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Comparative Developments in the Transport Market in the EU and Romania since 2000, under the Influence of Stress Factors*

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Abstract

The transport market is an essential element in the functioning of modern economies, being deeply influenced by a series of economic, geopolitical, energy, climate, and health stressors. Since 2000, the European Union has gone through multiple episodes of instability—the global financial crisis, successive enlargements, accelerated energy transition, the COVID-19 pandemic, and recent geopolitical tensions—which have had a significant impact on the dynamics of the transport market. This paper aims to analyse the evolution of the transport market in the European Union between 2000 and 2024, with a particular focus on Romania, through the lens of the influence of the aforementioned stressors. The methodology used combines theoretical analysis of the literature with an examination of relevant quantitative indicators on freight and passenger transport volumes, modal structure, and carbon dioxide emissions generated by the transport sector. The results highlight significant structural differences between European Union member states, as well as a process of gradual convergence of Romania towards the European average, marked, however, by persistent vulnerabilities in terms of infrastructure, energy efficiency, and resilience to external shocks. The analysis emphasizes the decisive role of European and national public policies in mitigating the negative effects of stress factors and in steering the transport sector towards a more sustainable and resilient model. The paper contributes to understanding the complexity of the relationship between stress factors and the evolution of the transport market, offering relevant conclusions for the development of future strategies in this field.

Keywords: transport market, stress factors, economic resilience, transport policies, sustainability

Introduction

In recent decades, the transport market has been subject to increasingly intense pressures generated by a variety of exogenous and endogenous factors, generically referred to as stress factors. These include economic crises, energy price volatility, climate change, health crises, geopolitical instability, and rapid technological change. The impact of these factors is not limited to cyclical fluctuations, but can lead to lasting structural changes in the organization and functioning of the transport market (OECD, 2019).

Since 2000, the transport market in the European Union has undergone profound changes, driven by the enlargement of the Union, market liberalization, increased trade flows, and greater labour mobility. These developments have been accompanied by a series of major stressors, such as the global economic crisis of 2008–2009, the COVID-19 pandemic, the energy crisis, and recent geopolitical tensions. Analysing the impact of these

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factors is essential for assessing the robustness of the single transport market and for informing European policies in the areas of infrastructure, energy, the environment, and digitalization.

Analysing the influence of stressors on the transport market is essential for understanding recent developments and anticipating future changes in the sector. The comparative approach, at the level of the European Union and Romania, highlights both common trends and national particularities, providing a solid analytical framework for assessing the performance and resilience of the transport market in a context marked by uncertainty and profound structural changes.

Literature Review

The literature highlights the central role of the transport sector in supporting economic growth, market integration, and territorial cohesion, particularly in the context of the European Union. Classic studies emphasize that the development of transport infrastructure stimulates productivity, labour mobility, and regional competitiveness (Banister & Berechman, 2001; Vickerman, 2018). At the same time, transport is recognised as a sector that is extremely sensitive to external shocks and multiple stressors, which can affect both the volume of activity and the modal structure of the market.

A significant part of the literature focuses on the impact of economic and financial crises on transport. Analyses conducted after the global financial crisis of 2008–2009 show that freight transport reacts quickly to economic downturns, while passenger transport is relatively more resilient, but with delayed effects (OECD, 2011; Rodrigue et al., 2020). Other studies highlight that emerging or converging economies in Central and Eastern Europe are more vulnerable to these shocks due to their high dependence on road transport and underdeveloped infrastructure (EC, 2019).

A growing body of research is examining the relationship between transport and environmental policies, highlighting the sector's significant contribution to carbon dioxide emissions. The European Environment Agency shows that transport is one of the main sources of greenhouse gas emissions in the EU, despite technological advances and decarbonization policies (EEA, 2022). Recent studies emphasize the need for a transition to more sustainable modes of transport, such as rail and intermodal transport, in order to achieve the objectives of the European Green Deal (IEA, 2023).

The impact of the COVID-19 pandemic has generated a new wave of literature highlighting the fragility of transport systems in the face of global health shocks. Research shows sharp declines in passenger transport and disruptions to logistics chains, followed by adaptation processes and accelerated digitalization (ITF, 2021; Zhang et al., 2022). In this context, the concept of transport market resilience has become central to public policy analysis.

With regard to Romania, the literature is more limited and fragmented, focusing mainly on infrastructure and the absorption of European funds. However, there is a lack of integrated analyses that comparatively assess the impact of stressors on the transport market in relation to the EU average. This paper fits into this framework, contributing to the existing literature through a comparative and longitudinal approach, focusing on post-2000 developments and economic and public policy implications.

Theoretical Clarifications

Stressors can be defined as those events, processes, or policies that exert significant pressure on the normal functioning of an economic system, generating temporary imbalances or structural transformations. In the case of the transport market, these are internal or external elements that exert pressure on this market, generating uncertainty, additional costs, imbalances, or operational risks, affecting the efficiency, stability, competitiveness, and sustainability of transport activities.

In general, stressors can be economic, energy-related, institutional, environmental, health-related, or geopolitical in nature (OECD, 2019).

Unlike small-scale cyclical shocks, major stressors tend to simultaneously affect transport demand and supply, cost structure, and the behaviour of economic agents. Analysing them requires an integrated approach that combines descriptive, comparative, and quantitative methods.

Stressors in the transport market have several common characteristics:

- Variability – they can occur suddenly (e.g., geopolitical crises) or gradually (e.g., climate change).
- Interdependence – one stress factor can trigger other factors (e.g., rising fuel prices → higher transport costs).
- High economic impact – they influence costs, tariffs, and profitability.
- Difficulty to control – most are external and difficult to anticipate.
- Short- and/or long-term effect – some effects are immediate, others structural.
- There are several categories of stressors that impact the transport market:

  - Economic factors, such as economic cycles and financial crises, which directly influence transport demand (EC, 2011);
  - Energy factors, in particular fuel price volatility, with significant effects on operating costs;
  - Environmental factors, associated with policies to reduce emissions and the transition to sustainable transport;
  - Health factors, exemplified by the COVID-19 pandemic, which has severely affected mobility;
  - Geopolitical factors, which influence trade routes and logistics chains;
  - Technological factors, particularly digitalisation and automation, which can mitigate or amplify the effects of systemic stress.

Economic factors are among the most important stressors, influencing:

- Fuel price variation (diesel, gasoline, electricity)
- Inflation and rising operating costs
- Exchange rate fluctuations
- Decreased demand for transport during periods of recession
- Limited access to financing for fleet modernization

In this context, increases in transport tariffs and reductions in profit margins generally lead to bankruptcy, with small transport companies being the most vulnerable.

Political, administrative, and legislative factors are causing new specific market disruptions, targeting:

- Strict regulations on CO_2 emissions
- Fiscal policies and additional taxes (road tolls, excise duties)
- Political instability or regional conflicts
- Trade restrictions and international sanctions
- Changes in labour legislation (driving time, minimum wages)

All these influences can lead to increased administrative costs, reorganization of transport routes, and loss of market share.

The analysis of stressors on the transport market has important theoretical implications, contributing to the development of concepts of resilience, adaptability, and economic sustainability. In the context of the European Union, these concepts are integrated into public policies on sustainable mobility and the development of trans-European transport networks (EC, 2020).

Social and demographic factors also create specific market disruptions through:

- Decline/shortage of skilled labour (drivers, mechanics)
- An aging working population
- Increased work stress and risk of burnout
- Changing consumer behaviour (demand for fast deliveries)

All these situations lead to delays in transport, a decline in service quality, and increased wage costs.

Technological factors have a significant influence on:

- Rapid digitization and support for IT investments
- Automation and the development of the autonomous vehicle market
- The evolution of fleet monitoring and management systems

- The reduction of cyber interference risks

These can be seen as favourable conditions for greater investment in innovative technological systems and products, while also creating significant differences between modern and traditional companies.

Environmental and climatic factors are expected to have an impact on:
- Climate change (extreme phenomena: floods, heat waves, snowfall)
- Environmental protection policies
- Traffic restrictions in urban areas
- Acceleration of the implementation of sustainable transport policies

In general, these factors lead to disruption of regular transport routes, increased delivery times for goods or travel times for people, and the need to adapt fleets to new requirements for environmental protection and sustainable development in general.

Health factors, as well as those related to global crises, contribute to:
- The closure of borders
- Decreased population mobility
- Disruption of logistics chains

In these situations, logistical bottlenecks, financial losses for transport companies, and, in general, structural changes/disruptions in the specific market occur.

Highlights of the EU transport market after 2000, under the influence of stress factors

After 2000, the transport market in the European Union (EU) was influenced by a number of major factors that shaped the way people and goods are transported, as well as the regulations and economic dynamics of the sector.

The main milestones in the evolution of the EU transport market, under the influence of stressors and other factors, are:
1. The enlargement of the European Union and the integration of the single market (2004–2007)
2. Increased dependence on fossil fuels and the energy crisis
3. The global financial crisis (2008–2013)
4. Environmental policies and decarbonization (2010–present)
5. Digitization and advanced technology for clean vehicles
6. The COVID-19 pandemic (2020–2022)
7. War in Ukraine (2022–present)
8. Climate change and extreme events
9. Changing demand for mobility
10. Socioeconomic factors

1. European Union enlargement and single market integration (2004–2007): After 2000, the EU underwent two major waves of enlargement (2004 and 2007), when countries from Central and Eastern Europe — including Romania — joined the single market. This allowed the free movement of people, goods, and services, led to an increase in cross-border transport of goods and people, and stimulated investment in trans-European infrastructure (the TEN-T network).

In this context, freight and passenger transport volumes increased significantly, and companies from the new Member States were integrated into European logistics chains.

2. Increased dependence on fossil fuels and the energy crisis: European transport was heavily dependent on fossil fuels, with over 90% of the energy used in transport coming from oil. This dependence made the market vulnerable to oil price fluctuations (e.g., the peak in 2008) and the emergence of the energy crisis in 2021–2023, which increased fuel and energy costs as a result of geopolitical tensions and reduced imports of resources from Russia.

All this has led to higher costs for carriers and consumers, and increased pressure on the tariffs and profitability of transport companies.

3. The global financial crisis (2008–2013): The global economic crisis hit demand for goods and services, reducing the volume of freight and passenger transport, especially in the early part of the period. This situation led to a

decline in exports and industrial production, financial constraints for companies, and reduced investment in infrastructure.

All of this resulted in restructuring in the transport sector and reduced profits from road and rail transport.

4. Environmental and decarbonization policies (2010–present): The EU has adopted a comprehensive set of climate policies, including (EEA, 2022):

- emission standards for passenger cars (Euro 6/7);
- legislative packages such as "Fit for 55" to reduce greenhouse gas emissions;
- the inclusion of maritime transport in emissions trading systems (EU ETS) and standards for cleaner fuels.

These measures have consistently supported the transition to less polluting transport, the need for investment in electric vehicles and specific infrastructure, and additional costs for companies.

5. Digitalization and technological evolution towards sustainable transport solutions: The digital transformation of transport has included:

- intelligent traffic and logistics systems;
- monitoring platforms;
- supply chain technologies;
- start-ups for urban mobility (ride-sharing, micro-mobility).

In the same context, new technological trends have led to the development of numerous types of less polluting vehicles, new types of energy sources for vehicle engines, and even new types of materials for the construction of sustainable transport infrastructure (Fistung, 2025).

These influences have led to increased operational efficiency, but the need for continued massive technological investment in these areas has also become apparent.

6. COVID-19 pandemic (2020–2022): The health crisis had a massive and immediate impact, causing:

- a sharp decline in passenger transport demand, especially in aviation and urban transport;
- disruptions in logistics chains;
- introduction of special measures for mobility safety.

After lockdown, traffic began to return, but at different rates for each mode of transport.

7. The war in Ukraine (2022-present): The conflict that began in 2022 has influenced the transport market through the emergence of political tensions and economic sanctions, rising energy prices, substantial changes in trade and logistics flows, especially in areas neighbouring the conflict, such as Romania, Poland, Bulgaria and the Baltic countries, and the imposition of air and sea restrictions on certain transport operators.

8. Climate change and extreme events: Severe weather events (floods, heat waves, storms) have directly affected transport infrastructure and networks, mainly targeting road, rail, and maritime networks. These issues have led to the need to adapt infrastructure and its planning for a proper resilience process.

9. Changing mobility demand: Changes in user preferences and social trends, such as increasing urbanization, have led to completely different developments in public transport demand before, during, and after the health crisis. At the same time, structural changes and changes in demand for other modes of transport have been observed, with the aviation sector being the most affected during the health crisis.

10. Socio-economic factors. In this category, the following was observed:

- the aging population affects transport demand;
- internal migration and urbanization: generate pressure on urban networks;
- The shortage of drivers and logistics skills has undermined the economic efficiency of some modes of transport, leading to structural disruptions in the transport market.

Developments in the EU transport market since 2000

Transport market analysis requires the use of a coherent set of quantitative indicators that reflect the size, structure, efficiency, and sustainability of the sector. In the literature and in the practice of European institutions, the most commonly used indicators include freight transport volume (tonne-km), passenger transport volume (passenger-km), modal structure, labour productivity in the sector, transport costs, energy consumption, and greenhouse gas emissions associated with transport (Rodrigue, 2020; Eurostat, 2023).

These indicators enable the assessment of both the economic performance and the social and environmental impact of the transport market.

On average, transport contributes around 4-5% of the EU's GDP and provides over ten million direct and indirect jobs.

After 2000, employment rose until 2008, fell during the crisis, and subsequently stabilized.

In fact, for the period analysed, operating costs rose steadily due to fuel prices (most notably after 2021 against the backdrop of the energy crisis and subsequently the war in Ukraine), wage costs, and the imposition of more clearly targeted environmental regulations.

From an environmental perspective, transport accounts for about a quarter of the EU's total CO_2 emissions. After 2000, the volume of these emissions increased until 2007, fell fortuitously during periods of crisis (financial and health), and continued to show a slow downward trend.

At the same time, from an energy efficiency perspective, there have been technological improvements (more efficient vehicles), but their positive effects have been partially offset by the increase in transport volumes.

In fact, between 2000 and 2022, the volume of freight transport in the European Union showed a general upward trend, with significant fluctuations during periods of crisis. Road transport remained dominant, accounting for over 70% of total freight transport, followed by rail and maritime transport (Eurostat, 2023).

In Romania, the evolution of transport volumes has been more volatile, reflecting high sensitivity to economic cycles. Road transport has expanded rapidly, while rail transport has seen a relative decline in its share of total transport.

The modal structure is an essential indicator for assessing the efficiency and sustainability of the transport market. At the European Union level, public policies have sought to reduce dependence on road transport and promote rail and river transport. However, progress has been uneven across Member States (EC, 2011).

In Romania, the modal structure shows a divergence from European objectives, with negative implications for the external costs of transport and economic competitiveness (Table 1).

Table 1. Comparison between the modal structure in the EU and Romania in 2022 (%)

Mode of transport	EU	Romania
Road	7	85
Rail	18	10
Maritime	10	4
River	2	1

Source: (Eurostat, 2023)

Analysing the transport market after 2000, we can say that it has evolved in a context marked by the transition to a market economy, institutional reforms, and the process of European integration. Transport played an essential role in supporting economic growth and trade, but the development of the sector was characterized by structural imbalances and uneven modernization between modes of transport (World Bank, 2018).

In terms of total freight volume (tonne-kilometres), the situation was as follows:

- ❖ Between 2000 and 2008, freight transport in the EU grew steadily, supported by economic expansion and the integration of the single market.
- ❖ The global financial crisis (2008–2009) led to a significant decline in transport volumes, particularly in road and rail transport.
- ❖ Between 2010 and 2019, freight transport volumes gradually recovered, but did not reach a uniform growth rate in all Member States.
- ❖ The COVID-19 pandemic (2020) caused a further contraction, albeit more moderate than in 2009, followed by a rapid recovery in 2021–2024.

During the period under review, the EU's modal structure for freight transport shows a persistent dependence on road transport, despite diversification objectives, with the main developments being:

Road:

- Road transport remained the dominant mode in the EU throughout the period under review.
- Its share increased in the 2000s as a result of its flexibility and relatively low costs.
- After 2010, the growth in the share of road transport slowed down, against the backdrop of modal shift policies.

Rail:

- Rail transport has seen modest growth, with frequent stagnation.
- Investments in infrastructure and the liberalization of the rail market had uneven effects across Member States.

Maritime:

- Maritime transport continued to dominate EU foreign trade.
- Inland waterway transport remained relatively stable, being dependent on geographical and climatic conditions.

For passenger transport, mobility increased almost steadily between 2000 and 2008, especially in air transport. After 2009, growth slowed down, but the air segment remained the most dynamic until 2019.

The COVID-19 pandemic caused a historic decline in mobility, particularly in aviation and urban public transport. Starting in 2022, mobility gradually returned, but with structural changes (teleworking, reduced commuting), the recovery being uneven from a modal point of view, also conditioned by environmental policies or the new conditions caused by the war in Ukraine, which began in 2022.

Romania's accession to the European Union in 2007 was a landmark moment for the transport market, leading to the alignment of the legislative framework and public policies with European standards. At the same time, this process has increased competitive pressures and the need for investment in infrastructure and operational efficiency.

During the period under review, the Romanian transport market experienced a significant increase in transport volumes, particularly in the road freight transport segment. This development reflects both the positive economic dynamics and the specific structure of the Romanian economy, which is characterized by a high dependence on road transport (Eurostat, 2023).

Rail transport has seen more modest growth, affected by significant underfunding, outdated infrastructure, and reduced competitiveness compared to road transport. Air transport has experienced rapid growth in the post-accession period, supported by market liberalization and increased population mobility.

The global economic and financial crisis of 2008–2009 had a significant impact on the Romanian transport market, more pronounced than the European Union average. The economic contraction led to a sharp decline in transport demand, particularly in the industrial and construction sectors (World Bank, 2018).

The post-crisis recovery was slow and uneven, highlighting the sector's structural vulnerabilities and its dependence on economic cycles.

Investments in transport infrastructure have been a central element of public policy in Romania since its accession to the European Union. Structural and cohesion funds have contributed to the modernization of road infrastructure and, to a lesser extent, rail infrastructure. However, the pace of investment has often been hampered by administrative constraints and limited absorption capacity (EC, 2021).

Infrastructure deficiencies continue to be a major stress factor for the Romanian transport market, negatively affecting logistics efficiency and economic competitiveness.

The COVID-19 pandemic has had a significant impact on Romania's transport market, severely affecting passenger transport, particularly air and rail transport. Road freight transport has shown relatively higher resilience, being essential for maintaining supply chains (EC, 2020). The data are summarized and compared in Table 2. This period highlighted the importance of operational flexibility and digitalization in crisis management.

Rising energy prices and intensifying geopolitical tensions after 2021 significantly affected the transport market in Romania. High fuel costs put pressure on transport operators, especially small and medium-sized road transport companies (OECD, 2022).

These developments have amplified existing vulnerabilities and highlighted the need for support and energy transition policies.

Currently, the Romanian transport market is in the process of adapting to new European requirements regarding sustainability, digitization, and resilience. Infrastructure projects financed by European funds and initiatives to modernize the sector offer opportunities for convergence, but their success depends on institutional capacity and the coherence of public policies.

An analysis of the evolution of the Romanian transport market highlights both the progress made and the persistence of certain structural stress factors.

For a more relevant illustration of the comparative evolution of transport markets in EU countries, Figures 1 and 2 show the evolution of freight and passenger volumes between 2000 and 2024 for several countries with similar population densities (number of people/km^2), with Romania (82 inhabitants/km^2) at the centre of the analysis.

Table 2. Key indicators of the transport market in the EU and Romania (2000–2022)

Year	EU Freight volume (billion t-km)	Romania Freight volume (billion t-km)	EU Passenger volume (billion p-km)	Romania Passenger volume (billion p-km)
2000	3.2	12	6	15
2005	3,500	140	6,900	160
2010	3,100	130	6,700	155
2015	3,600	145	7,200	165
2020	3,800	150	7,500	170
2022	3,900	155	7,700	175

Source: EUROSTAT, 2023 and own calculations

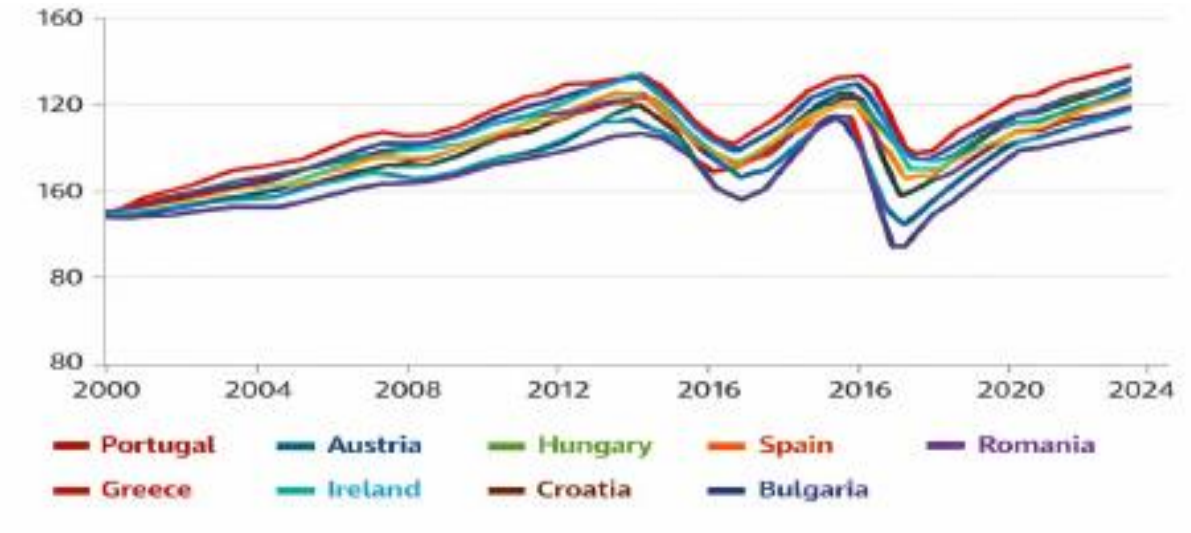
Thus, four countries with a population density immediately higher than that of Romania were considered, namely: Spain (95), Hungary (106), Austria (109), and Portugal (112), and four countries with a population density immediately lower than that of Romania, namely: Greece (80), Ireland (74), Croatia (69) and Bulgaria (61) – Table 3.

Table 3. Classification of EU countries by population density (persons/km²), 2000-2024

Position	Country	Density (inhabit/km²)	Average density (inhabit/km²)
1	Malta	~1600–1760	1680
2	Netherlands	~520–530	525
3	Belgium	~380–390	385
4	Luxembourg	~250–260	255
5	Germany	~240–243	242
6	Italy	~200–202	201
7	France	~120–122	121
8	Poland	~120–126	124
9	Czech Republic	~130–138	134
10	Denmark	~138–139	139
11	Portugal	~110–114	112
12	Hungary	~105–106	106
13	Austria	~108–110	109
14	Spain	~94–96	95
15	Romania	~80–83	82
16	Greece	~79–81	80
17	Ireland	~70–77	74
18	Croatia	~68–69	69
19	Bulgaria	~60–61	61
20	Estonia	~30–32	31
21	Latvia	~28–29	29
22	Finland	~17–18	18
23	Sweden	~25–26	26
24	Slovenia	~104–105	105

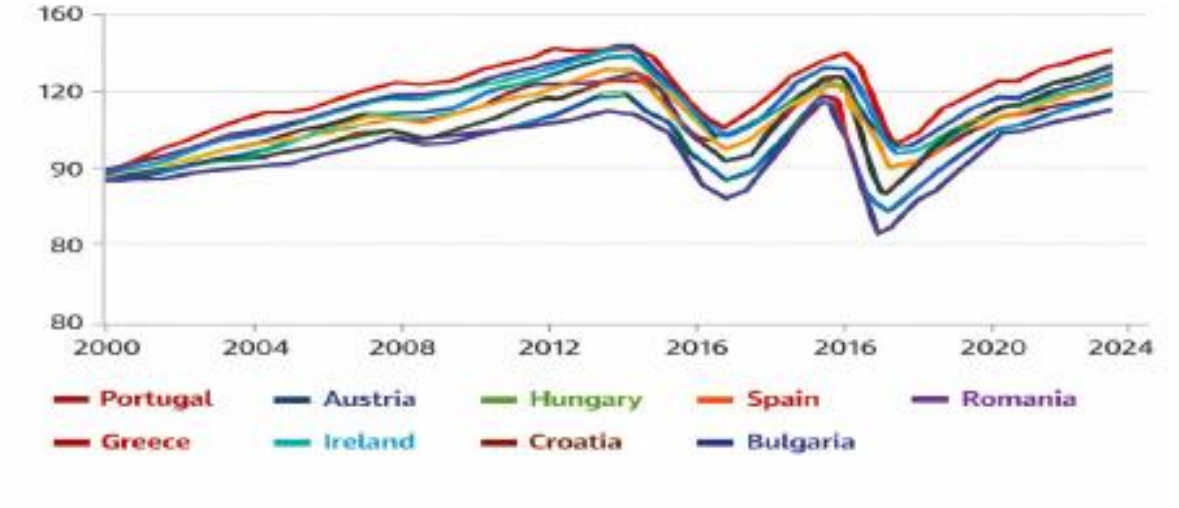
Source. Data and data processing according to (Eurostat, 2024), (Worldometer, 2026), (KSH, 2025), (DESTATIS, 2026),

The average EU density in 2022–2023 was approximately 109 people/km², a modest increase compared to the early 2000s.



Source: Created by authors

Figure 1. Evolution of freight volume in several EU countries for the period 2000-2024



Source: Realised by the authors

Figure 2. Evolution of passenger volume in several EU countries, for the period 2000-2024

Western European countries and small states (e.g., Malta, the Netherlands, Belgium) are significantly denser. Northern and Eastern European countries (e.g., Finland, Sweden, Estonia) have lower densities, reflecting different demographic and geographic structures.

The evolution of the indicators presented in Figure 1 shows that:

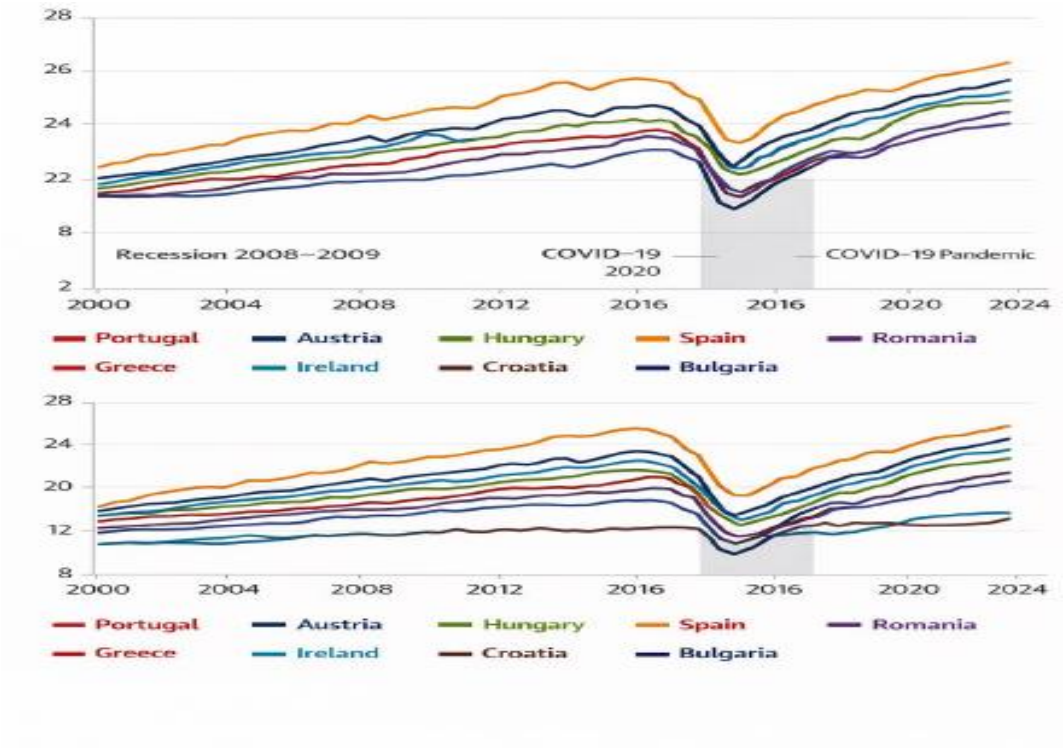
- General trend 2000–2008: gradual increase in transport volumes for all countries, reflecting European economic expansion and regional integration.
- 2008–2009: noticeable decline in all countries due to the global financial crisis, with freight transport in smaller, road-dependent economies (e.g., Romania, Hungary, Croatia) being the most affected.
- 2010–2019: recovery and steady growth, with western countries such as Austria, Spain, and Portugal growing more moderately, and Romania and Hungary experiencing more pronounced recoveries due to increased exports and international trade flows.

- 2020: major shock caused by the COVID-19 pandemic, with reduced economic activity and transport restrictions affecting passenger transport more, but also freight (especially intermodal logistics).
- 2021–2024: gradual recovery, with higher volumes for Romania, Hungary, and Spain due to the resumption of trade and economic recovery; countries with more developed infrastructure (Austria, Portugal) maintain stable volumes with moderate growth.

Figure 2 shows that the volume of passengers transported during the period analysed follows a similar pattern to that of freight, but:
- The COVID-19 pandemic (which began in 2020) had a dramatic impact, significantly reducing passenger numbers (travel restrictions, lockdowns).
- Countries with strong tourism (Spain, Greece, Romania) experienced more pronounced fluctuations.
- The recovery in the period 2021–2024 was much slower than the previous decline in countries with low density and less developed infrastructure (Ireland, Croatia, Bulgaria).

As general remarks, we highlight the following:
- Economically strong countries (Spain, Austria) experienced moderate and stable growth.
- Economically weaker or transition countries (Romania, Croatia, Hungary) show greater variability, with a stronger impact of stress factors (financial crisis, pandemic).

For the same time period, 2000-2024, and in the nine countries analysed, CO_2 emissions caused by transport are shown in Figure 3.



Source: Prepared by the authors

Figure 3. Evolution of CO_2emissions caused by transport (freight and passengers) in several EU countries, 2000-2024

Figure 3 highlights several important aspects, namely:

- 2000–2008: steady increase in emissions, correlated with the expansion of transport and dependence on fossil fuels.
- 2008–2009: stagnation or slight decline, due to the global economic crisis.
- 2010–2019: moderate increase in emissions, but slower than the increase in transport volumes, due to timid energy efficiency measures and environmental policies.
- 2020 (start of the COVID-19 pandemic): sharp decline in emissions, corresponding to the reduction in passenger transport and industrial activity/road transport.

- 2021–2024: gradual increase, but with a tendency to stabilize or decline slightly compared to previous peak levels (2020–2019), due to the adoption of more efficient technologies and emission reduction policies in the EU.

Comparison between countries:

- Spain and Austria: high emission levels due to high road and passenger transport volumes.
- Romania and Hungary: emissions are more volatile, reflecting the sensitivity of transport to economic and energy stressors.
- Croatia, Bulgaria, Ireland, Greece, Portugal: lower emissions, but growth proportional to economic development and tourism.

The trends shown in Figures 1, 2, and 3 reveal the following:

- Clear link between transport volume and CO_2 emissions: increases in volume lead to increases in emissions, while decreases (the 2009 crisis, COVID-19) reduce both transport and emissions.
- Impact of stress factors: economic crises and pandemics affect both transport and emissions, with more pronounced effects in countries with less developed infrastructure.
- Post-crisis recovery: for passengers and freight, but emissions tend to be more moderate due to energy efficiency measures.
- Differences between countries: reflect the structure of the economy, the dominant mode of transport (road vs. rail) and environmental policy.

Stress factors and their impact on the EU transport market between 2000 and 2024

The impact of stress factors on the main modes of transport in the EU since 2000 has varied, and can be summarized as follows:

- Road transport has remained dominant in the EU, particularly for freight transport. However, it has been severely affected by rising fuel prices, strict emissions regulations, and a shortage of skilled labour. Although it has remained the dominant segment in freight transport (with a share of over 70%), the current situation has put a lot of pressure on SMEs in the sector.
- Rail transport has been promoted as a sustainable alternative, but its development has been limited by interoperability issues and historical underfunding.
- Air transport experienced significant growth until 2019, stimulated by liberalization and the development of low-cost airlines. The pandemic severely affected this sector, and its recovery has been conditioned by new environmental regulations and the evolution of demand.
- Maritime transport has remained essential for the EU's international trade. Recent logistical crises and environmental regulations have increased pressure on this sector, accelerating the transition to alternative, environmentally friendly fuels.
- Urban transport has been influenced by urbanization, behavioural changes, the health crisis, and environmental policies. The focus has shifted to electric mobility, public transport, and micromobility solutions (short journeys that can be made on foot or with non-polluting vehicles).

Labor productivity in the transport sector has increased at the European Union level, supported by technological investments and the optimization of logistics chains.

In Romania, productivity remained below the EU average during the period analysed, reflecting both technological differences and institutional deficiencies (OECD, 2022).

Transport costs, influenced by fuel prices, taxes, and environmental regulations, are a critical factor for the competitiveness of operators. The increase in energy costs after 2021 has acted as a major stress factor, affecting in particular economies with low energy efficiency.

As mentioned above, transport is one of the main sources of greenhouse gas emissions in the European Union. Although progress has been made in terms of energy efficiency and reducing emissions per unit of transport, total emissions remain high as a result of growing demand for mobility (EEA, 2022).

In Romania, environmental indicators reflect a double pressure: the increase in road transport volumes and the relatively low level of modernization of the vehicle fleet.

However, there are significant relationships between the evolution of transport indicators and the stressors identified and presented above in detail. Economic crises are negatively correlated with transport volumes and positively correlated with their volatility, while rising energy prices are associated with higher transport costs and reduced demand (OECD, 2019).

The COVID-19 pandemic has had an asymmetric impact, severely affected passenger transport but having a more moderate effect on freight transport, highlighting the strategic role of the latter.

As mentioned above, since 2000, the transport market in the European Union has undergone complex developments, driven by economic integration processes, the enlargement of the Union, and the intensification of intra- and extra-Community trade flows. Transport has played a central role in the functioning of the single market, contributing to the increased mobility of production factors and the consolidation of European logistics chains (EC, 2011).

Between 2000 and 2007, the development of the transport market was supported by relatively stable economic growth, the gradual liberalization of transport services, and significant investments in infrastructure. The volume of freight and passenger transport has been on an upward trend, with a marked increase in road and air transport (Eurostat, 2023).

The enlargements of the European Union in 2004 and 2007 had a significant impact on the transport market, integrating countries with different economic structures and infrastructures. This enlargement led to increased transport demand, particularly on east-west routes, and to intensified trade between old and new Member States.

At the same time, enlargement highlighted considerable disparities in infrastructure quality and transport mode structure, creating additional challenges for European cohesion and transport policies.

The global economic crisis of 2008–2009 was one of the most significant stress factors affecting the transport market in the European Union. The decline in economic activity led to a significant reduction in freight and passenger transport volumes, highlighting the pro-cyclical nature of the sector (OECD, 2019).

Freight transport was severely affected, particularly in the industrial sectors and in maritime and rail transport, while air passenger transport experienced a sharp contraction. The post-crisis recovery was gradual and uneven across Member States and modes of transport.

Since the second decade of the 2000s, European transport policy has placed increasing emphasis on sustainability, energy efficiency, and reducing greenhouse gas emissions. Strategic documents such as the 's "White Paper on Transport" set ambitious targets for modal shift, rail transport development, and the promotion of intermodally (EC, 2011).

These policies have acted simultaneously as pressure factors and structural transformation factors, influencing the cost structure and behaviour of transport operators.

The COVID-19 pandemic has caused an unprecedented shock to the transport market in the European Union. Mobility restrictions and health measures have led to a dramatic decline in passenger transport, particularly in air and rail transport, while freight transport has shown relatively higher resilience (EC, 2020).

This period has highlighted the importance of flexibility and digitalization in ensuring the continuity of logistics chains.

The sharp rise in energy prices and intensified geopolitical tensions after 2021 have increased pressure on the transport market in the European Union. High operating costs have affected the competitiveness of transport operators, particularly in road and air transport, leading to fare adjustments and route restructuring (OECD, 2022).

The EU transport market is currently undergoing a profound transformation, focused on digitalization, decarbonization, and increased resilience. European initiatives on smart transport and the transition to sustainable mobility aim to reduce the vulnerabilities identified during periods of systemic stress (EC, 2020).

Conclusions

This paper analysed the evolution of the transport market in the European Union and Romania from 2000 to the present, under the influence of the main economic, energy, health, and geopolitical stressors. The analysis highlighted the strategic nature of the transport sector for the functioning of the European single market and for the process of economic convergence of Member States.

The results show that, at the European Union level, the transport market has demonstrated a relatively high capacity to adapt to external shocks, benefiting from a consolidated institutional framework and sustained investment in infrastructure. However, the vulnerabilities associated with dependence on road transport and fossil fuels remain significant.

The evolution of the main indicators of the EU transport market since 2000 highlights a dynamic but vulnerable sector, deeply influenced by economic, health, and geopolitical stressors. Although there is a long-term trend towards growth and modernization, the market structure remains marked by dependence on road transport and the challenges of transitioning to a sustainable system.

These indicators are summarised in Table 4.

Table 4 – Trends in key EU transport market indicators, 2000-2024

Indicator	Overall trend
Freight transport volume	Long-term growth with cyclical shocks
Road transport	Dominant, moderate growth
Rail transport	Stagnation/slow growth
Air transport	Rapid growth until 2019
Passenger mobility	High volatility
CO_2 emissions	Pressure to reduce
Transport costs	Clear upward trend

In Romania's case, the analysis showed partial convergence with the EU average, mainly through increased transport volumes and integration into European trade flows. At the same time, significant structural divergences remain, particularly in terms of modal structure, infrastructure quality, and energy efficiency.

From an economic perspective, the decisive role of transport in supporting economic growth and the functioning of logistics chains is highlighted. The high sensitivity of the sector to stress factors indicates the need for shock mitigation mechanisms, particularly in economies undergoing convergence.

For Romania, the economic implications are particularly relevant. Investments in infrastructure and modernization of the sector can generate significant multiplier effects, contributing to reducing logistics costs, increasing competitiveness, and attracting foreign investment.

At the European Union level, the results support the continuation of policies geared towards sustainable mobility, decarbonisation and digitalisation, while ensuring the sector's resilience to external shocks. The integration of transport policies with energy and industrial policies is essential to achieving European strategic objectives.

For Romania, public policies must aim to reduce structural divergences by accelerating investments in rail and intermodal infrastructure, improving the absorption of European funds, and stimulating the transition to more energy-efficient transport technologies.

Strengthening institutional capacity is a prerequisite for the success of these policies.

Between 2000 and 2024, the transport market in the European Union evolved under the influence of interdependent economic, political, technological, and environmental factors. From a phase of expansion and liberalization, the sector has progressively shifted towards sustainability, resilience, and digitalization.

The EU transport market has evolved from expansion and liberalization to resilience, sustainability, and digitalization. Successive crises have highlighted vulnerabilities but have also accelerated important structural reforms.

Transport continues to play a strategic role in the EU's economic development, but the future of this sector depends on the ability of the actors involved to adapt to increasingly complex climatic, technological, and geopolitical requirements.

In conclusion, the analysis shows that the transport market acts as a barometer of economic and geopolitical stability, reacting quickly to external shocks. In Romania's case, accelerating convergence towards the EU average depends decisively on the ability to transform stressors into catalysts for structural modernisation. Future research can extend the analysis by using panel data and dynamic models to assess long-term resilience.

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