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ECONOMIC RESILIENCE AS A VECTOR OF COMPETITIVENESS IN THE EU ANALYSIS AND LESSONS FROM THE POST-CRISIS AND POST-SHOCK PERIOD

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Abstract

This research aims to comparatively analyze the economic resilience of the European Union member states, in the context of successive economic shocks, by constructing composite scores that synthesize the adaptation and recovery capacity of each economy. The main goal was to highlight the structural and dynamic differences between economies, in terms of internal stability and response to crises, thus providing an integrated tool for evaluating and substantiating public policies. The objectives pursued included: (1) measuring structural resilience in the pre-crisis period, 2015–2019, (2) assessing post-shock resilience in the period 2020–2024, (3) comparing performances through standardized scores and (4) identifying the determinants of economic resilience in the EU. To achieve these objectives, a quantitative methodology was used, based on the aggregation and standardization of four main indicators: GDP per capita, unemployment rate, annual inflation (HICP) and total exports, with data from official sources (Eurostat) for all 27 EU Member States. The results show clear differences between economies, both in terms of structural fundamentals and post-crisis adjustment capacity. Germany, Ireland and the Netherlands stand out with high overall scores, while Greece, Spain and Estonia are at the bottom of the ranking, indicating persistent vulnerabilities or recent heightened pressures. Romania is in a middle position, with a balanced profile, but with clear needs for institutional consolidation and macroeconomic stability. The proposed scores provide a synthetic picture of resilience and can contribute to guiding development strategies and the efficient allocation of European resources.

Key words: *resilience, competitiveness, economy, post-crisis, E.U.*

INTRODUCTION

In the context of accelerated transformations of the global economy, the capacity of states to cope with external shocks is becoming not only a condition of stability, but also a strategic competitive advantage. Recent crises, the COVID-19 pandemic, supply chain disruptions, the energy crisis triggered by the Russian-Ukrainian conflict, global inflation, have profoundly tested the economic resilience of the European Union, exposing imbalances, but also differentiated adaptation capacities among member states [2, 24]. In this sense, resilience is no longer conceived exclusively as a capacity to return to the previous equilibrium, but as an active process of economic, institutional and structural reconfiguration [1, 16].

The specialized literature emphasizes the fact that resilience is a multidimensional construct, which includes components of shock resistance, rapid recovery capacity and the ability to structural transformation in the face of new challenges [5, 21, 26]. Recent studies emphasize the role of economic governance, the quality of institutions, human capital, the degree of economic diversification and trade integration as determinants of adaptability [4]. In the EU, initiatives such as the "Next Generation EU" and the "Recovery and Resilience Facility" reflect the effort to create systemic mechanisms for absorbing and adapting to crises [7, 18, 23]. To measure this capacity, empirical research often uses

indicators such as real GDP, unemployment rate, inflation, exports or the level of public debt, which are then integrated into synthetic resilience scores [6, 19, 22, 25]. These can be constructed through standardized aggregation methods, factor analysis or dimensional reduction (PCA), providing a comparative picture of how countries position themselves in relation to external shocks [3].

The present study aims to comparatively analyse the capacity of EU Member States to cope with successive shocks in the period 2020–2023 and, complementary, to assess long-term structural resilience for the period 2015–2023. The research is built on a unified statistical database, which includes key indicators of macroeconomic performance, trade openness and external vulnerability. By standardising them and constructing two composite scores, one post-crisis and one structural, we will be able to classify EU countries according to their resilience profile and identify the common features of the most adaptable economies. Furthermore, the analysis will be complemented by the exploration of correlation relationships and clustering, in order to capture regional adaptation patterns and distinguish between convergent and divergent models. Thus, the research contributes to the current literature by providing an applied analytical framework, based on real data and modern quantitative methods, which can support both academic analysis and the formulation of future-oriented economic policies.

MATERIALS AND METHODS

In order to assess the economic resilience of the European Union Member States to successive shocks in the period 2015–2023, the research was based on the construction of a multidimensional database, which integrates economic, trade and structural indicators essential for understanding the adaptation capacity of economies. The data were collected exclusively from official sources, in particular from the Eurostat database, thus guaranteeing international comparability and reliability of the sources.

The selection of the analyzed states was made according to the complete availability of data for the period 2015–2024. Only the 27 European Union Member States that have complete time series for the indicators considered relevant were included, excluding those states that presented significant gaps or methodological breaks, in order to maintain the statistical coherence of the analysis.

The methodology was structured in two stages: the first consisted of descriptive statistical analysis of each indicator: mean, standard deviation, minimum and maximum values, quartiles, in order to capture distributions, dispersion and possible anomalies or regional variations, as well as to understand the general directions of evolution of European economies in the context of recent instability. In the second stage, we constructed composite economic resilience scores, on two distinct temporal dimensions: (1) structural resilience in the period 2015–2019, defined as economic sustainability under conditions of stability, and (2) post-shock resilience in the period 2020–2024, which captures the capacity to adapt to shocks generated by the COVID-19 pandemic, the energy crisis and inflationary volatility. For each period, we selected four representative indicators: GDP per capita (as a proxy for economic development), unemployment rate (as an indicator of institutional capacity), inflation (as a measure of price stability) and exports (as an expression of external positioning).

To bring the indicators onto a common scale [0,1], we used the Min–Max normalization method:

$$X^* = (X - X_{min}) / (X_{max} - X_{min}), \text{ in care:}$$

X^*: normalized value of a raw indicator
X: raw value of the indicator for a given country and year.
Xmin: the lowest value of that indicator in the entire set of countries and years.
Xmax: the highest value of that indicator in the same set.
$X^* \in [0,1]$: the rescaled indicator – where 0 means minimum performance and 1 maximum performance in that domain.

For indicators with a negative meaning (unemployment, inflation), the formula was inverted as follows:

X = 1 - (X - Xmin) / (Xmax - Xmin)* [17, 20]

The composite scores were calculated as simple arithmetic means of the normalized indicators for each country:

Structural score = (GDP + Exports* + Unemployment* + Inflation*)/4 (for the years 2015–2019)*

Post-shock score = (GDP + Exports* + Unemployment* + Inflation*)/4 (for the years 2020–2024)*

Finally, the overall resilience score was obtained as the average of the two scores:

Overall score = (Structural score + Post-shock score)/2

This approach allows not only comparison between countries, but also monitoring the evolution over time of the economic response capacity and the potential for structural transformation within the European Union.

RESULTS AND DISCUSSIONS

This paper provides an analytical framework based on four essential pillars to examine the economic resilience of European Union Member States in the event of consecutive shocks between 2015 and 2024. This multimodal method enables an integrated examination of the potential of European economies to withstand, adapt, and change in the face of crises. The first pillar, economic capacity, reflects the structural potential of an economy, being assessed through indicators such as real GDP per capita, labor productivity and export dynamics. The second pillar targets external vulnerability, expressed through the degree of dependence on energy imports and the balance of trade balance. The third pillar focuses on institutional and fiscal capacity, analyzing indicators such as public debt, unemployment rate and macroeconomic stability. Finally, the capacity for adaptation and transformation reflects the potential for innovation and digitalization, being measured through productivity and specific indicators of structural modernization.

Table 1. GDP evolution in EU countries in the period 2015-2024 (Index, 2015=100)

Country	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Austria	105.45	107.69	110.13	112.87	114.85	107.59	112.75	118.70	117.57	116.19
Belgium	105.81	107.07	108.65	110.69	113.40	107.96	114.66	119.55	120.98	122.22
Bulgaria	106.78	110.01	113.03	115.91	120.30	116.43	125.49	130.56	133.02	136.76
Croatia	99.24	102.67	106.04	109.12	112.51	103.15	116.18	124.65	128.79	133.85
Cyprus	92.00	98.05	103.69	110.19	116.67	112.91	125.77	134.83	138.55	143.33
Czechia	108.33	111.13	116.88	120.18	124.47	117.87	122.62	126.11	126.04	127.45
Denmark	106.22	109.48	112.83	114.93	116.89	114.81	123.29	125.19	128.31	133.03
Estonia	119.45	123.14	130.08	134.89	139.92	135.88	145.61	145.69	141.29	140.92
Finland	99.83	102.40	105.78	107.04	108.49	105.78	108.62	109.44	108.41	108.26
France	105.58	106.48	108.70	110.49	112.73	104.34	111.52	114.39	115.46	116.81
Germany	108.69	111.18	114.20	115.48	116.62	111.84	115.95	117.54	117.22	116.94
Greece	81.19	81.17	82.36	84.06	85.98	78.07	84.83	89.70	91.79	93.88
Hungary	110.96	113.67	118.35	124.99	131.33	125.64	134.71	140.46	139.28	139.99
Ireland	140.97	142.69	157.03	168.88	177.39	190.09	220.99	240.04	226.76	229.53
Italy	96.62	97.82	99.39	100.21	100.64	91.71	99.90	104.72	105.47	106.23
Latvia	119.61	122.66	126.83	132.29	133.19	128.57	137.49	139.98	143.97	143.33
Lithuania	123.23	126.52	132.35	138.86	145.36	145.42	154.70	158.62	159.17	163.58
Luxembourg	111.22	116.75	118.29	120.20	123.50	122.87	131.39	129.95	129.05	130.38
Malta	131.85	137.23	155.03	166.17	172.96	167.15	189.38	197.47	210.89	223.48
Netherlands	104.54	107.08	110.06	112.54	115.13	110.68	117.62	123.51	123.61	124.82
Poland	116.75	120.29	126.49	134.39	140.54	137.68	147.22	154.96	155.34	159.88
Portugal	95.57	97.48	100.71	103.68	106.53	97.79	103.22	110.43	113.32	115.50
Romania	114.69	117.97	127.64	135.45	140.76	135.59	143.11	148.78	152.36	153.60
Slovakia	113.32	115.53	118.85	123.68	126.49	123.22	130.25	130.82	133.65	136.41
Slovenia	101.98	105.07	110.51	115.35	119.39	114.51	124.12	127.47	130.16	132.24
Spain	100.50	103.43	106.43	108.98	111.12	98.96	105.57	112.10	115.10	118.72
Sweden	110.98	113.59	115.66	117.86	120.87	118.44	125.47	127.31	127.16	128.40

Source: own processing [8, 9, 10, 11, 12, 13, 14, 15].

Each pillar is treated both from a cross-sectional perspective, through comparison between states, and longitudinally, based on the evolution over time of the associated indicators.

Economic capacity is the foundation of any form of systemic resilience. It reflects the level of structural development, productive potential and the capacity of an economy to absorb and adapt to external or internal shocks. In the context of the European Union, this dimension becomes especially essential in the post-pandemic period, marked by energy transitions, digital transformations and geopolitical tensions.

The data in Table 1 shows the dynamics of real GDP per capita (standardized values) in the 27 Member States of the European Union, in the period 2015–2024. A constant upward trajectory is noted for most economies, especially in Central and Eastern Europe (Romania, Poland, Hungary), but also in performing states in the euro area (Ireland, Malta, Estonia). The year 2020 marks a negative inflection, confirming the severe economic impact of the COVID-19 pandemic, with decreases of over 5–10 points on average, but followed by an accelerated recovery in 2021–2022.

Table 2. Descriptive statistics on economic capacity – GDP

Year	count	Mean Index, 2015=100	std	Min Index, 2015=100	25%	50%	75%	Max Index, 2015=100
2015	27	108.57	12.17	81.19	101.24	106.78	114.01	140.97
2016	27	111.42	12.60	81.17	104.25	110.01	117.36	142.69
2017	27	116.15	15.65	82.36	107.54	113.03	122.67	157.03
2018	27	120.35	18.14	84.06	110.34	115.48	128.64	168.88
2019	27	124.00	19.71	85.98	113.06	119.39	132.26	177.39
2020	27	119.44	22.80	78.07	106.69	114.81	127.10	190.09
2021	27	128.61	27.37	84.83	113.71	124.12	136.10	220.99
2022	27	133.44	29.59	89.70	118.12	127.31	140.22	240.04
2023	27	134.55	28.79	91.79	117.40	128.79	140.28	226.76
2024	27	136.88	30.35	93.88	117.83	132.24	142.13	229.53

Source: own processing [8, 9, 10, 11, 12, 13, 14, 15].

Table 2 summarizing the descriptive statistics of real GDP per capita captures a dual dynamic present within the European Union: a general trend of increasing economic capacity, but also an accentuation of differences between Member States. These developments reflect not only the effects of the accumulation of European policies in favor of recovery, but also the uneven degree of structural readiness of the states to capitalize on post-crisis opportunities. On one side, the average and median of standardized GDP reflect systemic development, backed by the 2020-2023 reforms, the digital transition, and the large inflow of capital through European funding. On the other hand, the increase in the dispersion of values between countries indicates that this progress has not been uniform. States with flexible economic structures, efficient administrations and investment capacity oriented towards innovation have managed to accelerate their economic convergence, while others have registered relative stagnation. This polarization is a direct effect of uneven resilience: external shocks, such as the pandemic or the energy crisis, have hit European economies with varying intensity, and government responses and the absorption capacity of European funds have led to different recovery trajectories. As a result, the differences between performing and vulnerable economies have deepened, affecting the internal cohesion of the Union and justifying the need for a multidimensional analysis of resilience.

In this context, descriptive statistics should not be seen as a simple description of levels, but as an x-ray of the capacity of each economy to transform resources and policies into sustainable adaptation. They thus provide a fundamental starting point for interpreting regional differences and for formulating differentiated policies to strengthen economic resilience in Europe. The external vulnerability of an economy reflects the degree to which it is exposed to global shocks, especially in terms of energy, one of the most sensitive components of the trade balance. Table 3

shows the evolution of the value of energy imports (in million euro) for all European Union Member States, during the period 2015–2023, while Table 4 summarizes descriptive statistics for each year.

Table 3. Evolution of energy imports in EU countries during 2015-2024 (Million euro)

Country	2015	2016	2017	2018	2019	2020	2021	2022	2023
Austria	11,978.91	12,855.65	13,575.58	13,410.92	15,722.32	11,879.75	10,832.93	14,712.21	11,996.78
Belgium	42,344.42	41,358.44	43,458.18	45,661.87	46,802.54	40,546.43	42,633.35	43,380.42	42,891.78
Bulgaria	6,633.10	6,640.60	7,024.96	6,162.43	6,584.83	5,526.12	5,498.79	6,808.01	5,817.89
Croatia	3,207.06	3,431.67	3,889.70	3,727.16	3,859.81	3,698.83	3,887.71	4,402.34	4,345.98
Cyprus	1,235.80	1,312.50	1,330.44	1,306.84	1,309.83	1,139.48	1,157.09	1,262.67	1,260.58
Czechia	11,526.70	11,394.20	12,613.26	12,158.90	12,947.13	11,045.15	12,477.30	12,470.59	11,129.11
Denmark	8,179.69	7,826.62	6,468.81	6,466.27	7,526.08	7,763.21	6,698.08	7,341.93	10,488.24
Estonia	1,125.70	1,223.70	1,264.11	1,356.90	1,237.05	1,385.29	1,335.66	1,105.63	896.71
Finland	10,931.40	11,839.60	11,448.70	11,684.10	11,447.30	10,770.20	9,020.85	10,048.80	8,997.80
France	80,305.11	79,334.23	82,108.22	80,281.42	82,060.42	67,576.15	69,541.87	76,844.54	71,115.44
Germany	143,156.80	141,527.50	152,998.67	129,959.46	133,837.87	116,426.74	122,188.12	127,950.59	109,463.96
Greece	17,684.30	18,923.30	19,864.22	20,135.03	19,541.01	19,281.94	20,271.07	19,620.30	18,667.43
Hungary	9,253.20	9,617.60	11,357.70	10,600.40	12,702.30	9,979.00	9,823.40	10,730.40	9,986.60
Ireland	7,773.04	6,248.00	6,027.93	6,135.74	6,267.84	6,173.87	6,828.24	7,088.76	6,559.83
Italy	83,122.40	85,219.80	88,908.15	85,813.35	86,095.16	74,827.50	82,209.49	86,172.07	77,474.58
Latvia	2,157.90	2,069.30	2,036.63	2,089.91	1,979.06	1,670.11	1,674.47	1,619.65	1,563.20
Lithuania	7,164.80	7,169.10	7,192.84	6,861.77	7,128.74	6,248.04	6,147.03	7,015.22	7,021.38
Luxembourg	1,886.59	1,860.89	1,920.43	1,989.17	2,022.94	1,703.25	1,813.68	1,595.79	1,518.25
Malta	1,359.50	1,345.00	1,645.16	1,734.21	1,795.11	1,606.30	1,448.29	1,585.08	1,668.00
Netherlands	104,242.20	107,119.11	94,386.91	97,203.97	98,054.09	88,514.41	91,779.25	99,777.56	96,487.99
Poland	25,865.40	27,447.10	30,686.50	33,475.22	33,370.87	30,841.41	31,895.88	33,944.74	33,431.92
Portugal	13,321.20	13,139.20	14,497.12	13,103.56	12,472.21	10,754.43	10,622.61	11,046.41	9,822.95
Romania	5,563.10	6,686.30	6,792.64	7,215.73	8,262.73	7,102.92	8,293.67	8,413.11	7,897.43
Slovakia	7,720.30	7,675.50	8,329.80	7,796.60	8,766.10	7,190.70	7,784.90	8,410.50	7,545.50
Slovenia	2,635.50	2,914.50	3,025.39	3,042.31	3,117.90	2,669.58	2,561.28	2,951.30	2,868.51
Spain	66,997.20	66,383.30	71,161.60	70,081.60	68,908.00	57,821.80	62,198.59	68,377.02	63,679.22
Sweden	15,310.60	16,737.10	16,032.80	16,115.00	13,908.13	14,573.73	14,049.88	14,515.71	14,053.81

Source: own processing [8, 9, 10, 11, 12, 13, 14, 15].

Overall, there is a significant increase in the average value of energy imports until 2019, followed by a sharp decline in 2020, as a direct effect of pandemic restrictions that reduced global demand and affected international prices. This decline was, however, temporary: in 2021–2022, energy imports return to an upward trend, driven by the energy crisis generated by the war in Ukraine, the volatility of gas and oil prices, and the reopening of European economies.

Table 4. Descriptive statistics on external vulnerability - Energy imports

Year	count	Mean (million euros)	std	Min (million euros)	25%	50%	75%	Max (million euros)
2015	27	25,654.89	36,924.01	1,125.70	4,385.08	9,253.20	21,774.85	143,156.80
2016	27	25,899.99	36,946.27	1,223.70	4,839.83	9,617.60	23,185.20	141,527.50
2017	27	26,668.39	37,954.39	1,264.11	4,958.82	11,357.70	25,275.36	152,998.67
2018	27	25,761.85	35,122.74	1,306.84	4,931.45	10,600.40	26,805.13	129,959.46
2019	27	26,212.12	35,619.36	1,237.05	5,063.82	11,447.30	26,455.94	133,837.87
2020	27	22,915.42	30,882.57	1,139.48	4,612.48	9,979.00	25,061.68	116,426.74
2021	27	23,876.80	32,671.25	1,157.09	4,693.25	9,020.85	26,083.47	122,188.12
2022	27	25,525.60	34,785.45	1,105.63	5,605.18	10,048.80	26,782.52	127,950.59
2023	27	23,653.74	31,465.15	896.71	5,081.93	9,822.95	26,049.67	109,463.96

Source: own processing [8, 9, 10, 11, 12, 13,14, 15].

However, the differences between countries are significant. Germany, with a volume of energy imports consistently above EUR 100 billion, remains the most exposed economy, and its variations have a systemic impact at European level. In contrast, countries such as Estonia, Cyprus or Malta present low values in absolute terms, but may be relatively more vulnerable when imports are reported in relation to the size of the economy or population. Another aspect is the stability of some economies in the face of energy shocks. For example, Romania and Poland are recording a gradual but controlled increase in

imports, which indicates a certain internal production capacity in diversifying sources. In contrast, countries such as Italy or France, although they have implemented energy transition strategies, continue to depend on imports to a high extent, which keeps them in an area of strategic risk. The high standard deviations in Table 4 indicate a high dispersion in the level of imports between countries, reflecting different economic structures and unequal levels of energy autonomy. This dispersion is accentuated in crisis years, confirming that external shocks amplify pre-existing imbalances.

Therefore, in the context of a European Union aiming for energy independence, the current level of dependence on energy imports represents a critical vulnerability. This dimension of resilience must be understood not only in economic terms, but also in geostrategic terms, and energy transition and source diversification policies must be calibrated according to these data.

The institutional capacity of an economy is not only expressed in the stability of the public budget, but especially in the efficiency with which it can absorb and counteract the effects of economic and social shocks. In this context, three key indicators – the unemployment rate, inflation and the level of public debt – provide a relevant picture of internal stability and the room for manoeuvre for anti-crisis policies.

Table 5. Evolution of the unemployment rate in EU countries in the period 2015-2024 (%)

Country	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Austria	6.1	6.5	5.9	5.2	4.8	6.0	6.2	4.8	5.1	5.2
Belgium	8.7	7.9	7.2	6.0	5.5	5.8	6.3	5.6	5.5	5.7
Bulgaria	10.1	8.6	7.2	6.2	5.2	6.1	5.2	4.2	4.3	4.2
Croatia	16.2	13.0	11.1	8.3	6.6	7.4	7.5	6.8	6.1	5.0
Cyprus	15.0	13.0	11.1	8.4	7.2	7.6	7.2	6.3	5.8	4.9
Czechia	5.1	4.0	2.9	2.2	2.0	2.6	2.8	2.2	2.6	2.6
Denmark	6.3	6.0	5.8	5.1	5.0	5.6	5.1	4.5	5.1	6.2
Estonia	6.4	6.8	5.8	5.4	4.5	6.9	6.2	5.6	6.4	7.6
Finland	9.4	8.9	8.7	7.5	6.8	7.7	7.7	6.8	7.2	8.4
France	10.3	10.1	9.4	9.0	8.4	8.0	7.9	7.3	7.3	7.4
Germany	4.4	3.9	3.6	3.2	3.0	3.7	3.7	3.2	3.1	3.4
Greece	25.0	23.9	21.8	19.7	17.9	17.6	14.7	12.5	11.1	10.1
Hungary	6.6	5.0	4.0	3.6	3.3	4.1	4.0	3.6	4.1	4.5
Ireland	9.9	8.4	6.7	5.8	5.0	5.9	6.2	4.5	4.3	4.3
Italy	12.0	11.7	11.3	10.6	9.9	9.3	9.5	8.1	7.7	6.5
Latvia	9.9	9.7	8.7	7.4	6.3	8.1	7.6	6.9	6.5	6.9
Lithuania	9.1	7.9	7.1	6.2	6.3	8.5	7.1	6.0	6.9	7.1
Luxembourg	6.7	6.3	5.5	5.6	5.6	6.8	5.3	4.6	5.2	6.4
Malta	5.4	4.7	4.0	4.0	4.1	4.9	3.8	3.5	3.5	3.1
Netherlands	7.9	7.0	5.9	4.9	4.4	4.9	4.2	3.5	3.6	3.7
Poland	7.7	6.3	5.0	3.9	3.3	3.2	3.4	2.9	2.8	2.9
Portugal	13.0	11.5	9.2	7.2	6.6	7.1	6.7	6.2	6.5	6.5
Romania	8.4	7.2	6.1	5.3	4.9	6.1	5.6	5.6	5.6	5.4
Slovakia	11.5	9.6	8.1	6.5	5.7	6.7	6.8	6.1	5.8	5.3
Slovenia	9.0	8.0	6.6	5.1	4.4	5.0	4.8	4.0	3.7	3.7
Spain	22.1	19.6	17.2	15.3	14.1	15.5	14.9	13.0	12.2	11.4
Sweden	7.5	7.1	6.8	6.5	6.9	8.5	8.9	7.5	7.7	8.4

Source: own processing [8, 9, 10, 11, 12, 13, 14, 15].

The data presented in Table 5 and summarized in Table 6 reveal a steady decline in unemployment in the EU during 2015–2019, followed by a slight increase in 2020, associated with the COVID-19 crisis. However, the rapid recovery after the pandemic is observable, reflecting the efficiency of the support measures applied in most Member States (wage subsidies, flexible work programs, European funds). Countries such as Poland, the Czech Republic and Malta managed to maintain unemployment rates below 4% even during the crisis, which indicates a structural resilience of the labor market, supported by dynamic economies and proactive policies. In contrast, the southern European countries (Greece, Spain, Italy) remained with significantly higher unemployment rates throughout the period. In the case of Greece, for example, the persistent level of unemployment reflects not only the effects of successive crises, but also deep

structural rigidities of the labor market and the reduced capacity for fiscal reform. Thus, weak institutional capacity accentuates social vulnerabilities, amplifying regional disparities.

Table 6. Descriptive statistics on institutional capacity – unemployment rate

Year	count	Mean %	std	Min %	25%	50%	75%	Max %
2015	27	9.99	4.86	4.40	6.65	9.00	10.90	25.00
2016	27	8.99	4.46	3.90	6.40	7.90	9.90	23.90
2017	27	7.88	4.07	2.90	5.80	6.80	8.95	21.80
2018	27	6.82	3.64	2.20	5.10	6.00	7.45	19.70
2019	27	6.21	3.32	2.00	4.45	5.50	6.70	17.90
2020	27	7.02	3.23	2.60	5.30	6.70	7.85	17.60
2021	27	6.64	2.89	2.80	4.95	6.20	7.55	14.90
2022	27	5.77	2.53	2.20	4.10	5.60	6.80	13.00
2023	27	5.77	2.26	2.60	4.20	5.60	6.70	12.20
2024	27	5.81	2.17	2.60	4.25	5.40	7.00	11.40

Source: own processing [8, 9, 10, 11, 12, 13, 14, 15].

Annual inflation, as measured by the Harmonized Index of Consumer Prices (HICP), was relatively stable between 2015 and 2020, but increased between 2021 and 2023, according to the data. This dynamic is caused by several factors: disruptions in global supply chains, rising energy costs, wage pressures and imbalances between supply and demand in the post-pandemic context.

Table 7. Evolution of annual inflation change in EU countries in the period 2015-2024 (%)

Country	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Austria	100	100.97	103.22	105.41	106.98	108.47	111.46	121.07	130.40	134.21
Belgium	100	101.77	104.03	106.44	107.77	108.23	111.71	123.26	126.07	131.52
Bulgaria	100	98.68	99.85	102.48	104.99	106.27	109.30	123.52	134.15	137.63
Croatia	100	99.37	100.67	102.23	103.04	103.06	105.82	117.11	126.94	132.04
Cyprus	100	98.78	99.45	100.23	100.78	99.67	101.92	110.17	114.50	117.09
Czechia	100	100.70	103.10	105.10	107.80	111.40	115.10	132.10	147.90	151.90
Denmark	100	100.00	101.10	101.80	102.50	102.90	104.90	113.80	117.60	119.10
Estonia	100	100.80	104.48	108.05	110.50	109.80	114.72	137.03	149.52	155.10
Finland	100	100.39	101.23	102.42	103.58	103.98	106.12	113.74	118.67	119.83
France	100	100.31	101.47	103.60	104.95	105.50	107.68	114.04	120.50	123.29
Germany	100	100.40	102.10	104.00	105.50	105.80	109.20	118.70	125.90	129.00
Greece	100	100.02	101.15	101.94	102.46	101.17	101.75	111.21	115.84	119.31
Hungary	100	100.45	102.84	105.84	109.46	113.15	119.04	137.22	160.59	166.56
Ireland	100	99.80	100.10	100.80	101.70	101.20	103.60	112.00	117.80	119.40
Italy	100	99.90	101.30	102.50	103.20	103.00	105.00	114.20	120.90	122.30
Latvia	100	100.10	103.00	105.63	108.53	108.62	112.14	131.47	143.38	145.32
Lithuania	100	100.68	104.42	107.07	109.47	110.63	115.75	137.57	149.52	150.79
Luxembourg	100	100.04	102.15	104.21	105.93	105.93	109.61	118.55	122.02	124.77
Malta	100	100.90	102.18	103.95	105.54	106.37	107.12	113.69	120.01	122.94
Netherlands	100	100.11	101.40	103.02	105.78	106.96	109.98	122.78	127.81	131.92
Poland	100	99.80	101.40	102.60	104.80	108.60	114.30	129.40	143.50	148.70
Portugal	100	100.64	102.20	103.40	103.71	103.58	104.55	113.03	118.98	122.15
Romania	100	98.93	100.00	104.08	108.15	110.67	115.21	129.06	141.64	149.91
Slovakia	100	99.52	100.90	103.46	106.33	108.47	111.53	125.05	138.79	143.17
Slovenia	100	99.85	101.40	103.36	105.11	104.82	106.97	116.94	125.38	127.87
Spain	100	99.66	101.69	103.46	104.26	103.91	107.04	115.95	119.89	123.33
Sweden	100	101.14	103.02	105.12	106.93	107.63	110.49	119.39	126.44	128.98

Source: own processing [8, 9, 10, 11, 12, 13, 14, 15].

It is observed that countries such as Hungary, Lithuania and Estonia have recorded record levels of inflation, exceeding 150% compared to the base year (2015), which reflects a combination of factors: high dependence on imported energy, rigidities in the fiscal structure and delayed reactions of central banks. In contrast, more stable economies, such as France, Denmark or Finland, have managed to maintain a firmer control over

inflation, which denotes a more solid institutional capacity to manage price shocks.

Table 8. Descriptive statistics on institutional capacity – annual inflation change

Year	count	Mean %	std	Min %	25%	50%	75%	Max %
2015	27	100.00	0.00	100.00	100.00	100.00	100.00	100.00
2016	27	100.14	0.72	98.68	99.80	100.10	100.66	101.77
2017	27	101.85	1.34	99.45	101.13	101.47	102.92	104.48
2018	27	103.79	1.85	100.23	102.49	103.46	105.11	108.05
2019	27	105.55	2.51	100.78	103.65	105.50	107.38	110.50
2020	27	106.29	3.40	99.67	103.75	106.27	108.54	113.15
2021	27	109.33	4.51	101.75	105.97	109.30	111.93	119.04
2022	27	121.19	8.49	110.17	113.92	118.70	127.06	137.57
2023	27	129.80	12.59	114.50	119.95	126.07	140.22	160.59
2024	27	133.26	13.50	117.09	122.62	129.00	144.25	166.56

Source: own processing [8, 9, 10, 11, 12, 13, 14,15].

Inflation is not only a monetary indicator, but also an expression of confidence in public policies. The large differences between countries confirm that financial sustainability is closely linked to administrative efficiency, the quality of governance and the capacity to intervene quickly.

The combination of the evolution of unemployment and inflation shows an uneven macroeconomic resilience within the EU. Although all states have benefited from the support of common European mechanisms, only some have managed to maintain a balance between price stability and employment. Institutional capacity, therefore, is not just a budget issue, but reflects a complex network of factors – fiscal policies, administrative efficiency, labor market flexibility and institutional robustness.

The ability of an economy to adapt and transform in times of crisis is essential for maintaining competitiveness and for sustainable recovery, and the dynamics of total exports, presented in Table 9 and summarized through descriptive statistics in Table 10, provide a clear benchmark on how European economies reacted to external and internal shocks between 2015 and 2024.

Table 9. Situation of exports to EU countries in the period 2015-2024 (million euros)

Country	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Austria	137,756.80	137,409.90	148,756.40	156,428.80	159,588.50	148,288.00	171,541.20	201,398.40	207,254.50	197,652.30
Belgium	357,771.80	359,757.30	380,590.40	396,270.00	399,841.10	369,963.60	466,867.60	595,727.90	525,287.60	495,054.00
Bulgaria	22,877.60	24,021.80	27,779.90	28,495.90	29,788.70	27,966.90	34,822.30	47,508.80	44,377.30	43,063.00
Croatia	11,663.30	12,489.50	14,201.40	14,750.50	15,350.00	15,022.60	18,520.80	24,284.20	23,089.70	23,998.30
Cyprus	2,960.80	2,680.60	2,904.40	4,251.70	3,079.00	2,696.90	3,367.70	4,296.30	4,638.90	4,085.40
Czechia	142,364.10	146,979.00	161,213.90	171,260.20	177,903.00	167,597.40	191,571.00	230,242.70	236,444.80	242,964.60
Denmark	86,060.30	86,136.70	90,756.30	92,913.30	99,237.20	95,027.50	106,533.20	125,216.60	120,370.30	123,136.10
Estonia	11,575.30	11,896.90	12,877.60	14,422.40	14,382.10	14,273.80	18,253.00	21,734.30	18,161.40	17,400.00
Finland	53,951.30	52,321.30	60,239.20	64,235.80	65,615.50	57,874.50	69,471.30	81,884.70	76,362.00	72,208.10
France	456,514.70	453,075.80	473,814.80	492,964.10	509,948.20	427,236.20	494,948.80	589,710.20	602,223.50	590,802.40
Germany	1,195,822.00	1,205,489.00	1,281,865.00	1,320,732.00	1,330,414.00	1,209,208.00	1,376,196.00	1,593,593.00	1,574,517.00	1,553,790.00
Greece	25,753.70	25,445.80	28,863.00	33,472.40	33,864.50	30,800.70	39,971.50	55,762.20	51,017.40	49,937.50
Hungary	88,846.10	92,073.20	100,752.40	105,572.80	110,578.60	105,428.50	119,912.10	144,218.00	149,234.00	145,251.70
Ireland	111,259.10	118,230.30	121,759.70	139,637.10	151,515.60	157,828.30	161,204.90	203,431.80	192,695.30	223,077.00
Italy	412,291.30	417,268.90	449,129.00	465,325.40	480,352.10	436,717.80	520,771.10	626,169.40	625,949.70	623,508.70
Latvia	11,079.90	11,111.70	12,351.00	13,703.30	14,034.70	14,266.10	17,650.50	22,954.80	20,954.50	19,068.90
Lithuania	22,903.90	22,607.00	26,410.50	28,271.00	29,623.50	28,648.20	34,474.90	44,312.60	39,759.90	36,680.80
Luxembourg	15,460.40	14,259.80	13,972.90	13,883.40	14,673.10	12,113.30	14,208.40	16,506.20	15,898.90	14,985.20
Malta	2,355.00	2,879.20	2,524.50	2,704.50	2,839.20	2,479.40	2,593.00	3,101.60	3,206.00	3,495.70
Netherlands	514,309.10	515,934.60	577,087.10	615,600.70	633,056.90	590,233.20	711,069.80	917,539.90	865,966.70	851,959.90
Poland	179,532.60	184,171.30	207,385.40	223,213.10	238,178.40	239,213.70	288,180.60	342,893.90	352,925.70	351,155.90
Portugal	49,634.00	50,038.80	55,018.00	57,850.00	59,902.80	53,757.40	63,618.50	78,402.70	77,340.10	79,222.10
Romania	54,620.20	57,392.40	62,615.60	67,424.50	68,667.10	61,775.60	73,923.00	91,972.80	93,069.90	92,691.00
Slovakia	67,764.50	69,606.50	73,790.10	79,136.90	79,962.00	75,586.20	87,868.10	103,042.80	108,711.90	106,845.10
Slovenia	28,792.60	29,742.40	34,007.20	37,423.00	40,147.20	39,246.80	48,544.40	66,410.60	67,578.50	73,074.30
Spain	254,599.40	262,041.30	283,094.60	293,458.80	298,337.00	269,521.00	321,434.90	394,896.90	390,840.00	392,122.80
Sweden	126,258.20	125,901.10	135,356.90	140,551.80	143,421.10	136,108.20	160,337.10	187,838.70	182,728.40	180,963.20

Source: own processing [8, 9, 10, 11, 12, 13, 14, 15].

Between 2015 and 2019, EU Member States' exports grew steadily, supported by the stability of the single market, trade openness and logistical and digital progress. This trend reflects the deep integration of European economies into global value chains and the development of export industries (automotive, chemicals, medical devices, processed food).

The COVID-19 crisis in 2020 caused a significant contraction, visible in the reduction in the average value of exports at EU level. However, the recovery was rapid and significant starting in 2021, and in 2022–2023, an acceleration of exports is observed in most countries, demonstrating that the economic structure was flexible enough to respond to sudden changes in global demand. Countries such as Germany, the Netherlands, Italy and Ireland recovered faster and with record volumes, reflecting not only the size of these economies, but also their ability to quickly reposition production and international logistics. Smaller economies, such as Slovenia, Lithuania or Romania, have also recorded increases in exports, demonstrating a high degree of adaptability and efficient specialization. For example, Romania managed to double its export volume between 2015 and 2023, a performance due to the expansion of the industrial network, the digitalization of the customs infrastructure and the strategic reorientation towards Western European markets.

However, not all economies followed the same trajectory. Countries such as Cyprus, Malta or Luxembourg had smaller volumes and more volatile developments, due both to the dependence on undeclared services in exports and to geographical and structural constraints. Also, the high dispersion of the values (highlighted by the large standard deviations in Table 10) underlines the existence of structural differences in competitiveness between states.

This variation shows us that the capacity to adapt is not evenly distributed within the Union, and the success in the return of exports depends on a combination of factors: the degree of industrialization, access to international markets, the level of digitalization and active policies to support internationalization.

Table 10. Descriptive statistics on adaptation and transformation capacity - exports

Year	count	Mean (million euros)	std	Min (million euros)	25%	50%	75%	Max (million euros)
2015	27	164,621.42	253,076.67	2,355.00	22,890.75	67,764.50	160,948.35	1,195,822.40
2016	27	166,331.92	254,698.44	2,680.60	23,314.40	69,606.50	165,575.15	1,205,488.80
2017	27	179,226.55	271,957.94	2,524.50	27,095.20	73,790.10	184,299.65	1,281,864.60
2018	27	187,924.21	281,368.22	2,704.50	28,383.45	79,136.90	197,236.65	1,320,732.40
2019	27	192,751.89	284,951.72	2,839.20	29,706.10	79,962.00	208,040.70	1,330,414.00
2020	27	177,365.91	258,358.59	2,479.40	28,307.55	75,586.20	203,405.55	1,209,207.70
2021	27	208,068.71	298,992.94	2,593.00	34,648.60	87,868.10	239,875.80	1,376,195.50
2022	27	252,409.33	355,277.30	3,101.60	45,910.70	103,042.80	286,568.30	1,593,593.00
2023	27	247,059.41	347,487.33	3,206.00	42,068.60	108,711.90	294,685.25	1,574,517.10
2024	27	244,747.91	342,143.27	3,495.70	39,871.90	106,845.10	297,060.25	1,553,789.50

Source: own processing [8, 9, 10, 11, 12, 13, 14, 15].

On the other hand, exports do not only reflect current economic performance, but also the systemic capacity for transformation. Thus, countries that have demonstrated a rapid resumption of exports following crises, while maintaining or diversifying their product and market portfolio, are those that can be considered resilient in the full sense of the term. This dimension completes the overall picture of economic resilience and justifies the inclusion of exports in composite resilience scores.

We have therefore considered that in a European economic context marked by uncertainties and successive shocks, the simple analysis of individual economic indicators is no longer sufficient to comprehensively assess the capacity of states to resist and adapt. From this perspective, the construction of composite economic resilience scores allows for the synthesis of national performances by aggregating essential indicators such as GDP per capita, unemployment rate, inflation and exports, each standardized and weighted

according to its economic meaning. The purpose of these scores is not only to provide a hierarchy between economies, but also to highlight structural fundamentals and the capacity for transformation in times of crisis. The two-stage approach – 2015–2019 and 2020–2024 – reflects two essential dimensions of resilience: the first period captures structural resilience, i.e. institutional robustness and stability under normal conditions, while the second period reflects the response of economies to major shocks, including the pandemic, the energy crisis and accelerated inflation. Thus, the resulting scores provide a balanced picture of economic performance and post-crisis adaptability, constituting a useful analytical tool for both research and policy formulation.

Table 10. Economic resilience scores in the EU

Country	Structural score 2015-2019	Postdoc score 2020-2024	Global resilience score
Germany	0.717	0.709	0.713
Ireland	0.690	0.707	0.698
Malta	0.582	0.634	0.608
Netherlands	0.553	0.571	0.562
Poland	0.568	0.496	0.532
Denmark	0.520	0.501	0.511
France	0.484	0.478	0.481
Cyprus	0.467	0.494	0.480
Slovenia	0.446	0.479	0.463
Italy	0.457	0.456	0.456
Bulgaria	0.480	0.421	0.450
Luxembourg	0.450	0.446	0.448
Czechia	0.465	0.416	0.441
Romania	0.497	0.384	0.441
Belgium	0.399	0.471	0.435
Slovakia	0.457	0.378	0.417
Finland	0.431	0.404	0.417
Austria	0.411	0.413	0.412
Croatia	0.412	0.406	0.409
Portugal	0.376	0.426	0.401
Sweden	0.413	0.388	0.401
Hungary	0.429	0.328	0.379
Latvia	0.396	0.332	0.364
Lithuania	0.390	0.332	0.361
Estonia	0.374	0.312	0.343
Spain	0.337	0.308	0.322
Greece	0.191	0.252	0.222

Source: own processing [8, 9, 10,11, 12, 13, 14, 15].

The synthetic resilience scores highlight clear differences between EU Member States in terms of their capacity to sustain long-term economic performance (structural resilience), but also in their ability to respond effectively to multiple recent shocks, such as the COVID-19 pandemic, the energy crisis and post-2020 inflation (post-shock resilience).

Germany ranks first in the overall resilience score rankings, with a structural score of 0.717 and a post-shock score of 0.709, reflecting long-term macroeconomic stability, institutional stability and a sustainable recovery of exports after the crisis. Ireland is close behind, with a balanced performance between stable fundamentals (0.690) and a broadly similar resilience capacity (0.707), supported by technological orientation and integration into global value chains. Malta, although a small economy, impresses with an overall score of 0.608, demonstrating efficiency in public policies and rapid adaptability in the recent period. At the opposite end, Greece has the lowest overall resilience score (0.222), with an extremely low structural score (0.191), signaling persistent fragility in terms of unemployment, inflation and overall economic performance. Spain and Estonia complete this category, with overall scores of 0.322 and 0.343 respectively, reflecting difficulties in adjustment and high volatility in the post-shock period. In the case

of Estonia, high inflation and labor market pressures have contributed significantly to the decline in the post-shock score, despite a good performance in previous years.

Romania occupies an intermediate position in the economic resilience ranking, with a balanced overall score, resulting from a combination of relatively stable structural fundamentals and a moderate capacity to adapt to recent shocks. Between 2015 and 2019, Romania recorded a sustained growth in GDP per capita and a steady expansion of exports, signs of an economy in the process of convergence with the European average. However, the unemployment rate remained slightly above the EU average, and inflation, although controlled, was consistently above Western European levels, affecting the structural resilience score. However, Romania has registered a visible convergence in relation to the European Union average, consolidating this score that allowed for a partial absorption of subsequent shocks. After 2020, a relatively rapid economic recovery was achieved, supported by accelerated digitalization, public investment and increased external demand. Exports continued to grow, and the labor market showed signs of resilience, with a relatively stable unemployment rate. However, high inflation in the period 2021–2023 exerted pressure on consumption and competitiveness. Thus, the post-shock score reflects an economy capable of reacting, but vulnerable to external volatility and persistent structural imbalances. Overall, Romania is part of the group of economies with resilient potential, but in need of institutional consolidation and macroeconomic stability to increase its long-term adaptive capacity.

The resilience score ranking confirms that overall economic performance is not only the result of the level of development, but also of structural adaptability, institutional efficiency and the quality of the crisis response. The differences between countries indicate the need for a tailored approach in public policies, especially for the states in southern and eastern Europe that have lagged behind in terms of stability and economic transformation.

CONCLUSIONS

The objective of this research was to compare economic resilience among the member states of the European Union, by constructing composite scores structured on two essential dimensions: structural resilience (2015–2019) and post-shock resilience (2020–2024). This approach allowed the assessment of both the stable economic background in the medium term and the effective capacity to react and adapt to successive crises: pandemic, energy crisis, accelerated inflation and geopolitical tensions.

The results obtained highlight a significant diversity of the adaptive capacity among the EU states. Large and advanced economies, such as Germany, Ireland or the Netherlands, are distinguished by high overall scores, which reflects a combination of solid economic fundamentals, stable institutional capacity and effective responses to shocks. In contrast, countries such as Greece, Spain or Estonia show lower resilience, caused either by historical structural weaknesses or by recent pressures on public budgets, the labour market or inflation.

Romania occupies an intermediate position, with a balanced evolution between structural consolidation and moderate economic recovery. Its performance shows a positive direction, but also the need for further strengthening of fiscal policies, institutional infrastructure and the capacity to absorb external shocks.

Overall, the statistically validated composite scores confirm that resilience is not a static attribute, but a result of the interaction between economic development, institutional coherence and the capacity to adjust to rapid changes. These conclusions can inform both national development strategies and common European policies focused on reducing vulnerabilities and strengthening economic convergence within the Union.

Moreover, we can outline several action directions with application relevance for these policies. First, for countries with low structural scores, it is essential to strengthen resilience through targeted investments in infrastructure, education and digitalization, especially in

vulnerable regions, to support internal convergence and long-term development. Second, post-crisis inflation has significantly affected post-shock resilience scores, which requires the adoption of more flexible fiscal and monetary measures, as well as instruments to protect consumers and small businesses from energy price volatility.

At the same time, employment policies need to be adapted to support mobility and reskilling, especially in economies experiencing structural rigidities and persistent unemployment. Export dynamics have proven to be a key determinant of resilience, suggesting the need for strategic diversification of the trade portfolio and the stimulation of high value-added sectors. Finally, the composite scores developed in this paper can be used as diagnostic tools in public policy-making, providing a synthetic picture of the capacity of economies to manage and overcome shocks. They can serve as an analytical basis for reform planning and the efficient allocation of European funds under the Recovery and Resilience Mechanism.

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