in carbon emissions to the "environmental protection fee to tax" policy. The environmental protection tax (EPT) significantly reduces the performance of polluting companies in the short run by forcing them to increase their R&D investments, thus inhibiting their performance. Therefore, the sustainable effect of EPT is frail, as companies do not feel incentivised to invest in green innovation and environmental protection (Long et al., 2022). Sarpong et al. (2023) emphasise that rigorous environmental tax rules will enable enterprises to transition manufacturing to green and sustainable alternatives. Additionally,

transferring tax money to research and development of sustainable technology programmes allows governments to meet the SDG-7 and SDG-13 objectives of the United Nations.

2.4. Bidirectional relationships

Zhang et al. (2022) found that tax revenue and education stabilised environmental quality and identified a bidirectional link between tax revenues and emissions, energy resources and emissions, and income and CO_2 emissions. A bidirectional causal association is confirmed amongst renewable energy, green innovation, and environmental taxes in this study (Xie & Jamaani, 2022).

2.5. Environmental tax vs. carbon trading

Xu et al. (2023) demonstrated that for economic development, carbon emission trading outperforms the carbon tax because trading has lower economic costs. Regarding the emission cuts, the carbon tax outperforms emission trading as total emissions from 2020 to 2030 are the smallest when the carbon tax policy is introduced.

2.6. Taxes, green technology, and human capital

Obobisa & Ahakwa (2024) also demonstrated that the use of renewable energy, environmental tax, and human capital significantly reduces CO_2 emissions in the realisation of Europe's net-zero goal. Utilising second-generation panel data methods, Hao et al. (2021) demonstrated that environmental tax, human capital and renewable energy use are found to decrease CO_2 emissions. While the extensive literature confirms the impact of environmental tax revenues on reducing greenhouse gas emissions, this research adds novelty by:

- Offering updates on econometric evidence based on data from seven EU member states, including Bulgaria and Romania, using greenhouse gas emissions in industrial processes and product use, and total environmental tax revenues.
- Applying Prais-Winsten regression models for Bulgaria and Romania to identify the lagged effects on emissions of environmental tax revenues.

3. Methodology or Methodological Approaches

Eurostat is the source for the analysed data (Appendix A and Appendix B). To ensure data reliability and significance, we selected the member states that ranked the best in terms of the chosen indicators, namely France, Germany, Italy and added Romania, Bulgaria, Hungary and Poland.

First, we examined the dynamics of total environmental tax revenues (ETR) and greenhouse gas emissions in industrial processes and product use (GHG*i*) from 2005 to 2022 to identify trends that could help better understand the results of the econometric analysis.

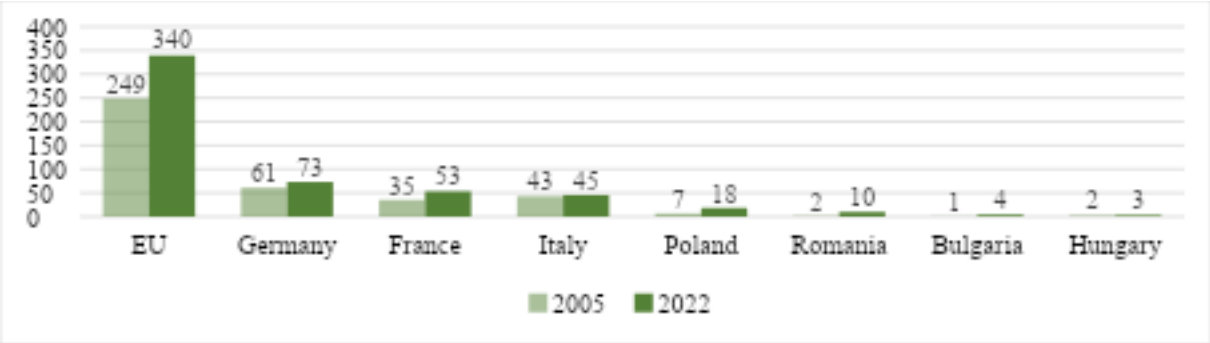
We continued with linear regression models in Gretl based on the log-transformed GHG as the dependent variable and the log-transformed data on ETR (lagged 3 years) as the predictor, to reveal how a 1% increase in ETR in year t-3 impacts GHG*i* as a percentage in year t. For Bulgaria and Romania, we used Prais–Winsten regression, a variant of linear regression that transforms the data to eliminate autocorrelation before applying regression. We used log-transformed data on ETR (lagged 1 year) as the independent variable to determine how a 1% increase in ETR in year t-1 impacts GHG*i* as a percentage in year t.

We tested the statistically significant relationships to see if they satisfy the linear regression assumptions of linearity, homoskedasticity, normality, and lack of autocorrelation.

4. Quantitative analysis

In 2022, the EU recorded total environmental tax revenues of 340 billion euros, representing a 37% increase from 2005 (Figure 3). Germany ranked first with revenues of 73 billion euros, representing a 20% increase. It was followed by France, with 53 billion euros and a 52% increase, and Italy, with 45 billion euros and a 5% increase.

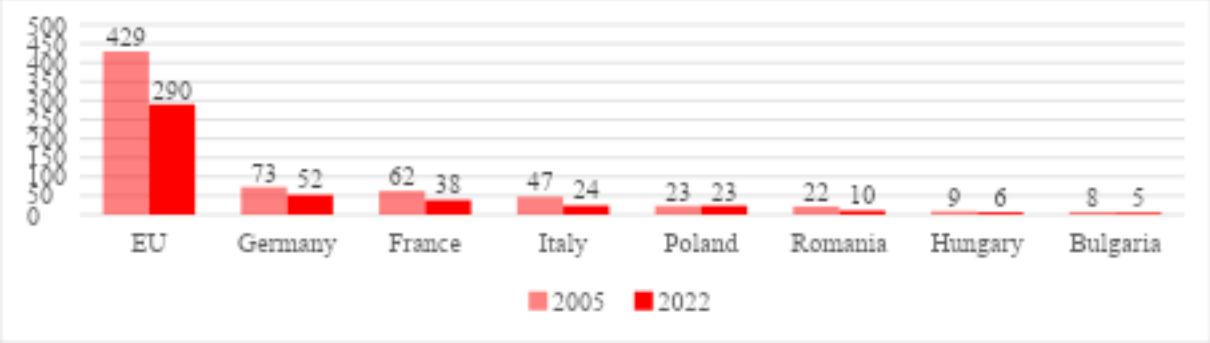
Figure 3. Total environmental tax revenues (ETR) in 2005 and 2022, billion euros



Source: Author, based on Eurostat 2025b.

From the Eastern Bloc, Poland led with 18 billion euros and a 177% increase, followed by Romania (10 billion euros, a 520% increase, the highest in the analysed countries), Bulgaria (4 billion euros, a 475% increase) and Hungary (3 billion euros and a 26% increase). In 2022, the EU recorded greenhouse gas emissions of 290 million tonnes, representing a 32% decrease from 2005 levels (Figure 4). Germany ranked first with GHG*i* of 52 million tonnes, representing a 29% decline. It was followed by France, with 38 million tonnes and a 38% reduction, and Italy, with 24 million tonnes and a 49% decline (second highest within the selected countries).

Figure 4. Greenhouse gas emissions in industrial processes and product use (GHGi) in 2005 and 2022, in million tonnes



Source: Author, based on Eurostat 2025a.

From the Eastern Bloc, Poland led with 23 million tonnes, a 1% increase from 2005, followed by Romania (10 million tonnes, with the highest decrease of -52%). Hungary (6 million tonnes, a 33% decrease) and Bulgaria (5 million tonnes, a 39% decrease).

4. Econometric analysis

For France, we used $\ln GHGi_t$ as the dependent variable and $\ln ETR_{t-3}$ as the regressor. The linear relationship was tested at a 95% confidence level to see if it was statistically significant. The

null hypothesis implies there was no statistically significant linear relationship between $\ln GHGi_t$ and $\ln ETR_{t-3}$ in France. H_0: $\rho = 0$. The alternate hypothesis supported a statistically significant linear relationship between the two variables. H_a: $\rho \neq 0$.

The regression statistics are displayed in Table 1.

Table 1. France: OLS, using observations 2008-2022 (T = 15),

Dependent variable: lnGHGi$_t$

	Coefficient	*Std. Error*	*t-ratio*	*p-value*
const	17.6594	0.936535	18.86	<0.0001
l_ETR_3	−0.643593	0.0878994	−7.322	<0.0001

Mean dependent var	10.80294	S.D. dependent var	0.121472
Sum squared resid	0.040316	S.E. of regression	0.055689
R-squared	0.804836	Adjusted R-squared	0.789823
F(1, 13)	53.61058	P-value(F)	5.82e-06
Log-likelihood	23.10878	Akaike criterion	−42.21757
Schwarz criterion	−40.80147	Hannan-Quinn	−42.23265
rho	−0.027957	Durbin-Watson	1.734840

Since the P-value = 0.0001, which is smaller than the significance level $\alpha = 0.05$, we are 95% confident that a statistically significant linear relationship exists between the variables in France. A 1% increase in environmental taxes in year t-3 corresponds to an average 0.64% reduction in emissions in year t, suggesting a strong responsiveness to ETR. Model tests confirm that classical linear regression assumptions are satisfied (Table 2).

Table 2: Results of the tests to verify the assumptions

Lagrange Multiplier (LM) test for non-Linearity (squared terms), Null hypothesis: relationship is linear, Significance level $\alpha = 0.05$	Test statistic: LM = 3.20635 with p-value = P(Chi-square(1) > 3.20635) = 0.0733528 p-value >α Relationship is linear
White's test for heteroskedasticity, Null hypothesis: heteroskedasticity not present, $\alpha = 0.05$	Test statistic: LM = 1.52705 with p-value = P(Chi-square(2) > 1.52705) = 0.466021 p-value >α Homoskedasticity
Test for normality of residuals, Null hypothesis: error is normally distributed, $\alpha = 0.05$	Test statistic: Chi-square(2) = 0.39871 with p-value = 0.819259 p-value >α Error is normally distributed
Breusch-Godfrey test for autocorrelation up to order 3, Null hypothesis: no autocorrelation, $\alpha = 0.05$	Test statistic: LMF = 0.106178 with p-value = P(F(3, 10) > 0.106178) = 0.954566 p-value >α No autocorrelation
Estimated Equation of the regression line	$\ln(GHGi_t) = 17.66 - 0.64 \ln(ETR_{t-3})$

$R^2 = 0.80$ explains approximately 80% of the variance in log GHG*i* emissions. Considering all the above, the model has a strong explanatory power. We followed the same routine for the remaining selected countries, with the results displayed in Table 3.

Table 3. Summary of linear regression statistical data and associated tests for countries with statistically significant relationships.

Country/ Indicators	**Germany: L_ETR_3**	**ITALY: L_ETR_3**
R^2	0.386728	0.841556
P-value	P-value=0.0133<α	P-value=0.0001<α
Intercept	15.0243	20.7520
Slope/Elasticity	−0.357809	−0.958144
Statistical significance at a 95% confidence level	Yes	Yes
Durbin-Watson	0.916142	0.973647
Lagrange Multiplier (LM) test for non-Linearity (squared terms) Null hypothesis: relationship is linear, Significance level α=0,05	Test statistic: LM = 0.0452272 with p-value = P(Chi-square (1) > 0.0452272) = 0.831587 p-value >α Relationship is linear	Test statistic: LM = 0.188637 with p-value = P (Chi-square (1) > 0.188637) = 0.664054 p-value >α Relationship is linear
White's test for heteroskedasticity, Null hypothesis: heteroskedasticity not present, α=0,05	Test statistic: LM = 2.91376 with p-value = P (Chi-square (2) > 2.91376) = 0.232962 p-value >α Homoskedasticity	Test statistic: LM = 3.88664 with p-value = P (Chi-square (2) > 3.88664) = 0.143228 p-value >α Homoskedasticity
Test for normality of residuals, Null hypothesis: error is normally distributed, α=0,05	Test statistic: Chi-square (2) = 1.09241 with p-value = 0.579142 p-value >α Error is normally distributed	Test statistic: Chi-square (2) = 0.722033 with p-value = 0.696968 p-value >α Error is normally distributed
Breusch-Godfrey test for autocorrelation up to order 3, Null hypothesis: no autocorrelation, α=0,05	Test statistic: LMF = 0.668724 with p-value = P (F (3, 10) > 0.668724) = 0.590284 p-value >α No autocorrelation	Test statistic: LMF = 2.05871 with p-value = P (F (3, 10) > 2.05871) = 0.169548 p-value >α No autocorrelation
Equation of the linear regression line	$Ln(GHG_0) = 15.02 - 0.36 \times ln(ETR_{t-3})$	$Ln(GHG_0) = 20.75 - 0.96 \times ln(ETR_{t-3})$

The model for Italy reveals a strong, linear, negative, and elastic relationship between ETR and GHG*i*. Specifically, a 1% increase in environmental tax revenues in year t-3 results in a 0.96% reduction in emissions in year t. The lag structure implies that tax effects are not immediate but rather appear after three years. For Germany, we identified a moderate, negative linear model where a 1% increase in environmental tax revenues in year t-3 is associated with an average decrease of 0.37% in emissions in year t. Both models are statistically significant ($p < \alpha=0,05$) and meet the linear regression assumptions. R-squared in France and Germany indicates that the relationship between the variables explains 84% and 39%, respectively, of the variation in GHG*i* emissions. R-squared in France and Germany indicates that the relationship between the variables explains 84% and 39%, respectively, of the variation in GHG*i* emissions. For Hungary and Poland, we attempted various regression models and lags, but they did not yield statistically significant relationships. For Bulgaria, we used Prais–Winsten regression, a variant of linear regression, which transforms the data to eliminate autocorrelation before applying the regression (Table 4).

Table 4. Bulgaria: Prais-Winsten, using observations 2006-2022 (T = 17)
Dependent variable: ln GHGi, rho = 0.643642

	Coefficient	*Std. Error*	*t-ratio*	*p-value*
const	12.2768	1.48048	8.292	<0.0001
l_TAX_1	−0.525735	0.207690	−2.531	0.0230

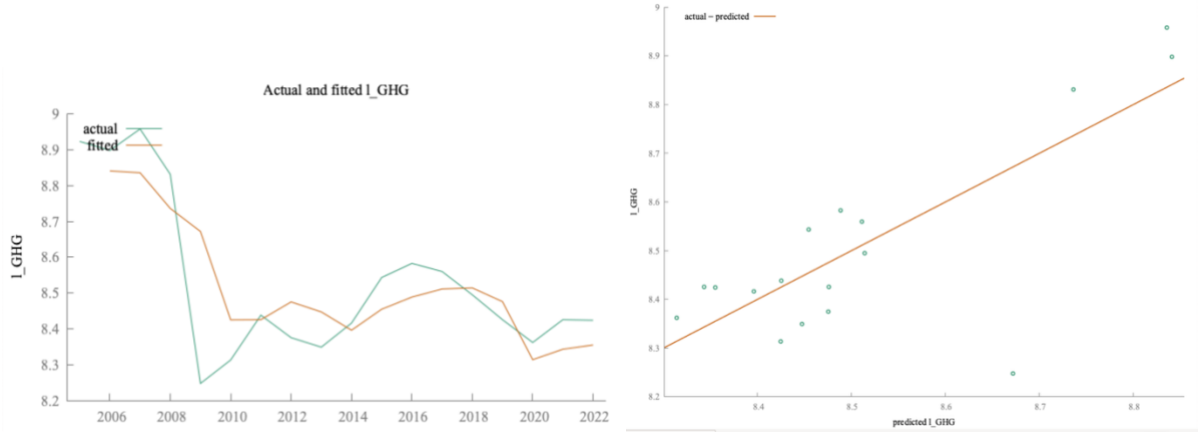
Statistics based on the rho-differenced data:

Sum squared resid	0.275866	S.E. of regression	0.135614
R-squared	0.591115	Adjusted R-squared	0.563856
F(1, 15)	742.2066	P-value(F)	3.44e-14
rho	0.195183	Durbin-Watson	1.587208

Statistics based on the original data:

Mean dependent var	8.508500	S.D. dependent var	0.205137

The model confirms a statistically significant and negative relationship between ETR and GHG*i*, with a one-year lag. According to the model, for a 1% increase in ETR in year t-1, GHG*i* emissions decrease by 0.53% in year t. The relationship between the variables explains nearly 59% of the variation in emissions.



Visual diagnostics of residuals (Fig. 5 and Fig. 6) support the assumptions of linearity and homoscedasticity. The 2009 outlier could be linked to an external economic shock (global financial crisis), not to model variance instability. The same model was applied to Romania (Table 5), where a 1% increase in ETR in year t-1 leads to a 0.43% decrease in GHG*i* in year t.
The relationship between ERT and GHG*i* explains nearly 70% of the variation in emissions.

Table 5. Romania: Prais-Winsten, using observations 2006-2022 (T = 17)
Dependent variable: ln GHGi, rho = 0.505727

	Coefficient	*Std. Error*	*t-ratio*	*p-value*
const	12.9670	1.01642	12.76	<0.0001
l_TAX_1	−0.426351	0.126270	−3.377	0.0042

Statistics based on the rho-differenced data:

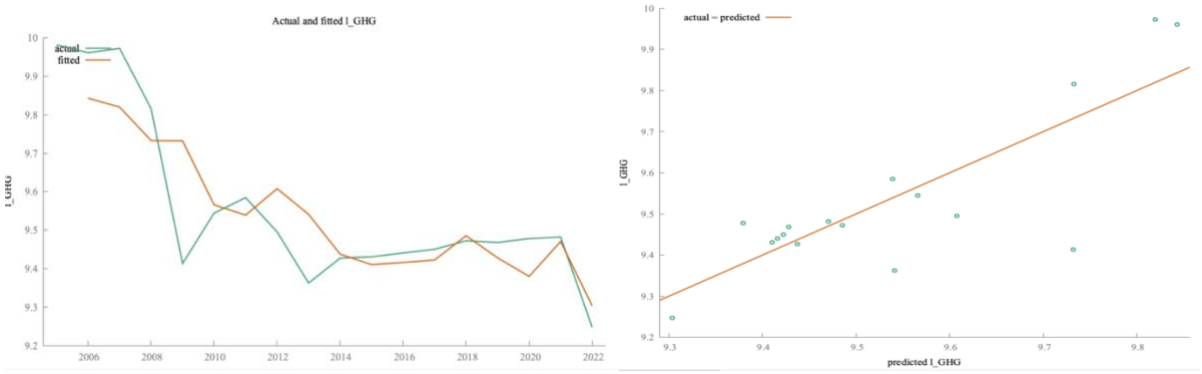
Sum squared resid	0.209507	S.E. of regression	0.118183

R-squared	0.671875	Adjusted R-squared	0.650000
F(1, 15)	1034.498	P-value(F)	2.97e-15
rho	0.152568	Durbin-Watson	1.617644

Statistics based on the original data

Mean dependent var	9.532229	S.D. dependent var	0.199437

Figures 7 and 8 support the assumptions of linearity and homoscedasticity.

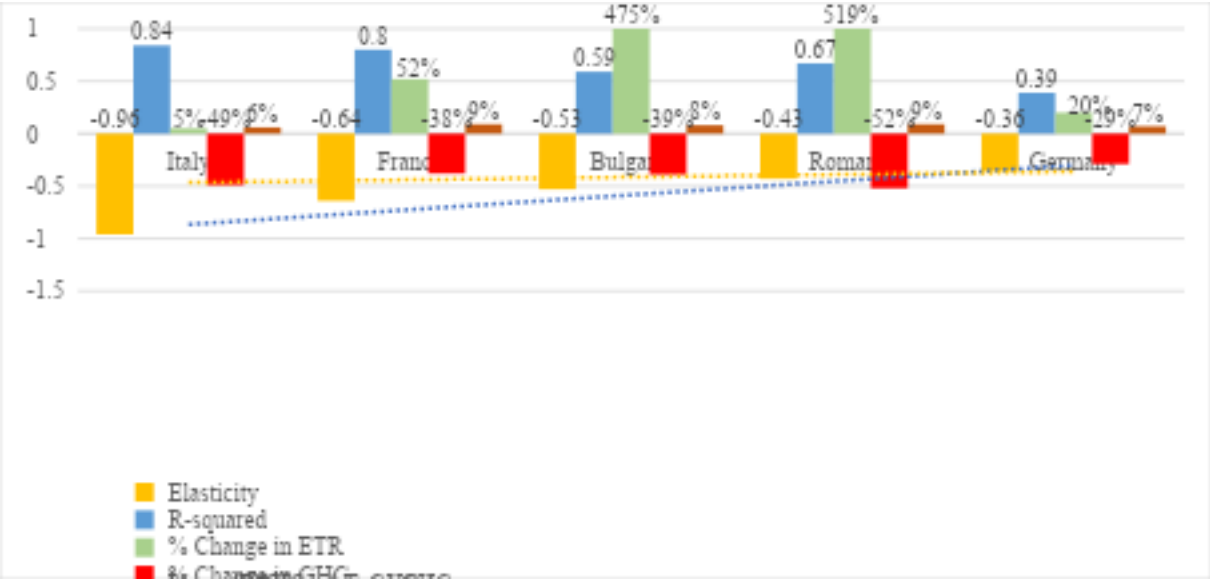


4. Discussion

In Figure 9, we summarised the results of the quantitative and econometric analyses. The results underscore that environmental tax revenues can reduce emissions in the analysed sector, but their effect differs from one country to another. Elasticities vary from close to -1 in Italy to almost -0.4 in Germany, indicating a higher responsiveness in some of the selected countries.
In Italy, elasticity and R^2 reveal a strong lagged relationship between ETR and GHG*i,* while France, Bulgaria and Romania also display strong to moderate relationships. Germany's lowest negative elasticity and almost symmetrical R^2 imply that other policy tools or sectoral characteristics may drive emissions more than revenues from environmental taxes. The time lag effect of three years in Italy, Germany, and France (Western countries) and one year in Romania and Bulgaria (Eastern countries) emphasises different policy implementation patterns due to administrative efficiency or sector readiness.

Bulgaria and Romania registered both ETR increases and significant GHG*i* declines, suggesting that strong fiscal incentives are conducive to emission reduction.

Summary Figure 9. Elasticity, R-squared, Tax & GHGi changes, share of sectoral emissions in total GHG



Even if the sector's emissions share in total GHG emissions is small, compared to energy or agriculture, the results suggest that targeted taxation can still lead to significant reductions when well-applied.

5. Conclusions

The results confirm that environmental taxation can be effective in reducing emissions from industrial processes and product use, though the degree of impact varies notably between countries. Romania and Bulgaria stand out for combining large tax increases with significant emission reductions and strong statistical results. Italy and France demonstrate strong model performance even with more moderate tax changes, suggesting possible advantages in tax policy structure or administrative implementation. Germany shows a moderate fit, indicating that while taxes may play a role, other instruments or sectoral characteristics may be more influential in reducing industrial emissions.

Overall, the findings highlight that environmental taxes can make a meaningful contribution, even in sectors with a smaller share of total emissions, when policies are well-targeted and consistently applied, providing actionable tools for EU policymakers aiming to meet the EU climate targets, both intermediate and final, across different member states.

Further research should investigate how environmental tax revenues impact emissions in other sectors, such as energy, agriculture, and waste management. Moreover, elucidate what exactly is the root cause of the heterogeneities between the selected countries, including why Eastern countries display shorter lags.

References

Chien, F., Sadiq, M., Nawaz, M. A., Hussain, M. S., Tran, T. D., & Le Thanh, T. (2021). A step toward reducing air pollution in top Asian economies: The role of green energy, eco-innovation, and environmental taxes. Journal of environmental management, 297, 113420.

Doğan, B., Chu, L. K., Ghosh, S., Truong, H. H. D., & Balsalobre-Lorente, D. (2022). How environmental taxes and carbon emissions related in the G7 economies?. Renewable Energy, 187, 645–656.

Du, J., Li, Z., Shi, G., & Wang, B. (2024). Can "environmental protection fee to tax" reduce carbon emissions? Evidence from China. Finance Research Letters, 62, 105184.

Eurostat. (2025a). Greenhouse gas emissions by source sector. Available at: https://ec.europa.eu/eurostat/databrowser/view/env_air_gge__custom_14955337/default/table [Accessed 16 June 2025]

Eurostat. (2025b). Environmental tax revenues. Available at: https://ec.europa.eu/eurostat/databrowser/view/env_ac_tax__custom_14955783/default/table [Accessed 16 June 2025]

Guo, B., Wang, Y., Zhou, H., & Hu, F. (2023). Can environmental tax reform promote carbon abatement of resource-based cities? Evidence from a quasi-natural experiment in China. Environmental Science and Pollution Research, 30(55), 117037–117049.

Hao, L. N., Umar, M., Khan, Z., & Ali, W. (2021). Green growth and low carbon emission in G7 countries: how critical the network of environmental taxes, renewable energy and human capital is?. Science of the Total Environment, 752, 141853.

Long, F., Lin, F., & Ge, C. (2022). Impact of China's environmental protection tax on corporate performance: empirical data from heavily polluting industries. Environmental Impact Assessment Review, 97, 106892.

Obobisa, E. S., & Ahakwa, I. (2024). Stimulating the adoption of green technology innovation, clean energy resources, green finance, and environmental taxes: The way to achieve net zero CO2 emissions in Europe?. Technological Forecasting and Social Change, 205, 123489.

Safi, A., Chen, Y., Wahab, S., Zheng, L., & Rjoub, H. (2021). Does environmental taxes achieve the carbon neutrality target of G7 economies? Evaluating the importance of environmental R&D. Journal of Environmental Management, 293, 112908.

Sarpong, K. A., Xu, W., Gyamfi, B. A., & Ofori, E. K. (2023). A step towards carbon neutrality in E7: The role of environmental taxes, structural change, and green energy. Journal of Environmental Management, 337, 117556.

Sharif, A., Kartal, M. T., Bekun, F. V., Pata, U. K., Foon, C. L., & Depren, S. K. (2023). Role of green technology, environmental taxes, and green energy towards sustainable environment: insights from sovereign Nordic countries by CS-ARDL approach. Gondwana research, 117, 194-206.

Tao, R., Umar, M., Naseer, A., & Razi, U. (2021). The dynamic effect of eco-innovation and environmental taxes on carbon neutrality target in emerging seven (E7) economies. Journal of Environmental Management, 299, 113525.

Wolde-Rufael, Y., Mulat-Weldemeskel, E. (2021). Do environmental taxes and environmental stringency policies reduce CO2 emissions? Evidence from 7 emerging economies. Environmental Science and Pollution Research, 28(18), 22392-22408. https://doi.org/10.1007/s11356-020-11475-8

Xie, P., & Jamaani, F. (2022). Does green innovation, energy productivity and environmental taxes limit carbon emissions in developed economies: Implications for sustainable development. Structural Change and Economic Dynamics, 63, 66-78.

Xu, H., Pan, X., Li, J., Feng, S., & Guo, S. (2023). Comparing the impacts of carbon tax and carbon emission trading, which regulation is more effective? Journal of Environmental Management, 330, 117156.

Zhang, Y., Khan, I., & Zafar, M. W. (2022). Assessing environmental quality through natural resources, energy resources, and tax revenues. Environmental Science and Pollution Research, 29(59), 89029-89044.

Appendix 1. Greenhouse gas emissions in industrial processes and product use (GHGi), in million tonnes

Year	EU	Bulgaria	Germany	France	Italy	Hungary	Poland	Romania
2005	429,069.21	7,504.16	72,794.93	62,139.09	47,134.84	8,905.68	23,184.89	21,629.12
2006	432,590.88	7,318.85	73,088.75	63,697.38	43,606.52	8,554.58	25,400.86	21,192.03
2007	444,485.01	7,770.17	76,234.95	64,771.09	43,660.97	8,416.45	27,697.39	21,434.53
2008	419,641.33	6,846.43	72,078.39	60,497.24	41,094.65	7,335.15	26,315.02	18,323.92
2009	347,056.92	3,818.37	64,112.02	50,439.09	35,734.19	6,371.23	20,883.65	12,250.09
2010	363,634.41	4,076.82	61,883.02	53,601.71	36,593.89	6,578.81	21,954.13	13,966.9
2011	363,237.93	4,619.91	63,315.51	53,189.84	36,345.13	6,757.97	24,599.75	14,540.12
2012	348,047.33	4,338.48	60,501.9	51,082.83	33,224.71	6,484.83	23,655.28	13,297.38
2013	344,869.04	4,225.19	60,365.95	52,835.32	31,756.84	5,868.73	22,886.98	11,644.7
2014	351,735.97	4,518.7	60,651.8	52,291.19	31,395.34	6,588.79	24,241.24	12,423.07
2015	342,339.24	5,132.26	59,861.45	50,782.07	29,522.31	7,132.42	23,651.6	12,465.6
2016	344,796.66	5,338.84	61,577.51	50,548.92	28,949.01	6,732.14	23,821.62	12,591.44
2017	351,162.74	5,218.85	65,488.47	51,780.15	28,469.54	7,247.8	24,386.06	12,712.13
2018	344,129.63	4,890.06	62,535.56	49,067.66	29,066.39	7,485.99	24,949.99	12,996.61
2019	331,231	4,561.88	59,442.16	45,920.84	27,769.35	7,384.28	24,655.39	12,940.18
2020	307,453	4,280.67	55,346.09	39,903.92	24,667.68	7,383.68	24,158.35	13,069.19
2021	317,869.44	4,562.2	57,250.73	42,226.91	25,695.15	7,161.39	24,211.14	13,122.39
2022	290,347.67	4,554.75	51,833.85	38,257.01	23,908.3	5,965.38	23,470.31	10,380.75

Source: Eurostat 2025a

Appendix 2. Total environmental tax revenues (ETR), billion euros

Year	EU	Bulgaria	Germany	France	Italy	Hungary	Poland	Romania
2005	249,050.84	712.49	60,837	35,221	43,140	2,477.32	6,605.77	1,589.63
2006	258,008.67	762.68	62,533	35,950	44,682	2,614.19	7,309.99	1,888.79
2007	264,534.26	1,036.06	62,772	36,205	44,242	2,828.63	8,614.58	2,562.14
2008	267,315.44	1,221.74	64,140	36,455	42,749	2,907.43	10,215.83	2,487.18
2009	266,578.13	1,062.74	66,381	35,894	47,335	2,476.05	8,448.56	2,244.58
2010	273,355.08	1,051.61	63,845	37,279	47,260	2,631.91	9,831.03	2,650.61
2011	290,990.96	1,107.8	72,185	39,144	52,471	2,600.05	10,002.18	2,573.54
2012	297,600.15	1,118.56	72,621	40,444	57,791	2,533.22	10,055.44	2,667.48
2013	310,953.88	1,200.95	78,210	42,404	58,111	2,489.64	9,503.28	2,957.28
2014	322,701.67	1,220.69	81,776	43,225	62,226	2,557.84	10,562.1	3,587.37
2015	329,560.6	1,351.75	80,837	47,101	59,533	2,787.77	11,401.74	3,919.76
2016	341,553.92	1,451.17	82,463	49,803	61,842	2,945.57	11,556.66	4,085.32
2017	349,284.93	1,468.91	85,260	52,775	59,977	3,100.77	12,512.1	3,640.19
2018	355,523.45	1,470.47	84,559	55,740	60,159	3,101.07	13,474.36	4,033.39
2019	362,986.32	1,839.15	85,723	56,162	62,231	3,307.92	13,545.47	4,731.71
2020	334,773.82	1,859.12	82,858	49,304	54,341	2,982.81	13,330.41	4,196.21
2021	353,521.84	1,978.7	81,966	54,099	56,022	3,095.85	16,735.08	5,867.48
2022	340,049.43	4,095.16	73,094	53,363	45,400	3,118.66	18,324.41	9,847.14

Source: Eurostat 2025b

Eduard MARINOV[19]

INNOVATING FOR SUSTAINABILITY: THE INTERSECTION OF CIRCULAR ECONOMY AND ECONOMIC GROWTH IN AFRICA[20]

***Abstract**: The article examines how the circular economy (CE) could promote sustainable and inclusive economic growth in Africa despite urgent environmental issues. Notwithstanding its low greenhouse gas emissions, Africa faces climate impacts and energy access inequalities that threaten development. Through a SWOT analysis and interviews with African CE entrepreneurs, the study identifies CE's strengths, such as abundant renewable resources and global climate alignment, as well as its weaknesses, including infrastructure deficits and financing barriers. Opportunities arise from technological innovation, international support, and growing local capacity. Threats stem from reliance on extractive industries and climate vulnerability. Empirical findings reveal a variety of circular practices across sectors, though scaling is limited by policy gaps and financial access constraints. The paper recommends policies tailored to specific sectors, enhanced stakeholder collaboration, improved financing mechanisms, and capacity building to unlock the transformative potential of CE. Ultimately, CE practices offer Africa a pathway to balance economic growth with environmental stewardship and resilience.*

***Keywords**: circular economy; sustainable development; economic growth; renewable energy; innovation.*

***JEL:** O13, O55, Q01*

1. Introduction

Africa is at a pivotal stage in its development. Although it accounts for less than 4% of global greenhouse gas emissions (Nartley, 2024), the continent suffers severe climate impacts such as droughts, resource scarcity, deforestation, and pollution, threatening food security, energy access, and socioeconomic stability (AJLabs, 2023; UNECA, 2024).

In this context, the circular economy (CE) offers a transformative model that balances economic growth with sustainability. Unlike the traditional linear economy focused on extraction and disposal, CE emphasizes resource efficiency, reuse, recycling, and regeneration (Ellen

[19] *Associate Professor, Ph.D., D.Ec.Sc., New Bulgarian University and Economic Research Institute at the Bulgarian Academy of Sciences, eddie.marinov@gmail.com, ORCID: https://orcid.org/0000-0002-0925-2875.*

[20] This research is done within research project "Circular Economy in the European Union and its Implementation in Bulgaria", part of the scientific research program of the Economic Research Institute at the Bulgarian Academy of Sciences.

MacArthur Foundation, 2021). It seeks to keep materials in use longer, reduce waste, and align production with ecological limits.

For Africa, CE extends beyond waste management; it is a pathway for industrial transformation, value creation, and inclusive development (Käsner et al., 2023). Integrating CE principles into development strategies can help African countries build resilient economies, create green jobs, foster innovation, and alleviate environmental pressures (ACEN, 2025). This approach is especially relevant in agriculture, construction, fashion, and e-waste sectors, where circular methods tackle both ecological and socioeconomic challenges.

This paper explores the intersection of CE and economic growth in Africa through the literature review, a SWOT analysis, and ten interviews with African CE entrepreneurs. It assesses how CE can catalyze sustainable industrial development and identifies conditions for its success. The guiding question is: How can Africa harness CE for green, inclusive growth?

The study contributes to scholarship on development models within planetary boundaries and stresses that Africa's sustainable future requires local innovation, supportive policies, financing, and international cooperation.

2. State of the problem

The relationship between CE practices and economic growth is central to global sustainability debates, especially for low- and middle-income countries pursuing inclusive development. CE seeks to decouple economic progress from resource extraction and environmental harm, addressing crucial ecological limits.

Numerous studies show CE can stimulate growth by improving resource productivity, lowering costs, fostering innovation, and creating jobs (Ellen MacArthur Foundation, 2021; Schröder et al., 2019). Research from Europe and East Asia reveals that CE strategies like remanufacturing and product-as-a-service models boost GDP while reducing environmental impacts (OECD, 2019).

In developing economies, including Africa, the CE-growth link is more complex. Institutional weaknesses, infrastructure gaps, and informal economies restrict large-scale adoption of circular practices (Käsner et al., 2023; Nartey, 2024). Circular activities often arise from necessity rather than strategic policy, complicating formal integration into development plans (Koech et al., 2023).

Nonetheless, some African countries lead CE efforts. Rwanda has a national CE roadmap, while Ghana and South Africa invest in green industries and policies for waste valorization and renewable energy (UNECA, 2024; ACEN, 2025). International initiatives like Switch Africa Green (SAG) and the African Circular Economy Alliance (ACEA) support these efforts.

Informal actors, including waste pickers and community repair groups, play a vital role in advancing circular outcomes where formal infrastructure is lacking (Velis, 2017). These grassroots models offer valuable lessons for inclusive CE strategies adapted to local conditions.

Overall, research underscores both the promise and challenges of CE as a sustainable development pathway for Africa. Unlocking its full potential requires context-specific policies and alignment with broader development goals.

3. Methodology

This research uses a mixed-methods approach, combining qualitative and analytical tools to explore the potential of CE for sustainable economic growth in Africa. It includes two main components: a SWOT analysis of Africa's green transition and ten semi-structured interviews with key CE stakeholders.

The SWOT analysis reviews academic and grey literature, including reports from international organizations such as UNECA, IEA, and the Ellen MacArthur Foundation; peer-reviewed articles; and policy documents from regional and national bodies. It provides an overview of CE strategies, infrastructure, and institutions in Africa, assessing internal strengths and external challenges affecting the sustainable transition.

Between January and May 2025, ten semi-structured interviews were conducted via Google Meet with founders, managers, and technical staff from African CE enterprises across sectors like plastics recycling, e-waste management, organic composting, sustainable fashion, and upcycling. Participants were identified through CE networks (e.g., ACEN and SAG) and snowball sampling.

Interviews followed a thematic guide covering business models, policy environment, finance access, environmental and social impact, and barriers. With consent, interviews were recorded, transcribed, and thematically coded. Patterns identified helped triangulate literature and SWOT findings, ensuring empirical depth and theoretical coherence.

This methodology combines macro-level policy insights with micro-level entrepreneurial experiences, offering a comprehensive understanding of CE innovation and economic development in Africa, and informing context-sensitive, scalable policy recommendations.

4. Research Results

This section presents empirical findings from two sources: a SWOT analysis of Africa's potential for a green transition through CE practices and insights from ten semi-structured interviews with African entrepreneurs involved in recycling, composting, sustainable fashion, and e-waste management.

The SWOT analysis (Table 1) highlights the mix of strengths and challenges shaping Africa's CE path. Strengths include abundant renewable resources – solar, wind, and hydropower – that provide a strong basis for green energy and industrialization. CE initiatives align with global sustainability goals like the Paris Agreement and Sustainable Development Goals, enabling access to international cooperation and climate finance (UNEP, 2024). Properly leveraged, this green transition can promote inclusive growth by creating jobs, enhancing industrial capacity, and driving innovation (AfDB, 2024; ACEN, 2025).

Table 1. SWOT Analysis of CE and green transition in Africa

Strengths	**Weaknesses**
Significant economic growth potential through renewable energy job creation and industrial development.	Inadequate infrastructure limits large-scale renewable energy investments.
Alignment with global climate goals enhances international cooperation and climate finance access.	Over 600 million Africans lack electricity, raising equity concerns in energy access.
Rich solar, wind, and hydropower resources support renewable energy expansion.	Green technologies may face implementation challenges due to infrastructure gaps and poor local conditions.
Opportunities	**Threats**
Technological innovations enable wider adoption of sustainable practices.	Dependence on extractive industries risks sustainability and resource conflicts.
Increased international climate focus can boost finance and technical support.	Global energy market volatility and declining fossil fuel investments threaten economic stability.
Growing capacity-building efforts can develop local expertise and infrastructure for self-sufficient green energy.	High climate vulnerability may undermine development progress and green transition efforts.

Source: created by the author.

However, progress is hindered by key weaknesses. Infrastructure for waste management, energy distribution, recycling, and repair is insufficient, especially outside urban areas (Bel, 2023). Institutional and physical capacity to support circular value chains is limited, while over 600 million Africans lack electricity, risking exclusion from the green transition (UNECA, 2024). Technologies designed for high-income countries often face challenges in African contexts, restricting scalability (Ikejemba et al., 2017).

Opportunities are expanding. Innovations like blockchain for material tracking and AI in waste collection offer new circular business models and partnerships (Koech et al., 2023). Growing climate momentum increases financial and technical support from multilateral banks and philanthropies. Capacity-building in circular design, green entrepreneurship, and policy integration paves the way toward resilience and self-reliance (Käsner et al., 2023).

Nevertheless, threats remain. Dependence on extractive industries risks sustainability, as pressure for short-term growth may clash with long-term goals. Global energy market volatility

and declining fossil fuel investments threaten economic stability. Climate change impacts – from extreme weather to biodiversity loss – endanger development and green transitions (AJLabs, 2023; Nartey, 2024).

Several themes emerged from interviews:

1. All enterprises applied at least two CE strategies, such as reuse, recycling, composting, or upcycling. Examples include turning tires into furniture, textile waste into bags, and composting organic waste for urban farming. These businesses often combined economic objectives with environmental and social missions, reflecting hybrid social enterprise models.
2. Access to financing was a major constraint. Most relied on donor funding, grants, or personal resources. Formal bank loans were largely inaccessible due to collateral demands and the financial sector's limited familiarity with CE models. Only two businesses accessed national or municipal green funds and often faced bureaucratic delays.
3. Entrepreneurs reported policy and regulatory gaps. Many operated in informal or semi-formal settings with unclear legal recognition. Municipal regulations were often overlapping or conflicting, especially in waste management. Entrepreneurs' awareness of national CE strategies was low, highlighting poor communication and stakeholder engagement from policymakers.
4. Interviewees emphasized their contributions to local sustainability, including diverting waste from landfills, creating seven to 25 jobs per enterprise, and conducting community education through workshops and schools. However, they noted the lack of standardized impact metrics, which limits visibility and access to impact investment.
5. Potential opportunities include rising consumer demand for sustainable products in urban areas, the emergence of extended producer responsibility schemes that mandate the return of packaging and electronics, and growing interest from foreign companies seeking sustainable suppliers.

Together, these findings underscore the untapped potential of CE as a catalyst for inclusive and sustainable growth in Africa. However, they also highlight the significant structural, financial, and institutional barriers that must be overcome to achieve systemic transformation.

5. Conclusions

This study emphasizes the substantial potential of CE to promote sustainable and equitable economic development in Africa. The continent's abundant renewable resources and alignment with global sustainability goals provide a strong foundation for a green transition. However, the continent faces considerable challenges, including inadequate infrastructure, limited access to

financing, regulatory gaps, and persistent energy inequalities. Interviews with African CE entrepreneurs reveal that, although innovative circular practices are being implemented in sectors such as recycling, composting, and sustainable fashion, scaling these initiatives requires overcoming systemic barriers.

To unlock the full transformative potential of CE, policymakers must prioritize developing supportive infrastructure and regulatory frameworks tailored to local realities. As evidenced in studies of the European Union's green transition and its financial sector challenges (Bobeva et al., 2023), effective alignment of public finance and financial institutions with sustainability goals is crucial. African countries, similarly, have to address institutional and financing barriers to unlock the full potential of circular economy initiatives. Enhancing communication and stakeholder engagement around CE strategies can increase awareness and integration. Additionally, investing in capacity building and establishing standardized impact measurement tools will strengthen the sector's credibility and attract further investments.

Ultimately, CE offers Africa a viable pathway to reconciling economic development with environmental stewardship. By addressing structural and institutional challenges, African countries can leverage CE as a catalyst for resilient, green growth that benefits people and the planet.

References

African Circular Economy Network (ACEN). (2025a). *State of Circular Economy in Africa – Sectoral Outlook and Policy Recommendations*. African Circular Economy Network.

African Development Bank (AfDB). (2024). *Climate Change in Africa*. Available at: https://www.afdb.org/en/cop25/climate-change-africa [Accessed 30 May 2025].

AJLabs. (2023). How much does Africa contribute to global carbon emissions? – *Al Jazeera. [online]* Available at: https://www.aljazeera.com/news/2023/9/4/how-much-does-africa-contribute-to-global-carbon-emissions [Accessed 30 May 2025].

Bel, A. (2023). *Growing green: Catalyzing climate finance in African markets*. Washington: Atlantic Council of the United States, Africa Center. Available at: https://www.atlanticcouncil.org/in-depth-research-reports/report/growing-green-catalyzing-climate-finance-in-african-markets/ [Accessed 30 May 2025].

Bobeva, D., Zhelyazkova, V., Aleksandrova-Zlatanska, Sv., Palova, Ya. (2023). *The transition to a green economy in the European Union and challenges for the financial sector and public finances in Bulgaria*. Plovdiv: UI "P. Hilendarski [Бобева, Д., Желязкова, В., Александрова-Златанска, Св., Пальова, Я. (2023). Преходът към зелена икономика на Европейския съюз и предизвикателства пред финансовия сектор и публичните финанси на България. Пловдив: УИ „П. Хилендарски"] (in Bulgarian).

Ellen MacArthur Foundation (EMAF). (2021). *Circular economy in Africa: examples and opportunities. How to build a circular economy*. Available at: https://ellenmacarthurfoundation.org/circular-economy-in-africa/overview [Accessed 30 May 2025].

Ikejemba, E., Mpuan, P., Schuur, P. and Hillegersberg, J.V. (2017). The empirical reality & sustainable management failures of renewable energy projects in Sub-Saharan Africa (part 1 of 2). *Renewable Energy*, 102(Part A), pp.234–240.

Käsner, S.A., Gihring, K., Desmond, P. and Schenck, C. (2023). Circular economy transitions in Africa: a policy perspective. In: R. Passaro, P. Ghisellini, M. Pansera, S. Barca and M. Calisto Friant, eds. *Circular Economy for Social Transformation: Multiple Paths to Achieve Circularity*. JUST2CE. Available at: https://just2ce.eu/wp-content/uploads/2024/06/2024-JUST2CE-eBook-Final_Version_19.4.24-ch21.pdf [Accessed 30 May 2025].

Koech, M.K., Munene, K.J., Kinoti, M.K. and Situma, D.K. (2023). Circular economy policies and innovations in Africa: Pillars for achieving sustainable development. In: S.K. Ghosh, ed. *Circular Economy Adoption*. Singapore: Springer. Available at: https://doi.org/10.1007/978-981-99-4803-1_4 [Accessed 30 May 2025].

Nartey, L (2024). Africa doesn't have a choice between economic growth and protecting the environment: how they can go hand in hand. – The Conversation Canada Edition. [online] Available at: https://theconversation.com/africa-doesnt-have-a-choice-between-economic-growth-and-protecting-the-environment-how-they-can-go-hand-in-hand-228529 [Accessed 30 May 2025].

OECD (2019). *Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences*, OECD Publishing, Paris, https://doi.org/10.1787/9789264307452-en [Accessed 30 May 2025].

Schröder, P., Anantharaman, M., Anggraeni, K. and Foxon, T. (2019). *The Circular Economy and the Global South: Sustainable Lifestyles and Green Industrial Development*. Routledge.

UNEP. (2024). *Five African countries unite to reduce release of hazardous chemicals from plastics*. – Press release 13 Dec 2024. Available at: https://www.unep.org/news-and-stories/press-release/five-african-countries-unite-reduce-release-hazardous-chemicals [Accessed 5 June 2025].

UNECA. 2024. *Economic Report on Africa 2024: Investing in a Just and Sustainable Transition in Africa*. Addis Ababa: UNECA. Available at: https://repository.uneca.org/handle/10855/50162 [Accessed 30 May 2025].

Velis, C.A. (2017). Waste pickers in global south: Informal recycling and the circular economy. – *Waste Management & Research*, 35(7), pp.681–683.

Alina-Cerasela AVRAM[21], *Mariana ȚĂRANU* [22]

ROMANIAN BUSINESSES AND THE SHIFT TO A GREENER ECONOMY

***Abstract**: Romania is currently aligning its economy with the standards of the green and circular economy. This shift follows the European Commission's ambitious plan for a cleaner and more competitive Europe, which has been turned into mandatory legislation across EU Member States. Methodologically, the study combines content analysis of policy documents with descriptive statistics from Eurostat and Statista (2024–2025) to capture Romania's progress toward a green and circular economy. Romania has set clear targets for multiple economic sectors to be achieved by 2050. While the green economy promises long-term competitive advantages, it also raises a key paradox. On the one hand, it promotes sustainability and environmental protection. On the other hand, it requires the replacement of existing, polluting technologies with new ones, often at odds with the circular economy principle of reuse. This study examines whether the green transition in Romania is driven by a real necessity or is mainly a reaction to increasingly strict EU regulations challenging the traditional economic model. The focus is on waste management, a key area under the European Green Deal. Through a content analysis of relevant policy documents, the research highlights the main challenges and implications for Romanian businesses in the process of adapting to circular economy principles.*

***Keywords**: Romanian businesses, green economy, green transition, waste management*
***JEL:** F64, D1, O1, R11*

1. Introduction

The transition toward a greener economy represents one of the most significant structural changes Romania has faced in recent decades. While it follows the direction set by the European Green Deal and the EU Circular Economy Action Plan, this transformation is proving more complex in Romania than in many other Member States. Beyond the institutional and regulatory adjustments it requires, the green transition also depends on deeper social and cultural shifts that take time to mature. For most Romanian companies, especially small and medium-sized

[21] *Senior Researcher Alina-Cerasela Avram, PhD, Institute for World Economy:* alina.cerasela@iem.ro
[22] *Researcher Mariana Țăranu, Institute for World Economy*

enterprises, the adoption of green technologies and sustainable production models remains challengind because of high implementation costs and limited access to financial instruments dedicated to the green economy. At the same time, the general behavior of consumers continues to be strongly oriented toward immediate consumption rather than responsible purchasing, which reduces the market incentives for firms to invest in sustainability.

Romania's post-communist economic history also plays an indirect role. Decades of resource scarcity have generated, paradoxically, a culture of overconsumption once economic freedom was regained. This collective tendency toward waste and rapid consumption still influences purchasing habits today and makes the idea of moderation or reuse less appealing. Consequently, businesses perceive the green transition not only as a financial challenge but also as a risk of market incompatibility, given that consumer demand for eco-friendly products remains relatively limited.

Despite these barriers, the transition is underway. Some sectors—particularly renewable energy, waste management, and recycling—have begun to adapt and demonstrate that sustainability can coexist with competitiveness. Others, however, struggle with outdated infrastructure and uncertainty about long-term policy directions. The purpose of this study is to explore how Romanian enterprises perceive and respond to the pressures of the green transition, focusing especially on waste management as a key indicator of how circular economy principles are being integrated into national business practices.

2. State of the Problem

The transition to a green and circular economy represents both a structural and behavioral transformation for businesses in Romania. The green economy represents a modern development strategy aimed at fostering economic growth while enhancing quality of life and ensuring long-term environmental sustainability. A well-designed resource management plan should promote the creation and adoption of sustainable technologies, as the transition toward a green economy fundamentally transforms both society and technology (Zhang et al., 2022). Moreover, the green economy aligns with concepts such as the sharing, peer-to-peer, and no-growth economies, offering strategic responses to the limits of traditional growth and the depletion of natural resources (Mikhno et al., 2021).

According to Simionescu and Gavurová (2023), the new EU Member States—including Romania—face intertwined challenges of pollution, inequality, and financial fragility, where green finance emerges as a vital instrument for sustainable recovery. Their findings indicate that renewable energy investment and public environmental spending are among the few policy tools capable of effectively reducing greenhouse gas emissions in the long term. Similarly, Li and Wu (2024) argue that sustainable development in emerging European economies depends on the

synergy between green finance and innovation. Business model innovation allows firms to adapt to regulatory change and turn environmental responsibility into a potential source of competitiveness. Sustainable development requires shared responsibility from businesses, governments, and society to balance present and future resource needs, addressing environmental and social challenges alike and underscoring the need for interdisciplinary research to guide the green economy's evolution (Zhironkin & Cehlár, 2022).

For Romania, however, this alignment with EU sustainability goals is proving more difficult in practice. The private sector, particularly small and medium-sized enterprises, plays a central role in this transformation but struggles with significantly higher implementation costs compared to firms in more advanced economies. These costs—linked to technological modernization, energy efficiency measures, and compliance with environmental regulations—inevitably lead to higher prices for consumers, reducing both the competitiveness of Romanian firms and their domestic client base. On the internal market, already affected by declining purchasing power, the shift toward higher-priced green products and services narrows the pool of potential customers. This economic reality discourages companies from fully embracing sustainability, especially when short-term profitability remains a priority. Maniu, Costache, and Dumitrașcu (2021) also highlight that most Romanian SMEs adopt environmental practices in an informal and fragmented way, driven more by managerial initiative than by long-term strategic planning. Individual commitment to sustainability is visible, but organizational and financial constraints hinder consistency. This situation reflects a broader paradox described by Statista (2024) across Central and Eastern Europe, where the green transition is often perceived as externally imposed by EU regulations, rather than an internally motivated necessity. The result is a partial and reactive adaptation, rather than a proactive transformation of business models. In Romania, as in many other countries, the COVID-19 pandemic accelerated digitalization to some extent; however, the absence of adequate digital infrastructure and institutional inertia limited its effectiveness. These shortcomings hindered the proper regulation and implementation of green economy principles and policies, as reflected in the evident lack of integrated digital platforms for managing waste, green spaces, and forests—an issue frequently noted by both practitioners and scholars in the field (Mihai et al., 2021).

From a sectoral perspective, Romania's renewable energy industry provides insight into the opportunities and vulnerabilities of emerging green business models. Nichifor (2015) notes that wind and solar energy companies have developed hybrid approaches combining energy trading and production flexibility. These firms remain highly sensitive to legislative instability and regulatory uncertainty, which continue to discourage long-term investment in sectors requiring high upfront capital. This instability amplifies the structural gap between Romania and Western European economies, where clearer long-term frameworks support investor confidence. At the

same time, Galli et al. (2023) point out that unsustainable consumption patterns across the EU—particularly in food systems—remain a major contributor to ecological overshoot, emphasizing the need for systemic change beyond isolated business initiatives. In Romania, these consumption patterns are further influenced by the legacy of the communist era. Decades of scarcity have created, paradoxically, a culture of overconsumption and wastefulness once market freedom was restored. This consumer behavior, still focused on quantity rather than sustainability, discourages companies from fully adopting circular practices. The post-transition economic mentality—often driven by immediate consumption and visible comfort—creates structural resistance to the principles of reduction, reuse, and recycling. Puiu et al. (2025) further underline that energy-saving behavior in Romanian institutions, including academia, depends largely on personal attitudes rather than structural incentives, reflecting a persistent gap between national policy objectives and day-to-day organizational realities. This behavioral dimension reinforces the idea that Romania's green transition requires more than legislation—it needs a deeper cultural and institutional shift.

Despite these challenges, there are also visible areas of progress that could become strategic advantages. One of Romania's strongest sectors in the green transformation is tourism**,** particularly ecotourism and authentic rural tourism. These niches have gained international recognition and attract a growing number of visitors each year. However, achieving genuine "green tourism" involves more than developing environmentally friendly destinations—it also requires sustainable transport infrastructure**,** green accommodation standards, and supply chains based on local and eco-certified products. In other words, the success of these initiatives depends on how well the entire tourism ecosystem integrates sustainability principles, from production and logistics to visitor experience.

Overall, the literature suggests that Romania's green transition is progressing slowly and unevenly. The country faces structural and behavioral constraints that make adaptation more costly and less appealing for both businesses and consumers. The gap between Romania and more developed EU economies is already visible and could widen unless viable, context-specific solutions are found. For Romania to remain competitive, it must focus on accessible financing instruments, policy coherence, and better coordination between the public and private sectors**,** while leveraging its existing strengths—such as ecotourism—to demonstrate that sustainability can indeed generate long-term value.

3. Methodological Approaches

This study employs a descriptive statistical analysis based on secondary data from Eurostat and Statista (2024–2025). The dataset includes indicators that describe both the business perspective (green entrepreneurship and waste sector dynamics) and the consumer perspective (attitudes and barriers toward sustainable products). The business-related indicators comprise i)

the share of SMEs offering green products or services in Central and Eastern Europe (CEE); ii) the number of enterprises in the waste collection sector in Romania, and iii) comparative data on the waste management sector within the EU. The consumer-related indicators include: i) the importance attributed by Romanian respondents to sustainable production and materials; and ii) the main barriers to purchasing sustainable products. The selected indicators were chosen for their relevance in capturing both business and consumer dimensions of Romania's green transition. They reflect key aspects of sustainable entrepreneurship, waste management dynamics, and consumer attitudes toward eco-friendly products—areas identified as critical by the European Green Deal and related EU statistical frameworks. The analysis follows a comparative and trend-based approach, examining Romania's performance over time and against other Central and Eastern European countries to identify progress patterns and structural gaps in adopting circular economy principles.

4. Research Results

The process of transition toward a greener economy in Romania can be best understood by examining how businesses internalize sustainability principles in their operations. Data from Ipsos and the European Commission (2024) revealed that only 16% of Romanian SMEs reported offering green products or services in 2024. This figure is among the lowest in Central and Eastern Europe (CEE), where Slovakia (36%), Slovenia (35%), and Poland (34%) lead the regional rankings. The modest share observed in Romania reflects both structural and institutional barriers to sustainable entrepreneurship, such as limited access to green finance, insufficient market incentives, and relatively low consumer demand for eco-labeled products.

Romania's position contrasts with that of neighboring CEE states that have progressively implemented supportive public policies, including tax reductions for green technologies, targeted state aid, and public-private partnerships promoting circular economy models (Statista, 2024). The data thus suggest that Romania's private sector, while aware of environmental trends, still perceives sustainability primarily as a regulatory requirement rather than a strategic source of competitive advantage. This interpretation aligns with earlier studies emphasizing that Romanian SMEs often adopt sustainability practices informally and sporadically, driven more by managerial attitudes than by institutionalized policies (Maniu, Costache, & Dumitrașcu, 2021).

Table 1. Key Statistical Indicators on Green Business and Consumer Behavior in Romania (2021–2024)

Indicator	Year(s)	Romania	Comparative Benchmark/Regional Context	Source

Share of SMEs offering green products or services (% of total SMEs)	2024	16%	Slovakia–36%; Slovenia–35%; Poland–34%; Czechia–23%; Bulgaria–22%; Hungary–16%	Ipsos and European Commission (2024)
Number of enterprises in the waste collection industry (in 1,000s)	2021	1.11	EU average – 2.9 (approx.)	Barostat (2025)
	2022	1.13		
	2023	1.14		
Number of enterprises in the EU waste collection sector	2023	Romania–1,140	Germany – ~5,800; Italy – ~5,500; France – ~4,900; Poland – ~3,700	Barostat (2025)
Consumer perception: importance of sustainable materials in production (% respondents "important" or "very important")	2021	82%	Youth sample (aged 16–24), Romania	IZI Data & Romanian Business Leaders (2021)
Consumer perception: importance of sustainable production methods (green energy, reduced water use, low carbon footprint) (% respondents "important" or "very important")	2021	80%	Similar pattern in EU consumer surveys (75%–85%)	IZI Data & Romanian Business Leaders (2021)
Main barriers to purchasing sustainable products (% of respondents, 2024)	2024	Higher product price–48%		MKOR Consulting (2024)
		Lack of trust in eco-label authenticity–44%		
		Reduced availability of eco-alternatives in stores–29%		
		Lack of information about product impact and origin–23%		
General trends in Romanian waste collection enterprises (2021–2023)	–	+2.7% growth	Gradual increase in line with the EU circular economy targets	Barostat (2025)

Further evidence comes from Eurostat (2025), which documents the slow but steady expansion of the waste collection sector, one of the key pillars of the circular economy. Between

2021 and 2023, the number of enterprises in this industry grew from 1,110 to 1,140, representing an increase of approximately 2.7%**.** Although modest in absolute terms, this growth demonstrates an incremental process of sectoral adjustment to EU environmental directives. Nevertheless, when compared to Western European countries such as Germany or Italy, where thousands of firms operate in the waste collection and recycling sectors, the Romanian market remains underdeveloped in both scale and diversification (Eurostat, 2025).

The limited number of enterprises and their concentration in major urban areas indicate that the transition to circular business models is still in its infancy. The sector's growth potential is constrained by the lack of an integrated waste management infrastructure, inconsistent enforcement of environmental legislation, and weak coordination between public authorities and local entrepreneurs. At the same time, some positive signals can be observed in the increasing participation of start-ups and social enterprises in waste recovery, textile recycling, and energy valorization initiatives—fields that reflect the gradual diffusion of green innovation across the Romanian economy.

Overall, the business data illustrate a dual pattern. On the one hand, regulatory pressure and access to EU structural funds have stimulated awareness and incremental change; on the other hand, the structural transformation of business models remains incomplete. For most Romanian SMEs, sustainability still represents an *additional cost* rather than an *investment in resilience*. This suggests that policy interventions should move beyond compliance-oriented incentives toward mechanisms that link sustainability to productivity gains, export competitiveness, and long-term profitability.

From the consumer perspective, the transition toward green consumption in Romania is marked by a pronounced discrepancy between environmental awareness and behavioral change. According to IZI Data and Romanian Business Leaders (2021), over 80% of respondents consider the use of sustainable materials (such as recycled plastics or glass) and eco-friendly production methods (such as low-emission energy and reduced water consumption) as *important* or *very important*. These results suggest a strong normative commitment to sustainability among Romanian consumers, particularly among the younger demographics (16–24 years old). However, when analyzing purchasing behavior, MKOR Consulting (2024) identified a persistent set of barriers limiting the adoption of sustainable consumption habits. The survey highlights that 48% of respondents cite higher prices as the main obstacle, followed by lack of trust in eco-label authenticity (44%)**,** limited availability of green products (29%)**,** and insufficient information about environmental impact (23%). These findings underscore that economic and informational constraints play a decisive role in shaping consumer behavior.

The price barrier remains the most significant constraint. Given Romania's median disposable income level, sustainable products are often perceived as luxury goods, accessible

primarily to urban middle-class consumers. Consequently, the market for eco-friendly alternatives remains niche and price-sensitive. This finding supports previous research across CEE countries, which shows that consumers in emerging economies prioritize affordability and convenience over ecological impact, particularly during periods of inflation or economic uncertainty (Statista, 2024).

The trust barrier also has deep roots. Repeated cases of misleading environmental claims—so-called *greenwashing*—have eroded consumer confidence in corporate sustainability messages. As MKOR Consulting (2024) shows, nearly half of the surveyed respondents doubt the credibility of eco-labels and sustainability certifications. The absence of a unified national framework for environmental labeling in Romania further intensifies this skepticism. Another challenge concerns product accessibility. Despite growing awareness, sustainable alternatives are often unavailable in rural or small-urban retail environments, which limits the diffusion of green consumption practices nationwide. The information barrier—reported by 23% of respondents—suggests that public communication about the environmental impact of products remains fragmented and largely confined to online channels targeting specific consumer groups. The coexistence of these barriers results in a well-known attitude–behavior gap, a phenomenon widely documented in sustainability research. Romanian consumers recognize the importance of environmental protection, yet their actions lag behind their values due to systemic market limitations. This behavioral inertia mirrors the cautious approach of Romanian SMEs, suggesting a mutually reinforcing dynamic: limited green supply discourages green demand, and vice versa.

The analysis of both business and consumer data reveals that Romania's transition to a green economy is gradual, uneven, and largely driven by EU regulatory pressure rather than internal demand. Although Romania has aligned its legislation with European environmental standards, the integration of sustainability into daily business operations and consumption habits remains partial. Institutionally, the framework supporting the green transition is still fragile. Programs such as the National Recovery and Resilience Plan (PNRR) include sustainability targets, yet implementation is often slowed by bureaucracy and limited coordination between public and private actors. Consequently, many companies perceive sustainability as an obligation that increases operational costs rather than a competitive advantage. The market itself reflects a mismatch between supply and demand. Firms hesitate to invest in green technologies without sufficient consumer demand, while consumers expect affordable, credible eco-products that are still scarce. Addressing this gap requires clearer incentives—such as tax deductions and transparent eco-labeling—as well as education and communication campaigns to build trust and awareness. Romania's young workforce and regional cooperation with other Central and Eastern European countries offer opportunities for faster progress. However, sustainability must evolve from a compliance exercise into a national development strategy that connects competitiveness, innovation, and responsible consumption.

5. Conclusions

This study explored the dual dynamics of Romania's shift toward a greener economy from both the entrepreneurial and consumer perspectives. The findings indicate that, while awareness of sustainability principles is steadily increasing, structural transformation within Romanian businesses and consumption patterns remains limited. SMEs continue to perceive sustainability as a regulatory obligation rather than a source of innovation and competitiveness, while consumers—although environmentally conscious—are still constrained by affordability, lack of trust, and limited access to green products. The gradual expansion of the waste collection sector and the growing discourse on sustainability signal the early stages of a systemic transition but also reveal the country's lag behind its more advanced Central and Eastern European peers.

The research, however, is not without limitations. It relies primarily on secondary statistical data from Eurostat and Statista, which, while reliable, provide aggregated quantitative indicators and do not capture qualitative dimensions such as entrepreneurial motivations, institutional barriers, or consumer perceptions beyond self-reported behavior. Moreover, the short time frame (2021–2024) restricts the ability to assess long-term structural changes and policy impacts. Therefore, future studies should adopt mixed-method approaches, integrating survey-based evidence, case studies, and econometric modeling to deepen the understanding of the relationship between regulatory frameworks, green finance access, and firm-level adaptation.

Acknowledgment:

This scientific paper was presented during the sustainability period of the project with the title: "Support Center for IEM research projects-competitive innovation in Horizon 2020", ID 107540. The project was co-financed by the European Regional Development Fund through the Competitiveness Operational Program 2014-2020.

References:

Barostat. (2025). *Number of enterprises in the waste collection industry in Romania from 2021 to 2023.* Retrieved from https://www.statista.com/

Barostat. (2025). *Number of enterprises in the waste collection sector in the European Union (EU-27) in 2022 and 2023, by country.* Retrieved from https://www.statista.com/

Galli, A., Antonelli, M., Wambersie, L., Bach-Faig, A., Bartolini, F., Caro, D., ... & Wackernagel, M. (2023). *EU-27 ecological footprint was primarily driven by food consumption and exceeded regional biocapacity from 2004 to 2014.Nature Food, 4*(9), 810–822. https://doi.org/10.1038/s43016-023-00843-5

Ipsos and European Commission. (2024). *Share of SMEs offering green products or services in Central and Eastern Europe in 2024, by country.* Statista.

IZI Data & Romanian Business Leaders. (2021). *In your opinion, how important are the following actions?* Statista.

Li, W., & Wu, D. (2024). *Sustainability through business model innovation and climate finance in developing countries.Humanities and Social Sciences Communications, 12*(66). https://doi.org/10.1057/s41599-024-04297-3

Maniu, I., Costache, C., & Dumitrașcu, D.-D. (2021). *Adoption of green environmental practices in small and medium-sized enterprises: Entrepreneur and business policies patterns in Romania. Sustainability, 13*(9), 4968. https://doi.org/10.3390/su13094968

Mihai, F., Aleca, O. E., Gogu, E., Dobrin, C., & Gheorghe, M. (2021). The challenges of the green economy in Romania: Scientific literature review. Sustainability, 13(23), 13113.

Mikhno, I., Koval, V., Shvets, G., Garmatiuk, O., & Tamošiūnienė, R. (2021). Green economy in sustainable development and improvement of resource efficiency.

MKOR Consulting. (2024). *Sustainable product barriers for Romanian consumers in 2024.* Statista.

Nichifor, M. A. (2015). *Sustainable business models for wind and solar energy in Romania. Management & Marketing. Challenges for the Knowledge Society, 10*(1), 52–60. https://doi.org/10.1515/mmcks-2015-0004

Puiu, S., Yilmaz, S. E., Udriștioiu, M. T., Raganova, J., Raykova, Z., Yildizhan, H., & Ameen, A. (2025). *The expanded theory of planned behavior for energy saving among academics in Romania, Bulgaria, Turkey, and Slovakia. Scientific Reports, 15*(2772). https://doi.org/10.1038/s41598-025-86795-1

Simionescu, M., & Gavurová, B. (2023). *Pollution, income inequality and green finance in the new EU Mmember Sstates. Humanities and Social Sciences Communications, 10*(677). https://doi.org/10.1057/s41599-023-02197-6

Statista. (2024). *The green transition in Central and Eastern Europe.* Statista Research Department.

Zhang, L., Xu, M., Chen, H., Li, Y., & Chen, S. (2022). Globalization, green economy and environmental challenges: State of the art review for practical implications. Frontiers in Environmental Science, 10, 870271.

Zhironkin, S., & Cehlár, M. (2022). Green economy and sustainable development: The outlook. Energies, 15(3), 1167.

Claudia Gabriela BAICU[23]

SOME CONSIDERATIONS ON CLIMATE CHANGE AND INTERNATIONAL TRADE

***Abstract**: Climate change has led to the adoption of climate policies to combat its negative effects. Against this background, this work aims to highlight some implications of climate change and climate policies on international trade. The study results reveal that these implications include development of global trade in environmental goods, reconfiguration of international trade flows, and restructuring of global supply chains in order to align with the Environmental, Social and Governance requirements. At the same time, proliferation of government subsidies with environmental objectives, besides their beneficial effects, may distort international trade flows, contributing to the escalation of international trade tensions. In addition, climate change affects the resilience of global supply chains, with negative consequences on supply, which can imply changes in their configuration. It's also worth noting that climate change influences the trade regulations established both at the multilateral level within the World Trade Organization and at the regional level.*

***Keywords**: climate change; climate policies; global trade in environmental goods; international trade regulations, World Trade Organization*

***JEL:** F10, F13, F18, Q56*

1. Introduction

Climate change weigh on the volume of international trade. It is expected that, compared to the baseline scenario where there are no climate damages, both global exports and global imports will decrease by 1.8% and 1.6% respectively by 2060. Regionally, the impact of climate change will be most acutely felt by countries in Africa and Asia. Trade flows will also suffer from a sectoral perspective, with agriculture and food products being among the most affected (Dellink et al., 2017).

Under these conditions, international trade in environmental goods began to develop. There is no unique definition of environmental goods but according to widely accepted perception, they are considered to be goods that have a positive impact on the environment. For illustration, below are some of the most relevant definitions in the literature:

[23] *Dr. Claudia Gabriela Baicu, Institute for World Economy, Romanian Academy: baicuclaudia70@yahoo.ro.*

- "The environmental goods and services industry consists of activities which produce goods and services to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems.

This includes cleaner technologies, products and services that reduce environmental risk and minimise pollution and resource use" (OECD/Eurostat, 1999, p. 9).

- "Green goods, also called environmental goods, refer to products that are thought to be more environmentally friendly. They are designed to be more energy-efficient, use fewer resources, and emit less pollution than their traditional counterparts. Examples include solar panels, wind turbines, electric cars, and water filtration systems" (UNCTAD, 2023a, p. 1).
- Environmental goods have the main function "to address or contribute to solving an environmental issue or challenge" (Brenton, Chemutai, 2021, p. 55).
- Environmental goods include "environmental technologies" - "specific technologies that are used solely for the purpose of solving environmental problems" and "environmentally preferable products (EPPs)" that "have climate benefits relative to substitute goods in production, end-use, or disposal, e.g. green hydrogen" (ECORYS, 2023, p. 18).

Starting from these considerations, the purpose of this work is to highlight some changes that climate change brings to world trade in goods and trade regulations.

2. State of the Problem

Trade in environmental goods reached $ 1.9 trillion in 2022 (UNCTAD, 2023b). Although there is a consensus regarding the general understanding of green goods, the lists with these products developed in different international frameworks – such as the World Trade Organization (WTO), the Organization for Economic Co-operation and Development (OECD), the Asia-Pacific Economic Cooperation (APEC) - are not harmonized (UNCTAD, 2023a). This issue highlights the need for cooperation among different international organizations since the lack of comparability of data regarding trade in environmental products and services can constitute an obstacle in trade negotiations (WTO, 2022a). A key issue for increasing the contribution of trade to the transition to a low-carbon economy is reducing import tariffs on green goods (WTO, 2022a). Moreover, this issue is becoming even more pressing under the impact of the new tariff policy promoted by the Trump administration since the beginning of the year including a 10% tariff on all countries (The White House, 2025) and the possible retaliatory measures of other countries.

3. Methodology

In order to achieve our purpose we used secondary data provided by previous research. From this point of view, the reports and documents published by the WTO are of particular relevance. Other contributions, including those of the United Nations Conference on Trade and

Development (UNCTAD), United Nations Environment Programme (UNEP), the OECD, the World Bank, and the International Monetary Fund (IMF), are also significant.

The remainder of this work is organized as follows. First of all, we provided an overview of possible influences of climate change on global supply chains. Secondly, some effects of green subsidies on international trade flows are analyzed. Thirdly, the impact of climate change on trade regulations is considered both at the multilateral and regional levels, with focus on the most relevant initiatives of the WTO in the area.

4. Research Results

4.1. Restructuring global supply chains

The increasing integration of ESG (Environmental, Social, Governance) considerations into companies' business models is likely to lead to a shift towards suppliers of sustainable products (DMCC, 2024). From this point of view, the European Union (EU) Carbon Border Adjustment Mechanism (CBAM) is relevant. This instrument, which began to be applied only in the transitional phase from 2023, aims to establish a "fair price" for greenhouse gas (GHG) emissions generated in the production of some goods imported into the EU (European Commission, 2023a). It is worth noting that according to the European Green Deal, the EU has set the goal of achieving climate neutrality by 2050 (European Commission, 2019). The CBAM will be fully in force from 2026 and, initially, will target a limited number of products including iron, steel, aluminum, cement, and hydrogen (European Commission, 2023b). Such measures, however, can have adverse effects. In addition to increasing administrative costs, they can generate trade tensions. Furthermore, they can lead to a reconfiguration of trade flows, with companies being encouraged to relocate their production to their home country to avoid imports (Kyriakopoulou et al., 2023). Moreover, in order to avoid markets with stringent regulations, exporters can direct their products towards more permissive countries, with negative impact at the global level (Cadarso et al., 2025). On the other hand, under the impact of regulations such as those concerning "deforestation-free products", companies are increasingly required to monitor the negative environmental impact produced within their supply chains (WTO, 2023). Illustratively, the entities subject to the EU Corporate Sustainability Reporting Directive (CSRD) are required to report on social and environmental impacts through their supply chains (Haddad et al., 2024).

Besides, these regulations can have effects on companies that cannot comply with the requirements, even leading to their exclusion from global supply chains, with small and medium-sized enterprises in developing countries being the most exposed to this risk (Haddad et al., 2024). As a result, some measures have been taken to promote the inclusion of these countries in international trade. Thus, in 2023, the World Economic Forum, the WTO, and the World Bank

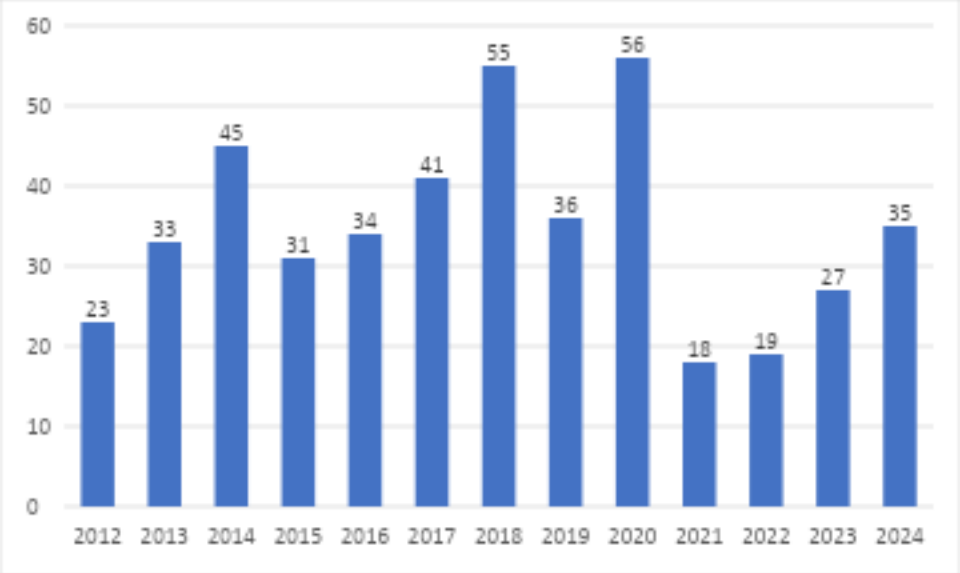
Group launched the Action on Climate and Trade initiative aimed at supporting trade flows while also achieving the climate objectives of developing economies (World Economic Forum, 2023). Furthermore, climate change can also affect the resilience of supply chains, increasing their vulnerability to extreme weather events, which implies rising costs associated with international trade (UNEP, WTO, 2009). Therefore, the need to strengthen their resilience against climate risks can contribute to supply chain restructuring (DMCC, 2024).

4.2. Green subsidies

Since the global financial crisis of 2008, subsidies have proliferated, primarily, promoted by the major economies of the world that have the necessary financial capacity (including the EU, China, and the USA) (World Bank, 2023). Many of these subsidies "have legitimate economic and social goals" including the development of environmentally friendly goods (Signoret, 2023). In their turn, environmental subsidies can have various objectives including stimulating innovation in environmental technologies and increasing production of renewable energy (WTO, 2023). Data from the World Bank's Green Subsidies Database indicate that subsidies with environmental goals increased from 359 in 2018 to 403 in 2022. Most subsidies in 2022 were directed towards environmental preservation (133 subsidies) and clean energy (105 subsidies) (Signoret, Cieszkowsky, 2024). These results are in line with the WTO (2024a), which reveal that, during the period from mid-October 2023 and mid-May 2024, subsidies in areas related to climate change have risen rapidly.

However, subsidies can have negative effects on trading partners, by distorting trade flows, causing tensions, and leading to countermeasures (Signoret, 2023; World Bank, 2023). Therefore, initiations of countervailing investigations in the period 2012–2020 followed an predominant upward trend that peaked in 2020 (56 investigations). After a considerable decrease in 2021 (18 investigations), investigations have resumed the upward trend (Figure 1).

Figure 1. Number of initiations of countervailing investigations, 2012-2024



Note: Data for 2024 cover January to June.

Source: WTO (2024b).

On the other hand, many subsidies have negative effects on the environment (IMF et al., 2022). According to the estimates made by the International Energy Agency, in 2022, global fossil fuel consumption subsidies reached a record level of USD 1 trillion (IEA, 2023). As a result, addressing environmental challenges involves a better understanding of subsidies and increasing international cooperation (IMF et al., 2022).

4.3. Climate change and international trade regulations

Climate change and sustainable development have also influenced trade regulations established both at the multilateral level, within the WTO, and at the regional level, within trade agreements.

In recent years, the challenges related to climate change have gained increasing importance on the WTO agenda. When the multilateral trading system was established, they were not as pressing as they are today (UNCTAD, 2021). However, the Preamble to the Marrakesh Agreement Establishing the WTO recognizes that trade flows must align with actions to protect the environment and sustainable development (Weder et al., 2020). Furthermore, with the establishment of the WTO, the Committee on Trade and Environment (CTE) was also created (Weder et al., 2020) to explore "the synergies between trade and environmental protection" (Paugam, 2024).

Later, negotiations to facilitate trade in environmental goods and services have been launched, as follows: in 2001, the multilateral negotiations to reduce/eliminate barriers on

environmental goods and services and, in 2014, the negotiations of a plurilateral Environmental Goods Agreement (WTO, 2022a).

Subsequently, the activity concerning trade and environmental sustainability within the WTO intensified. In 2020, the Trade and Environmental Sustainability Structured Discussions (TESSD), which has 76 co-sponsors covering over 85% of global trade, was launched (WTO, 2024c).

Fisheries subsidies can have negative effects on the ecosystem and marine resources (WTO, 2023), representing one of the causes of the global fish stocks crisis (UNEP, 2008). It is estimated that, globally, fisheries subsidies reach impressive amounts that range from USD 14 billion to USD 54 billion per year (WTO, n.d.). As a result, the approach of fisheries subsidies represents a field of great interest for the WTO. In this regard, the 12th Ministerial Conference (MC12) of the WTO, which took place in Geneva in June 2022, is particularly significant as it led to the conclusion of a multilateral agreement on harmful fisheries subsidies. It should be noted that the Agreement on Fisheries Subsidies "is the first WTO agreement to place environmental sustainability at its core" (WTO, n.d.).

The WTO has also achieved some accomplishments regarding trade regulations related to the environment during the 13th Ministerial Conference (MC13). The ministerial statement regarding plastics pollution (Ministerial Statement on Plastic Pollution and Environmentally Sustainable Plastics Trade), adopted at the CM13 in 2024, includes several actions aimed at reducing trade in harmful plastics (WTO, 2024d; WTO, 2024e). It is worth mentioning that the WTO actions related to plastic pollution include the launch of the Plastics Pollution Dialogue in 2020 (WTO, 2024e). On the other hand, the Ministerial Statement on Fossil Fuel Subsidies also adopted at the CM13 highlights some actions "to achieve the rationalisation, phase out or elimination of harmful fossil fuel subsidies" (WTO, 2024f, p. 2).

Table 1 synthetically illustrates the most important WTO initiatives that address climate change and environmental protection.

Table 1. Relevant WTO initiatives on trade, climate change and environment

Year	Initiative
1995	The establishment of the Committee on Trade and Environment (CTE). (1)
2001	The launch of multilateral negotiations on environmental goods and services. (2)
2014	The launch of the negociations of the Environmental Goods Agreement (EGA). (2)
2020	The launch of the Trade and Environmental Sustainability Structured Discussions (TESSD). (3)
2020	The launch of the Plastics Pollution Dialogue. (4)
2022	The conclusion of the Agreement on Fisheries Subsidies. (5)
2024	The adoption of the Ministerial Statement on Plastic Pollution and Environmentally Sustainable Plastics Trade. (6)

2024	The adoption of the Ministerial Statement on Fossil Fuel Subsidies. (7)

Source: author's elaboration based on (1) Weder et al., 2020; (2) WTO, 2022a; (3) WTO, 2024c; (4) WTO, 2024e; (5) WTO, n.d.; (6) WTO, 2024d; (7) WTO, 2024f.

The challenges related to climate change and environmental protection are also reflected in the provisions of trade agreements. It is noteworthy that environmental norms are used especially in regional trade agreements (RTAs) concluded between developed and developing countries (UNCTAD, 2023a). 97% of RTAs notified to the WTO contain at least one environmental provision. Furthermore, both the number of these provisions and their level of detail have increased in the most recent RTAs. On the other hand, 18% of RTAs have at least one climate change provision (WTO, 2022b). It should be noted that trade agreements began to include "specific" provisions related to the liberalization of trade in environmental goods around the year 2005 (ECORYS, 2023).

In this context, the conclusion, in 2024, of the negotiations regarding the Agreement on Climate Change, Trade and Sustainability (ACCTS) by New Zealand, Switzerland, Norway, Costa Rica and Iceland is relevant. According to the National Board of Trade Sweden, the ACCTS is "the first trade agreement that seriously addresses climate issues". Among other things, this agreement eliminates tariffs on over 300 environmental goods and establishes a framework for harmful fossil fuel subsidies (National Board of Trade Sweden, 2024).

5. Conclusions

Climate change and the necessity of protecting the environment are important factors in reshaping international trade flows and in developing trade regulations.

Under these conditions, it is anticipated that the climate policies adopted by various countries and extreme weather events will contribute to the restructuring of global supply chains. From this perspective, the mechanisms adopted at the EU level, including the CBAM, are relevant for their positive impact that is expected to have on the environment. However, promoting sustainable suppliers within global supply chains is not without costs and risks that can affect companies' competitiveness. On the other hand, to have the expected effect, such policies should be adopted at a global level. In addition, companies that cannot align with ESG requirements may be excluded from global supply chains. At the same time, extreme weather events affect the resilience of global value chains, disrupting supply, which may also lead to a reconsideration of external suppliers.

In recent years, government subsidies with environmental objectives have proliferated. Even though they encourage local production of green goods, they can distort international trade flows and exacerbate international tensions. On the other hand, global subsidies for fossil fuel

consumption are still relevant. All of these will likely affect the multilateral trading system centered around the WTO, which is already undergoing a profound crisis, exacerbated by the COVID-19 pandemic, the war in Ukraine, and recently, by the protectionist policies promoted by the USA.

Climate change and environmental issues are also reflected in trade regulations designed both at the WTO level and RTA level. It should be mentioned that the actions of the WTO in this direction have intensified since 2020, in line with the strengthening of the international agenda regarding climate change. The WTO results include addressing harmful fishing subsidies and combating plastic pollution.

Acknowledgment

This paper is based on a part of the author's contribution to the study "Reflecting the reshaping of climate change policies on international trade in goods and services", coordinated by Dr. Claudia Gabriela Baicu and Dr. Georgeta Ilie, the Romanian Academy, the National Institute of Economic Research "Costin C. Kiritescu", the Institute for World Economy, Bucharest 2024.

References

Brenton, P., Chemutai, V. (2021). The Trade and Climate Change Nexus: The Urgency and Opportunities for Developing Countries. Washington, DC: World Bank. doi:10.1596/978-1-4648-1770-0.

Cadarso, M. Á., García-Alaminos, Á., Curran, L., Joltreau, T. (2025). Global trade is fracturing: here's why the EU needs the Green Deal more than ever. The Conversation, 6 February. Available at: https://theconversation.com/global-trade-is-fracturing-heres-why-the-eu-needs-the-green-deal-more-than-ever-247500 [Accessed 3 June 2025].

Dellink, R., Hwang, H., Lazi, E., Chateau, J. (2017). International trade consequences of climate change. OECD Trade and Environment Working Papers, No. 2017/01, OECD Publishing, Paris. Available at: https://www.oecd-ilibrary.org/docserver/9f446180-en.pdf?expires=1727952009&id=id&accname=guest&checksum=DCE1CA8F9FE1B52E74E95BBC354C97F7 [Accessed 26 May 2025].

DMCC. (2024). The Future of Trade 2024: Decoupled and Reconfigured, DMCC.

ECORYS. (2023). Trade in Environmental Goods and Services, Final Report, Ministry of Foreign Affairs, Rotterdam, 3 March 2023.

European Commission. (2023a). Carbon border adjustment mechanism - Information for importers of iron & steel. Publications Office of the European Union. https://data.europa.eu/doi/10.2778/544161.

European Commission. (2023b). Carbon Border Adjustment Mechanism (CBAM). – News, 17 October. Available at: https://trade.ec.europa.eu/access-to-markets/en/news/carbon-border-adjustment-mechanism-cbam [Accessed 5 June 2025].

European Commission. (2019). Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions - The European Green Deal, COM(2019) 640 final, Brussels, 11.12.2019.

Haddad, M., Hansl, B., Pechevy, A. (2024). Trading in a new climate: How mitigation policies are reshaping global trade dynamics. - World Bank Blogs, 13 February. Available at: https://blogs.worldbank.org/en/developmenttalk/trading-new-climate-how-mitigation-policies-are-reshaping-global-trade-dynamics [Accessed 2 June 2025].

International Energy Agency (IEA). (2023). Fossil Fuels Consumption Subsidies 2022, IEA, Paris. Available at: https://www.iea.org/reports/fossil-fuels-consumption-subsidies-2022 [Accessed 3 June 2025].

International Monetary Fund (IMF), Organisation for Economic Co-operation and Development (OECD), World Bank, and World Trade Organization (WTO). (2022). Subsidies, Trade, and International Cooperation. Available at: https://www.wto.org/english/res_e/booksp_e/repintcoosub22_e.pdf [Accessed 26 May 2025].

Kyriakopoulou, D., Kyriacou, G., Pearson, N. (2023). How do climate policy and carbon border adjustments affect international trade? - Explainers, 12 June, The London School of Economics and Political Science. Available at: https://www.lse.ac.uk/granthaminstitute/explainers/how-do-climate-policy-and-carbon-border-adjustments-affect-international-trade/#:~:text=It%20is%20important%20to%20understand%20how%20climate%20policy [Accessed 4 June 2025].

National Board of Trade Sweden. (2024). New trade agreement for climate change leaves door open for countries to join. – News, 5 July. Available at: https://www.kommerskollegium.se/en/about-us/news/2024/new-trade-agreement-for-climate-change-leaves-door-open-for-more-countries-to-join/ [Accessed 29 May 2025].

OECD/Eurostat. (1999). The Environmental Goods & Services Industry: Manual for Data Collection and Analysis, OECD Publishing, Paris, https://doi.org/10.1787/9789264173651-en.

Paugam, J.-M. (2024). WTO at a “crossroads” in addressing trade and climate nexus. Speech by the WTO's Deputy Director-General Jean-Marie Paugam at the Trade Horizons Conference in Dublin, 4 July. Available at: https://www.wto.org/english/news_e/news24_e/ddgjp_04jul24_e.htm [Accessed 5 June 2025].

Signoret, J., Cieszkowsky, M. (2024). To tackle climate change, governments increasingly turn to green subsidies. - World Bank Blogs, 4 June. Available at: https://blogs.worldbank.org/en/trade/to-tackle-climate-change--governments-increasingly-turn-to-green#:~:text=Given%20the%20global%20concern%20about%20the [Accessed 4 June 2025].

Signoret, J. (2023). Global trade tensions fueled by rising government subsidies risk undermining efforts to fight poverty. - World Bank Blogs, 9 August. Available at: https://blogs.worldbank.org/en/trade/global-trade-tensions-fueled-rising-government-subsidies-risk-undermining-efforts-fight [Accessed 4 June 2025].

United Nations Conference on Trade and Development (UNCTAD). (2023a). Key Statistics and Trends in Trade Policy 2022. United Nations. Available at: https://unctad.org/system/files/official-document/ditctab2023d2_en.pdf [Accessed 3 June 2025].

UNCTAD. (2023b). Global Trade Update, March 2023. United Nations. Available at: https://unctad.org/system/files/official-document/ditcinf2023d1_en.pdf [Accessed 27 May 2025].

United Nations Conference on Trade and Development (UNCTAD). (2021). A European Union Carbon Border Adjustment Mechanism: Implications for developing countries. Available at: https://unctad.org/system/files/official-document/osginf2021d2_en.pdf [Accessed 3 June 2025].

United Nations Environment Programme (UNEP), World Trade Organization (WTO). (2009). Trade and Climate Change. Available at: https://www.wto.org/english/res_e/booksp_e/trade_climate_change_e.pdf [Accessed 27 May 2025].

UNEP. (2008). Fisheries Subsidies: A Critical Issue for Trade and Sustainable Development at the WTO. An Introductory Guide. Available at: https://stg-

wedocs.unep.org/bitstream/handle/20.500.11822/23020/Fisheries_Subsidies_Intro.pdf?sequence=1 [Accessed 3 June 2025].

Weder, G., Whittaker, J., Naas, P., Thorn, S. (lead authors). (2020). How Can Trade Rules Support Environmental Action? Briefing Paper, World Economic Forum. Available at: https://www3.weforum.org/docs/WEF_GFC_Briefing_on_Trade_and_Environment_Report_2020.pdf [Accessed 5 June 2025].

The White House (2025). Fact Sheet: President Donald J. Trump Declares National Emergency to Increase our Competitive Edge, Protect our Sovereignty, and Strengthen our National and Economic Security, 2 April. Available at: https://www.whitehouse.gov/fact-sheets/2025/04/fact-sheet-president-donald-j-trump-declares-national-emergency-to-increase-our-competitive-edge-protect-our-sovereignty-and-strengthen-our-national-and-economic-security/ [Accessed 26 May 2025].

World Bank. (2023). Unfair Advantage: Distortive Subsidies and Their Effects on Global Trade. Available at: https://thedocs.worldbank.org/en/doc/0534eca53121c137d3766a02320d0310-0430012022/related/Unfair-Advantage-Distortive-Subsidies-and-Their-Effects-on-Global-Trade-2023.pdf [Accessed 29 May 2025].

World Economic Forum. (2023). Action on Climate and Trade – a Developing World Imperative for Climate-Adjusted Trade Flows. - News Release, 19 April, Geneva, Switzerland. Available at: https://www.weforum.org/press/2023/04/action-on-climate-and-trade-a-developing-world-imperative-for-climate-adjusted-trade-flows/ [Accessed 29 May 2025].

World Trade Organization (WTO). (2024a). WTO Trade Monitoring: Latest Trends. The Trade Monitoring Update – 08 July 2024. Available at: https://www.wto.org/english/news_e/news24_e/tmwto_08jul24_e.pdf [Accessed 4 June 2025].

World Trade Organization (WTO). (2024b). Trade Policy Review Body. OVERVIEW OF DEVELOPMENTS IN THE INTERNATIONAL TRADING ENVIRONMENT. ANNUAL REPORT BY THE DIRECTOR-GENERAL (Mid-October 2023 to mid-October 2024), WT/TPR/OV/27, Geneva, 20 November. Available at: https://docs.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=q:/WT/TPR/OV27.pdf&Open=True [Accessed 27 May 2025].

World Trade Organization (WTO). (2024c). Trade and environmental sustainability initiative maps path to concrete outcomes by MC14. – News, 27 February. Available at: https://www.wto.org/english/news_e/news24_e/tessd_27feb24_e.htm [Accessed 3 June 2025].

World Trade Organization (WTO). (2024d). Dialogue on Plastic Pollution and Environmentally Sustainable Plastics Trade (DPP): Ministerial Statement on Plastic Pollution and Environmentally Sustainable Plastics Trade. World Trade Organization, Ministerial Conference Thirteenth Session, Abu Dhabi, 26-29 February 2024. Available at: https://docs.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=q:/WT/MIN24/14.pdf&Open=True [Accessed 5 June 2025].

World Trade Organization. (WTO). (2024e). Ministerial statement at MC13 outlines concrete action to tackle plastics pollution. – News, 27 February. Available at: https://www.wto.org/english/news_e/news24_e/ppesp_27feb24_e.htm [Accessed 2 June 2025].

World Trade Organization (WTO). (2024f). Ministerial Statement on Fossil Fuel Subsidies. World Trade Organization, Ministerial Conference, Thirteenth Session, Abu Dhabi, 26-29 February 2024. Available at: https://docs.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=q:/WT/MIN24/19.pdf&Open=True [Accessed 2 June 2025].

World Trade Organization (WTO). (2023). World Trade Report 2023: Re-globalization for a secure, inclusive and sustainable future. Available at:

https://www.wto.org/english/res_e/booksp_e/wtr23_e/wtr23_e.pdf#:~:text=We%20would%20like%20to%20show%20you [Accessed 30 May 2025].

World Trade Organization (WTO). (2022a). World Trade Report 2022: Climate change and international trade, Geneva: WTO. Available at: https://www.wto.org/english/res_e/booksp_e/wtr22_e/wtr22_e.pdf [Accessed 28 May 2025].

World Trade Organization (WTO). (2022b). Trade and Climate Change - Information Brief No 2. Available at: https://www.wto.org/english/news_e/news21_e/clim_03nov21-2_e.pdf [Accessed 4 June 2025].

World Trade Organization (WTO). (n.d.). MC12 "Geneva package" - in brief. Available at: https://www.wto.org/english/thewto_e/minist_e/mc12_e/geneva_package_e.htm [Accessesed 4 June 2025].

Iulia Monica OEHLER-ŞINCAI, Georgeta ILIE[24]

PERSPECTIVES OF THE STRATEGIC PARTNERSHIP EU-US IN THE CONTEXT OF THE NEW "AMERICA FIRST" PRIORITIES

Abstract

This paper focuses on the consequences of the new protectionist wave of the Trump 2.0 administration for the EU-US relationship, examining three key sectors: energy, trade, and critical minerals. Between January 20 and May 23, many executive orders supporting the America First policy have been adopted. These initiatives have led to opposite paths taken by the US and the EU, the first one terminating the Green New Deal, and the second continuing to prioritize the green transition. For President Trump, an affordable and reliable domestic energy supply is vital to America's national security, economic prosperity, and foreign policy, and this is prioritized taking action against laws and policies purporting to address "climate change" policies, or involving "environmental, social, and governance" initiatives, "environmental justice," carbon or "greenhouse gas" emissions, and funds to collect carbon penalties or carbon taxes. One can remark that these are in antithesis with the EU priorities, goals, and principles under the EU Green Deal. As for China, it was the first target of the global trade war initiated by the US in April 2025 (with collateral victims, including here the Asian Tigers), while the EU was the second major target. The situation changed for the EU on 27 July 2025, when a deal on tariffs and trade was agreed between the US and the EU. As regards critical minerals, one can remark two different paths chosen by the two partners in order to secure access to critical minerals: for the US, it is important to unleash America's offshore critical minerals and resources, while for the EU, it is more important to strengthen partnerships with countries worldwide.

Keywords: *EU; US; environmental objectives; energy; tariff policy; trade policy; critical minerals*

JEL: *F13; F18; O24*

1. Introduction

The strategic partnership between the European Union (EU) and the United States (US) is a complex and dynamic relationship built on a foundation of shared interests and values, but also shaped by the competitive advantages and different priorities of both sides. The strengths of their economies, on which their environmental actions are based, are: (i) for the US - innovation and

[24] *Scientific Researcher II, PhD. Iulia Monica Oehler-Şincai, Scientific Researcher III, PhD. Georgeta Ilie, Institute for World Economy, Romanian Academy: oehler.sincai@gmail.com, georgeta.ilie@iem.ro.*

technology leadership; dominance of the US Dollar; large domestic market; strong capital markets; resilient and diverse economy; productivity; strong higher education system; entrepreneurial culture and business dynamism; extensive natural resources; robust legal framework and property rights; and (ii) for the EU - a functioning single market, stability of the euro; significant research and innovation capacity; well-developed social model and skilled workforce; openness to investment; high standards of regulatory framework; sustainability and circular economy; global trading power; strong industrial base and high-value manufacturing; political stability and rule of law.

In his second term in office as President, Donald Trump continues the policies from his first term (2017-2021), including his "America First" policy, with higher tariffs, subsidies, and fierce competition. His approach is even more insistent, as demonstrated by his executive orders. April 2, 2025, is the date proclaimed by President Trump as "Liberation Day", which he considers the day of the "declaration of economic independence" of the US. The four key stated objectives are: "pursuing reciprocity to rebuild the economy and restore national and economic security; taking back national economic sovereignty; reprioritizing US manufacturing, as increased domestic production is essential to US national security; addressing trade imbalances" (WH, 2025a).

2. State of the Problem

The objective of our study is to assess the potential consequences of the new protectionist wave of the US administration on the EU-US bilateral relationship, taking into account also their environmental goals. Although recent measures and statements by the US administration show that environmental goals have been overshadowed by the desire to solve the US trade deficit and security issues, for the EU, the environmental objectives remain a priority.

3. Methodology Approaches

Given the complexity and the fact that the issue addressed is ongoing, with a high degree of uncertainty, mainly from the US administration with the adoption of new measures regarding US policies with an impact on its external partners, throughout our paper we have used methods based on qualitative analysis of the extensive relevant documents adopted by US Administration and EU institutions, with personal interpretations and opinions. We also used the quantitative analysis, mainly of statistical data published by the US and EU institutions, in order to reflect aspects related to trade and investment relations between the US and the EU, as well as the evolution of the US trade deficit, and eventually to formulate the conclusions of our research.

4. Research Results

4.1. The EU-US economic relationship - A strong strategic partnership, but with various bilateral issues difficult to solve

The EU and the US "have the largest bilateral trade and investment relationship and enjoy the most integrated economic relationship between major players in the world", therefore, strengthening the EU-US bilateral cooperation has been high on the agenda. In terms of overall trade, the two strategic partners maintained the largest bilateral trade and investment relationship in the world, with EUR 1,680 billion worth of goods and services exchanged in 2024 (CEU, 2025). While the EU has a significant trade surplus in trade in goods with the US (more than EUR 157 billion), the second largest after that of China with the US, it records a remarkable trade deficit in services (EUR 109 billion, in 2023) (EP, 2025). The EU and the US have a significant trade relationship in environmental goods and services, with the US being a strong advocate for liberalizing trade in environmental goods (e.g., wind turbines, solar panels, and water treatment filters) to promote green growth and innovation. Both the EU and the US sustained the Environmental Goods Agreement (EGA), initiated in 2014, aiming to eliminate tariffs on these products. In terms of investment relations, the US direct investors accounted for most of the FDI stocks held by the rest of the world in the EU (EUR 2,299 billion, 30.9%). At the end of 2023, the US absorbed 26.6% (EUR 2,437 billion) of the total FDI stocks held by the EU in the rest of the world (Eurostat, 2024).

In 2022, both the EU and the US supported the launch of the Partnership for Global Infrastructure and Investment (PGII), as a joint G7 commitment to stimulate public and private investments in sustainable quality infrastructure. This initiative has the main goal of mobilizing an amount of up to USD 600 billion by 2027 and is often described in the literature as a counterbalance to China's Belt and Road Initiative (BRI) (Zhu, 2022; Yu, 2024). Forming a united front against China and Russia, among others, has become an increasingly common motivation among developed countries for ambitious projects and initiatives.

In spite of various objectives for enhanced cooperation, the relationship between the EU and the US is not without its challenges. Since Donald Trump's 2016 presidency, "the US-centric trade policy has persisted" (Schmucker, 2024). The first evidence in this regard is the failure of the negotiations on a Transatlantic Trade and Investment Partnership (TTIP) between the EU and the US, after 14 rounds of negotiations. The TTIP, launched in 2013 as an ambitious project generating "jobs and growth", was described as a possible "economic NATO", "ready to take on China in the emerging game of geopolitics" (Van Ham, 2016). The conflicting interests of both parties intensified little by little, culminating in the second presidency of Donald Trump.

Previously, under the Biden administration, various bilateral issues have been difficult to solve, for instance: (i) the Global Arrangement on Sustainable Steel and Aluminium (GSA),

negotiated since late 2021, not concluded before the initial deadline of October 2023 (EC, 2021); (ii) negotiations for a Critical Minerals Agreement (CMA), started in 2023, but did not advance as smoothly as intended (EC, 2023). That would have allowed European companies to benefit from green subsidies provided through the Inflation Reduction Act (IRA) of 2022. However, the IRA is not applied anymore (USDE, 2023). The specific measures adopted by the Trump 2.0 administration have shaken the confidence of the Europeans in a fair-trade relationship with the US. At the same time, the US has distanced itself from the EU in the area of sustainable development, as underscored by controversial executive orders (See section 4.2).

The 25% tariff on steel and aluminium imports announced on February 10, 2025, and the additional "reciprocal" 20% tariff announced on April 2, 2025, for almost all imports from the EU, generated various reactions in the EU, including plans of retaliation in the event that the US tariffs were implemented. Based on the report by Mario Draghi, "*The Future of European Competitiveness*", the European Commission in charge for 2025-2029 is prepared for a more evident interventionist approach, helped by both offensive and defensive instruments (EC, 2024). Trump recommended on May 23 a 50% tariff against the EU, effective from June 1, "expressing frustration that trade negotiations with the EU were not moving quickly enough". During a call on May 25, Ursula von der Leyen asked President Trump to delay the tariffs until July 9, the deadline he had originally set when he announced new tariffs in April. The request was accepted, as "Europe is ready to advance talks swiftly and decisively".

There were various calls for action, such as the French proposal to suspend European investments in the US. However, the EU gave up the retaliatory 25% tariffs on US goods, and the US and the EU announced a preliminary trade agreement on July 27, 2025 (EC, 2025a). One of the few concrete actions of the EU was the decision to impose long-awaited fines on the American Big Tech companies Apple and Meta (EC, 2025b). It is worth noting that after Trump threatened to impose a 30% tariff on most imports from the EU from August 1, 2025, in a Statement by President Ursula von der Leyen on EU-U.S. trade was underscored that "the EU has consistently prioritized a negotiated solution with the U.S., reflecting our commitment to dialogue, stability, and a constructive transatlantic partnership" (EC, 2025c).

4.2. The EU-US Trade relationship under the new US tariffs and environmental goals

The Trump 2.0 administration adopted various protectionist measures, and many of those implemented in the First 100 days have been intended to stop green policies. President Trump has initiated 145 actions to undo rules protecting clean air, water, and a livable climate in the administration's first 100 days – more than in the entire first term as US President, all of them mainly through executive orders and agency memos. Many of these initial moves are not complete and face severe legal challenges (Milman, 2025). On his first day back as President, Trump signed

an executive order to withdraw the US from the Paris climate agreement for the second time (President Biden had rejoined in 2021). President Trump does not support the IRA, which Congress passed and President Biden signed into law in 2022, containing at least 119 distinct climate change-related provisions to be implemented by sixteen federal agencies. Climate spending has been frozen, and pollution standards for cars, trucks, and power plants will be rewritten (Guarna and Turner, 2025).

Our analysis takes into account three main sectors, namely energy, trade, and critical minerals. In President Trump's America First priorities (January 20, 2025), "*Make America affordable and energy dominant again*" is one of the four key priorities, together with: "*Make America safe again*", "*Drain the swamp*", and "*Bring back American values*". Considering these priorities, it was declared that: (i) the President will unleash American energy by ending Biden's policies of climate extremism, streamlining permitting, and reviewing for rescission all regulations that impose undue burdens on energy production and use, including mining and processing of non-fuel minerals; (ii) President Trump's energy actions empower consumer choice; (iii) President Trump will declare an energy emergency and use all necessary resources to build critical infrastructure; (iv) President Trump's energy policies will end leasing to massive wind farms that degrade our natural landscapes and fail to serve American energy consumers; (v) President Trump will withdraw from the Paris Climate Accord; (vi) All agencies will take emergency measures to reduce the cost of living; (vii) President Trump will announce the America First Trade Policy; (viii) America will no longer be beholden to foreign organizations for national tax policy, which punishes American businesses (WH, 2025b).

Between January 20 and May 23, 2025, there had been adopted many executive orders supporting the America First Priorities: (i) Executive Order 14154 "*Unleashing American Energy*" (January 20), with immediate review of all agency actions that potentially burden the development of domestic energy resources, unleashing energy dominance through efficient permitting, and terminating the Green New Deal, including the immediate pause of the disbursement of funds appropriated through the IRA of 2022 or the Infrastructure Investment and Jobs Act (IIJA); (ii) Executive Order 14156 (January 20), President Trump's declaring a National Energy Emergency; (iii) Executive order protecting American energy from STATE overreach (April 8); President Trump believes that an affordable and reliable domestic energy supply is vital to America's national security, economic prosperity, and foreign policy. It will be prioritized taking action against laws and policies claiming to address climate change policies, or involving environmental, social, and governance initiatives, environmental justice, carbon or greenhouse gas emissions, and funds to collect carbon penalties or carbon taxes; (iii) Executive order reinvigorating America's beautiful clean coal industry and amending executive order 14241 (April 8); (iv) Executive order strengthening the reliability and security of the US electric grid (April 8); (v) Proclamation

Regulatory relief for certain stationary sources to promote American energy (April 8); (vi) Executive order unleashing America's offshore critical minerals and resources (April 24); (vii) Executive order reinvigorating the nuclear industrial base (May 23) (Federal Register, 2025).

One can remark that these are in antithesis with the EU priorities, goals, and principles under the EU Green Deal, which covers the following areas: a zero pollution Europe; transition to circular economy; farm to fork; towards a green common agricultural policy; take everyone along (just transition mechanism); financing the transition; clean, reliable and affordable energy; achieving climate neutrality; sustainable transport; preserving Europe's natural capital.

Under the new executive orders, the American fossil fuel industry is favoured, urging the extraction of fossil fuels and other minerals from all corners of the US, speeding up required permits, and opening up the Pacific Ocean's seabed to mining. Based on the National Energy Emergency, renewable energy is not supported anymore. The Green New Deal is terminated, including the immediate pause of the disbursement of funds appropriated through the IRA of 2022 or the IIJA.

Demand for electricity is growing across the nation, with some estimates suggesting that demand will more than double over the next ten years. Events in recent years have demonstrated that there is already a lack of supply during peak seasons (e.g., summer and winter) or catastrophic events (e.g., hurricanes, blizzards, and heat waves). Based on these evidences, the Trump Administration, as demonstrated in his Presidential Actions, seeks to make America energy dominant, through (i) streamlining administrative processes; (ii) reducing regulatory red tape; (iii) expanding domestic energy to include an increase in coal generation; and (iv) shifting away from state-led climate laws and initiatives (IEA, 2025).

The US President announced a comprehensive new set of tariffs on April 2, 2025, declaring a national emergency to enhance competitive advantage, protect sovereignty, and strengthen the national and economic security of the US. However, the negative effects for businesses and consumers are evident, and it can be predicted: inflation rise, potential input shortages, lower employment, and output.

On the official White House website, the fact sheet on the declaration of national emergency states that foreign trade and economic practices have created a national emergency, which imposes response tariffs to strengthen the US international economic position and protect American workers (WH, 2025c). According to the White House, the motivations for increasing tariffs are the following: "large and persistent annual US goods trade deficits have led to the hollowing out of our manufacturing base; resulted in a lack of incentive to increase advanced domestic manufacturing capacity; undermined critical supply chains; and rendered our defense-industrial base dependent on foreign adversaries". Main tariffs invoked are: Section 301 tariffs

that seek to tackle the unfair trade practices and Section 232 tariffs related to national security concerns (mainly on steel, aluminium, and automobiles).

The data reflect a tripling in the monthly value of the US trade deficit over the past 10 years, from about USD 40 billion in January 2015 to USD 131 billion in January 2025. Since 2020, each year the average monthly deficit has exceeded USD 50 billion, approaching USD 80 billion in 2022, before falling to USD 65 billion in 2023 and rising to USD 76 billion in 2024 (Chart 1).

Chart 1. Evolution of the US trade balance, trade in goods and services, January 1992-May 2025 (in millions of dollars, monthly values)

Source: Authors' representation based on FRED (2025).

President Trump has invoked his authority under the International Emergency Economic Powers Act of 1977 (IEEPA). Consequently, "basic" tariffs on all imports into the US have been imposed. The level was set at 10% and took effect from April 5, 2025. Imports from a number of countries were subject only to "basic" duties, namely the UK, Singapore, Brazil, Australia, New Zealand, Turkey, Colombia, Argentina, El Salvador, the United Arab Emirates, and Saudi Arabia (with all of these countries, in trade in goods, the US records a surplus or an insignificant deficit). The situation has changed in the meantime for countries such as Brazil (50%), where additional tariffs were imposed based on specific reasons.

Specific (personalized and individualized) reciprocal tariffs were going to be imposed on about 60 of the "biggest offenders" (meaning countries with which the US has the biggest trade deficits). Initially, these should have taken effect from April 9, 2025. However, with the exception of China, the others have been postponed in order to stimulate negotiations on a bilateral basis. Among the main trading partners subject to those tariffs were: China (faced by

an evident escalation of a trade war in April[25], followed by de-escalation in May), Vietnam (46%), Thailand (36%), Japan (24%), Cambodia (49%), South Africa (30%), and Taiwan-China (32%). In the first stage of reciprocal tariffs, the US followed a simple formula: the value of the US trade deficit is divided by the value of US imports of goods from the partner country, and the result is divided by 2. China was the first target of the global trade war initiated by the US in April 2025 (with collateral victims, including the Asian Tigers). The EU was the second major target.

To date, the US has concluded framework agreements with the EU (15%), the UK (10%), Japan (15%), South Korea (15%), Indonesia (19%), Vietnam, the Philippines (19%), and Pakistan (19%). The average US customs duty on imports of goods rose from less than 2.5% at the beginning of the year to over 18% in September 2025 (Clarke, 2025).

The EU-US political agreement of July 27 paved the way for the Joint Statement of August 21, 2025, on transatlantic trade and investment. Under the new circumstances, the new US tariff regime towards the EU is based on a "clear **maximum, all-inclusive, tariff rate of 15%** for the vast majority of EU exports, including strategic sectors such as cars, pharmaceuticals, semiconductors and lumber". As regards cars and car parts, the 15% US tariff ceiling will apply "in tandem with the EU initiating the procedures for tariff reductions vis-à-vis US products". This new ceiling for cars and car parts is 10 p.p. lower than the previous level of 25% on imports of automobiles and parts (announced on March 26 and effective April 3 for automobiles and no later than May 3, 2025, for parts). Supplementary, "effective as of 1 September, a number of product groups will benefit from a special regime, with only MFN tariffs applying" (e.g., unavailable natural resources, such as cork, all aircraft and aircraft parts, generic pharmaceuticals and their ingredients, and chemical precursors). Moreover, "both sides agree to continue to ambitiously work to **extend this regime to other product categories** – a key deliverable for the EU" (EC, 2025c).

The European Commission presented on May 19, together with the *Spring 2025 Economic Forecast*, three stylised scenarios related to the sharp protectionist turn of US trade policy and potential countervailing measures. Results of all three scenarios indicated that the imposition of tariffs was going to weaken the US economy, with moderate negative effects also on the EU GDP. However, all these fears were overcome on August 21, 2025, with the conclusion of the framework agreement between the US and the EU (EC, 2025a).

Similar to most US partners, the EU was affected by other measures, such as the imposition of an additional 25% tariff on US imports of steel and aluminium (announced on

[25] The successive increases in tariffs on US goods imported from China from 54% to 104% and 145%, respectively, and the Chinese retaliation by increasing tariffs on US imports from 34% to 84% and 125%, respectively, have nothing to do with normal economic relations.

February 10 and effective March 12, 2025). The completion of the current investigations under Section 232 might also be accompanied by new duties (Bureau of Industry and Security, 2025). In addition, the EU has committed that European private companies will invest heavily in the US (announcing plans to invest $600 billion in various sectors, although the authorities in Brussels have no control over private sector investment decisions and therefore cannot guarantee this promise) (Sorgi, 2025). At the same time, the EU intends to purchase $750 billion worth of energy products from the US over the next three years.

Overall, US trade measures are still considered to be well above so-called welfare-maximizing levels, with trade policy unpredictability affecting investment, employment, output, and economic growth. The strained relations between the US and its traditional partners could lead to an acceleration of trade liberalization among other partners.

At the beginning of the trade war, as mentioned before, China and the EU were the key targets. They are the largest competitors for the US, being the first and second largest exporters worldwide, followed by the US, while the EU and China are the second and third largest importers globally. Meanwhile, other countries were much more affected by tariffs imposed by the Trump 2.0 Administration. For instance, on August 27, 2025, new customs duties on imports of goods from India came into effect. Set at a record level of 50%, these are among the highest customs duties currently applied by the US and include a 25% penalty for India's transactions with Russia (energy and arms imports). The 50% tariff level was imposed after five rounds of bilateral negotiations, which did not result in the conclusion of an official trade agreement.

4.3. Two different paths to secure access to critical raw materials (CRM)

President Donald Trump has distanced himself from the EU in the CRM area as well. While the US intends to unleash America's Offshore Critical Minerals and Resources, the EU is continuing to strengthen its partnerships with countries worldwide. For the US, partnerships with countries such as Canada (2021), Ukraine (2021), Kazakhstan (2022), Namibia (2022), Greenland (2023), D.R. Congo (2023), Argentina (2023), Chile (2023), Zambia (2023), Norway, Uzbekistan, Serbia and Australia (2024) are notable (European Parliament, 2024).

On 24 April 2025, US President Trump signed an Executive Order intended to promote deep-sea mining. The International Seabed Authority (ISA) has reacted negatively to the Executive Order issued by President Trump, stating that any project that is not carried out by the recognised international framework or attempts to circumvent international law entails legal, diplomatic, economic, security, and financial risks. Furthermore, a "circumvention" of the ISA supervisory authority would violate international law. According to the ISA, the parties to the UN Convention on the Law of the Sea (UNCLOS) are obliged not to recognise the acquisition

or exercise of any rights to minerals extracted from the deep sea by any state, individual, or legal entity that does not comply with Part XI of UNCLOS (ISA, 2025).

Under these circumstances, the perspectives of a Critical Minerals Agreement (CMA) of the EU with the US are remote. In June 2023, the European Commission adopted its negotiating directives for a Critical Minerals Agreement (CMA) with the US. The objective was to foster EU-US supply chains in critical raw materials needed in the production of electric vehicle batteries. In 2022 alone, the EU exported EUR 8.3 billion worth of critical raw materials relevant to this industry. Concluding an EU–US CMA would have ensured that, as an ally, the EU is granted a status equivalent to US free trade agreement partners pursuant to the US Inflation Reduction Act. EU firms will then be able to compete on a level playing field with US and third-country competitors on the US market, such as Chile, the Republic of Korea, and Japan.

Critical raw materials are the backbone of the EU Green Deal. All the clean technologies (e.g., wind turbines, batteries, electrolysers for hydrogen production) depend on the supply of lithium, cobalt, and rare earth elements. The EU adopted the Critical Raw Materials Act (CRMA) in 2024. It aims to diversify CRM sourcing, boost domestic mining and refining, and increase recycling efforts. However, the US does not seem interested in strengthening cooperation with the EU in this field. Due to the concentration of the extraction and processing of critical resources in several countries, most of them in the Global South, the EU adopted the Critical Raw Materials Act to diminish the high dependence on several suppliers.

5. Conclusions

The US-EU trade flows will definitely be affected, but differently, according to the competitive advantages of each partner. The recent measures taken by the US are expected to generate distortions in bilateral trade in goods and services, which could affect the EU environmental objectives, caused by the reprioritisation of actions by the EU's main trade and investment partner.

Although recent measures and statements by the US administration show that environmental goals have been overshadowed by the desire to solve trade deficit issues, for the EU, the environmental objectives remain a priority. The effects of the new tariff measures negotiated between the US and the EU on EU economies will be: increased domestic prices of imported goods, reduced demand for imported finished and intermediate goods, with an impact on the competitiveness of EU exporting companies and investments. The new US tariff measures also have an important impact on the actions to achieve environmental goals, as they also affect trade in goods, where environmental goods are also included. Trade in environmental services will also be affected, as the US partners will respond with measures on trade in services as well (in this field, the US registers a surplus with all its major partners, including the EU). The service-related

business models bring important benefits to environmental objectives, as many services serve environmental objectives.

Despite the current challenges, the EU remains a defender of stability and business confidence in the bilateral relations. Environmentally friendly goods and techniques are essential for the transition to a greener economy, and the EU is well-positioned compared to its competitors. The EU continues to pursue its goals under the EU Green Deal. Even in times of polycrisis, the EU remains committed to its green and just transition. By contrast, in the US, based on the National Energy Emergency, renewable energy is not supported anymore. The American Green New Deal is terminated, including the immediate pause of the disbursement of funds appropriated through the IRA of 2022 or the IIJA. The European Commission, in charge for 2025-2029, is prepared for a more evident interventionist approach, helped by both offensive and defensive instruments. The EU objective is fair and rules-based trade as a basis for shared prosperity. According to the President of the European Commission, the EU has always been ready to negotiate with the US to remove any remaining barriers to transatlantic trade. But, at the same time, it is prepared to retaliate. Negotiations are the preferred solution, with the EU working to reduce barriers, not increase them, with the EU trade and security commissioner constantly engaged in talks with his US counterparts.

References

Bureau of Industry and Security (2025). *Section 232 Investigations : The Effect of Imports on the National Security,* https://www.bis.doc.gov/index.php/other-areas/office-of-technology-evaluation-ote/section-232-investigations.

Clarke, J. (2025). *What tariffs has Trump announced and why?*, BBC.

European Commission (EC). (2021). *Joint EU-US Statement on a Global Arrangement on Sustainable Steel and Aluminium.* Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_21_5724

European Commission (EC). (2023). *EU moves forward with Critical Minerals Agreement negotiations with the US.* Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3214.

European Commission (EC). (2024). *The Draghi report on EU competitiveness*. Available at: https://commission.europa.eu/topics/eu-competitiveness/draghi-report_en.

European Commission (EC). (2025a). *The EU-US trade deal: Restoring stability and predictability*. Available at: https://commission.europa.eu/topics/trade/eu-us-trade-deal_en.

European Commission (EC). (2025b). *Commission finds Apple and Meta in breach of the Digital Markets Act*. Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_25_1085.

European Commission (EC). (2025c). *Statement by President von der Leyen on EU-U.S. trade*. Available at: https://ec.europa.eu/commission/presscorner/detail/en/statement_25_1816.

European Council of the EU (CEU). 2025. *EU relations with the United States.* Available at: https://www.consilium.europa.eu/en/policies/united-states/#:~:text=The%20EU%2DUS%20partnership%20is%20founded%20on%20shared,most%20extensive%20bilateral%20trade%20and%20investment%20relationship.

European Parliament (EP). (2025). *EU-US trade: how tariffs could impact Europe*. Available at: https://www.europarl.europa.eu/topics/en/article/20250210STO26801/eu-us-trade-how-tariffs-could-impact-europe.

Eurostat. (2024). *EU stocks outside EU amounted €9 160 billion in 2023.* Available at: https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20241203-1.

Federal Register. (2025). *2025 Donald J. Trump Executive Orders.* Available at: https://www.federalregister.gov/presidential-documents/executive-orders/donald-trump/2025.

Federal Reserve Bank of St. Louis (FRED). (2025). *U.S. International Trade in Goods and Services - Exports, Imports, and Balances.* Available at: https://fred.stlouisfed.org/release/tables?rid=51&eid=124.

Guarna, O. and Turner, A. (2025, 29 April). *100 Days of Trump 2.0: The Inflation Reduction Act*, *Climate Law Blog series, Columbia Law School.*

International Energy Agency (IEA) (2025). *Electricity 2025 – Analysis and Forecast to 2027*. Available at: https://iea.blob.core.windows.net/assets/0f028d5f-26b1-47ca-ad2a-5ca3103d070a/Electricity2025.pdf.

Milman, O. (2025, 1 May). *Trump has launched more attacks on the environment in 100 days than his entire first term*, The Guardian. Available at: https://www.theguardian.com/environment/2025/may/01/trump-air-climate-pollution-regulation-100-days.

Schmucker, C. (2024, November). "The Economic and Geopolitical Importance of TTIP Is Undiminished", German Council on Foreign Relations.

Sorgi, G. (2025, 28 iulie). *EU admits it can't guarantee $600B promise to Trump*, Politico.

The European Parliament (2025, November). Implementing the EU's Critical Raw Materials Act. Available at: https://www.europarl.europa.eu/RegData/etudes/BRIE/2024/766253/EPRS_BRI(2024)766253_EN.pdf.

The International Seabed Authority (ISA, 2025, 30 April). Statement on the US Executive Order: 'Unleashing America's Offshore Critical Minerals and Resources'. Available at: https://www.isa.org.jm/news/statement-on-the-us-executive-order-unleashing-americas-offshore-critical-minerals-and-resources/.

The White House (WH). (2025a). *Fact Sheet: President Donald J. Trump Declares National Emergency to Increase our Competitive Edge, Protect our Sovereignty, and Strengthen our National and Economic Security.* Available at: https://www.whitehouse.gov/fact-sheets/2025/04/fact-sheet-president-donald-j-trump-declares-national-emergency-to-increase-our-competitive-edge-protect-our-sovereignty-and-strengthen-our-national-and-economic-security/.

The White House (WH). (2025b). *President Trump's America First Priorities.* Available at: https://www.whitehouse.gov/briefings-statements/2025/01/president-trumps-america-first-priorities/.

The White House (WH). (2025c). *Regulating Imports with a Reciprocal Tariff to Rectify Trade Practices that Contribute to Large and Persistent Annual United States Goods Trade Deficits.* Available at: https://www.whitehouse.gov/presidential-actions/2025/04/regulating-imports-with-a-reciprocal-tariff-to-rectify-trade-practices-that-contribute-to-large-and-persistent-annual-united-states-goods-trade-deficits/.

US Department of Energy (USDE). (2023). *Inflation Reduction Act of 2022.* Available at: https://www.energy.gov/lpo/inflation-reduction-act-2022.

Van Ham, P. (2016, 30 August). *TTIP is dead, long live transatlantic trade*, Clingendael. Available at: https://www.clingendael.org/publication/ttip-dead-long-live-transatlantic-trade.

Yu, H. (2024). *G7's Plan for Partnership for Global Infrastructure and Investment: An Alternative to the BRI?*. In: Understanding China's Belt and Road Initiative. Asia in Transition, vol 26. Springer, Singapore. https://doi.org/10.1007/978-981-99-9633-9_8.

Zhu, M. (2022). *The Partnership for Global Infrastructure and Investment: An Alternative for China's Belt and Road Initiative?*, China Quarterly of International Strategic Studies, Vol. 08, No. 02, pp. 197-213, https://doi.org/10.1142/S2377740022500087.

Andreea – Emanuela DRĂGOI [26]

SUPPORTING SUSTAINABLE DEVELOPMENT THROUGH STATE AID: EVIDENCE FROM ROMANIA AND BULGARIA

***Abstract**: Over the last decade, sustainable development has been a central objective of the European Union (EU) economic policy. Sustainable growth has become even more central to the EU's economic agenda with the adoption of the European Green Deal. Against this background, various EU-level policies — including competition policy — have increasingly supported sustainability goals through targeted measures. This paper examines how State Aid policy has contributed to sustainable development in Romania and Bulgaria by analysing recent data from the EU State Aid Scoreboard. Through a comparative approach, we identify the main financial tools used — such as loans, guarantees, and tax exemptions — and assess their role in advancing sustainable growth. Our findings highlight the significant impact of the Temporary Crisis and Transition Framework (TCTF), which introduced special derogations in response to the Ukraine war and broader economic challenges. While both countries have increased the share of State Aid allocated to sustainability objectives, further progress is needed to fully capitalize on the current regulatory flexibility supporting the green transition.*

***Keywords**: European Union, sustainable development, State Aid, Romania, Bulgaria*
***JEL:** H23; H25; Q58; L52; O52*

1. Introduction

The EU's legal framework governing State aid is highly restrictive, aiming to prevent undue advantages and safeguard free competition in the internal market. Under Article 107 of the Treaty on the Functioning of the European Union (TFEU), State aid may be granted only in exceptional circumstances and subject to strict conditions, including the involvement of state resources, selective benefits, absence of competition distortion, and no adverse effect on intra-EU trade. Member States may use various tools such as direct grants, tax relief, guarantees, and soft loans[27] to implement aid measures. This paper examines how Romania and Bulgaria have used State aid policies to support their economies during the post-pandemic period, with particular

[26] *Senior Researcher Andreea - Emanuela Drăgoi, PhD, Institute for World Economy: andreeadragoi@iem.ro.*

[27] "Soft loans" refer to loans offered on terms more generous than standard market conditions, typically to promote economic or social objectives, and they may be guaranteed by the state to reduce the lender's risk.

attention to the Temporary Crisis and Transition Framework (TCTF). Adopted in response to the COVID-19 crisis and the war in Ukraine, the TCTF enables targeted aid to mitigate economic disruptions while pursuing Green Deal objectives. The primary goal of this article is to assess the performance of Romania and Bulgaria relative to EU averages and other Member States, focusing on key aid objectives—such as environmental protection and resilience—and on the financial instruments used to deliver this support.

2. State of the Problem

In recent years, numerous studies have examined the role of State Aid policy in supporting the economies of EU Member States (Friederiszick et al., 2006; López, 2015; Santa Maria, 2025; Werner & Verouden, 2025), while simultaneously safeguarding free competition in the EU. Although several works have highlighted the restrictive nature of State Aid rules and their effects on the support of specific economic sectors (Bartha & Horváth, 2023; Callaerts, 2015; Nowag et al., 2021)—such as the energy and agricultural sectors (Gołaś, 2017; Sekulić et al., 2024)—some studies have also emphasized the positive, stimulating impact of State Aid in areas frequently affected by market failures (such as RDI) (Kassim & Lyons, 2013).

A significant body of research has focused on the effects of State Aid in fostering the circular economy and the green transition (Drăgoi, 2024a; Ofak, 2024; Furuseth, 2025; Hildebrandt, 2022), especially following the adoption of the European Green Deal. Moreover, while there is extensive literature (Bianchi, 2024; Cseres & Reyna, 2021; Działo, 2014; Drăgoi, 2020) addressing the flexibility of the regulatory framework that has allowed State Aid to be granted in exceptional circumstances—such as the 2008–2009 financial and economic crisis and the crisis triggered by the COVID-19 pandemic—there remains a gap concerning the impact of the most recent regulatory measures, such as Temporary Crisis and Transition Framework (TCTF).

The TCTF supports both economic resilience in the post-pandemic period and the achievement of the Green Deal's sustainability objectives (Drăgoi, 2024b; Yi, 2024; Vaupot & Plešej, 2024). This framework has played a significant role in maintaining industrial stability and promoting the transition toward climate-neutral economic models in the EU.However, there is a limited number of studies examining the experiences of Central and Eastern European countries (Hölscher et al., 2017; Pekarskiene et al., 2023), and to date, few studies (Clichici et al., 2024) specifically focus on Romania and Bulgaria regarding the use of State Aid during and after the pandemic period. Against this background, our study examines how Romania and Bulgaria have used TCTF derogations to support sustainability goals.

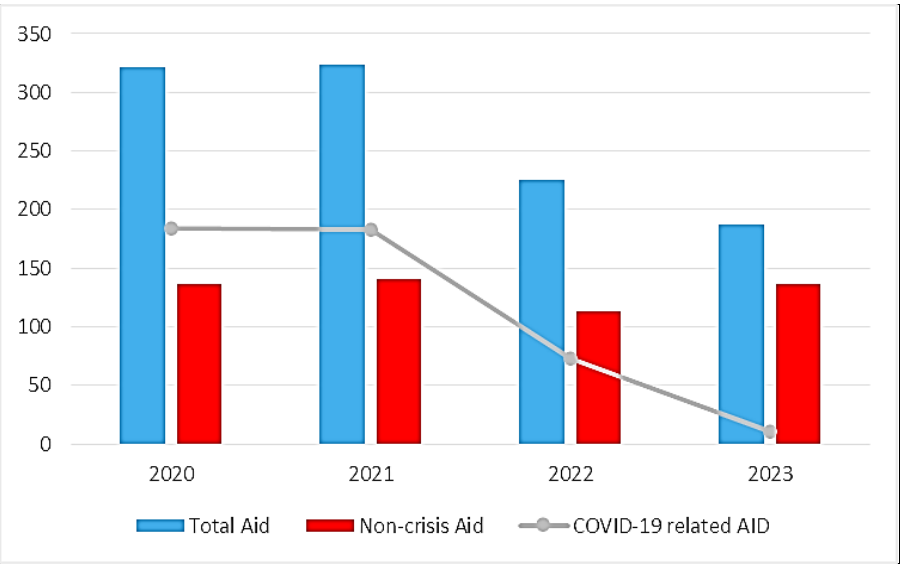
3. Methodological Approaches

This paper employs a comparative analysis of Romania and Bulgaria, using quantitative data from the EU State Aid Scoreboard and complemented by policy documents, to examine crisis and non-crisis State Aid measures—particularly under the TCTF—and the use of diverse financial instruments in supporting the green transition and sustainable development, while recognizing limitations due to incomplete data for 2024.

4. Research Results

As illustrated in Graph 1, State aid expenditure in the European Union reached a peak of EUR 323 billion in 2021, reflecting the significant fiscal interventions adopted during the COVID-19 pandemic. By 2023, this figure had declined to EUR 187 billion, signalling a deliberate fiscal consolidation as economies began to recover. Pandemic-related support proved effective in stabilising economic activity, enabling authorities to gradually scale back extraordinary aid measures in line with the principle of proportionality and the evolving economic context. However, new forms of crisis-driven State aid emerged following the outbreak of the conflict in Ukraine. In this regard, the EU recorded State aid of approximately EUR 43 billion in 2022 (equivalent to 0.27% of EU GDP), slightly decreasing to EUR 39 billion in 2023 (0.25% of EU GDP). The European framework demonstrated considerable flexibility, swiftly adapting to authorise targeted, time-bound, and crisis-specific support measures. Importantly, eligibility for such aid was contingent upon evidence of a direct impact from the crisis, a safeguard designed to preserve the integrity of the internal market and prevent undue distortions of competition (European Commission, 2025).

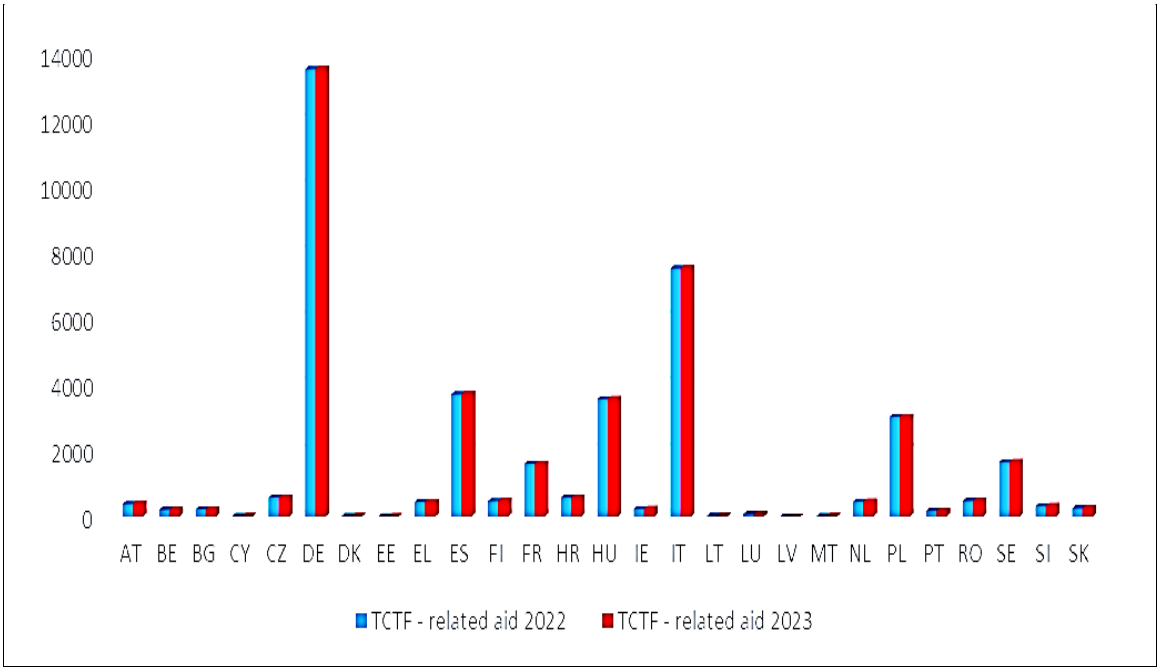
Graph 1: Evolution of crisis and non-crisis State Aid in EU, 2020 and 2023 (EUR billion)



Source: Author based on European Commission (2025). *State Aid Scoreboard*, available at: https://competition-policy.ec.europa.eu/state-aid/scoreboard/scoreboard-state-aid-data_en.

The Member States of the European Union have been significantly impacted by the crisis stemming from the war in Ukraine, prompting the allocation of substantial State aid to cushion the adverse economic consequences of this geopolitical shock. Notably, Germany and Italy emerged as the principal providers of Ukraine war-related aid, disbursing the largest amounts both in 2022 and 2023, as depicted in Graph 2. By contrast, Bulgaria and Romania ranked lower in aid volume, reflecting differences in GDP, fiscal capacity, and economic exposure, which shape each country's ability to respond effectively to external shocks.

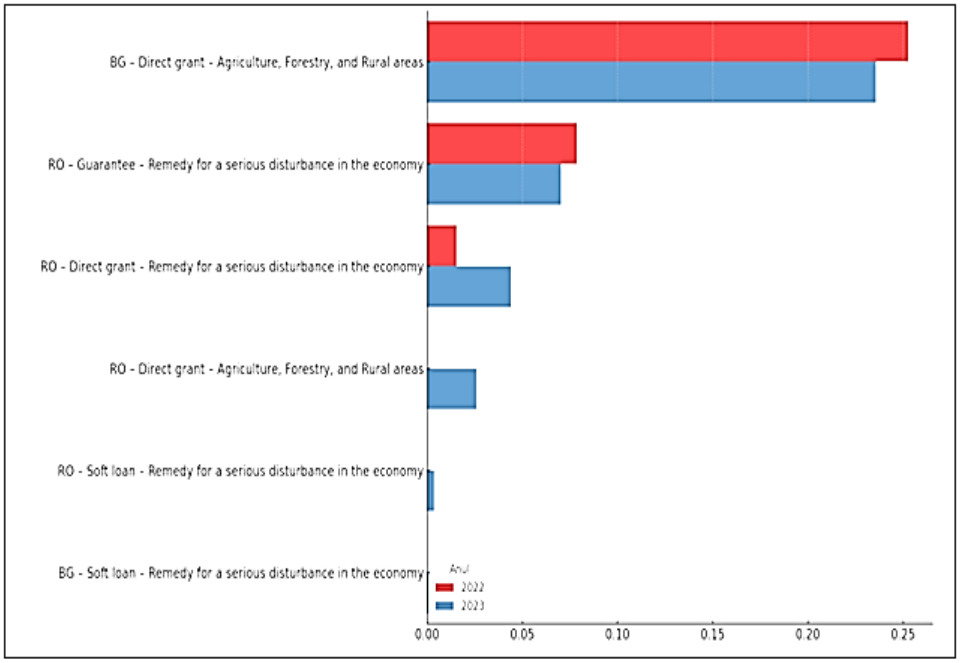
Graph 2: TCTF – related aid per Member State in 2022 and 2023 (EUR million)



Source: Author based on European Commission (2025). *State Aid Scoreboard*, available at: https://competition-policy.ec.europa.eu/state-aid/scoreboard/scoreboard-state-aid-data_en.

As shown in Graph 3, State aid to Romania and Bulgaria under the TCTF peaked in 2023, largely targeting economic disruptions and key sectors like agriculture. While Bulgaria mainly relied on direct grants, Romania pursued a more diverse mix of instruments. Soft loans, however, remained marginal in both countries, reflecting limited use within their broader crisis-response strategies.

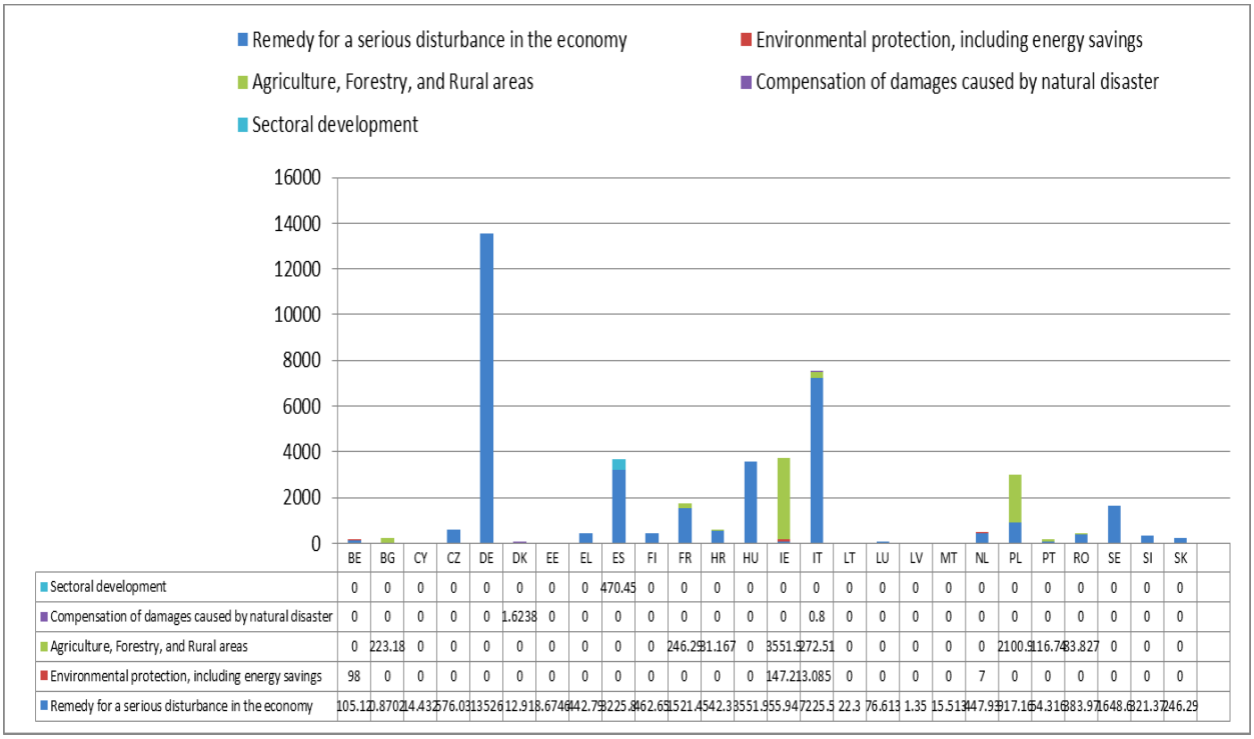
Graph 3: State aid granted under TCTF in Romania and Bulgaria, by instrument and objective, 2022-2023 (% from GDP)



Source: Author based on European Commission (2025). *State Aid Scoreboard*, available at: https://competition-policy.ec.europa.eu/state-aid/scoreboard/scoreboard-state-aid-data_en.

In 2023, environmental protection became the top State aid objective in twelve Member States, including Denmark and Germany, comprising about 30% of total EU aid and reflecting the Union's focus on the green transition. Addressing economic disturbances was the main priority in nine countries, like Hungary and Italy, and ranked second in Germany and Romania, accounting for roughly 25% of aid. Regional development also remained relevant, leading in Portugal and ranking second in Latvia, Croatia, and Italy, with an 8% share of total expenditure, as shown in Graph 4.

Graph 4: State aid expenditure under the TCTF by Member State and policy objective in 2023 (EUR million)

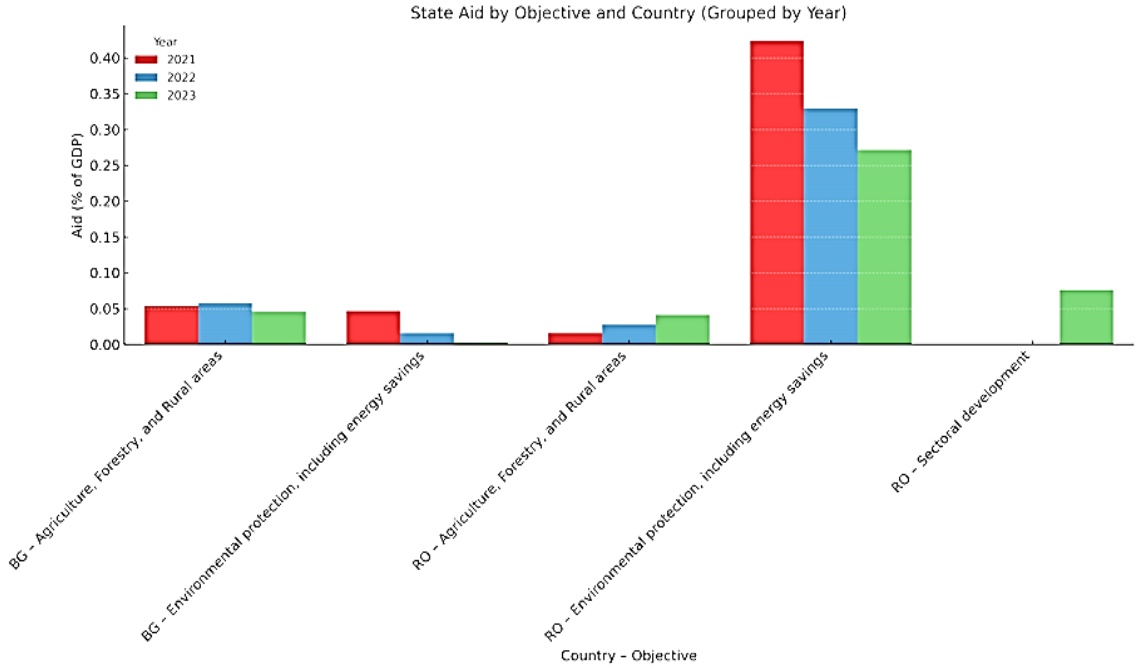


	BE	BG	CY	CZ	DE	DK	EE	EL	ES	FI	FR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK
Sectoral development	0	0	0	0	0	0	0	0	470.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compensation of damages caused by natural disaster	0	0	0	0	0	1.6238	0	0	0	0	0	0	0	0	0.8	0	0	0	0	0	0	0	0	0	0	0
Agriculture, Forestry, and Rural areas	0	223.18	0	0	0	0	0	0	0	0	246.29	31.167	0	3551.5	272.51	0	0	0	0	0	2100.9	116.74	83.827	0	0	0
Environmental protection, including energy savings	98	0	0	0	0	0	0	0	0	0	0	0	0	147.21	3.085	0	0	0	0	7	0	0	0	0	0	0
Remedy for a serious disturbance in the economy	105.12	0.8702	14.432	576.03	13526	12.918	18.674	642.73	3225.8	62.65	1521.4	542.33	3551.9	55.947	7225.5	22.3	76.613	1.35	15.513	347.93	317.16	54.316	383.97	1648.6	321.37	246.29

Source: Author based on European Commission (2025). *State Aid Scoreboard*, available at: https://competition-policy.ec.europa.eu/state-aid/scoreboard/scoreboard-state-aid-data_en.

As depicted in Graph 5, support for environmental protection was consistently and significantly higher in Romania than in Bulgaria throughout the three-year period analysed. For example, in 2021, Romania dedicated 0.42% of its GDP to environmental objectives, whereas Bulgaria allocated only 0.04%. This substantial gap persisted in subsequent years, with Romania spending 0.32% of GDP in 2022 and 0.27% in 2023, compared to merely 0.01% and 0.002% in Bulgaria, respectively. These figures underscore Romania's relatively stronger commitment to environmental initiatives within the broader framework of State aid. In contrast, the agricultural sector exhibited a different pattern. Bulgaria maintained a steady level of support for agriculture, consistently allocating around 0.05% of GDP each year, exemplified by values of 0.05% in 2021, 0.05% in 2022, and 0.04% in 2023. Meanwhile, Romania showed a gradual increase in aid directed towards agriculture, rising from 0.01% of GDP in 2021 to 0.03% in 2023, reflecting growing policy attention to this sector in the post-pandemic context. These developments highlight divergent national priorities and reveal differences in how Romania and Bulgaria have leveraged State Aid instruments to address sectoral challenges and strategic objectives.

Graph 5: State Aid by Objective in Romania and Bulgaria (2021–2023), % of GDP



Source: Author based on European Commission (2025). *State Aid Scoreboard*, available at: https://competition-policy.ec.europa.eu/state-aid/scoreboard/scoreboard-state-aid-data_en.

In Romania, environmental protection efforts were predominantly supported through instruments classified as "other," which include mechanisms such as repayable advances and unspecified non-grant measures. These instruments accounted for substantial allocations, representing 0.31% of GDP in 2021, 0.25% in 2022, and 0.19% in 2023, and thereby clearly dominating Romania's environmental aid strategy across the entire period. Direct grants constituted the second most used tool, maintaining a stable allocation of approximately 0.045% of GDP each year reflecting a consistent approach to funding environmental initiatives. Meanwhile, tax advantages and subsidies played a minor but steady role, contributing, for instance, 0.0452% of GDP in 2021 and decreasing slightly to 0.0250% in 2023. In contrast, Bulgaria's environmental aid structure was far more limited in scale and scope. The primary instrument employed was the direct grant, albeit at notably low levels, with allocations decreasing from 0.04% of GDP in 2021 to 0.01% in 2022, and reaching only 0.002% in 2023. Other instruments, including categories such as "other" measures or subsidies, were used only marginal, with their shares remaining close to zero throughout the three-year period. These figures highlight significant differences between the two countries in terms of both the scale of commitment and the diversity of financial instruments deployed to support environmental objectives.

5. Conclusions

The Temporary Crisis and Transition Framework (TCTF) provided timely regulatory flexibility to facilitate green transition initiatives amidst a backdrop of overlapping crises, including the war in Ukraine. While the TCTF played a relevant role in enabling targeted interventions, its overall impact remained limited in numerous Member States. In the case of Romania, environmental protection and energy efficiency emerged as prominent objectives, with approximately 0.34% of GDP allocated to these areas over the period 2021–2023, representing the highest share among all national State aid priorities. This commitment reflects a consistent and diversified policy approach, utilising a wide range of instruments such as repayable advances, direct grants, tax advantages, and subsidies. Conversely, Bulgaria's support for environmental protection was considerably narrower, focusing almost exclusively on direct grants, which also declined in intensity over time. Romania's substantial reliance on "other instruments," comprising various non-grant mechanisms, suggests a broader and more strategic engagement with the green transition agenda. Overall, Bulgaria's environmental aid remained limited in both scope and scale, lacking diversification and diminishing notably after 2021. Furthermore, neither Romania nor Bulgaria ranked among the top users of the TCTF, indicating an untapped potential to leverage the framework's provisions more effectively for achieving long-term environmental and energy transition goals.

Acknowledgement:

This scientific paper was presented during the sustainability period of the project with the title: "Support Center for IEM research projects - competitive innovation in Horizon 2020", ID 107540. The project was co-financed from the European Regional Development Fund through the Competitiveness Operational Program 2014 - 2020.

References:

Bartha, I., & Horváth, T. M. (2023). State aid as a risk in the policy of competitive advantages in the European Union. *Studia Iuridica Lublinensia, 32*(2), 35–55.

Bianchi, L. (2024). *Economic analysis of state aid control in the European Union*. *Economic Review of the European Union, 7*(1), 1–38.

Callaerts, R. (2015). State aid for the production of electricity from renewable energy resources. *European Energy & Environmental Law Review, 24*, 17–29.

Clichici, D., Drăgoi, A. E., & Timuș, A. (2024). Monetary support and state aid under the pandemic challenges in Romania: A comparative approach. *Romanian Journal of European Affairs, 24*(1), 67–85.

Cseres, K. J., & Reyna, A. (2021). EU state aid law and consumer protection: An unsettled relationship in times of crisis. *Journal of European Competition Law & Practice, 12*(8), 617–629.

Drăgoi, A. E. (2020). Supporting the EU economy through state aid during COVID-19 crisis: A comparative approach. *Global Economic Observer, 8*(1), 15–27.

Drăgoi, A. E. (2024a). Financing the circular economy through state aid: A cross-country analysis. *Global Economic Observer, 12*(2), 55–70.

Drăgoi, A. E. (2024b). How the Russian-Ukrainian war has shaped the state aid policy in the EU. *Global Economic Observer, 12*(1), 12–28.

Działo, J. (2014). State aid in the European Union in the period of the economic crisis. *Comparative Economic Research. Central and Eastern Europe, 17*(1), 5–19.

European Commission (2025). *State Aid Scoreboard*, available at: https://competition-policy.ec.europa.eu/state-aid/scoreboard/scoreboard-state-aid-data_en.

Friederiszick, H. W., Röller, L. H., & Verouden, V. (2006). European state aid control: An economic framework. In P. Buccirossi (Ed.), *Handbook of antitrust economics* (pp. 625–669). MIT Press.

Furuseth, E. (2025). The green transition: Tax incentives and state aid. *Intertax, 53*(3), 245–260.

Gołaś, J. (2017). State aid schemes for small-scale agriculture in Poland under the rural development programme for the years 2014–2020. [Report]. Ministry of Agriculture and Rural Development of Poland.

Hildebrandt, T. H. (2022). Towards green EU state aid law? The Guidelines on State aid for Climate, Environmental Protection and Energy 2022 in light of the European energy transition. *European State Aid Law Quarterly, 21*(4), 356–370.

Hölscher, J., Nulsch, N., & Stephan, J. (2017). State aid in the new EU Member States. *JCMS: Journal of Common Market Studies, 55*(4), 779–797.

Kassim, H., & Lyons, B. (2013). The new political economy of EU state aid policy. *Journal of Industry, Competition and Trade, 13*(1), 1–21.

López, J. J. P. (2015). *The concept of state aid under EU law: From internal market to competition and beyond*. Oxford University Press.

Nowag, J., Mundaca, L., & Åhman, M. (2021). Phasing out fossil fuel subsidies in the EU? Exploring the role of state aid rules. *Climate Policy, 21*(8), 1037–1052.

Ofak, L. (2024). EU environmental regulation for a circular economy in the light of national sovereignty. *Journal of Agricultural and Environmental Law, 19*, 81–96.

Pekarskiene, I., Bruneckiene, J., & Sarlauskaite, S. (2023). State aid impact on Central and Eastern European economies. *Inžinerinė ekonomika, 34*(2), 193–204.

Santa Maria, A. (Ed.). (2025). *Competition and state aid: An analysis of the EU practice* (Vol. 63). Alphen aan den Rijn, The Netherlands: Kluwer Law International BV.

Sekulić, N. M., Kovačević, M., & Jovičić, R. (2024). The EU state aid regime in agriculture–legal aspect. *Ekonomika poljoprivrede, 71*(1), 239–252.

Vaupot, Z., & Plešej, M. (2024). State aid in recent times of crisis. *European State Aid Law Quarterly, 23*(4), 421–435.

Werner, P., & Verouden, V. (Eds.). (2025). *EU state aid control: Law and economics*. Kluwer Law International BV.

Yi, X. (2024). State aid through and after the temporary crisis: The transition framework of the European Commission related to the Russian-Ukrainian war. *Yearbook of European Union Competition Law, 3*, 1027–1052.

Mădălina TOCAN, Oana CHINDRIŞ-VĂSIOIU[28]

ASSESSING ROMANIA'S INDUSTRIAL SECTOR - A COMPARATIVE ANALYSIS IN THE EU CONTEXT

Abstract: *This paper aims to conduct a comparative analysis of the Romania's industrial sector in European context. By analysing a set of indicators, the research compares Romania's industrial performance in European context. One of the objectives of the paper is to highlight the differences and similarities between Romania and EU average regarding the industrial sector development. Using statistical data from official sources - such as Eurostat, the Romanian National Institute of Statistics, and reports from the European Commission - the analysis seeks to provide a comprehensive overview of Romania's position within the broader European context. The paper concludes with recommendations to enhance Romania's industrial competitiveness, emphasizing the importance of innovation, infrastructure development, and workforce upskilling in aligning with EU standards. The research findings may contribute to the design of more effective economic and industrial policies, supporting sustainable development and the deeper integration of the Romanian economy into European value chains.*

Keywords: *Industry 4.0; Industrial Policy; Productivity; Industrial Sector; Digital Transformation.*

JEL: *L60; O25*

1. Introduction

The industrial sector has long represented a pillar of economic development across the European Union (EU), acting as a key driver for productivity growth, technological advancement, and international competitiveness. In the context of increasing global uncertainties, energy transitions, and digital transformations, understanding the structural dynamics of national industries has become more important than ever. For emerging economies within the EU, such as Romania, the performance of the industrial sector is especially critical, as it not only contributes significantly to Gross Domestic Product (GDP) and employment but also reflects the broader integration into the European single market.

[28] *Assoc. Prof. Dr. Mădălina Tocan, Faculty of Financial Management, Ecological University of Bucharest and Senior Researcher, Institute for World Economy, Romanian Academy; Dr. Oana Chindriş-Văsioiu, Senior Researcher, Institute for World Economy, Romanian Academy:* madalina.tocan@gmail.com, oana.vasioiu@gmail.com

Romania's accession to the EU in 2007 has brought both opportunities and challenges for its industrial sector. While increased access to investment capital, structural funds, and external markets has fostered growth in several industrial sub-sectors, disparities persist when compared to more advanced EU economies. Issues such as labour productivity gaps, limited innovation capacity, and infrastructure bottlenecks continue to constrain the sector's full potential.

The main objective of the paper is to conduct a comparative assessment of the performance of Romania's industrial sector within the context of the European Union. The research brings a novel contribution by performing a comparative analysis of Romania's industrial performance relative to the EU-27 average and by integrating the dimensions of digitalization and the green transition into the evaluation of industrial competitiveness, issues that have been insufficiently addressed in previous studies.

2. State of the Art

The assessment of industrial sector performance is essential for understanding national and regional economic dynamics, particularly in the context of European integration. In the academic literature, the industrial sector is frequently analysed through its contribution to gross value added, labour productivity, innovation capacity, and export performance. (Eurostat, 2023; OECD, 2023). At the same time, the challenges posed by the energy transition and recent global crises have necessitated a re-evaluation of industrial strategies, increasingly oriented toward sustainability and resilience (European Environment Agency, 2023). Consequently, current literature advocates for an integrated approach that combines technological development, digitalization, and the green transition to support the competitiveness and sustainable growth of Romania's industrial sector.

The industrial sector's role as a catalyst for economic growth and structural transformation is widely acknowledged in economic literature. Studies, such as those by Eurostat (2023) and OECD (2023), highlight the sector's contribution to gross value added (GVA), employment, and productivity as critical indicators for assessing industrial performance. Moreover, the adoption of advanced technologies and investment in research and development (R&D) are increasingly recognized as key drivers of competitiveness and innovation in the industry (European Innovation Scoreboard, 2023).

In the context of Central and Eastern European (CEE) countries, including Romania, numerous scholars emphasize the sector's dualistic nature, marked by legacy industrial structures and emerging modern manufacturing clusters. The digital transformation, encapsulated in the concept of Industry 4.0, is a frequent theme in recent analyses. European Commission (2023) reports underline the persistent gap between Eastern and Western EU member states in the integration of digital technologies into manufacturing processes.

Environmental sustainability and green transition have become increasingly prominent in literature assessing industrial sectors. The European Environment Agency (2023) and UNCTAD (2023) highlight the pressure on industries to reduce carbon emissions and increase energy efficiency. Romanian industry faces specific challenges in this regard, including high energy intensity and reliance on fossil fuels.

Furthermore, infrastructure quality and workforce skills are consistently identified as barriers to industrial development in Romania. The mismatch between education systems and industry needs exacerbates labour shortages in technical and high-skill occupations, constraining sectorial growth.

The role of foreign direct investment (FDI) in facilitating technological transfer and integration into global value chains is also widely documented. While Romania has attracted significant FDI in manufacturing, scholars caution about the limited spillover effects to local firms and insufficient linkages within the domestic industrial ecosystem (NBR, 2023).

Overall, the literature converges on the need for an integrated policy framework that promotes innovation, digitalization, sustainability, and skills development to enhance Romania's industrial competitiveness and align it with broader EU strategic goals.

3. Methodology

This study employs a comparative, quantitative approach to assess the performance of Romania's industrial sector in relation to other EU average. The main objective of the methodology is to evaluate Romania's industrial development within the European context by: measuring a set of indicators and comparing them to EU average and highlighting Romania's relative strengths and weaknesses in industrial performance.

The following indicators were selected to provide a multidimensional evaluation of industrial performance:

- Industrial Gross Value Added (% of GDP);
- GDP/capita;
- Employment in industry (% total);
- Research and development (R&D) expenditure (% of GDP);
- High-tech export share.

The indicators used in the analysis are relevant as they provide a comprehensive and balanced overview of the industrial sector's performance from both economic and structural perspective.

The empirical analysis is based on the latest available data (2023) obtained from: Eurostat, World Bank, National Institute of Statistics, European Commission reports.

4. Research Results

The industrial sector in Romania remains a fundamental component of the national economy, contributing significantly to GDP, employment, and export performance. Despite undergoing major transformations in the post-socialist transition and following EU accession in 2007, the sector continues to reflect both structural vulnerabilities and emerging opportunities within the broader European context.

Romania's Industrial Sector: Short overview

In 2024, industry accounted for approximately 18% of Romania's GDP (NIS, 2025), compared to over 30% in 1995 (Ziarul Financiar, 2016). Although the structure of the Romanian economy has evolved, industry has remained a key pillar of economic activity. The declining share of industry in GDP, in favour of the services sector, indicates that Romania is converging toward the European economic model.

Romania's industrial base is relatively diversified, with significant activity in automotive manufacturing (Dacia-Renault, Ford), machinery and equipment, metallurgy and chemicals, textile and clothing, food and beverage processing. Among these, the automotive sector has become a national flagship, attracting substantial foreign direct investment and contributing strongly to export performance. However, low value-added segments, such as textile and raw material processing, continue to occupy a significant share of the industrial landscape. (Ionașcu et al., 2024)

In terms of employment, industry accounts for approximately 33% of total employment (World Bank Group, 2025), well above the EU-27 average, reflecting the labour-intensive nature of many Romanian industrial operations. However, this high employment share is not always matched by high productivity, highlighting existing inefficiencies and technological gaps.

Romania's Position Relative to the EU Average

Romania's industrial sector displays a mixed performance when compared to the EU-27 average, revealing both areas of convergence and persistent structural gaps. The comparison is based on several key indicators: gross value added, labour productivity, employment share, R&D intensity, and export of high-tech goods.

Romania consistently records a higher share of industrial gross value added in total GDP than the EU average, approximately 19,1% in Romania versus 18,2% at the EU-27 level (as of 2023) (Eurostat, 2025a). This indicates a strong industrial orientation, particularly in manufacturing, but also reflects a relatively lower contribution from high-value services compared to Western economies.

Labour productivity in Romania, measured as GDP per capita, remains significantly below the EU average. In 2023, Romania's GDP per capita reached around 78% of the EU-27 average (Eurostat, 2025b). This productivity gap is largely explained by: limited technological adoption, labour-intensive production models, low capital intensity and automation.

At national level, in 2023, the employment rate was 63%, 7.4 percentage points lower than the EU27 average (EURES, 2025). An analysis published by the European Trade Union Institute (ETUI) shows that, in terms of labour market share, industry is the most significant sector in the Czech Republic (15%), followed by Slovakia (13%), Slovenia (13%), Hungary (12%), Romania (12%), Poland (12%), Bulgaria (12%), and Germany (11%) (Bechir, 2024).

Romania has one of the highest manufacturing employment shares in the EU, at approximately 24.2%, compared to the EU average of 15,5% (EURES, 2025). Also, according to World Bank, Romania has one of the highest rates of employment in industry of approximately 33%, compared to the EU average of 24% (World Bank Group, 2025). While this suggests the sector's social importance, it also highlights a reliance on labour rather than efficiency gains.

One of the most striking disparities appears in research and development (R&D) intensity. In 2023, Romania's R&D intensity stood at just 0.52% of GDP compared to the EU average of 2.24%, the lowest in the EU and far behind Romania's own target of reaching 2% of GDP by 2027 (European Commission, 2025).

Romania has made significant progress in integrating into European and global industrial value chains, but the export structure remains concentrated in medium-low technology products, particularly in the automotive and machinery segments and the high-tech exports as a share of total exports are still below EU standards (Eurostat, 2024).

Table 1. Romania vs EU-27 (2023 data)

Indicator	*Romania*	*EU-27 Average*	*Relative Position*
Industrial GVA (% of GDP)	*19,1%*	*18,2%*	*Above average*
GDP/capita	*78%*	*100%*	*Below average*
Employment in industry (% total)	*33%*	*24%*	*Above average*
R&D expenditure (% of GDP)	*0,52%*	*2,2%*	*Below average*
High-tech export share	*8,89%*	*17,32%*	*Below average*

Source: Author's own processing, Eurostat, World Bank

Despite its high share in GDP and employment, the Romanian industrial sector continues to suffer from low labour productivity relative to the EU average. This reflects both limited technological modernization and weak managerial and organizational capacities, particularly among domestic SMEs.

Romania consistently ranks among the lowest in the EU in terms of industrial R&D spending and innovation output (Table 1). The weak link between academia, research institutes,

and industry, coupled with low private sector involvement in innovation, impedes the sector's movement up the value chain.

Also, Romania registers a digitalization deficit, most Romanian industrial firms, especially in traditional manufacturing, lag in digital transformation, which undermines their competitiveness and resilience.

5. Conclusions

The analysis conducted in this paper underscores the dual character of Romania's industrial sector: while it maintains a significant contribution to GDP and employment—exceeding the EU-27 average, it simultaneously reveals structural deficiencies that hinder its full integration into the European model of industrial competitiveness.

Romania's industrial sector contributes approximately 19.1% to national GDP, slightly above the EU average of 18.2%, and accounts for around 33% of total employment, which is significantly higher than the EU-27 average of 24%. However, this strong presence in terms of employment is not paralleled by comparable levels of productivity or innovation, reflecting inefficiencies rooted in low technological adoption and capital intensity.

Despite progress in attracting foreign direct investment, particularly in the automotive and machinery sub-sectors, the industrial base remains heavily reliant on medium- and low-tech production. Romania's high-tech export share remains modest at 8.89%, far below the EU average of 17.32%, and R&D expenditure stagnates at only 0.52% of GDP, the lowest in the European Union.

The productivity gap, measured by GDP per capita (78% of the EU average), is a direct outcome of limited digitalization, low automation levels, and a weak innovation ecosystem. The digital transformation of Romanian industry is still in its infancy, and the diffusion of Industry 4.0 technologies remains marginal, particularly among small and medium-sized enterprises.

In sum, Romania's industrial sector presents a profile of partial convergence with the EU, supported by high employment and manufacturing weight, but challenged by lagging productivity, low innovation capacity, and limited digital transformation. Bridging these gaps requires an integrated and coherent industrial policy, emphasizing investment in R&D, workforce upskilling, infrastructure development, and digital and green transition, in order to align Romania more closely with the industrial standards of leading EU member states and to foster sustainable, resilient growth.

References

Bechir, M. (2024). The Industry's Share in the Labor Market: in the EU and Romania. Key Trends That Have Driven Change [online]. Available at: https://cursdeguvernare.ro/ponderea-industriei-pe-piata-muncii-romania-ue-tendinte.html [Accessed 14 May 2025].

EURES. (2025). Labour Market Information: Romania [online]. Available at: https://eures.europa.eu/living-and-working/labour-market-information-europe/labour-market-information-romania_en [Accessed 20 May 2025].

European Commission. (2025). Romania – 2025 Country Report [online]. Available at: https://economy-finance.ec.europa.eu/document/download/7cb47fb4-4517-431a-95c8-17cb161d5078_en?filename=RO_CR_SWD_2025_223_1_EN_autre_document_travail_service_part1_v4.pdf) [Accessed 11 June 2025].

European Environment Agency. (2023). Greenhouse gas emissions by sector [online]. Available at: https://www.eea.europa.eu [Accessed 21 May 2025].

European Innovation Scoreboard. (2023). European innovation performance [online]. Available at: https://research-and-innovation.ec.europa.eu [Accessed 22 May 2025].

Eurostat. (2023). Industry statistics [online]. Available at: https://ec.europa.eu/eurostat [Accessed 18 June 2025].

Eurostat. (2024). High-tech exports [online]. Available at: https://ec.europa.eu/eurostat/databrowser/view/tin00140__custom_13099988/default/table [Accessed 19 June 2025].

Eurostat. (2025a). Gross value added and income by main industry [online]. Available at: [nama_10_a10] Gross value added and income by main industry (NACE Rev.2) [Accessed 24 June 2025].

Eurostat. (2025b). GDP per capita, consumption per capita and price level indices [online]. Available at: GDP per capita, consumption per capita and price level indices - Statistics Explained - Eurostat [Accessed 24 June 2025].

Ionașcu, A.E., Goswani, S.S., Dănilă, A., Horga, M.G., Barbu, C.A., Șerban-Comănescu, A. (2024). Analyzing Primary Sector Selection for Economic Activity in Romania: An Interval-Valued Fuzzy Multi-Criteria Approach [online]. Available at: https://www.mdpi.com/2227-7390/12/8/1157 [Accessed 15 May 2025].

National Institute of Statistics. (2025). Press Release [online]. Available at: https://insse.ro/cms/sites/default/files/com_presa/com_pdf/pib_tr4r2024_1.pdf [Accessed 25 June 2025].

OECD. (2023). Productivity and labour market indicators [online]. Available at: https://stats.oecd.org [Accessed 21 May 2025].

The National Bank of Romania. (2023). Annual Report on Foreign Direct Investment [online]. Available at: https://bnro.ro [Accessed 27 May 2025].

UNCTAD. (2023). World Investment Report 2023 [online]. Available at: https://unctad.org [Accessed 12 June 2025].

World Bank Group. (2025). Employment in industry (% of total employment) (modeled ILO estimate) [online]. Available at: Employment in industry (% of total employment) (modeled ILO estimate) | Data [Accessed 2 July 2025].

Ziarul Financiar. (2016). Romania Ranks 6th in the EU for Industry's Share of GDP [online]. Available at: România, pe locul 6 în UE la ponderea industriei în PIB [Accessed 1 July 2025].

Paul CALANTER[29]

THE EVOLUTION OF EU'S ENERGY TRADE IN LIGHT OF THE CURRENT GEOPOLITICAL CLIMATE

***Abstract**: The primary objective of the European Union's energy policy is to establish a secure energy supply within the EU. In this regard, the Russian invasion of Ukraine, which commenced in February 2022, has resulted in a paradigm shift in the energy trade landscape of the European Union. Considering the Union's response, which took the form of multiple packages of sanctions with direct and indirect implications for trade in energy products, EU Member States found themselves compelled to adopt a new approach towards potential sources of imports and to diversify their supplier base. This research employs an analytical approach to examine the evolution of energy trade within the European Union, encompassing both its external and internal trade dynamics. The primary focus of this research is to examine the impact of the current geopolitical climate, specifically the ongoing conflict between Ukraine and the Russian Federation, together with the EU's embargo on energy imports from Russia, on energy trade developments.*

***Keywords**: energy trade, European Union, policies, Russian Federation*
***JEL:** Q37, Q43, O2*

1. Introduction

The European Union's energy policy is predicated on three fundamental principles: decarbonisation, competitiveness, and security of supply, all of which are underpinned by sustainability (Nagaj et al., 2024). The objectives of the EU's energy policy are manifold. These include the facilitation of the functioning of the energy market and a secure energy supply within the EU, along with the promotion of energy efficiency and energy savings (Ball et al., 2024; Almeida et al., 2023). Furthermore, the development of renewable energy and the interconnection of energy networks are recognised as key objectives. A range of measures designed to achieve a comprehensive Energy Union are pivotal to the EU's energy policy (Vezzoni, 2023).

As the extant data demonstrate, the EU is, with a few isolated exceptions, a net importer of energy products (Gonand et al., 2024). The analysis conducted in this study thus prioritises the examination of energy product imports into the European Union.

[29] *Dr. Paul Calanter, Institute for World Economy – Romanian Academy: paul.calanter@yahoo.com*

Following Russia's invasion of Ukraine, the European Union responded with several packages of sanctions that directly and indirectly affected trade in energy products (Chen, 2023). In the immediate aftermath, a significant diversification of the European Union's suppliers began to emerge.

2. State of the Art

The European Union has imposed a embargo on the importation of raw materials and refined petroleum products that are shipped by sea from Russia (Rahman et al., 2023). The ramifications of the prohibition on Russian oil are substantial. Approximately 50% of its total oil exports were destined for the European Union. In 2021, the EU imported oil from Russia worth a total of 71 billion euro, of which 48 billion euro was crude oil and 23 billion euro was refined petroleum products (Dias, 2024). The long-term loss of this revenue-generating market is expected to have a significant and detrimental effect on Russia's economy, which is heavily reliant on the revenues generated from oil exports (Cooper, 2025).

The price limits agreed with the G7+ alliance have reduced Russia's oil profits and helped make global energy markets more stable (Mustapic, 2024). The idea behind putting a limit on prices is to stop companies in the European Union from providing transport or insurance services, like transporting Russian oil, if the price goes above the limit (McWilliams et al., 2023a; Cardoso et al., 2025). Currently, there are three price caps in place on Russian oil exports transported by sea, with a maximum price of $60 per barrel, ‘premium products’ (such as diesel, kerosene and gasoline) at $100 per barrel, and ‘low-cost products’ (such as fuel oil and kerosene) at $45 per barrel (Hilgenstock et al., 2023). In addition, to deal with the ‘ghost fleet’ that Russia is using to circumvent the price caps, the G7+ group of countries that set the price caps recently introduced measures to strictly monitor tank sales to third countries.

In the energy sector, other sanctions include a prohibition on the importation of all coal varieties from Russia, as well as a prohibition on the importation of liquefied petroleum gas (LPG) (Jakusev, 2024). These sanctions had an impact on imports valued at over 1 billion euro per year, with the exception of existing contracts for a maximum duration of 12 months. Additionally, a prohibition has been imposed on the utilisation of European ports for the transportation of Russian liquefied natural gas, or on the importation of Russian liquefied natural gas into specific stations that are not connected to the European gas network (Pesini, 2023; Diomis, 2024).

The EU has also banned the supply of goods, technology and services to Russian projects involving liquefied natural gas and oil (McWilliams et al., 2023b). New EU investments in the Russian metal sector have also been banned, with the exception of certain raw materials and exports of certain refining technologies (Štěpánek et al., 2024). This will make it more difficult and costly to modernise oil refineries in Russia. At the same time, there is a ban on new investments

in the Russian energy sector, with a few exceptions for civil nuclear energy and the transfer of certain energy products back to the EU.

Concurrently, Russian citizens or entities are prohibited from reserving gas storage capacity in European Union member states, and imports of Russian oil through pipelines in Germany and Poland have been suspended (Takácsné 2023). Further sanctions have been implemented, encompassing a prohibition on the provisional storage or transhipment of Russian oil or oil products in European Union ports, and a prohibition on the export, supply, or offer of oil and gas exploration software to Russia.

The objective of this research is to examine the evolution of energy trade within the European Union, covering both its external and internal trade dynamics. The primary focus is to assess the impact of the current geopolitical climate, in particular the ongoing conflict between Ukraine and the Russian Federation, along with the EU's embargo on energy imports from Russia, on developments in energy trade. Following a thorough review of the existing literature on this subject, it has been determined that there is a gap of research focusing on this particular approach.

3. Methodology

The methodological design is based on an analysis of indicators related to energy trade in the European Union (using the latest Eurostat data) and a qualitative assessment of the literature on the sanctions imposed by the European Union on the Russian Federation following the latter's invasion of Ukraine.

The quantitative analysis is based on Eurostat data to show the evolution of the European Union's energy trade after 24 February 2022. In order to achieve this, we chose a time frame long enough to cover both the period before the start of the war in Ukraine and the present moment. The comparative analysis in this paper also focuses on the alternatives found by the European Union to adapt to the fact that the EU is unable to import energy products from the Russian Federation.

Much of the data used and background information on EU sanctions has been extracted from the literature in the field (scientific papers and expert reports). It should also be highlighted that our research is limited by the absence of statistical data for 2025 and we are considering extending our research in a future paper when this data becomes available.

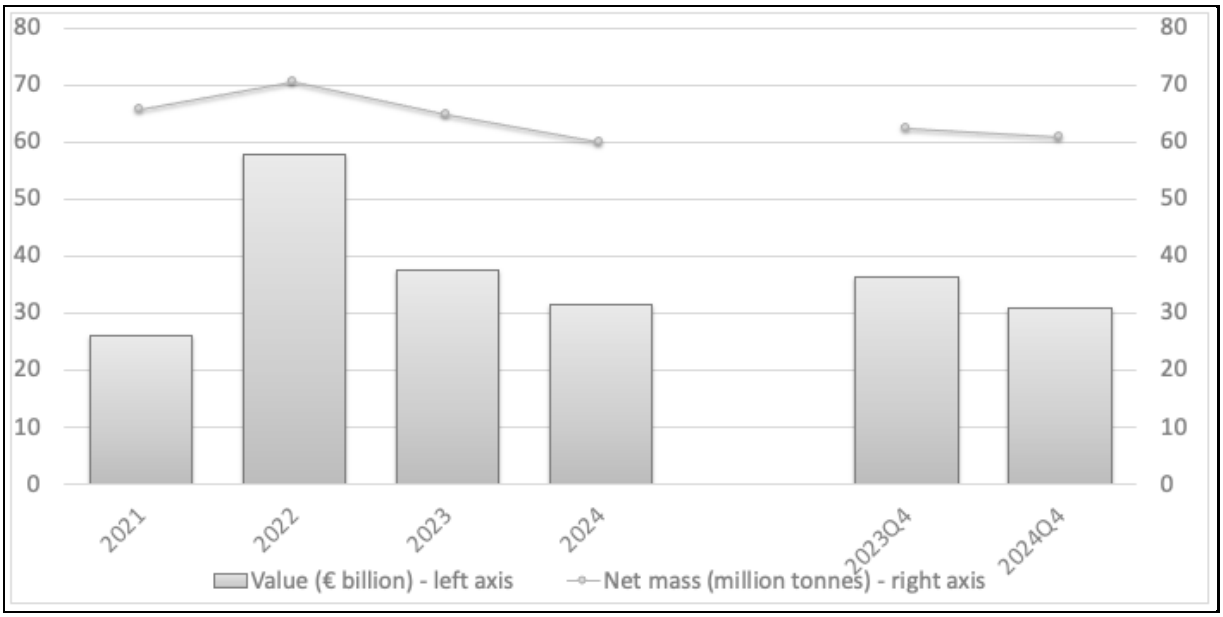
4. Research Results

The analysis provides data for the period between 2021 and 2024, with a particular focus on the last two quarters of 2023 and 2024. Until the end of 2021, Russia was the main supplier of raw materials and natural gas. Following Russia's invasion of Ukraine, the European Union imposed several rounds of sanctions that affected trade in these products. Over time, a significant

diversification of suppliers has been observed. We will provide data on trade in value (expressed in millions of euro) and net weight (weight expressed in tonnes).

The latest data show a decline in the last quarter of 2024 compared to the same quarter of 2023 (Figure 1). This is similar to what was observed in 2022. In the last three months of 2024, compared to the same period in 2023, the value fell by 15.3% and the net mass fell by 2.5%. Compared to 2023, there was a 16.2% decline in value and a 7.1% decline in net mass in 2024.

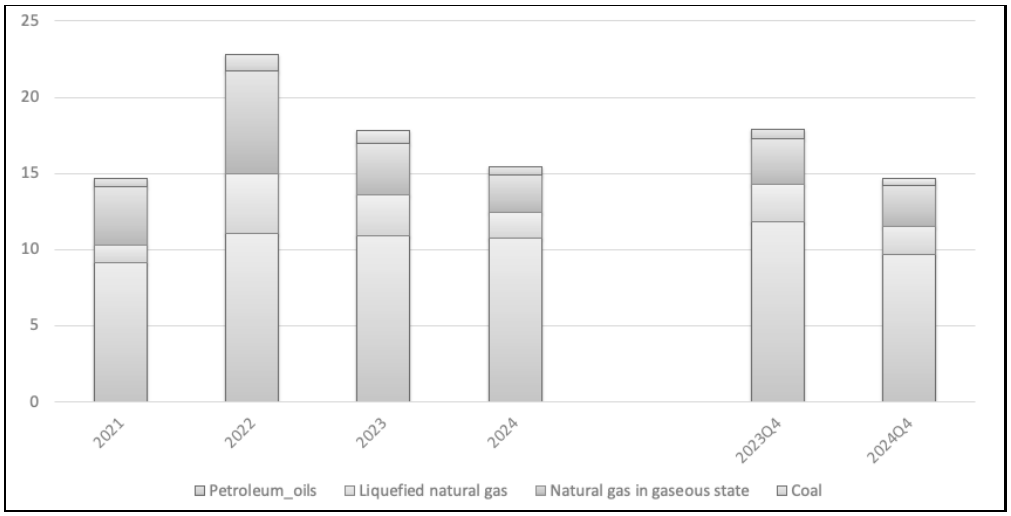
Figure 1. EU imports of energy products, 2021-2024



Source: Author's processing based on Eurostat data, 2025

The share of energy products in total EU imports has fluctuated significantly due to sharp price increases, peaking at 22.8% of total imports in 2022. This was followed by a notable decline in 2023 to 17.8% and a further decline to 15.4% in 2024. In addition, in the fourth quarter of 2024, a decline of 3.2% was observed compared to the same quarter of 2023. Data analysis reveals a decline in the share of liquefied natural gas (-1%) and natural gas in gaseous form (0.9%) between 2023 and 2024 (Figure 2).

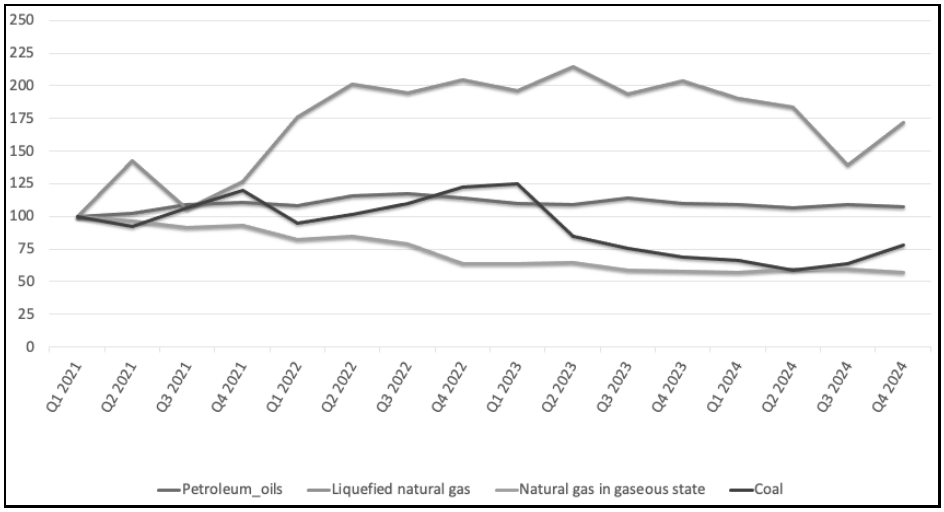
Figure 2. Share of energy products in total EU imports, 2021-2024 (%)



Source: Author's processing based on Eurostat data, 2025

Figure 3 shows the development of the volume of energy imports for the period 2021-2024. In the fourth quarter of 2024, there was an increase in the volume of liquefied natural gas compared to the previous quarter and an increase of 71.6% compared to the first quarter of 2021. The increase in the popularity of liquefied natural gas can be explained by a number of factors, including transport, high efficiency and cleaner use compared to other energy sources. On the other hand, the volume of crude oil increased by 7.6% between the first quarter of 2021 and the fourth quarter of 2024. At the same time, there was a significant decrease in the volumes of natural gas in gaseous form (-43%) and coal (-21.8%) during this period.

Figure 3: EU energy imports, 2021-2024 (first quarter of 2021 = 100)

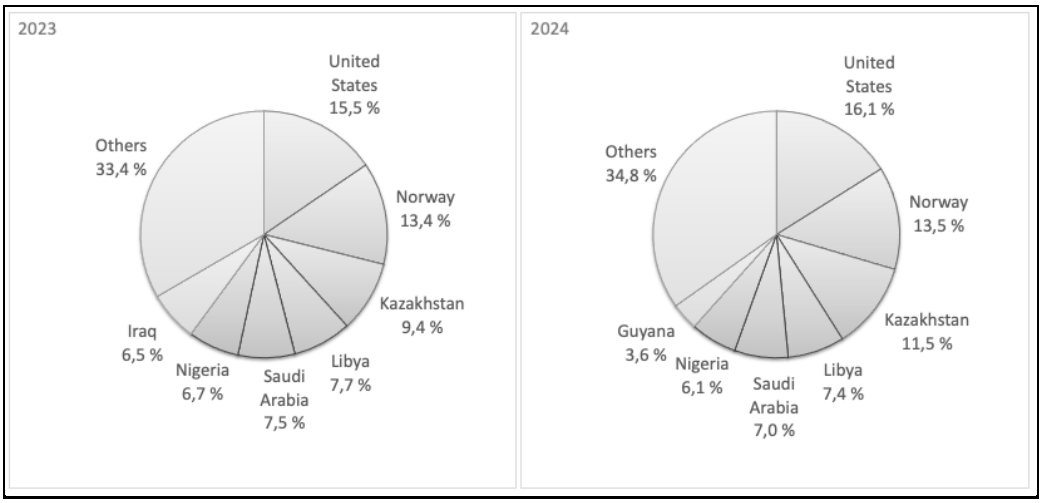


Source: Author's processing based on Eurostat data, 2025

The European Union imposed a ban on Russian crude oil imports by sea on 5 December 2022, followed by a ban on refined petroleum products on 5 February 2023. As a result, over the

past two years, Russia is no longer one of the seven largest partners. In 2024, the United States (16.1%), Norway (13.5%) and Kazakhstan (11.5%) were the most important partners (Figure 4). The largest increase between 2023 and 2024 was in Kazakhstan's share (2.1%).

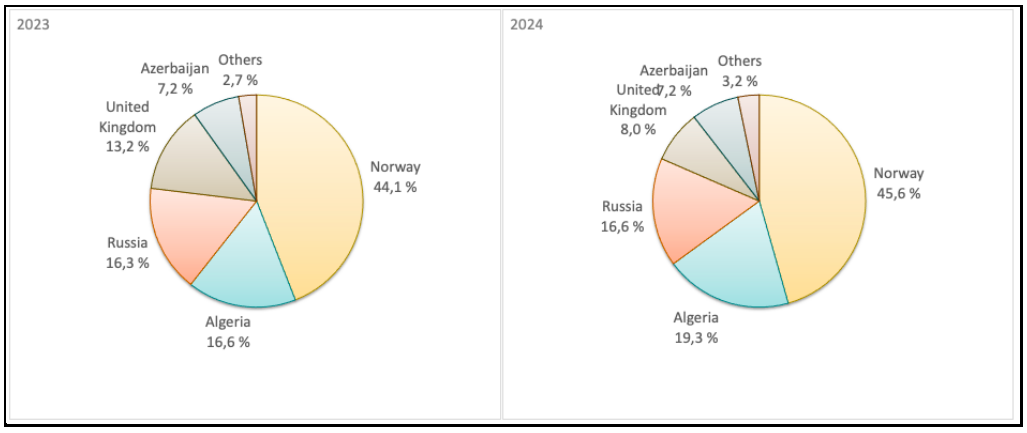
Figure 4: EU imports of crude oil (%)



Source: Author's processing based on Eurostat data, 2025

In 2024, Norway was the largest supplier of natural gas to the European Union, accounting for 45.6% of the total. It was followed by Algeria (19.3%) and Russia (16.6%). Compared to 2023, Algeria's share increased by 2.8% (Figure 5). On the other hand, the United Kingdom's share decreased by 5.2% during this period.

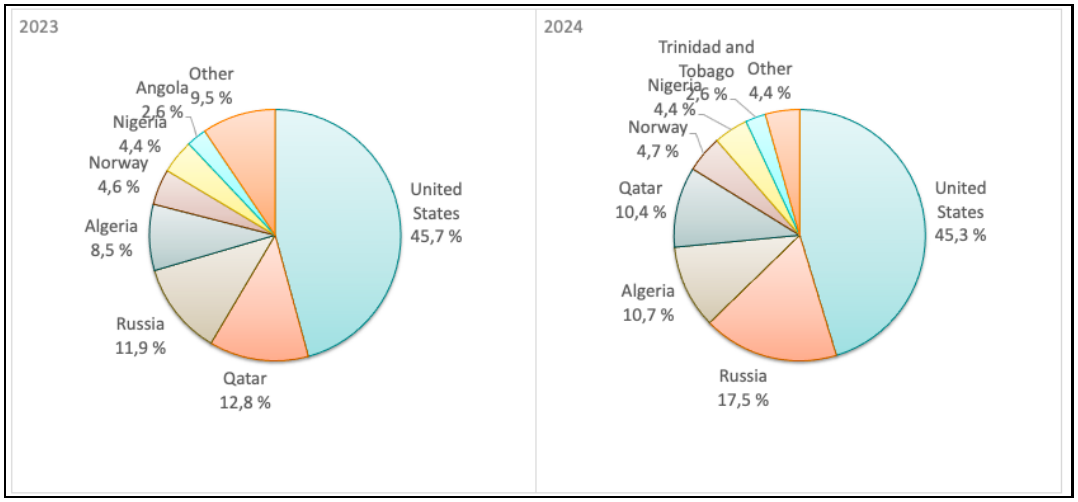
Figure 5. EU natural gas imports (%)



Source: Author's processing based on Eurostat data, 2025

According to Figure 6, there was a 5.5% increase in Russia's share of natural gas imports to Europe in 2024 compared to 2023. In 2024, Russia was the second largest supplier of natural gas (17.5%), after the United States (45.3%).

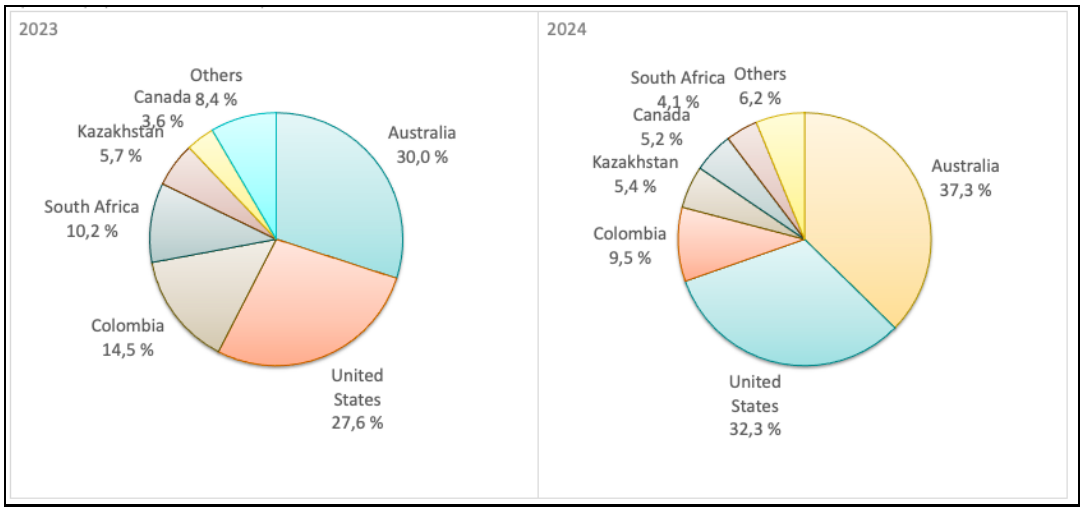
Figure 6. EU imports of liquefied natural gas (%)



Source: Author's processing based on Eurostat data, 2025

In the last three months of 2021, Russia was the largest supplier of coal, accounting for 47.9% of the total amount of coal imported by the European Union (Figure 7). As part of the fifth package of sanctions, the European Union banned the purchase, import or transport of coal from Russia into the European Union. In the last three months of 2022, Russia was no longer one of the countries from which the European Union imported coal. In 2024, the main partners were Australia (37.3%) and the United States (32.3%).

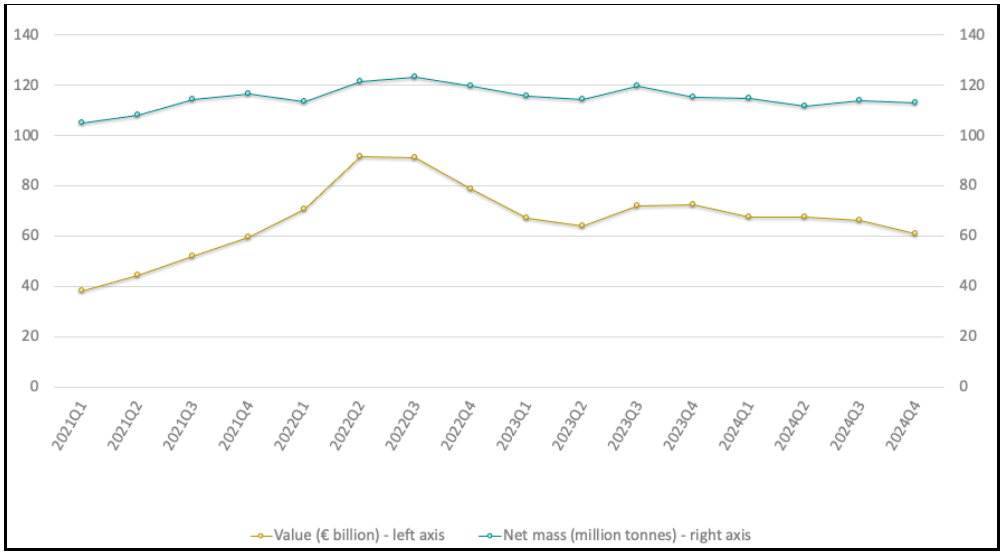
Figure 7. EU coal imports (%)



Source: Author's processing based on Eurostat data, 2025

Between January 2021 and December 2022, the value and volume of imported crude oil increased (Figure 8). In the last three months of 2024 compared to the first three months of 2021, there was a 61% increase in value, but only an 8% increase in volume.

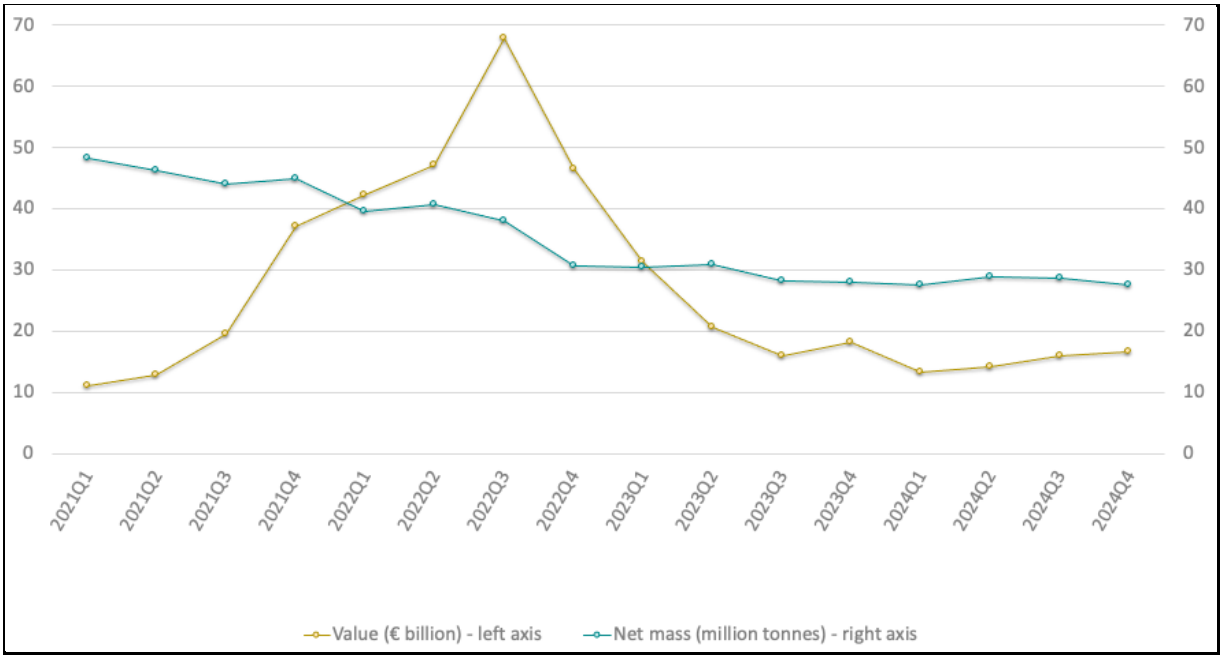
Figure 8. EU crude oil imports, 2021-2024 (billion euro and million tonnes)



Source: Author's processing based on Eurostat data, 2025

Between January and September 2021 and from July to December 2022, the value of natural gas imports increased, but the volume decreased. In the last three months of 2024, compared to the first three months of 2021, the value increased by 50%, but the volume decreased by 43% (Figure 9).

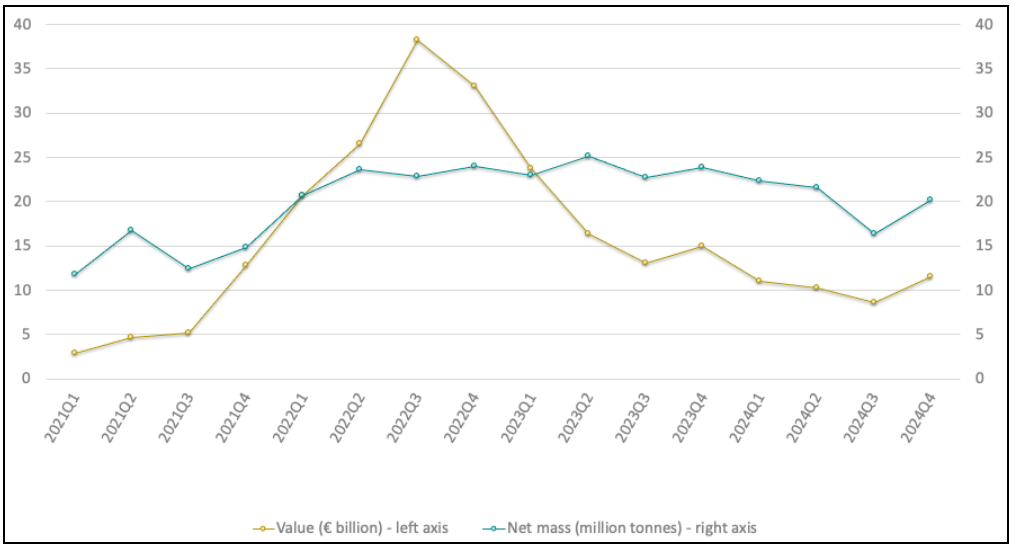
Figure 9. EU natural gas imports, 2021–2024 (billion euro and million tonnes)



Source: Author's processing based on Eurostat data, 2025

According to Figure 10, the volume of imported LNG increased between the third quarter of 2021 and the fourth quarter of 2022. However, it declined from that point until the end of 2023, when it began to increase again.

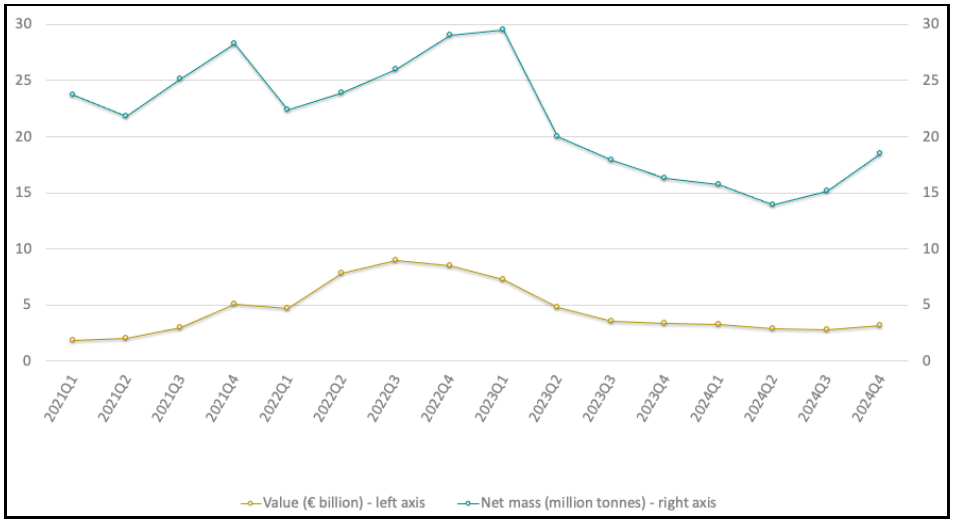
Figure 10. EU imports of liquefied natural gas, 2021-2024 (billion euro and million tonnes)



Source: Author's processing based on Eurostat data, 2025

From the beginning of 2021 to the beginning of 2023, the volume of coal imports from the European Union increased (Figure 11). This was followed by declines until mid-2024, followed by a period of stagnation.

Figure 11. EU coal imports, 2021–2024 (billion euro and million tonnes)



Source: Author's processing based on Eurostat data, 2025

5. Conclusions

Up to the end of 2021, the Russian Federation was the largest supplier of energy products to the European Union. After Russia's invasion of Ukraine, the EU imposed several packages of energy sanctions, which have had an impact on trade in these products. In assessing the aforesaid, there has been a gradual diversification of suppliers in the following period.

With regard to crude oil, the EU banned imports of crude oil by sea in 2022, followed in 2023 by an embargo on imports of refined petroleum products, which resulted in the EU's three main partners in 2024 in terms of crude oil imports being the United States, Norway and Kazakhstan. This has a significant impact on the Russian Federation, as the country's budget depends on oil imports.

In terms of coal trade, Russia was the European Union's largest supplier until the start of the war. However, the fifth package of sanctions prohibited the purchase, import or transfer of coal or other solid fuels if they originate in Russia or are exported from Russia. As a result, by mid-2022, coal imports from Russia had fallen to zero, and by 2024, the two largest partners were the United States and Australia.

Acknowledgement: Scientific paper carried out during the sustainability period of the project entitled: "Support Center for IWE competitive research – innovation projects in Horizon 2020", ID 107540. The project was co-financed by the European Regional Development Fund through the Competitiveness Operational Program 2014-2020.

References

Almeida, D. V., Kolinjivadi, V., Ferrando, T., Roy, B., Herrera, H., Gonçalves, M. V., & Van Hecken, G. (2023). The "greening" of empire: The European Green Deal as the EU first agenda. Political Geography, 105, 102925.

Ball, C. S., & Degischer, D. (2024). IoT implementation for energy system sustainability: The role of actors and related challenges. Utilities Policy, 90, 101769.

Cardoso, D. S., Salant, S. W., Daubanes, J., & Daubanes, J. X. (2025). The Dynamics of Evasion: The Price Cap on Russian Oil Exports and the Amassing of the Shadow Fleet(No. 11618). CESifo Working Paper.

Chen, Y., Jiang, J., Wang, L., & Wang, R. (2023). Impact assessment of energy sanctions in geo-conflict: Russian–Ukrainian war. Energy Reports, 9, 3082-3095.

Cooper, L. (2025). Russo-Ukrainian war: the political economy of the present balance of forces.

Dias, T. M. (2024). The impact of the Russian invasion of Ukraine on the European Union's energy transition: Energy independence as both a catalyst and consequence (Master's thesis).

Diomis, N. (2024). The effects of the energy crisis on LNG freights: a theoretical approach (Master's thesis, Πανεπιστήμιο Πειραιώς).

Gonand, F., Linares, P., Löschel, A., Newbery, D. M., Pittel, K., Saavedra, J., & Zachmann, G. (2024). Watts next: Securing Europe's energy and competitiveness where the EU's energy policy should go now (No. 49). EconPol Policy Report.

Jakusev, A. (2024). Strategic Analysis of EU Energy Security: Crude Oil, Petroleum Products and the Impact of Russian Sanctions.

Hilgenstock, B., Ribakova, E., Shapoval, N., Babina, T., Itskhoki, O., & Mironov, M. (2023). Russian oil exports under international sanctions. Available at SSRN 4430053.

McWilliams, B., Sgaravatti, G., Tagliapietra, S., & Zachmann, G. (2023a). How would the European Union fare without Russian energy?. Energy Policy, 174, 113413.

McWilliams, B., Sgaravatti, G., Tagliapietra, S., & Zachmann, G. (2023b). The EU can manage without Russian liquified natural gas (No. 16/2023). Bruegel Policy Brief.

Mustapic, M. (2024). An Analysis on the Effectiveness of Economic Sanctions on Russian Oil, Specifically the G7+ Price Cap.

Nagaj, R., Gajdzik, B., Wolniak, R., & Grebski, W. W. (2024). The impact of deep decarbonization policy on the level of greenhouse gas emissions in the European Union. Energies, 17(5), 1245.

Pesini, S. (2023). European energy security and the role of LNG (Master's thesis, Πανεπιστήμιο Πειραιώς).

Rahman, Y. M., Adeningtyas, W. J., & Jaya, B. P. M. (2023). The effect of European Union's implementation of the Russian economic embargo on international trade sector. Jurnal Dinamika Hukum, 23(2), 273-285

Štěpánek, V. (2024). Europe's strategy for Tech Security in the Era of Raw Critical Materials.

Takácsné Tóth, B. (2023). Natural gas pipeline politics in and around the European Union Modelling–based assessment of Russian and European strategies (Doctoral dissertation, Budapesti Corvinus Egyetem).

Vezzoni, R. (2023). Green growth for whom, how and why? The REPowerEU Plan and the inconsistencies of European Union energy policy. Energy Research & Social Science, 101, 103134.

Ion-Matei Dumitrescu[30]

ESG IMPACT METRICS AS A BRIDGE BETWEEN SUSTAINABLE INVESTMENTS AND INDUSTRIAL POLICY

Abstract: *Early-stage startups in Central and Eastern Europe (CEE) face a dual opportunity: rising investor demand for sustainable, ESG-aligned ventures and new industrial policies prioritizing green and inclusive growth. This paper explores how ESG-aligned impact metrics can bridge sustainable investments and industrial policy goals in Romania and Bulgaria. It argues that a common framework of environmental, social, and governance (ESG) indicators helps align startups' strategies with policy targets, such as the green transition, digital innovation, and social inclusion, while engaging impact-oriented investors. We review the state of the art in sustainable direct investment trends and policy initiatives, including the EU's twin digital and green transition agenda. Using a qualitative approach and illustrative cases, we show that adopting ESG metrics early can improve funding prospects for startups and provide policymakers with measurable outcomes to support via incentives. This synergy can foster economic innovation, mitigate brain drain, reinforce the European social model under pressure, and increase competitiveness in international trade. The findings highlight the value of ESG metrics as a policy-relevant tool for guiding sustainable growth in CEE.*

Keywords: ESG metrics; sustainable investments; startups; Romania; Bulgaria
JEL Codes: O25; Q01; L26; O16

Introduction

Traditional venture capital valuation has focused on financial indicators like revenue, EBITDA, or cash flow, often overlooking the social and environmental externalities that impact-driven startups create. This leads to systematic undervaluation and underinvestment in ventures that contribute to public goods and align with the Sustainable Development Goals (SDGs). Policymakers and investors currently lack clear frameworks to quantify these positive externalities and integrate them into funding decisions, resulting in missed opportunities for both financial

[30] *PhD. Candidate, Romanian Academy, School of Advanced Studies of the Romanian Academy, Doctoral School of Economic Sciences, National Institute for Economic Research "Costin C. Kiriţescu", Institute for World Economy, Bucharest, ROMANIA, mateidumitrescu@me.com*

returns and societal benefits. At the same time, European industrial policy has shifted toward promoting sustainable and inclusive growth, notably through the EU's twin transition (green and digital) agenda. There is a growing recognition that economic competitiveness must go hand-in-hand with environmental sustainability and social inclusion.

In this context, ESG (environmental, social, governance) impact metrics have emerged as a potential bridge between the objectives of investors and policymakers. ESG metrics provide standardized ways to measure a venture's non-financial performance – from carbon footprint and energy efficiency to social impact and governance practices. Global sustainable investment has expanded rapidly in recent years, reaching an estimated USD 1.5 trillion in assets under management by 2024 (GIIN, 2024). However, integrating ESG considerations into early-stage startup investment remains rare in CEE markets. Romania and Bulgaria, for example, rank among Europe's nascent startup ecosystems, with venture investment levels near the lowest in the EU (Dumitrescu, 2024). They have yet to experience a wave of "impact startups" attracting significant capital. Bridging this gap represents both a challenge and an opportunity: it requires aligning public policy priorities with private-sector investment strategies through a common language of impact measurement.

The aim of this study is to qualitatively assess how ESG impact metrics can link sustainable investments with industrial policy goals in Romania and Bulgaria. By analyzing policy trends and illustrative startup cases, we show how adopting ESG metrics early in a company's development can improve its funding prospects while providing policymakers with indicators to target support. Effective use of ESG metrics by startups could enable governments to direct incentives toward ventures that advance national development priorities (such as the green transition and digital innovation), creating a virtuous cycle between policy and investment.

2. State of the Art

Sustainable Investment and ESG Metrics have become over the past decade increasingly important in investment decisions worldwide. In public markets, ESG reporting is increasingly standard due to regulations and investor pressure, and high ESG ratings have been linked to lower capital costs and better long-term performance. However, in venture capital, ESG integration remains rare, especially at early stages. Impact investing is growing rapidly (global assets now in the trillions with double-digit annual growth), but investors still lack robust methods to evaluate and price startup-level impact, so most early-stage assessments continue to rely on traditional metrics like user growth and revenue.

European industrial policy emphasizes the "twin transitions" of sustainability and digitalization. Programs such as the Green Deal and EU recovery funds channel resources into green innovation, clean energy, and digital transformation. Romania and Bulgaria have committed

to these goals but historically provided only modest startup support, focusing on general business climate improvements rather than ESG-oriented initiatives (Dumitrescu, 2024). In other CEE countries, targeted measures have shown results – Estonia's Startup Visa attracted hundreds of foreign founders (Invest in Estonia, 2021), and Poland's public VC fund-of-funds catalyzed local venture investment, but similar initiatives in Romania and Bulgaria are still nascent.

Aligning the sustainable investment trend with industrial policy goals will require a deliberate framework that encourages startups and investors to incorporate ESG metrics from the ground up. Proposed tools include green taxonomies, mandatory sustainability disclosures, and impact-focused public funding. Yet implementation in emerging ecosystems remains inconsistent. Policymakers in CEE have yet to fully leverage ESG metrics to guide capital toward national priorities such as decarbonization and inclusive growth. Integrating impact measurement into the startup ecosystem could complement traditional support measures by directly aligning entrepreneurial activity with broader societal goals.

3. Methodology

We adopt a qualitative, exploratory approach. The research draws on policy analysis and case studies rather than quantitative modeling. First, we reviewed relevant literature, reports, and policy documents on ESG metrics adoption and startup support programs. We also drew on the author's prior comparative research on CEE startup ecosystems (Dumitrescu, 2024) to frame the context for Romania and Bulgaria. Second, we examined illustrative examples of Western European startups known for leveraging ESG metrics (notably climate tech and impact-oriented ventures), using public information on their funding and impact achievements. These cases provide insight into how alignment with ESG criteria can enhance a startup's appeal and outcomes. Finally, based on the literature and case insights, we identified a set of policy recommendations aimed at strengthening the ESG–investment–policy linkage in the Romanian and Bulgarian context. The goal is to blend academic insight with practical policy suggestions relevant to stakeholders.

4. Research Results

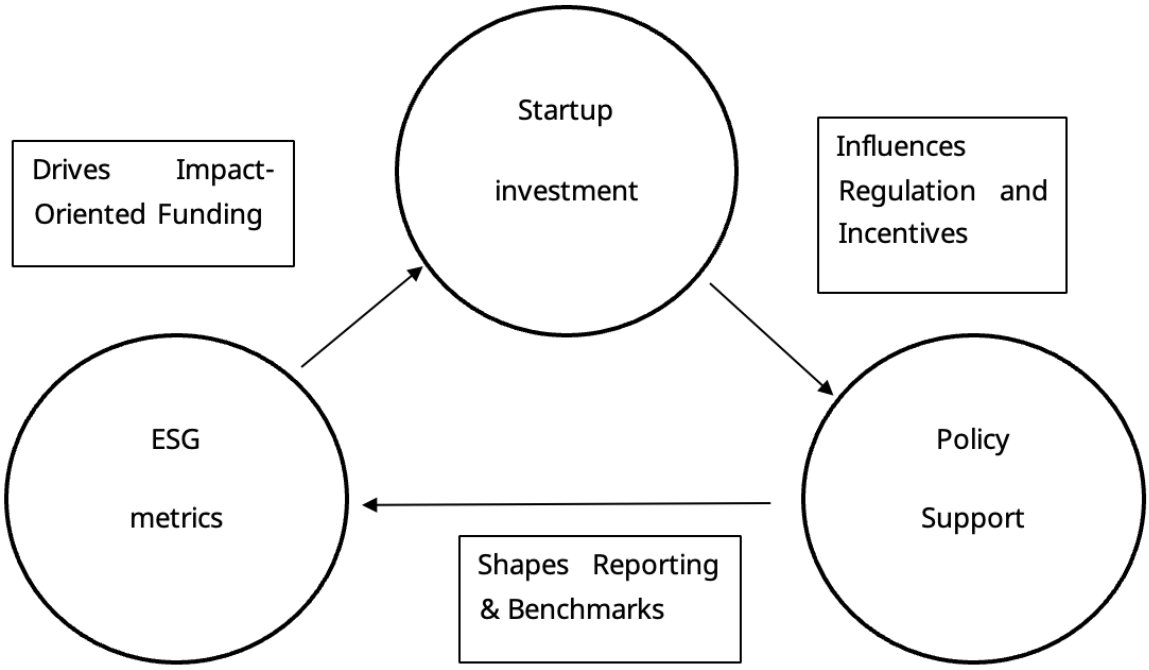
Figure 1 illustrates a conceptual feedback loop connecting ESG metrics, startup investment, and policy support. When governments incorporate ESG criteria into funding programs or regulations, startups are incentivized to adopt and report standardized impact metrics. This in turn provides investors with clear signals of long-term value and risk mitigation, prompting more capital to flow into ESG-aligned ventures. As those ventures grow and demonstrate measurable societal benefits, they contribute to the very policy targets. In short, effective ESG metrics can create a virtuous cycle.

• Startup Investment - Policy Support: Investment trends push governments to adjust regulations, incentives, and funding instruments.

• Policy Support - ESG Metrics: Policies shape the standards and expectations for ESG reporting and benchmarks.

• ESG Metrics - Startup Investment: Strong ESG metrics attract more impact-oriented capital and guide investor decision-making.

Figure 1. Conceptual Feedback Loop: ESG Metrics, Startup Investment, Policy Support



Source: Author's conceptualization.

4.1 ESG Adoption

A number of Western European startups exemplify how early adoption of ESG impact metrics can enhance both their growth and their contribution to policy goals. For instance, Berlin-based Plan A offers a platform for companies to monitor CO2 emissions and manage ESG indicators. Founded in 2017 (with CEE roots), Plan A aligned its mission with climate policy objectives by enabling corporate clients to track and reduce their carbon footprints. It grew rapidly, securing a $10 million Series A in 2021 just six months after its seed round (Ionita, 2021), and expanded internationally to meet rising demand. Likewise, Planetly, founded in Berlin in 2019,

attracted over 170 corporate customers for its carbon tracking software and was acquired by U.S.-based OneTrust in 2021 after just two years (Taylor, 2021). These ventures thrived in ecosystems where investors and customers valued ESG performance. Recognized metrics and frameworks allowed Plan A and Planetly to credibly quantify their impact (e.g. tons of CO2 abated), making them attractive to venture capital and corporate acquirers. In contrast, Romania and Bulgaria have seen few such success stories. Local startups focusing on ESG or cleantech are rare, and those that emerge often relocate to more supportive environments (as Plan A did). Scarce local impact investors and the absence of incentives for startups to report ESG performance contribute to this gap. Preliminary evidence suggests that in CEE, even mission-driven startups do not enjoy the valuation benefits seen in the West, due to limited ESG integration by investors and weak policy support (Dumitrescu, 2024). This underscores the need for public action to cultivate an environment in which measuring and striving for impact is rewarded.

4.2 Public policies

To connect sustainable investment flows with national development objectives, Romania and Bulgaria can implement a set of complementary policy measures. Table 1 summarizes key proposals drawn from successful practices elsewhere, tailored to the local context. Each measure is designed to embed ESG considerations into the startup ecosystem – encouraging ventures to adopt impact metrics and guiding investors toward ESG - aligned opportunities – thereby aligning private initiative with public interest.

Table 1. Proposed policy initiatives linking ESG metrics with investment and policy goals

Policy measure	Description
ESG registry and reporting standards	Establish a national ESG startup registry to collect standardized impact metrics from ventures, improving transparency and helping investors and policymakers identify high-impact startups.
Integration of ESG in public funding	Incorporate ESG criteria into government startup grants and co-investment funds, requiring or rewarding startups that report ESG indicators. This aligns public funding with policy goals by channeling support to impact-oriented ventures.
Targeted tax incentives for impact investment	Offer tax breaks to investors (angels, VC funds, corporates) who fund startups with clear ESG objectives. Poland's 50% tax deduction for VC investors (PFR Ventures, 2021) could be emulated to reward investment in SDG-aligned startups or impact funds.
Pension fund ESG allocation mandates	Mandate or encourage pension funds to allocate a portion of assets to impact investment vehicles. Even a small quota can mobilize substantial capital for local sustainable startups, based on the experience of countries with advanced ESG investment guidelines.
ESG-focused accelerators and education	Provide funding and support for accelerators and incubators focused on SDG/ESG-oriented ventures, and integrate ESG metrics training into entrepreneurship education. This builds a pipeline of startups skilled in measuring and managing impact.
Green public procurement for startups	Use public procurement to stimulate demand for sustainable startup solutions by including ESG impact criteria in tenders. Early-stage companies gain reference customers and revenue, while the public sector advances its sustainability targets.

Impact-oriented startup visa programs	Expand startup visa schemes to attract foreign founders in sustainability and social innovation. Fast-tracking visas for impact-driven entrepreneurs can import talent and ideas – for example, Estonia's Startup Visa issued over 500 visas in its first few years (Invest in Estonia, 2021a), demonstrating the boost such talent inflows can provide.

Source: Author's elaboration, based on Dumitrescu (2024).

Implementing these measures in concert would create an environment where impact metrics are a natural part of doing business and a key factor in investment decisions. For instance, a startup registry of ESG outcomes would complement incentives like tax breaks or procurement preferences by verifying which companies deliver tangible impact. Likewise, educational initiatives would ensure entrepreneurs can measure and improve ESG performance, making them more competitive. Notably, the policies are mutually reinforcing: a founder attracted via a startup visa could join an ESG accelerator and later secure public co-investment by meeting impact criteria, while pension funds spurred by new mandates would find a pipeline of sustainable startups to invest in.

5. Conclusions

Aligning sustainable investment with industrial policy is a practical strategy for Romania and Bulgaria to accelerate development. ESG metrics offer a common language that translates policy priorities (decarbonization, digitalization, social inclusion) into criteria guiding startup strategy and investor decisions. Our analysis suggests that when startups measure and communicate their impact, they can unlock funding and partnerships while providing policymakers with evidence of progress. ESG-oriented startups became magnets for capital and effective instruments of policy goals. Conversely, the lack of such cases at home underscores the cost of inaction, including ongoing brain drain of talent to more supportive ecosystems and missed opportunities to tap global impact investment capital.

The proposed measures form an integrated toolkit. Adopting them would mark a shift to a proactive industrial policy that not only removes obstacles for startups but actively steers the ecosystem toward generating social and environmental value. An ESG-focused accelerator could nurture cleantech ventures that later benefit from pension fund investments and public procurement contracts, creating a feedback loop of growth and impact. Crucially, this approach aligns private investors' interests with governments' sustainable development goals. Embedding ESG metrics into the startup ecosystem would improve transparency and accountability, ensuring public support yields measurable outcomes and private investment advances the public good.

ESG impact metrics can indeed bridge sustainable investments and industrial policy in emerging economies. They enable a shared understanding of value that encompasses both financial returns and positive externalities. To move forward, policymakers might start with pilot initiatives

to build early momentum and evidence. As results accumulate, successful tools should be scaled up and refined, continuously aligning market incentives with policy objectives. Ultimately, by redefining value to include impact and rewarding it through smart policies, countries like Romania and Bulgaria can foster more innovative, resilient, and inclusive economies while contributing to Europe's broader sustainability goals.

References

Dean Hand, Sophia Sunderji, Maddie Ulanow, Renée Remsberg and Kelly Xiao (2024). State of the Market 2024: Trends, Performance and Allocations - The GIIN, [online] Available at: https://thegiin.org/publication/research/state-of-the-market-2024-trends-performance-and-allocations/

Dumitrescu, I.-M. (2024). Smart Public Policies for Startup Growth in Romania. (forthcoming).

Global Impact Investing Network (GIIN). (2024). *State of the Market 2024: Trends, Performance and Allocations*. New York: GIIN (September 30, 2024).

Invest in Estonia. (2021). Fifth of Estonian Startups Founded with Help of Startup Visa Programme. [Online]. Available at: https://investinestonia.com/fifth-of-estonian-startups-founded-with-help-of-startup-visa-programme/

Ionita, A. (2021). Lubomila Jordanova, Plan A: You don't need to climb Everest, just pick a hill and go. – *The Recursive* [online], 29 November 2021. Available at: https://therecursive.com/lubomila-jordanova-plan-a-you-don-t-need-to-climb-everest-just-pick-a-hill-and-go/

PFR Ventures. (2021). New Tax Relief: 50% Deduction for Investors in VC Funds and Business Angels. Polish Development Fund, 2 June 2021. [Online]. Available at: https://pfrventures.pl/en/artykul/new-tax-relief-50-deduction-investors-vc-funds-and-business-angels

Taylor, D. (2021). Berlin's Planetly acquired by US-based OneTrust. – *Tech.eu* [online], 8 December 2021. Available at: https://tech.eu/2021/12/08/berlins-planetly-acquired-by-us-based-onetrust/