DETERMINANT FACTORS OF ECONOMIC RESILIENCE OUTPUT INDICATORS. A PRINCIPAL COMPONENT REGRESSION APPROACH

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Abstract: *This paper investigates the determinant factors influencing economic resilience output indicators in a sample of European Union (EU) countries using a principal component regression (PCR) approach. Economic resilience, defined as a country's ability to withstand and recover from economic shocks and crises, has become an increasingly crucial aspect of economic policymaking in a highly interconnected global landscape. To identify the key drivers of resilience, we employ principal component analysis (PCA) to reduce the dimensionality of a comprehensive set of potential determinants. The retained principal components serve as predictors in a linear regression model to estimate their impact on economic resilience output indicators. The study's findings reveal a set of critical factors that significantly influence resilience, enabling policymakers to design targeted strategies and policies to enhance countries' capacity to navigate economic uncertainties and challenges effectively. The research contributes to the understanding of economic resilience and offers valuable insights for policymakers aiming to foster sustainable economic growth and stability in the EU.*
Keywords: *economic resilience, principal components regression, social dimension, institutional dimension*

Introduction

The way a socio-economic system develops is closely linked to its ability to implement reforms during periods of radical changes and economic, political, and social instability. Therefore, it is crucial to identify common solutions, both internally and externally, in order to integrate a systematic analysis of these changes and vulnerabilities, for their appropriate addressing. In the last decade, in the context of rapid transformations in the economic, social, and natural environment, such as natural disasters, economic crises, or political changes, the concept of resilience has gained increasing attention in specialized literature. According to relevant studies (Friedman, 1993; Hill, 2008; Shaw,

2013; Cellini, 2014; Boschma, 2015; Martin, 2015), resilience can be defined as the capacity of a socio-economic system (such as a city, region, or country) to pursue a sustainable development path, considering a multitude of internal and external factors.

Through resilience analysis, vulnerabilities of a system can be identified in the face of various types of shocks, which can provide insights into its capacity to withstand, recover, and adapt, thereby adopting a new pattern of development and economic growth. The objective of this paper is to identify determinant factors of the main output indicators of economic resilience. The determinant factors cover three important dimensions, namely they measure the economic, social and institutional impact on economic resilience. To achieve this objective, we employ a principal component regression (PCR) approach, which combines the benefits of principal component analysis (PCA) and linear regression. PCA reduces the dimensionality of a wide range of potential determinants, capturing the underlying patterns of variability among these variables. The retained principal components, serving as proxies for the latent factors influencing resilience, are then used as predictors in a linear regression model to estimate their impact on economic resilience output indicators. By employing a PCR approach, this study offers a comprehensive and innovative analysis of the multifaceted determinants of economic resilience. Understanding these factors not only contributes to the theoretical understanding of economic resilience but also has practical implications for policymakers and stakeholders in the EU. The findings of this research can assist policymakers in developing targeted strategies and evidence-based policies to enhance economic resilience, facilitate sustainable economic growth, and foster regional stability.

The rest of the paper is organized as follows: Section 2 provides a review of relevant literature on economic resilience and its determinants. Section 3 outlines the data and methodology used in the analysis, including a detailed explanation of the PCR approach. Section 4 presents the empirical results, highlighting the significant determinant factors influencing economic resilience output indicators in EU countries. The paper concludes by summarizing the key findings and emphasizing the importance of promoting economic resilience in the EU to navigate an increasingly complex and uncertain economic landscape.

Literature review

Economic resilience is defined as the ability of an economy to maintain its stability and recover swiftly following periods of instability or economic crises. A resilient economy can successfully adapt to abrupt changes in the economic environment, preserve its stability, and continue to grow and develop even in challenging circumstances. Economic resilience refers to the capacity to avoid or minimize the negative impact of economic shocks, as well as the ability to adapt and recover from them. Economic resilience is a complex and multidisciplinary concept that has gradually evolved across various fields and contexts. However, the term "resilience" began to be used in economic context in reports of international organizations, academic papers, and government documents starting in 1975. A concrete example in the field of economics can be found in the work of American economist Hollis B. Chenery published in the journal "American Economic Review" in 1975, where he used the term "economic resilience" to analyze the capacity of economies in developing countries to adapt and recover after economic disruptions. In subsequent

years, the term "economic resilience" has become widely used in various contexts, including reports by international organizations such as the World Bank, the World Economic Forum, and the United Nations. These reports address the importance of building resilient economies capable of coping with economic challenges and risks.

In recent years, due to global events such as the 2008 financial crisis, increasing economic uncertainty, climate change, as well as the COVID-19 pandemic and the economic consequences of the 2022 military conflict, the interest in analyzing economic resilience has significantly increased in discussions on the economy and sustainable development. According to analyses and research in the specialized literature, there are several key elements that contribute to the economic resilience of a country or region, including the following:

1. Economic diversification: it plays a vital role in ensuring economic resilience, as it reduces the likelihood of a downturn in one sector significantly impacting the entire economy. Diversification may involve expanding and developing sectors such as agriculture, industry, services, technology, tourism, and others, in line with the country's or region's resources and comparative advantages. In a report conducted by the World Bank in 2019, the essential role of economic diversification in promoting economic resilience was highlighted. According to Sekar et al. (2019), economic diversification can reduce the risk of exposure to fluctuations in a single sector and enhance economic resilience by creating opportunities in multiple domains, thus providing compensation for potential declines in other sectors. Likewise, a study by S. Lange et al., (2019) found that the diversification of the economy at the regional level contributes to increasing economic resilience in the face of economic shocks, such as financial crises or decline in a certain sector.

2. Stable Financial System: A stable financial system is also important for a resilient economy. According to Claessens et al. (2018), a sound and well-regulated financial system can contribute to economic resilience by stabilizing the economy in times of crisis. Financial institutions must be well supervised and follow strict rules and regulations to avoid financial crises that can have negative effects on the economy. Also, the stable financial system was studied by S. Claessens and M. A. Kose (2017). The authors argue that a stable financial system that is well supervised and well-regulated can help reduce the risks of financial crises and increase the resilience of the economy as a whole. In a report published in 2016, the European Central Bank (ECB) emphasized that ensuring financial system stability is essential for strengthening economic resilience in the euro area, and that the implementation of appropriate policies and measures is necessary to prevent the occurrence of financial crises.

3. The ability to cope with shocks: A resilient economy is characterized by its ability to absorb and adapt to economic shocks through appropriate fiscal and monetary policies. These policies are designed to mitigate the negative impact of shocks and support economic recovery (Cerra et al., 2020). Additionally, implementing social protection measures can provide support to vulnerable populations and alleviate the social impact of economic crises.

4. Robust infrastructure: A well-developed and resilient physical and digital infrastructure is essential for ensuring economic resilience. According to a study conducted by the World Bank (2019), it has been found that well-established infrastructure, such as transportation, energy, and communication networks, plays a crucial role in the ability to recover quickly

after natural disasters and supports long-term economic development. Moreover, digital infrastructure, such as internet access and communication technologies, can enhance the economy's capacity to adapt and innovate in the face of rapid changes in the business environment.

5. Human and social capital: The level of education, along with social cohesion and community stability, the skills and health of the population, are essential elements in enhancing economic resilience. For example, a strong human and social capital can support the creation of a skilled and flexible workforce, capable of adapting to technological and economic changes. Additionally, the health status of the population plays a crucial role in economic resilience, as a healthy population is more capable of engaging in economic activities and coping with crises. (World Bank, 2020).

6. Sustainable approach: Adopting a sustainable approach to economic development can support the building of long-term economic resilience. In a United Nations report from 2015, it was emphasized that embracing a sustainable economy can reduce vulnerability to climate change, shifts in resource markets, and risks associated with environmental degradation. At the same time, promoting and developing renewable energies can decrease dependence on unsustainable and volatile energy sources, positively impacting long-term economic stability (World Bank, 2021).

7. Effective governance: An effective, transparent, and accountable governance system is essential for economic resilience. According to a study by the World Bank (2020), strong governance and institutions can play a key role in building economic resilience by promoting sound fiscal management, effective regulation and fair competition in the private sector. Also, appropriate government policies and effective regulation can support long-term economic development by helping to create an environment conducive to business and investment (Hallegatte et al., 2018).

8. Capacity to innovate: The potential to innovate and adopt new technologies can strengthen economic resilience. Innovation is a crucial element in stimulating economic growth and supporting sustainable development, with a positive impact through the creation of new jobs, increased productivity, and economic diversification (OECD, 2021). Therefore, collaboration between governments, the private sector, and research institutions can facilitate the promotion of innovation and technology transfer in the economy, contributing to enhanced competitiveness and the ability to adapt to economic changes.

9. Capacity to attract investment: In a resilient economy, there is an observed capacity to attract foreign direct investments and encourage domestic investments. According to a recent report by the United Nations Conference on Trade and Development (UNCTAD, 2021), foreign direct investments play a significant role in supporting economic development, with a positive impact on job creation, technology transfer, and the development of the private sector. Thus, creating a conducive business environment characterized by stability and predictability, and implementing effective regulations, can play a crucial role in attracting investments and strengthening economic resilience (Lazorec and Pintilescu, 2023).

10. Responsible public debt management: Administration of public debt is crucial for maintaining macroeconomic stability and promoting economic resilience. In addition, high levels of public debt can constrain the ability of a government to interfere in the economy in the event of a crisis. Consequently, the conscientious management of public debt is

crucial for maintaining economic stability and preventing financial crises (Fontana et al., 2021).

According to the research conducted by Reinhart and Rogoff (2009), an excessive level of public debt can have serious consequences on economic stability and diminish the economic resilience of a country in the face of economic turbulence. According to the analysis performed by the OECD, a rapid increase in public debt can lead to higher financing costs, a downgrade in sovereign rating, and a decline in investor confidence, which can negatively impact the economy and restrict the government's ability to respond to a crisis. To prevent such scenarios, it is crucial to conduct rigorous monitoring of the level of public debt, assess the risks associated with debt accumulation, and adopt appropriate long-term debt management strategies with a strong emphasis on fiscal sustainability. Additionally, it is essential to have transparency in managing public debt, including proper reporting of data related to the level, structure, and costs of debt, to maintain investor confidence and support macroeconomic stability (Reinhart and Rogoff, 2009).

11. International cooperation: To support economic resilience, international cooperation and collaboration are essential aspects. According to a study published by the International Monetary Fund (IMF), intensifying international cooperation can mitigate systemic risks and optimize the functioning of the global financial system. Additionally, international partnerships and trade linkages can provide opportunities for market diversification and facilitate access to resources and technologies, while also offering support during times of crisis. Moreover, international cooperation can promote the development of common solutions to global economic challenges, such as climate change or pandemics, thereby reducing the adverse impact of these issues on national economies (IMF, 2021).

Finally, developing a resilient engaged economy or global approach that includes economic diversification, the ability to manage shocks, a sound financial system, strong human and social resources, strong infrastructure, a sustainable approach, capacity for innovation and international collaboration. These elements can work together to develop an economy capable of adapting, responding to economic challenges and progressing in the long term, thus guaranteeing sustainable economic resilience.

Data and methodology

Economic resilience refers to the ability of an economy, region or sector to withstand and recover from economic shocks, disruptions or challenges. It involves the ability of an economic system to maintain its stability, adjust to changing conditions and recover from negative events, such as economic decline, market fluctuations, trade disturbances or other economic crises. Indicators of economic resilience are quantitative or qualitative measurements that assess an economy's ability to withstand shocks, recover from disruptions, and adapt to change. These indicators provide data on the economic resilience of a nation, geographic area, or domain, and can support policymakers and stakeholders in identifying strengths, weaknesses, and areas for improvement. However, it is essential to emphasize that economic resilience is a complicated and ever-changing concept that can be affected by different factors, and its assessment can differ depending on the particular context and level of analysis.

• GDP Growth Rate: The Gross Domestic Product (GDP) growth rate is a commonly used indicator to assess the economic resilience of an economy. Higher GDP growth rates may indicate a more resilient economy, able to withstand shocks and recover more quickly.
• Employment rate: The employment rate, which measures the proportion of the working-age population that is employed, is an important indicator of economic resilience. A higher employment rate may suggest a more resilient economy with more job opportunities and stability in the labor market.
• Diversification of economic sectors: The diversity of economic sectors, measured by the contribution of various industries to the overall economy, can indicate the level of resilience of an economy.
Economies with a diversified range of industries are less dependent on a single sector and may be more resilient to shocks in specific sectors. Diversification of trading partners and markets can be an indicator of economic resilience. Economies that have diversified trade relationships are less dependent on a single market and may be more resilient to disruptions in specific trade relationships.
• Foreign direct investment (FDI): investments made by foreign companies in the domestic economy) can also be an indicator of economic resilience. Higher inflows of FDI can suggest a more resilient economy, attractive to foreign investments, and capable of withstanding shocks.
• Innovation and technological capabilities: Indicators related to innovation and technological capabilities, such as research and development (R&D) expenditures, patents, and technology adoption, can indicate the level of economic resilience of an economy. Innovative and technologically advanced economies may be more resilient to technological changes and have a competitive advantage in times of crisis.
• Macroeconomic stability: Macroeconomic stability characterized by indicators such as inflation, public debt level, appropriate fiscal and monetary policies, budget deficit, and the size of the government can contribute to economic resilience. Economies with a stable macroeconomic foundation may be less vulnerable to shocks and have the capacity to manage crises more effectively. An economy with adequate foreign exchange reserves and sustainable levels of external debt may be better equipped to handle external shocks and maintain financial stability.
• Infrastructure and natural resources: The quality of infrastructure and the availability of natural resources can influence the economic resilience of an economy. A robust infrastructure, including transportation infrastructure (quality of air, maritime, and railway infrastructure), energy (access to electricity, energy imports), communications, and water, can contribute to a rapid recovery after a shock. Additionally, available natural resources such as energy resources and raw materials can impact an economy's capacity to cope with changes and adapt.
• Foreign exchange reserves and the level of external debt: The level of foreign exchange reserves and external debt can be indicators of economic resilience at the macroeconomic level. An economy with adequate foreign exchange reserves and sustainable levels of external debt may be better able to withstand external shocks and maintain financial stability.
• Poverty and inequality: Indicators of poverty and inequality can be used to assess the social and economic resilience of an economy. Economies with low levels of poverty and inequality may be more resilient to social shocks and can benefit from a stable social

foundation. Poverty and inequality indicators, such as the poverty rate, Gini coefficient, and access to basic social services, can impact economic resilience.

There are various ways to assess the level and type of resilience of a region in the face of an economic shock. In the specialized literature, different approaches are identified to address this issue, ranging from descriptive case analyses to complex economic and statistical models, aiming to evaluate regional recovery rates and other relevant characteristics. Multivariate statistical data analysis is defined by a set of techniques that focus on investigating correlations (associations) between several statistical variables and/or grouping statistical units into homogeneous sets (clusters) based on their similarity in relation to the recorded variables. The complexity of the economic and social reality requires the consideration of a variety of influencing factors on a phenomenon. Studying the concurrent impact of these factors requires the use of multivariate statistical data analysis techniques.

The main methods of multivariate data analysis are the methods of factorial analysis and the methods of classification of statistical units. Factorial analysis methods aim to highlight the similarities and differences between the statistical units, as well as the variables "responsible" for these approaches or oppositions between the units. The purpose of principal component analysis (PCA) is to reveal how different variables vary in relation to each other and how they are associated. This is done by transforming the correlated variables into a new set of uncorrelated variables using a covariance matrix or its standardized form - the correlation matrix. The lack of correlation in the principal components is a useful property. This indicates that the principal components measure different “statistical dimensions” of the data.

PCR is a simple extension of Principal Component Analysis and Multiple Linear Regression. The first step is to determine the principal components. Scores of the most important principal components are used as observations of independent variables that are part of a multiple regression predicting a dependent variable. PCR is a method used to model the dependent variable when there are a large number of independent variables (predictors) and they are highly correlated or even collinear. The method constructs new predictor variables, known as components, as linear combinations of the original independent variables. PCR creates components to explain the observed variability in the predictor variables without considering the response variable at all. Because the dependent variable is not taken into account, a disadvantage of PCR is that we may retain some variables in the model that are not strong predictors of the response variable, and we may drop some variables that are excellent predictors. We want to analyze the resilience of the countries of the European Union. For this analysis we will use data from the period 2000-2019. I chose this interval, because it can be considered as a period in which the economies of Central and Eastern European countries can also be considered as market economies, as a result of the economic reform processes implemented after 1990. As dependent variables we considered two quantitative measures of resilience that focused on aspects of the labor market and economic growth: GDP growth rate and Employment rate. The impact of a crisis first manifests itself on the labor market, which will in turn affect the economy of a country. To reduce costs, companies will adjust their workforce, and under these circumstances, the analysis of employment conditions will support understanding the impact of the crisis at the national level.

Table 2. Description of the dependent variables

Variable	Definiton
GDP growth per capita- anual (%)	The annual percentage increase or decrease in gross domestic product compared to the previous year.
Employment rate (% population>15 years)	It represents the share of the active population in age group x/ the total population in the same age group x.

The independent variables considered are 21 in number and are presented in the table below. The data sources used are: The World Bank, Eurostat, OECD, Econstats, The Global Economy, Country Economy, Worls Economic Forum, HDR, Numbeo, EuCham, Statista and Our Worls in Data.

Table 3. Description of independent variables

Dimension	Variables	Definition
Economic dimension	Government budget deficit ratio (% of GDP)	The difference between government revenues and expenditures. A budget deficit occurs when the expenditures of an entity (a government) exceed receipts.
	National debt (% of GDP)	It represents the total financial liabilities incurred by a nation's government.
	Size of Government (% GDP)	The ratio of government expenditures to the total output of the economy.
	Freedom to trade (rank from 0 to 100)	The higher this value, the lower the prices of goods entering the market.
	Foreign direct investment-net inflows (% of GDP)	Foreign Direct Investment (FDI) flows represents the new investment inflows less disinvestment in the economy from foreign investors.
	Agriculture, forestry, and fishing, value added (% of GDP)	It includes forestry, hunting and fishing, as well as crop cultivation and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs.
	Services, value added (% of GDP)	The services provided for the population include those activities that are the subject of sale and purchase on the market, mainly for the population, regardless of the time of payment, the type of price applied (sale price, tariff, etc.) and the collection methods (excluding transport services, post and telecommunications).
	Industry (% of GDP)	It comprises value added in mining, manufacturing, construction, electricity, water and gas.
	Inflation consumer prices-annual (%)	The CPI measures the overall evolution of the prices of goods purchased and the rates of services used by the population in a certain period, called the current period, compared to a previous period or the base period (reference).
Social dimension	Education Index- (ranging from 0 to 1)	It is calculated using the average number of years of schooling and the expected number of years of schooling. A high value indicates an educationally developed country (at least 0.8).
	Income Index (ranging from 0 to 1)	It is calculated according to the formula: (lnGNI-ln100)/(ln75000-ln100). GNI measures a country's income (includes income of that country's residents and businesses and earnings from foreign income).

	Population by educational attainment leve - Less than primary, primary and lower secondary education, levels 0-2 (%)	Proportion of the population between 15 and 64 years old by level of education (kindergarten, primary and secondary).
	Life expectancy at birth (years)	The average number of years a newborn is expected to live if current mortality rates continue to apply.
	Labor market regulations (rank from 0 to 10)	Labor market regulation plays an important role in protecting workers. This indicator is composed of other indicators such as: (i) Employment and Minimum Wage Regulations (ii) Employment and Firing Regulations (iii) Centralized Collective Bargaining (iv) Hours Regulations (v) Mandatory Cost of Firing Workers (vi) Recruitment . A higher value means greater efficiency in the labor market (increase in productivity).
Institutional dimension	Government Effectiveness (ranging from -2.5 (weak) to 2.5 (strong))	It reflects perceptions of the quality of public services, the quality of the public service and its degree of independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.
	Regulatory Quality (ranging from -2.5 (weak) to 2.5 (strong))	It reflects perceptions of the government's ability to formulate and implement sound policies and regulations that enable and promote private sector development.
	Rule of Law (ranging from -2.5 (weak) to 2.5 (strong))	It reflects perceptions of the extent to which agents trust and respect the rules of society and, in particular, the quality of contract enforcement, property rights, the police and courts, and the likelihood of crime and violence.
	Control of Corruption (ranging from -2.5 (weak) to 2.5 (strong))	Reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption and state 'capture' by elites and private interests.
	Political Stability and Absence of Violence/Terrorism (ranging from -2.5 (weak) to 2.5 (strong))	It measures the perception of the likelihood of political instability and/or politically motivated violence, including terrorism.
	Legal System & Property Rights (rank from 0 to 10)	The Legal System and Property Rights focuses on the importance of the legal system as a determinant of economic freedom. The higher the score, the more protected the rights are by law.
	Voice and Accountability (rank from 0 to 100)	It reflects perceptions about the extent to which a country's citizens can participate in selecting their government, as well as freedom of speech, freedom of association and a free media.

Empirical results

Principal component analysis (PCA) on the independent variables corresponding to the 27 countries, allowed the extraction of factorial axes, which represent linear combinations of the independent variables. The choice of these axes is made according to

the explained variance associated with each one. The number of factors and the variables explaining each factor within countries are shown in the table below.

Table 13. Number of factors and variables explaining each factor

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Austria	Life_exp_birth_total (-)	Voice_Accountability (+)	Reg_Quality (+)	Size_Government (+)	Infl_cons_prices (+)
	National_debt (-)	Labor_market_reg (+)	Rule_Law (+)		
	Industry (+)	Gover_deficit (-)			
	Agric_for_fish (+)				
	Govern_Effect (+)				
	Reg_Quality (+)				
	Control_Corruption (+)				
	Freedom_trade (+)				
	Education_Index (-)				
	Legal_Syst_Prop_Rights (+)				
	Pop_educ_level (+)				
	Income_Index (-)				
	Serv_value_ad (-)				
Belgium	Life_exp_birth_total (-)	National_debt (+)	Gover_deficit (+)	Voice_Accountability (-)	
	Industry (+)	Reg_Quality (-)			
	Agric_for_fish (+)	Rule_Law (+)			
	Pol_Absence_Violence (+)	Control_Corruption (+)			
	Govern_Effect (+)				
	Freedom_trade (+)				
	Size_Government (+)				
	Education_Index (-)				
	Labor_market_reg (-)				
	Pop_educ_level (+)				
	Serv_value_ad (-)				
	Income_Index (-)				
Bulgaria	Life_exp_birth_total (+)	FDI (+)	Reg_Quality (+)	Legal_Syst_Prop_Rights (+)	Pol_Absence_Violence (+)
	National_debt (-)	Infl_cons_prices (+)		Gover_deficit (+)	Rule_Law (+)
	Agric_for_fish (-)	Govern_Effect (-)			
	Freedom_trade (+)				
	Education_Index (+)				
	Labor_market_reg (+)				
	Pop_educ_level (-)				
	Serv_value_ad (+)				
	Income_Index (+)				
Czechia	Life_exp_birth_total (+)	Voice_Accountability (+)	Industry (-)	Infl_cons_prices (-)	Control_Corruption (+)
	Rule_Law (+)	Pol_Absence_Violence (+)	Reg_Quality (+)		Freedom_trade (+)
	Size_Government (+)	Govern_Effect (+)	Serv_value_ad (+)		
	Education_Index (+)				
	Legal_Syst_Prop_Rights (+)				
	Labor_market_reg (+)				
	Pop_educ_level (-)				
	Gover_deficit (+)				
	Income_Index (+)				
Ciprus	Life_exp_birth_total (+)	Freedom_trade (+)	Govern_Effect (+)	Voice_Accountability (+)	
	National_debt (+)	Size_Government (+)	Reg_Quality (+)		

	FDI (+)	Legal_Syst_Prop_Rights (+)	Rule_Law (+)		
	Industry (-)	Income_Index (+)			
	Agric_for_fish (-)				
	Infl_cons_prices (-)				
	Education_Index (+)				
	Labor_market_reg (+)				
	Pop_educ_level (-)				
	Serv_value_ad (+)				
Croatia	Life_exp_birth_total (+)	Pol_Absence_Violence (+)	Voice_Accountability (-)	Gover_deficit (-)	
	National_debt (+)	Reg_Quality (+)	Control_Corruption (-)		
	FDI (-)	Income_Index (+)			
	Industry (-)				
	Agric_for_fish (-)				
	Infl_cons_prices (-)				
	Rule_Law (+)				
	Freedom_trade (+)				
	Size_Government (+)				
	Education_Index (+)				
	Labor_market_reg (+)				
	Pop_educ_level (-)				
	Serv_value_ad (+)				
Denmark	National_debt (+)	Infl_cons_prices (+)	Industry (+)	Voice_Accountability (-)	Rule_Law (+)
	Agric_for_fish (+)	Govern_Effect (+)	Gover_deficit (-)		
	Pol_Absence_Violence (+)	Reg_Quality (+)	Serv_value_ad (+)		
	Freedom_trade (+)	Control_Corruption (+)			
	Education_Index (-)				
	Labor_market_reg (-)				
	Income_Index (-)				
Estonia	Life_exp_birth_total_y (+)	National_debt (+)	Size_Government (+)		
	Pol_Absence_Violence (-)	FDI (-)	Gover_deficit (+)		
	Govern_Effect (+)	Infl_cons_prices (-)	Serv_value_ad (-)		
	Rule_Law (+)	Reg_Quality (+)			
	Control_Corruption (+)				
	Freedom_trade (-)				
	Education_Index (+)				
	Legal_Syst_Prop_Rights (+)				
	Labor_market_reg (+)				
	Income_Index (+)				
Finland	Life_exp_birth_total_y (-)	Agric_for_fish (+)	FDI (+)	Infl_cons_prices (+)	
	National_debt (-)	Reg_Quality (+)	Govern_Effect (-)	Voice_Accountability (-)	
	Industry (+)	Freedom_trade (+)			
	Pol_Absence_Violence (+)	Income_Index (-)			
	Control_Corruption (+)				
	Size_Government (+)				
	Legal_Syst_Prop_Rights (+)				
	Pop_educ_level (+)				
	Gover_deficit (+)				
	Serv_value_ad (-)				

France	Life_exp_birth_total (-)	Control_Corruption (+)	Gover_deficit (+)	Income_Index (+)	Voice_Accountability (+)
	National_debt (-)	Size_Government (+)		Reg_Quality (+)	
	Industry (+)	Legal_Syst_Prop_Rights (+)			
	Agric_for_fish (+)				
	Pol_Absence_Violence (+)				
	Govern_Effect (+)				
	Education_Index (-)				
	Pop_educ_level (+)				
	Serv_value_ad (-)				
Germany	Life_exp_birth_total_y (+)	FDI (+)	National_debt (-)	Infl_cons_prices (+)	Rule_Law (+)
	Reg_Quality (+)	Govern_Effect (+)	Control_Corruption (+)		Size_Government (+)
	Education_Index (+)				
	Legal_Syst_Prop_Rights (-)				
	Labor_market_reg (+)				
	Pop_educ_level (-)				
	Gover_deficit (+)				
	Income_Index (+)				
Greece	Industry (+)	Size_Government (+)	FDI (-)		
	Agric_for_fish (-)	Income_Index (+)	Labor_market_reg (-)		
	Pol_Absence_Violence (+)		Pop_educ_level (-)		
	Control_Corruption (+)		Gover_deficit (-)		
	Freedom_trade (+)				
	Education_Index (-)				
	Serv_value_ad (-)				
Ireland	Life_exp_birth_total_y (-)	Industry (+)	FDI (+)	Reg_Quality (+)	Voice_Accountability (+)
	Agric_for_fish (+)	Rule_Law (-)		Control_Corruption (+)	
	Infl_cons_prices (+)	Size_Government (+)			
	Pol_Absence_Violence (+)	Gover_deficit (+)			
	Govern_Effect (+)	Serv_value_ad (-)			
	Freedom_trade (+)				
	Education_Index (-)				
	Labor_market_reg (-)				
	Pop_educ_level (+)				
	Income_Index (-)				
Italy	Life_exp_birth_total (-)	Agric_for_fish (+)	Voice_Accountability (+)	Gover_deficit (+)	
	National_debt (-)	Govern_Effect (+)			
	Industry (+)	Rule_Law (+)			
	Infl_cons_prices (+)	Freedom_trade (+)			
	Reg_Quality (+)	Education_Index (-)			
	Size_Government (+)	Legal_Syst_Prop_Rights (+)			
	Pop_educ_level (+)	Labor_market_reg (-)			
	Serv_value_ad (-)				
	Income_Index (+)				
Latvia	Life_exp_birth_total_y (+)	FDI (+)	Gover_deficit (+)	Voice_Accountability (+)	Size_Government (+)
	National_debt (+)	Infl_cons_prices (+)			
	Industry (-)				
	Agric_for_fish (-)				
	Govern_Effect (+)				

	Reg_Quality (+)				
	Rule_Law (+)				
	Control_Corruption (+)				
	Education_Index (+)				
	Labor_market_reg (+)				
	Pop_educ_level				
	Serv_value_ad (+)				
	Income_Index (+)				
Lithuania	Agric_for_fish (-)	Life_exp_birth_total_y (+)	Freedom_trade (+)	Pol_Absence_Violence (+)	
	Govern_Effect (+)	National_debt (+)	Gover_deficit (+)		
	Rule_Law (+)	FDI (-)			
	Education_Index (+)	Industry (-)			
	Legal_Syst_Prop_Rights (+)	Voice_Accountability (+)			
	Pop_educ_level (-)	Control_Corruption (+)			
	Income_Index (+)	Serv_value_ad (+)			
Luxembourg	Life_exp_birth_total_y (-)	Govern_Effect (+)	Voice_Accountability (-)	FDI (+)	
	National_debt (-)	Rule_Law (+)	Size_Government (+)		
	Industry (+)	Freedom_trade (+)	Gover_deficit (+)		
	Agric_for_fish (+)	Labor_market_reg (+)			
	Control_Corruption (-)				
	Education_Index (-)				
	Legal_Syst_Prop_Rights (-)				
	Pop_educ_level (+)				
	Serv_value_ad (-)				
	Income_Index (+)				
Malta	Life_exp_birth_total_y (+)	National_debt (+)	Govern_Effect (+)	FDI (+)	
	Industry (-)	Control_Corruption (+)	Reg_Quality (+)		
	Agric_for_fish (-)				
	Pol_Absence_Violence (-)				
	Freedom_trade (+)				
	Education_Index (+)				
	Labor_market_reg (+)				
	Pop_educ_level (-)				
	Gover_deficit (+)				
	Serv_value_ad (+)				
	Income_Index (+)				
Netherlands	Life_exp_birth_total_y (-)	National_debt (+)	Reg_Quality (+)	Voice_Accountability (+)	FDI (-)
	Agric_for_fish (+)	Rule_Law (+)	Legal_Syst_Prop_Rights (+)	Control_Corruption (-)	
	Pol_Absence_Violence (+)	Size_Government (-)	Gover_deficit (+)		
	Govern_Effect (+)				
	Freedom_trade (+)				
	Education_Index (-)				
	Labor_market_reg				
	Pop_educ_level (+)				
	Serv_value_ad (-)				
	Income_Index (-)				
Poland	Life_exp_birth_total_y (+)	Voice_Accountability (+)	Industry (+)	Control_Corruption (+)	
	National_debt (+)	Pol_Absence_Violence (-)	Legal_Syst_Prop_Rights (+)		

	Agric_for_fish (-)	Rule_Law (+)	Serv_value_ad (-)		
	Infl_cons_prices (-)				
	Freedom_trade (+)				
	Education_Index (+)				
	Labor_market_reg (+)				
	Pop_educ_level (+)				
	Income_Index (+)				
Portugal	Life_exp_birth_total_y (-)	Pol_Absence_Violence (+)	Size_Government (+)	FDI (+)	
	National_debt (-)	Govern_Effect (+)	Gover_deficit (+)		
	Industry (+)	Rule_Law (+)			
	Infl_cons_prices (+)	Freedom_trade (+)			
	Control_Corruption (+)				
	Education_Index (-)				
	Labor_market_reg (-)				
	Pop_educ_level (+)				
	Serv_value_ad (-)				
Roumania	Life_exp_birth_total_y (+)	National_debt (-)	Industry (-)	Govern_Effect (+)	Pol_Absence_Violence (+)
	Agric_for_fish (-)	FDI (+)	Serv_value_ad (+)	Gover_deficit (+)	
	Infl_cons_prices (-)	Size_Government (+)			
	Reg_Quality (+)				
	Rule_Law (+)				
	Control_Corruption (+)				
	Freedom_trade (+)				
	Education_Index (+)				
	Legal_Syst_Prop_Rights (+)				
	Labor_market_reg (+)				
	Pop_educ_level (-)				
	Income_Index (+)				
Slovakia	Life_exp_birth_total_y (+)	National_debt (-)	Voice_Accountability (+)	Pol_Absence_Violence (-)	
	FDI (-)	Industry (+)			
	Agric_for_fish (+)	Govern_Effect (+)			
	Infl_cons_prices	Reg_Quality (+)			
	Freedom_trade (+)	Control_Corruption (+)			
	Education_Index (+)	Size_Government (+)			
	Legal_Syst_Prop_Rights (-)	Labor_market_reg (+)			
	Pop_educ_level (-)				
	Serv_value_ad (+)				
	Income_Index (+)				
Slovenia	Life_exp_birth_total_y (+)	FDI (+)	National_debt (-)	Rule_Law (+)	
	Agric_for_fish (-)	Size_Government (+)	Control_Corruption (+)		
	Infl_cons_prices (-)	Gover_deficit (+)			
	Voice_Accountability (-)				
	Govern_Effect (+)				
	Education_Index (+)				
	Legal_Syst_Prop_Rights (+)				
	Labor_market_reg (+)				
	Pop_educ_level (-)				
	Income_Index (+)				
Spain	Life_exp_birth_total_y (-)	Agric_for_fish (+)	Labor_market_reg (+)	Legal_Syst_Prop_Rights (+)	

	National_debt (-)	Pol_Absence_Violence (+)	Income_Index (+)		
	Industry (+)	Govern_Effect (+)			
	Infl_cons_prices (+)	Freedom_trade (+)			
	Voice_Accountability (+)				
	Reg_Quality (+)				
	Rule_Law (+)				
	Control_Corruption (+)				
	Size_Government (+)				
	Education_Index (-)				
	Pop_educ_level (+)				
	Serv_value_ad (-)				
Sweden	Life_exp_birth_total_y (-)	Gover_deficit (+)	Education_Index (+)	Control_Corruption (+)	Infl_cons_prices (+)
	National_debt (+)			Legal_Syst_Prop_Rights (+)	
	Industry (+)				
	Agric_for_fish (+)				
	Pol_Absence_Violence (+)				
	Freedom_trade (+)				
	Labor_market_reg (-)				
	Income_Index (-)				
Hungary	Life_exp_birth_total_y (-)	National_debt (-)	Freedom_trade (-)	FDI (+)	
	Infl_cons_prices (+)	Agric_for_fish (+)	Size_Government (+)		
	Voice_Accountability (+)	Education_Index (-)			
	Govern_Effect (+)	Labor_market_reg (-)			
	Reg_Quality (+)				
	Rule_Law (+)				
	Control_Corruption (+)				
	Legal_Syst_Prop_Rights (+)				
	Pop_educ_level (+)				
	Gover_deficit (-)				
	Income_Index (-)				

These factors are used in the next paragraph as independent variables, considering the same dependent variables as in PLS regression.

Estimated PCR regression equations

As we have already stated, the factors obtained above are used as independent variables for two multiple regressions: in the first regression we will use the employment rate as the dependent variable, and in the other regression we will use the GDP growth rate as the dependent variable). The estimates obtained for each country are shown in Tables 14 and 15.

Table 14. Regression coefficients for the model with the dependent variable employment rate

	Constant	F1	F2	F3	F4	F5	F stat
Austria	56.482***	-0.851*** (0.000)	-0.116 (0.480)	0.109 (0.506)	-0.155 (0.348)	0.121 (0.461)	6.204*** (0.003)
Belgium	48.965***	-0.775***	-0.011 (0.911)	0.040 (0.685)	0.310*** (0.005)		19.037*** (0.000)

		(0.000)					
Bulgaria	47.558***	3.156*** (0.000)	0.074 (0.836)	0.726* (0.056)	0.785** (0.041)	0.692* (0.067)	19.080*** (0.000)
Czechia	55.827***	1.173*** (0.000)	-0.175 (0.332)	0.372* (0.051)	-0.287 (0.122)	0.872*** (0.000)	15.705*** (0.000)
Ciprus	57.975***	-2.243*** (0.000)	1.104*** (0.001)	0.849*** (0.004)	0.710** (0.013)		29.427*** (0.000)
Croatia	45.618***	-0.710** (0.012)	0.957*** (0.002)	0.705** (0.012)	-0.775*** (0.007)		10.203*** (0.000)
Denmark	60.785***	0.656*** (0.001)	1.174*** (0.000)	1.609*** (0.000)	0.000 (0.998)	0.142 (0.403)	32.493*** (0.000)
Estonia	55.348***	2.679*** (0.000)	0.796 (0.129)	-0.098 (0.846)			10.560*** (0.000)
Finland	54.924***	0.715*** (0.000)	-0.572*** (0.000)	-0.124 (0.266)	0.492*** (0.000)		23.688*** (0.000)
France	50.668***	0.302*** (0.002)	0.405*** (0.000)	-0.112 (0.186)	0.254*** (0.007)	0.132 (0.125)	10.711*** (0.000)
Germany	55.288***	2.256*** (0.000)	0.426** (0.012)	-0.339** (0.037)	0.089 (0.556)	-0.412** (0.014)	51.158*** (0.000)
Greece	44.644***	1.542*** (0.000)	3.288*** (0.000)	1.375*** (0.001)			47.069*** (0.000)
Ireland	58.129***	1.257*** (0.000)	1.921*** (0.000)	-1.276*** (0.000)	1.370*** (0.000)	1.465*** (0.000)	85.877*** (0.000)
Italy	44.147***	0.628*** (0.000)	-0.487*** (0.000)	0.521*** (0.000)	0.002 (0.988)		19.881*** (0.000)
Latvia	52.409***	2.081*** (0.000)	1.288** (0.011)	1.146** (0.021)	0.918* (0.056)	-0.117 (0.794)	8.442*** (0.001)
Lithuania	52.194***	1.828*** (0.000)	0.630** (0.023)	2.099*** (0.000)	0.222 (0.389)		32.844*** (0.000)
Luxembourg	53.738***	-1.512*** (0.000)	-0.149 (0.254)	-0.073 (0.570)	-0.301** (0.030)		38.249*** (0.000)
Malta	48.511***	2.086*** (0.000)	-1.851*** (0.000)	-0.436* (0.073)	-1.579*** (0.000)		51.135*** (0.000)
Netherlands	60.968***	0.119 (0.435)	-0.443** (0.010)	-0.116 (0.446)	-0.627*** (0.001)	0.407** (0.016)	7.156*** (0.002)
Poland	49.611***	2.212*** (0.000)	-0.243 (0.409)	1.226*** (0.001)	2.183*** (0.000)		34.424*** (0.000)
Portugal	55.146***	2.598*** (0.000)	0.494* (0.068)	0.829*** (0.005)	-0.962*** (0.002)		34.024*** (0.000)
Romania	51.912***	-1.862*** (0.000)	-0.974*** (0.005)	1.074*** (0.003)	-0.637** (0.048)	-0.269 (0.376)	13.997*** (0.000)
Slovakia	51.579***	1.838*** (0.000)	0.304 (0.382)	-0.184 (0.594)	0.701* (0.056)		8.739*** (0.001)

Slovenia	54.348***	0.201 (0.409)	0.727*** (0.008)	1.181*** (0.000)	-0.015 (0.949)		8.782*** (0.001)
Spain	48.110***	1.865*** (0.000)	-0.903*** (0.000)	1.667*** (0.000)	0.766*** (0.000)		124.756*** (0.000)
Sweden	59.074***	-0.105 (0.248)	0.269*** (0.008)	0.479*** (0.000)	-0.175* (0.063)	0.415*** (0.000)	13.700*** (0.000)
Hungary	48.057***	-2.821*** (0.000)	0.757** (0.048)	-0.910** (0.021)	0.250 (0.489)		18.963*** (0.000)

* Significance at the 0.1 level ** Significance at the 0.05 level *** Significance at the 0.01 level

Table 15. Regression coefficients for the model with the dependent variable GDP growth rate

Țara	Constant	F1	F2	F3	F4	F5	F statistic
Austria	1.641***	0.321 (0.317)	-0.513 (0.119)	0.197 (0.534)	0.836** (0.017)	0.448 (0.169)	2.734* (0.063)
Belgium	1.688***	0.203 (0.470)	-0.197 (0.484)	0.725** (0.019)	0.030 (0.913)		2.013 (0.144)
Bulgaria	3.629***	-1.059** (0.025)	0.818* (0.074)	0.008 (0.985)	1.696*** (0.001)	-0.441* (0.315)	5.426*** (0.006)
Czechia	2.861***	-0.181 (0.734)	-0.353 (0.511)	-1.083* (0.057)	-0.861 (0.122)	1.176** (0.041)	2.523* (0.079)
Ciprus	2.495***	-1.978*** (0.001)	0.949* (0.052)	-1.760*** (0.001)	1.002** (0.042)		10.992*** (0.000)
Croatia	2.026***	-0.925 (0.108)	-0.434 (0.435)	-1.117* (0.057)	-1.895*** (0.003)		5.022*** (0.009)
Denmark	1.410***	0.221** (0.582)	-0.938* (0.031)	0.712 (0.091)	-0.098 (0.806)	-0.153 (0.702)	1.916 (0.155)
Estonia	4.070***	-1.294 (0.209)	0.057 (0.955)	3.783*** (0.001)			5.467*** (0.009)
Finland	1.647**	1.128* (0.069)	0.313 (0.595)	1.559** (0.016)	-0.077 (0.896)		2.866* (0.060)
France	1.420***	0.331 (0.273)	-0.146 (0.623)	0.727** (0.025)	0.094 (0.750)	0.045 (0.880)	1.596 (0.225)
Germany	1.368***	0.362 (0.397)	0.753 (0.091)	-0.109 (0.796)	1.182** (0.013)	0.361 (0.398)	2.611* (0.072)
Greece	0.399	3.522*** (0.000)	1.247*** (0.004)	-1.530*** (0.001)			38.221*** (0.000)
Ireland	4.996***	-0.033 (0.973)	3.725*** (0.001)	3.433*** (0.003)	-0.312 (0.747)	-0.210 (0.828)	5.759*** (0.004)
Italy	0.392	0.243 (0.520)	0.778* (0.052)	0.456 (0.235)	0.985** (0.017)		3.402** (0.036)
Latvia	3.818***	-2.157*** (0.002)	2.556*** (0.000)	4.472*** (0.000)	-0.437 (0.440)	-0.335 (0.553)	20.787*** (0.000)
Lithuania	4.153***	-0.740 (0.395)	-2.283** (0.016)	2.526*** (0.009)	2.021** (0.030)		5.690*** (0.005)
Luxembourg	3.100	0.485 (0.499)	0.062 (0.931)	0.753 (0.299)	0.487 (0.497)		0.532 (0.714)
Malta	4.001***	1.379** (0.046)	-0.326 (0.615)	-0.755 (0.252)	-0.979 (0.144)		2.198 (0.119)
Netherlands	1.565***	0.177 (0.493)	-0.577** (0.038)	1.262*** (0.000)	0.288 (0.272)	-0.535* (0.052)	7.329*** (0.001)
Poland	3.830***	-0.058 (0.777)	-1.136***	0.693*** (0.003)	-0.232 (0.263)		11.461*** (0.000)

			(0.000)				
Portugal	0.874**	0.167 (0.686)	0.422 (0.314)	1.138** (0.013)	-0.597 (0.162)		2.823* (0.063)
Roumania	4.064***	-0.566 (0.394)	2.245*** (0.004)	0.986 (0.148)	1.542** (0.031)	-0.324 (0.623)	4.247** (0.015)
Slovakia	3.798***	-1.138* (0.081)	1.511** (0.025)	1.116* (0.087)	0.703 (0.266)		3.589** (0.030)
Slovenia	2.412***	-0.441 (0.349)	2.236*** (0.000)	-0.427 (0.364)	-1.274** (0.014)		8.430*** (0.001)
Spain	1.846***	0.813** (0.014)	1.606*** (0.000)	1.036*** (0.003)	0.628* (0.050)		13.606*** (0.000)
Sweden	2.295***	0.350 (0.551)	0.646 (0.279)	0.175 (0.765)	-0.288 (0.624)	-0.005 (0.993)	0.397 (0.843)
Hungary	2.632***	-0.429 (0.319)	2.154*** (0.000)	-0.897** (0.048)	0.144 (0.735)		8.144*** (0.001)

* Significance at the 0.1 level ** Significance at the 0.05 level *** Significance at the 0.01 level

The obtained results highlight the fact that the influence of the economic, social and institutional dimensions manifests itself mainly on the employment rate compared to the GDP growth rate. Regarding the influence on the employment rate, in the case of the Western European countries, a positive influence of the economic and social dimensions is observed, in contrast to the countries of Central and Eastern Europe, where alongside the economic dimension, the institutional dimension also appears as significant. Regarding the GDP growth rate, a significant influence of the economic and social dimension is observed for most countries in the European Union. The meaning of this influence is positive, except for a few countries (Bulgaria, Cyprus, Slovakia).

Identifying the main drivers of economic resilience in EU countries is essential for guiding policy decisions, managing risks, promoting sustainable development, and building a more robust and competitive economic environment in the European Union. Countries with higher economic resilience are often more competitive globally. By understanding the main drivers, EU countries can improve their competitiveness and seize opportunities in international markets. Furthermore, economic resilience is not a static characteristic; it requires adaptability. Identifying the main drivers allows for continuous monitoring and adjustment of policies to meet changing economic conditions and emerging challenges. By focusing on strengthening the identified drivers, governments can enhance their country's ability to withstand economic shocks and recover more quickly from crises.

Conclusions

The paper’s objective is to identify the main economic, social and institutional drivers for two of the most important output indicators of economic resilience, GDP growth rate and Employment rate, for the countries in the European Union. The results of the analysis revealed several important aspects:

- The influence of the economic, social and institutional dimensions is mainly manifested on the employment rate compared to the GDP growth rate.
- Regarding the influence on the employment rate, in the case of the countries of Western Europe, a positive influence of the economic and social dimensions is observed, in contrast

to the countries of Central and Eastern Europe, where the institutional dimension appears as significant along with the economic dimension.
- Regarding the GDP growth rate, a significant influence of the economic and social dimension can be observed for most countries in the European Union, the influence being positive, except for a few countries (Bulgaria, Cyprus, Slovakia).
Analyzing economic resilience in European Union (EU) countries is of paramount importance due to several reasons, such as:
- Economic Stability: Economic resilience measures a country's ability to withstand and recover from economic shocks and crises. Given the interconnectedness of EU economies, a shock in one country can have ripple effects across the region. Understanding the resilience of individual EU countries helps policymakers identify vulnerabilities and design appropriate measures to manage and mitigate potential economic crises;
- Investment Decision-Making: For investors, economic resilience is a critical factor in determining where to allocate resources. Countries with higher resilience are often seen as safer investment destinations, as they are better equipped to weather economic downturns and provide more stable returns;
- Social Well-being: Resilient economies are better equipped to maintain employment levels and protect the well-being of their citizens during challenging economic times. Understanding resilience helps policymakers design social safety nets and support mechanisms that can safeguard people's livelihoods during economic disruptions;
- Sustainable Development: Economic resilience is closely linked to the concept of sustainable development. Countries with higher resilience are better positioned to address environmental, social, and economic challenges in a sustainable manner. By fostering resilience, countries can work towards achieving the United Nations Sustainable Development Goals (SDGs) in a more robust and effective manner;
- Regional Cohesion: The EU aims to promote cohesion among its member states, reducing economic disparities and fostering shared prosperity. Analyzing economic resilience can help identify regions and countries that may require additional support to strengthen their economic foundations and contribute to overall regional cohesion.
Overall, analyzing economic resilience in European Union countries provides valuable insights that can inform policy decisions, foster stability and growth, and contribute to the long-term prosperity and well-being of both individual member states and the EU as a whole.

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