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Economic Resilience and Sustainable Finance Path to Development and Convergence in Romanian Counties

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Abstract: Economic resilience and sustainable finance are two interlinked and crucial issues for development and convergence in Romania's counties increasing cohesion. These issues can contribute to sustainable and balanced growth of local and regional economies and to the reduction of inequalities in regional development. Economic resilience in counties refers to their capacity to adapt and survive in the face of unforeseen economic shocks or challenges, and sustainable finance refers to ensuring responsible management of financial resources to support long-term development and protect the environment. Identifying and understanding the significant variations in economic resilience and sustainable financing between counties is essential for the formulation of regional development policies and strategies. These variations provide valuable information about the vulnerabilities and opportunities of individual counties and guide resource allocation and investment decisions. The research provides new data and relevant information on the significant variations among counties in economic resilience and sustainable financing, using a Markov transition probability matrix and exploratory–visual method. This study on Romanian counties aims to provide valuable information for the formulation of public policies to support balanced economic development across the country. The results showed that economic diversification is essential to increase the resilience of the economy to shocks and fluctuations. Counties that have a diversified economic structure, with multiple sources of income and economic activities, are less vulnerable to the negative impact of economic or natural events. Governance and political stability are key factors in creating a favorable environment for investment and economic development. Well-managed government policies can help maintain macroeconomic stability and increase the resilience of the economy to external fluctuations.

Keywords: corporate finance and governance; sustainable finance; economic development; economic resilience; economic convergence



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1. Introduction

Economic resilience and sustainable finance are two key concepts in the context of sustainable economic and social development. They are key to ensuring stable and balanced economic growth, protecting the environment, and managing resources efficiently.

The motivation for choosing the theme “Economic resilience and sustainable finance, parts of the path to Development and Convergence in Romanian counties” is based on a number of key considerations, such as: current relevance, local economic and social issues, sustainable development at global level, promoting regional convergence, research and innovation potential, and the global context marked by major changes such as the

COVID-19 pandemic and climate change, highlighted the essentiality of resilient development and sustainable finance. This study responds to these current challenges. Many counties in Romania are also facing significant economic and social challenges, such as high unemployment, youth migration, and depopulation of rural areas. These problems require tailor-made solutions at the regional level. We know that sustainable development has become a global priority and sustainable finance is an essential component of this effort. This study aims to bring these concepts into the specific context of Romanian counties to contribute to the achievement of sustainable development goals. Another important motivation is the desire to reduce the economic gap between developed and less-developed counties in Romania. This study focuses on identifying ways in which less-developed regions can catch up and converge towards the more economically developed ones.

In essence, this study highlights economic resilience, the ability of a region to adapt to economic and social shocks, and sustainable finance, which involves the responsible management of financial resources to ensure long-term development, including environmental and social aspects. The aim is to improve the outlook of Romania's counties by providing concrete solutions for economic development and sustainable regional convergence.

The theme focuses on economic resilience, i.e., the ability of a region to withstand economic and social shocks, and sustainable finance, which involves the responsible management of financial resources to support long-term development, including environmental and social aspects. It aims to improve the situation of Romania's counties, providing solutions for sustainable regional economic development and convergence.

As far as the contribution of this study is concerned, it is significant and brings tangible benefits to regional development in Romanian counties by simply providing concrete solutions and practical strategies for developing economic resilience and implementing sustainable finance in those regions. These recommendations do not remain only at a theoretical level, but can be implemented by local authorities, non-governmental organizations, and other stakeholders to improve the economic and social situation of local communities. The rigorous research and data collected in the study become a solid basis for the development and adaptation of public policies at the local and national levels. These policies are geared towards promoting equitable economic development and sustainability and can help address the specific problems of each region. Moreover, the study highlights the role of the research and evaluation at a deep territorial granularity to better identify, with specificity, the appropriate solutions and support.

By promoting economic resilience and sustainable finance, this study contributes to regional development, creating opportunities for people and businesses in Romania's counties. This not only improves economic prospects, but also supports the strengthening of local communities and infrastructure, with a positive impact on the lives of residents.

Overall, the rationale behind this study is to make a significant contribution to sustainable development and the reduction in economic inequalities in Romania's counties, offering concrete solutions to address current challenges and create better prospects for the future of these regions.

2. Literature Review

It is a significant topic of research to make sure that economic, social, and regional development can be achieved with balanced economic growth, and improved convergence is one of the significant priorities of the European Union. The welfare theory assumes that life is constantly changing and every individual needs to develop economic stability. Advanced trends are required to analyze the economic and social perspective of member countries of the European Union that could share increasing economic and social convergence [1,2]. To obtain convergence among the countries, it is necessary to increase the GDP per capita by increasing investment in different sectors that could increase the overall GDP level. The purpose of training in economic development and social convergence is to achieve a high standard through the implementation of effective policies and economic reforms. Development can not be obtained overnight, as it requires effort, and Romania

is currently facing difficulties in managing the economic convergence by improving economic and financial integration. The studies conducted by experts provided information about wealth development. The evaluation of these studies provides information about the perspective of research by supporting the statistics and providing an overview of economic development in specific regions [3].

In the literature on regional development and local economy in Romanian counties, various gaps can be identified. These gaps may include lack of specific regional studies, insufficient approaches to sustainability, and a lack of in-depth evaluations. As a result, this article focuses on counties in Romania, providing a regional perspective on economic resilience and sustainable finance, analyzes the relationship between economic resilience and sustainable finance, paying particular attention to sustainability issues, and includes a detailed assessment of specific data and indicators to assess economic resilience and sustainable finance in the counties. Closely related to the gaps identified in the literature and to the objectives of the article, two working hypotheses were established at the outset, related to the existence of a positive relationship between the level of economic resilience and sustainable financing in Romanian counties and the existence of significant variations in economic resilience and sustainable financing between Romanian counties. The first hypothesis is formulated to investigate the relationship between economic resilience and sustainable financing, a relationship that can be highlighted in the literature but that needs further examination to be understood in the specific context of Romanian counties. The second hypothesis aims to investigate notable regional variations in economic resilience and sustainable finance. It resonates with the identified gap related to the insufficient approach to regional specificity in previous research. Therefore, the article and hypotheses were developed to address the gaps identified in the literature and to contribute to the understanding of the relationship between economic resilience and sustainable finance in Romanian counties, with the aim of supporting regional development and economic convergence.

2.1. Economic Resilience

Economic resilience is the ability of an economy to cope with and adapt to unforeseen shocks, disruptions, or changes, such as economic crises, natural disasters, price fluctuations, technological changes, or any other event that may affect the normal functioning of the economy [4]. A resilient economy can maintain stability and return to sustainable growth quickly after experiencing difficult times [5]. Key elements of economic resilience include economic diversification, labor market flexibility, ability to attract investment and sources of finance, well-managed fiscal and monetary policies, robust infrastructure, governance and political stability, and responsible management of natural resources and the environment. An economy with a diversified structure is less vulnerable to shocks affecting sectors [6]. Diversification of the economy means that there are more sources of income and economic activity, which reduces the risk of over-reliance on one sector [7]. A flexible and well-trained workforce is essential for adapting to economic change. Investment in education, training, and skills development can increase the capacity of the workforce to adapt to new conditions, and effective government policies can help maintain macroeconomic stability and increase the resilience of the economy to external fluctuations [8]. The gap observed in the studies cited can be summarized by the idea that economic resilience is often discussed in the context of economic growth and risk management, but the link with social and economic inequalities may be underestimated. It is important to explore in more detail how economic resilience affects vulnerable and poor groups.

Economic resilience is important to ensure sustainable and stable development. In the face of challenges such as climate change, pandemics, or unforeseen economic events, the ability of an economy to be resilient can make the difference between a rapid recovery and a prolonged recession [9]. By adopting policies and measures that promote resilience, governments and economic actors can help build a more stable and adaptable economy in the face of future challenges [10].

The connection between economic resilience and economic convergence at the county level in Romania is a close one and relevant for the balanced and sustainable development of the whole country. These two concepts complement each other and can have a significant impact on regional development and the reduction of economic disparities between counties [11]. This link between the two concepts highlights that a resilient economy can contribute to economic convergence. Counties with a resilient economy are more likely to cope with economic shocks and remain on a sustainable development trajectory, which can lead to a reduction in economic disparities between them. Developing economic resilience at the county level can, therefore, support the convergence process and contribute to a balanced development of the whole country [12]. Combining efforts at all levels—central government, local government, the private sector, and civil society—is essential to promote economic resilience and convergence at the county level in Romania. From the research, economic resilience can vary significantly by region and local community. This is another shortcoming of studies that focus on more aggregate levels and may neglect local differences and specificities. Collaboration and coordination between these parties is fundamental to building a strong and balanced economy that can face challenges and seize development opportunities [13]. Through close and coordinated collaboration between these entities, Romania can create an enabling framework for balanced development and increased economic resilience at the county level. Promoting economic convergence and supporting less-developed regions can help increase prosperity and well-being across the country, ensuring a sustainable future for all citizens [14]. Developing valid and consistent measures for economic resilience is also a challenge. Many studies use different indicators and different approaches to assess resilience, which can make it difficult to compare results between different studies.

As a conclusion, we can say that these are just some of the gaps identified in the literature on economic resilience. Over time, research will continue to address these challenges and bring clarity to this complex and vital concept for economic and social development.

2.2. Sustainable Finance

Sustainable finance is a concept and approach to finance that aims to integrate economic, social, and environmental aspects to ensure sustainable and balanced development [15]. It involves managing financial resources in a responsible way to ensure that the needs of the present are met without compromising the ability of future generations to meet their own needs [16].

Economic resilience and sustainable finance are closely and mutually linked, as both concepts focus on ensuring a sustainable, balanced, and responsible development of the economy. Sustainable finance encourages the allocation of capital to projects and activities that have a positive impact not only on financial performance but also on social and environmental aspects [17]. Responsible investment supports sustainable economic development and contributes to long-term economic resilience [18]. In terms of financial inclusion and social equity, sustainable finance encourages access to financial services for all sections of society, including the disadvantaged. By increasing financial inclusion and promoting social equity, it can stimulate balanced economic development and reduce social inequalities which contribute to social and economic resilience [19]. Through transparency and proper reporting, sustainable finance enables the financial impact of investment decisions and business strategies on economic, social, and environmental aspects to be monitored and assessed [20]. This enables informed and responsible decision-making, which increases the resilience of the economy in the face of change and risk [21]. Many studies and practices focus on achieving financial sustainability in the short term, but it is important to consider the long-term implications, especially in terms of climate change and limited natural resources.

Sustainable finance and economic resilience are, therefore, intrinsically linked, with the aim of ensuring sustainable and responsible economic development that considers the needs of the present and the future [22]. An integrated approach to these two concepts can help build a resilient, equitable, and sustainable economy in the face of global challenges

and ongoing changes. All these studies should examine in more detail how global economic changes may influence financial sustainability at the national and regional levels.

The interconnection between the two concepts is that sustainable finance can contribute to strengthening economic resilience [23]. Responsible investment and proper management of risks associated with climate change and other environmental factors can enhance the economy's ability to cope with challenges and recover more quickly from shocks [24].

There is also a close interdependence between the Legatum Prosperity Index and sustainable finance [25]. The Legatum Prosperity Index is a global indicator that measures well-being and prosperity in a country, considering a range of factors such as the economy, health, education, personal freedom, the environment, and governance [26]. Sustainable finance can contribute to improving these factors by promoting sustainable and responsible economic development, managing environmental and climate risks appropriately, and investing in innovative and sustainable sectors [27]. By adopting responsible financial and economic practices, a country can achieve better performance on the Legatum Prosperity Index. Another gap in all these studies in the literature is that they should focus more on financial education and public awareness of the importance of sustainable and responsible financial management.

Not insignificant is also the fact that economic resilience can have a significant impact on a country's well-being and prosperity, which is reflected in the Legatum Prosperity Index [28]. A resilient economy may be better able to adapt to change and weather difficult times, which contributes to a country's long-term stability and growth. As a result, countries with a resilient economy can perform better on the Legatum Prosperity Index.

In this sense, economic resilience and sustainable finances can positively influence key indicators of well-being and prosperity, such as the Legatum Prosperity Index. An integrated and responsible approach to managing finances and the economy can contribute to building a resilient, equitable, and sustainable economy, which has a positive impact on people's living standards and well-being [29]. The Legatum prosperity index is used to arrange the ranking of countries and represents the prosperity of individuals, which reflects economic and well-being development. It is helpful to obtain an overview of the lives of rich people by considering the income level, gross domestic product per capita, and the factors of production. Economic and social well-being could be captured by using the prosperity index, which is based on multiple pillars. In the ranking of the composite prosperity index, Romania ranked 47th in 2021, which is three places higher than its rank in 2011 [26,30]. Romania performed better in the security and personal liberty sectors, which improve the overall ranking of the country as compared to the previous 10 years, because the country increased the efficient use of social capital and the natural environment [3].

Sustainable finance can help improve Legatum's prosperity index by promoting responsible investment and allocating financial resources in a sustainable way [31]. These investments can support economic growth, leading to higher GDP and thus increased income and prosperity in a country. It has been stated that GDP could be used to gain information about the products and services achieved by an economy over a specific period [2]. However, the use of GDP in measuring welfare is controversial, as there are different problems in calculating the GDP. The GDP of Romania was USD 11,589.66 in 2021, which represents that it grew 3.27% as compared to the previous years. Since 2012, the GDP of Romania has drastically increased, which represents that the wealth of individuals in Romania is also increasing; however, the saving rates decreased because Romanians are not investing in financial assets [32]. In the Romanian economy, a major contribution is made by the real estate sector; however, unequal distribution is increasing the gap between GDP and per capita income. Thus, all these elements are closely linked and contribute to the development of a prosperous and sustainable economy.

Income inequalities are studied from different perspectives: positive correlation with public expenditure in education and fiscal redistribution was identified by Checchi et al. [33]; the inequality–wellbeing link was studied by Schneider [34] and strategically

orientations were suggested; and Toma et al. [35] studied the sharing responsibility of the income inequalities.

The Gini index is used to measure the inequality of income or distribution of resources in each population. In other words, it quantifies the degree of economic inequality in a society, where 0 represents a perfectly equal distribution of income (everyone has the same amount) and 1 indicates maximum inequality (one person or group of people owns all the wealth). The Gini index is mostly used to measure income inequality in a state, and it was developed by Corrado Gini in 1912. According to Sârbovan [36], the Gini index values range from 0 to 1, in which 0 represents perfect equality and 1 represents inequality. The Gini index could be calculated with the help of income distribution data originating from household surveys, tax expenses, and other sources to obtain a summary of income inequality. For this purpose, it is necessary to collect the data and arrange the data in ascending order. The cumulative percentage of population and income could be calculated and provide a summarized percentage of household income. According to the analysis of 2021, the Gini index of Romania is valued at 35.7 [37]. Income inequality is considered to be a major problem in the way of obtaining sustainable development for a country, as it may be created due to different issues, such as gender discrimination, obstacles in obtaining education, and other financial hurdles. The objective of the Gini index is to analyze the resources and adopt measures that could help to decrease the inequalities of income, which will be helpful for promoting social, economic, and political development [3]. With the adoption of fiscal and social policies, different regulations could be improved that help to achieve the objectives of the market and financial institutions in order to strengthen the implementation of such regulations. The Gini index and sustainable finance are directly linked through the influence that sustainable finance can have on income inequality and the distribution of resources in a society [38]. With the right policies and investments, governments and authorities can help reduce inequality, thereby promoting more equitable and sustainable development.

In addition to the linkages observed in the studies reviewed, there is a growing need to develop standardized indicators and metrics to measure financial sustainability in different contexts, including at the organizational, public sector, and macroeconomic levels.

The gaps identified in the literature related to financial sustainability reflect the complexity of the field and the need for a multidimensional approach to understanding and promoting financial sustainability in a holistic way. As the research continues to evolve, it is expected that these gaps will be addressed and more comprehensive and accurate understandings in this area will develop.

2.3. Economic Wealth and Development

Wealth is an indicator that is based on the value of assets owned by a community or a country. The developed economic wealth of a country could be improved by increasing the gross domestic product and creating a relationship that promotes economic growth in the region. This perspective highlights that economic growth and well-being development are helpful in strengthening each other; therefore, it is significant to consider that economic growth could be achieved by implementing well-being development. Munteanu et al. [37] stated that gross domestic product could be used to measure economic growth and provide information about the overall production of goods and services in a country. Well-being development is based on different factors, such as quality of life, healthcare, education, and sustainability [37]. It is necessary to make sure that sustainable development is achieved in society, and it is required to consider the economic development and growth that contribute to the overall development of well-being. With the implementation of proper social policies and investment in human resource capital, a sustainable environment could be achieved, as it is a comprehensive approach that could enhance the economic growth of citizens. The reinforcement of the well-being of individuals and economic growth are mutually interrelated, as, with the development of individuals, the per capita income increase improves the living standard of individuals and, overall, increases economic growth.

Dodge et al. [39] stated that the measurement of individuals' development is not possible, but it could be considered by analyzing the living standard and quality of life that may vary from individual to individual in the contexts of philosophy and psychology [40]. Kuznets asserted that the collection of economic data related to income distribution and economic development must be determined by considering the different variables that influence the welfare of the state [3]. It would be possible to examine indicators like gross domestic product, household consumption, and other economic variables that have a greater influence on the development of well-being. These indicators provide information about the resources available for individuals and households that could significantly impact the quality of life and satisfaction among the individuals. Different parameters could be used to measure the well-being performance, such as the Human Development Index (HDI), which is helpful for analyzing the human skills that not only consider economic growth but also provide information about the skillful human resources of the country that could contribute to its economic development. Different dimensions, including health, knowledge, and living standards, could provide information about the HDI [41]. By analyzing health, life expectancy could be measured, and education provides an understanding of the overall qualifications of adults above 25 years and discusses the technological advancement that improves the overall level of economic growth. By analyzing the living standards, it would be easy to analyze per capita income and collect data related to the poverty rate, housing facilities, life expectancy, etc. [42].

Sustainable development cannot be achieved without cohesion and competitiveness [43,44], and measuring the development indexes is a way to estimate the trends and the intervention needed.

The human development index could be calculated by United Nations Development Program (UNDP), which is used to measure the individual development in a country [32]. Different indicators are considered that provide an overview of the analysis of a country's development, including life expectancy, education level, and gross national income (GNI) per capita. To calculate the HDI, every indicator is required to be a standardized value between zero and one. The aggregated values are used in a specific formula to obtain the HDI value. In the current study, the calculated HDI of Romania is 0.821, which is calculated with the help of life expectancy at birth and education level at the regional level (Figure 1). It represents that Romania has fallen in the rankings of developed countries because the HDI is calculated with the help of life expectancy, which is 74.2 years, and educational years of schooling, which is 14.2 with a mean of 11.3 years. The GNI per capita of Romania was USD 30,027 during the year 2017. The country rank is 53rd, which represents increased human development. It is significant to consider that Romania is experiencing the lowest HDI compared to other European Union countries. Romania has a negative HDI, and it represents that Romania has a higher GNI per capita as compared to the HDI value, which is -4 [37].

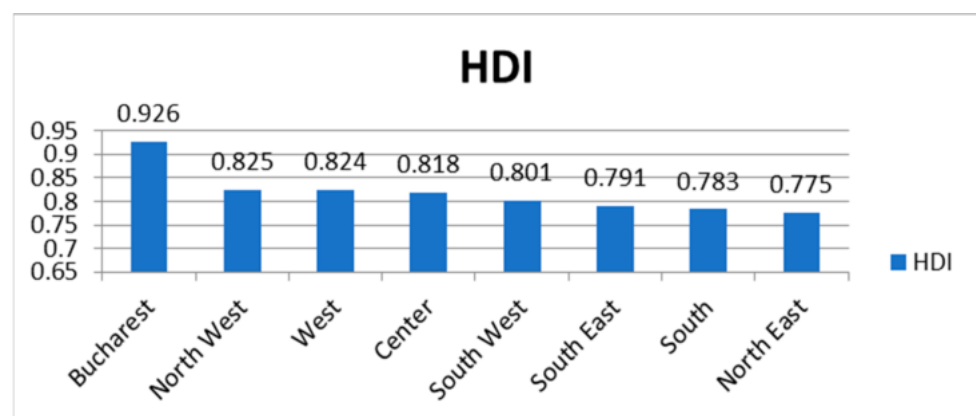


Figure 1. HDI Index for Romanian regions. Source: Human Resource Development Report 2019 [45].

According to the data collected from the human development index in 2021, it is notable that the HDI is different in different regions, such as Bucharest, which has the highest value of HDI. Bucharest's HDI is 0.926, North West's HDI is 0.825, West's HDI is 0.824, Centre's HDI is 0.818, Southwest's HDI is 0.801, South East's HDI is 0.791, South's HDI is 0.783, and North East's HDI is 0.775 [41].

2.4. Economic Convergence and Development

Economic convergence represents the achieved level of development by the country; therefore, the researchers analyzed the basic factors that represent the identification of procedures to find the development gaps and track the reduction in the income between the comparative countries. Economies strongly emphasized economic convergence, as it is significant and helpful for highlighting the difference between two countries. In 1990, the average per capita income of developing countries started to grow more than the developed countries because they follow the new era of convergence [41]. In the convergence, technology is considered to be a significant factor that could improve economic development; therefore, researchers highlight the gap in technology development and limited resources that may create hurdles in the convergent growth. OECD conducted studies; however, Romania is not a member of the OECD, but there was discussion about the convergence in Romania in the previous year. The United Nations considered Romania to be a developed country; however, OECD and other organizations are not agreed because a direct economy is considered to have high growth, and they examine the growth in the short run and long run. During the past two decades, Romania increased its average income per capita. Although the country recovered from the pandemic situation of COVID-19, the poverty rate is still very high, which is creating difficulties for the labor market [46]. According to Pirciog et al. [47], the calculated composite development index considered three basic factors to analyze the convergence: economic development, demographics, and multiculturalism.

In terms of economic growth and development, many studies focus on national or global economic growth, but do not take sufficient account of regional gaps and inequalities. It is important to examine how economic growth affects different regions and communities, and how gaps can be reduced.

2.5. Public Policies

Public policy plays a key role in promoting and implementing the principles of sustainable finance. This involves the adoption of measures, rules, and strategies by governments and public authorities to support balanced and sustainable economic, social, and environmental development [48]. Although evaluations of public policies are carried out, a comprehensive and continuous assessment of their impact is often lacking. More attention needs to be paid to measuring the effects of public policy in terms of the objectives set and the actual impact on society.

Economic convergence could provide information about well-being development that is not possible without the implication of strong public policies. Public policies could play a significant role in the economic resilience and sustainable development of specific regions; therefore, different public policies, such as education policy, could increase the quality of life, and the government could invest in education by promoting skills development programs that could increase the human capital and create a more educated workforce. Education policy could improve the quality of education and health of the individuals and allow them to gain lifelong learning skills based on innovation and advanced skills that could promote economic growth. These policies could resolve the issues related to educational discrimination and make sure that quality education is provided to all the individuals living in the country [42]. With the advancement of technology, it is important to consider how governments can use technology to improve policy-making and implementation, which highlights another gap in the literature.

Jordan and Chilian [40] stated that government could implement innovative and advanced policies by developing a supportive environment for the professionals engaged

in research, development, and the entrepreneurship sector of the economy. These policies are helpful for increasing the communication between industry and government, which promotes the advancement of organizations. These policies could develop mechanisms for intellectual property and develop regulatory frameworks that are helpful for obtaining assistance in promoting economic resilience. Infrastructure development policies including transportation, communication networks, and energy systems could develop the foundation for economic growth and resilience. Every developed economy is interested in promoting infrastructure policies that are helpful for increasing foreign investment productivity and improving connectivity to promote the use of renewable energy, as well as for helping the organization to achieve the target of economic sustainability [34].

Social welfare policies are used to develop the health sector of the economy, as they contribute to obtaining sustainable development in the healthcare sector by providing quality services related to health. It provides equal opportunities to the individual to access health facilities and enhances economic resilience. Besides this, regional development policies also help to overcome discrimination and create balanced development and economic convergence. They could stimulate growth by focusing on investments in job creation programs and infrastructure development [37]. Strong public policies could focus on improving education, innovation, regional development, and economic resilience in order to obtain sustainable regional development. With the help of such public policies, the government could overcome discrimination in the economy and promote economic convergence to create a sustainable environment [49].

Through these public policies and measures, governments can ensure an integrated and coordinated approach to the sustainable development of the economy, society, and the environment. Ultimately, these policies can contribute to building a more resilient, equitable, and sustainable society for current and future generations.

3. Research Gap and Research Questions

Studies and other research on economic resilience and financial sustainability in Romania, where income levels are considered as a share of GDP per capita at NUT2 level, have revealed that no other previous analyses or studies have been identified using our proposed methods at this geographical scale.

The absence of these pre-existing analyses highlights the lack of research in this specific area and opens the way for new and relevant contributions. By conducting research according to the methods proposed at the NUT2 level for Romania, we have provided valuable information on economic resilience and sustainability in different county regions.

This approach has helped to gain a deeper understanding of regional disparities, to identify key factors influencing development and convergence in different counties, and to provide meaningful pointers for the development of sustainable policies and initiatives in these areas.

Thus, our research has not only filled previous gaps in the knowledge of economic resilience and financial sustainability at the regional level in Romania but has also contributed substantially to the existing knowledge base. It can serve as a starting point for regional decision-makers and planners, providing them with the necessary tools to promote equitable and sustainable development in different counties.

The research gap related to analyzing the development and convergence in Romanian counties could be found by analyzing the capital belonging to the wealthy individuals that promote the equality in country. The analysis of capital belongings is helpful for adopting a comprehensive approach that promotes transparency and accountability in capital allocation, from wealthy individuals to the financial holdings of households and individuals. With the implementation of transparency in the financial transaction, the government could avoid tax evasion, money laundering, and other illegal capital flows. The government could implement a progressive tax system to obtain a high tax rate from individuals who have higher income levels so that equal distribution of wealth could be possible. Counties could enforce tax compliance and ensure the policies that are used

to prevent tax avoidance are helpful for promoting the stable development of society. Effectively designed targeted investment programs are helpful in overcoming inequality and poverty, as these programs are helpful for allocating resources by promoting education, healthcare, and social protection. Although capital allocation is a complex procedure, it provides long-term benefits, and effective policies with efficient capital allocation could promote this sustainable development in the country [42].

Distances between rich and poor regions are a measure of inequality and wealth. Homer-Dixon [50,51] shows that poor regions will not catch up with rich ones, no matter how fast they converge, calling this “the dirty little secret of development economics”. In these situations, the brain drain phenomenon is predictable, and if, in addition to this, there is also a tendency for migration from poor areas to rich ones, the latter will have problems providing health infrastructure, social protection, and housing. In response to these challenges, the United Nations and World Bank promotes shared prosperity, which envisages policies to stem these migration phenomena [52,53].

The two questions on which this research is based are:

Q1—To what extent could Romania’s economic development be useful for promoting economic convergence and resilience in the region?

Q2—What measures could be taken by the government to promote convergence and sustainability in the region?

They are related in the sense that they focus on how Romania’s economic development can help promote economic convergence and resilience in the region and what measures can be taken by the government to achieve these goals.

The first question looks at the extent to which Romania’s economic development can influence economic convergence and resilience across the region. For example, by attracting foreign direct investment, creating new jobs, and stimulating regional trade, Romania’s economic development can have a positive effect on neighboring countries, contributing to economic convergence by bringing them closer to Romania’s economic level and to economic resilience in the face of external shocks.

Hypothesis 1 (H1). *There is a positive relationship between the level of economic resilience and sustainable financing in Romanian counties.*

The second question focuses on what the government can do to promote convergence and sustainability in the region. These measures may include regional development policies that support investment in key sectors and encourage balanced development of regions. Promoting sustainability through environmental protection policies and investment in green technologies can also contribute to more sustainable and durable economic development in the region.

Hypothesis 2 (H2). *There are significant variations in economic resilience and sustainable financing between counties in Romania.*

Thus, the question on government measures acts as a continuation of the first question, suggesting that government can play an active role in promoting economic convergence and resilience in the region through its policies and actions. By implementing appropriate policies and well-thought-out strategies, the government can create an enabling environment for balanced and sustainable economic development across the region, thus having a positive impact on the convergence and resilience process.

4. Research Methodology

The research methodology used the analysis by the Markov transition probability matrix combined with an exploratory–visual spatial representation (ESDA—Exploratory Spatial Data Analysis)

The Markov transition probability matrix is a method of analyzing the evolution and transitions of a variable over time. In the context of the study, the Markov transition

probability matrix could be used to assess the probability of a region remaining in the same GDP/capita category or moving into a higher or lower category over the time under analysis.

Applying the Markov transition probability matrix for the GDP/capita in the NUTS 3 regions of Romania, we characterize the convergence process of the counties as a measure of cohesion policy outcome. Therefore, the presence of a positive transition, which means the transition from a lower class of income to a higher class of income, indicates the presence of a positive convergence process. By using these three dimensions in the research methodology, researchers can gain a deeper and more detailed understanding of the evolution of GDP/capita in the NUTS 3, as well as of the factors that may influence this evolution. These analyses can provide important insights into economic convergence and divergence in the regions and contribute to the development of appropriate policies to promote equitable and sustainable regional development.

The 2010–2018 timeframe for the research is due to the fact that in, December 2019, the COVID-19 pandemic started, and it represents a significant shock on various dimensions of the economy and society. By focusing on this pre-pandemic period, the research can assess the impact of structural funds in a context where major disruptive events, such as the pandemic, had not yet influenced the situation. This strategic choice allows us to better analyze how structural funds investments influenced regional development in a stable period and to reveal their real effects without the subsequent interference of the pandemic.

Setting the same level of the Human Development Index (HDI) in 2019, like the 2018 level, suggests that the human development process had not changed significantly during that time. This creates a stable framework for assessing the impact of the structural funds on county convergence, without being influenced by immediate factors generated by the pandemic or potential abrupt changes in 2020.

An examination of convergence between counties in the period 2010–2018 clearly reveals the impact of structural funds implementation on economic inequalities between the various regions of Romania. This global perspective provides an opportunity to identify patterns and directions, to assess the effectiveness of regional development policies, and to understand how investments have contributed to the convergence process.

Separating the analysis of the emergence and effects of the COVID-19 pandemic into a later study is a wise approach to prevent introducing bias into the assessment of county convergence. The major and unpredictable impact of the pandemic on the economy, society, and human behavior made significant changes to previous models of development. By investigating pandemic influences separately, we can gain a clearer and deeper understanding of the specific effects of structural funds on the convergence process of counties prior to the pandemic event. This approach allows us to dissect, in more detail, the contribution of regional development investments in a more stable context and to assess their implications more accurately, unaffected by the immediate disruptions generated by the pandemic.

In conclusion, the selection of the 2010–2018 timeframe for the research provides an appropriate framework for assessing the influence of structural funds on convergence between counties in a pre-pandemic context. Unpacking the analysis of the impact of the pandemic in subsequent research helps to prevent the results from being skewed and to gain a more precise understanding of the effects of various factors on economic and social development.

To represent the cumulative frequency of GDP/capita at the county level in the two years 2010 and 2018, we used indicators provided by Eurostat:

- Gross domestic product (GDP) at current market prices by NUTS 3 regions.
- Average annual population to calculate regional GDP data (thousand persons) by NUTS 3 regions.

The national average at the county level is calculated as a population-weighted average:

$$YE = Y \text{ average} = \frac{\sum_{i=1}^n Pm_i * Y_i}{\sum_{i=1}^n Pm_i} \quad (1)$$

where:

$i = 1$ to n NUTS 3 regions analyzed,

YE is the weighted average of variable Y (e.g., GDP/capita) for a given group of counties,

n is the number of counties in that group,

P_i is the share (or population) of each county in that group,

Y_i is the value of variable Y (e.g., GDP/capita) for each individual county,

Using this formula, the weighted average of the variable Y is calculated for the group of counties according to the population of each county. This means that counties with a larger population will have a higher contribution to the weighted average than those with a smaller population.

Applying this formula in the context of the cumulative frequency analysis of GDP/capita at the county level in 2010 and 2018, one can obtain weighted averages of GDP/capita for each year. These weighted averages can provide a more accurate picture of the average value of GDP/capita in the region under analysis, considering the population of each county and its contribution to the total value of GDP/capita in that year.

Let us first define a set of n regional GDPs by major classes. We take this classification from [54]. Five classes are chosen with the following ranges: [0–50]; [50–75]; [75–100]; [100–150]; [>150 –]. Let d_{it} be the percentage of regions in class i at time t . And $d_t = (d_{1t}, \dots, d_{nt})$ is the corresponding distribution over the selected classes.

The evolution of the distribution of regions over time by income classes can be described by the equation:

$$\begin{aligned} d &= A * d_{it} + 1 \\ d &= Ad_{it} + 1_t \end{aligned} \quad (2)$$

If we assume that

- (i) A is constant over time, and
- (ii) d_{it} independent of its past values,

Then Equation (2) can be analyzed as a time-homogeneous Markov chain with properties of the transition probability matrix A that conveys several information about the dynamics of the distribution.

First, if A is the transition probability matrix of an ergodic Markov chain, then the chain is characterized by a stationary distribution corresponding to an equilibrium state to which the distribution will converge over time. This stationary distribution, which is sometimes referred to as the ergodic distribution, is an interesting feature because it can be interpreted as a projection of the distribution into the future, given the transition process described by P .

Second, we can obtain an indicator of the speed regarding how fast the distribution should converge to this steady state of equilibrium. This can be expressed, for example, as the half-life of the chain, i.e., the time needed to cover half of the distance separating the current distribution from the stationary distribution. The half-life is defined as:

$$\text{Half - life} = (-\ln 2) / (-\ln |\lambda_2|) \quad (3)$$

where λ_2 is the second eigenvalue of the matrix A .

A large half-life value indicates a rapid convergence to steady state.

The speed of the transition process can also be examined by assessing how long it takes to transition from one state i to another state j . In Markovian terminology, this is called the mean time of the first transition.

It is represented by an $n \times n$ MA matrix, whose element ij is the average time taken to move from class i to class j .

Third, the matrix also provides information about the stability of the process, i.e., the probability of remaining in the same class.

Pellegrini [55] proposes the following stability index for the transition matrix P of dimension n :

$$S = \text{Tr}(A)/n \tag{4}$$

where $\text{Tr}(A^{-1}) = A^{-1} 11 + A^{-1} 22 + A^{-1} 33 + A^{-1} 44 + A^{-1} 55$.

If S is large, it indicates a stable process, which translates, in the interpretation of transitions, into a low probability of transitioning from one state to another.

5. Results and Discussion

In the year 2010, for time t , the initial time of transition, we have the distribution $d_t = (2.4\%, 45.2\%, 26.2\%, 19\%, 7.1\%)$ in the selected classes (Table 1).

Table 1. Regions by 5 income classes in 2010.

	Frequency	Percent of it	Valid Percent	Cumulative Percent
Valid	"0–50" GDP/capita	1	2.4	2.4
	"50–75" GDP/capita	19	45.2	47.6
	"75–100" GDP/capita	11	26.2	73.8
	"100–150" GDP/capita	8	19	92.9
	">150" GDP/capita	3	7.1	100
	Total	42	100	100

Source: calculation was computed by the authors in SPSS.

In the year 2018, for time $t + 1$, the end of the transition, we have the distribution $d_t = (2.4\%, 50\%, 23.8\%, 21.4\%, 2.4\%)$ in the selected classes (Table 2).

Table 2. Regions by 5 income classes in 2018.

	Frequency	Percent of it	Valid Percent	Cumulative Percent
Valid	"0–50" GDP/capita	1	2.4	2.4
	"50–75" GDP/capita	21	50	52.4
	"75–100" GDP/capita	10	23.8	76.2
	"100–150" GDP/capita	9	21.4	97.6
	">150" GDP/capita	1	2.4	100
	Total	42	100	100

Source: calculation was computed by the authors in SPSS.

We can then calculate the proportion of regions belonging to category i in t that move to category j in $t + 1$. This information can be collected in the form of a transition probability matrix A . Indeed, for any two income classes i and j , the element A_{ij} defines the probability of moving from class i to j between time t and $t + 1$. If, for example, we chose $t + 1 = 2018$, we have the transition probability matrix. For example, the value obtained for A_{22} (the element in the matrix in the second row and 2nd column) is 89.5% and means that 89.5% of the regions that were in the 50–75% class in 2010 remained in this class in 2018. And for element A_{23} (the second row of the 3rd column), the value is 10.5% and reflects the share of regions that were in the 50–75% class in 2010 and have transitioned to the 75–100% class in 2018.

The Markov transition probability matrix (Table 3) shows relative persistence for low incomes. Thus, for the 0–50% class average GDP/capita is 100%; practically no transitions of these regions into higher classes are possible. The second income class analysis, with incomes between 50 and 75% national average GDP/capita, has an 89.5% probability of remaining in this class. The third stable class is Class 4, i.e., “100–150” GDP/capita with a probability of 75%.

Table 3. Markov transitions matrix 2010–2018.

A		1	2	3	4	5	
		“0–50” GDP/Capita	“50–75” GDP/Capita	“75–100” GDP/Capita	“100–150” GDP/Capita	“>150” GDP/Capita	
1	“0–50” GDP/capita	1	0	0	0	0	1.00
2	“50–75” GDP/capita	0	0.895	0.105	0	0	1.00
3	“75–100” GDP/capita	0	0.364	0.545	0.091	0	1.00
4	“100–150” GDP/capita	0	0	0.25	0.75	0	1.00
5	“>150” GDP/capita	0	0	0	0.667	0.333	1.00

Source: calculation was computed by the authors in SPSS.

The most unstable class turns out to be the 5th class, the one with income “>150” GDP/capita, with a probability of 33.3%. The middle class (“75–100” GDP/capita) is relatively stable, with only 54.5%.

This information shows how transitions can be made between different GDP/capita performance classes in Romania’s counties based on the Markov transitions matrix. The transition probabilities show how likely it is that a county will move from one class to another in each time interval.

Positive transitions: transition from Class 2 to Class 3 has a probability of 10.5%. This means that there is a small probability that Class 2 counties will experience an increase in economic performance and move to Class 3; transition from Class 3 to Class 4 has a probability of 9.1%. This shows that there is a small probability that counties in Class 3 will experience a greater increase in economic performance and advance to Class 4.

Negative transitions: transition from Class 3 to Class 2 has a probability of 36.4%. This indicates that there is a significant probability that Class 3 counties will experience a decline in economic performance and drop to Class 2; transition from Class 4 to Class 3 has a 25% probability. This indicates that there is a significant probability that counties in Class 4 will experience a decline in economic performance and drop to Class 3; transition from Class 5 to Class 4 has the highest probability of 66.7%. This indicates that there is a high probability that counties in Class 5 will experience a significant decline in economic performance and drop to Class 4.

These transition probabilities highlight the dynamics and behavior of the economy in the different counties of Romania. This information can be useful for assessing economic convergence and divergence in the region and for identifying the factors influencing these transitions. It can also be used to formulate policies and strategies to promote economic convergence and sustainability in the counties of Romania.

Based on the Markov transitions, matrix we calculated the transpose of the matrix (Table 4).

In the Table 5, we calculated the stability index S , which resulted in a value of 0.25. The stability of the GDP/capita income distribution in the period 2010–2018 is low, indicating an unstable process.

The half-life/half-life is 2.07 periods (Table 5) which indicates duration of 2 periods (i.e., $9 \times 2 = 18$ years) needed to converge to the equilibrium structure.

The equilibrium structure is obtained by a nonlinear GRG model computed with Solver for slightly nonlinear problems. The stable structure towards which the coefficients

in the transition matrix converge after iterating an infinite number of steps, resulting from Markov chain analysis, is represented by the following distribution:

$$d_t = (0\%, 71.7\%, 20.8\%, 7.5\%, 0\%) \tag{5}$$

The equilibrium distribution is sharp, indicating a tendency towards polarization, especially in the lower income classes, which are below the national average.

Table 4. Transposed Markov transitions matrix 2010–2018.

TA = A ⁻¹					
Transpose A	"0–50" GDP/Capita	"50–75" GDP/Capita	"75–100" GDP/Capita	"100–150" GDP/Capita	">150" GDP/Capita
"0–50" GDP/capita	1	0	0	0	0
"50–75" GDP/capita	0	0.89	0.36	0	0
"75–100" GDP/capita	0	0.11	0.55	0.25	0
"100–150" GDP/capita	0	0	0.09	0.75	0.67
">150" GDP/capita	0	0	0	0	0.33
<i>Check:</i>	1	1	1	1	1

Source: calculation was computed by the authors in SPSS.

Table 5. Markov chain analysis.

TA-1		"0–50" GDP/Capita	"50–75" GDP/Capita	"75–100" GDP/Capita	"100–150" GDP/Capita	">150" GDP/Capita		
1	"0–50" GDP/capita	0	0	0	0	0	=	0
2	"50–75" GDP/capita	0	-0.11	0.36	0	0	=	-1.58×10^{-15}
3	"75–100" GDP/capita	0	0.11	-0.45	0.25	0	=	2.10×10^{-15}
4	"100–150" GDP/capita	0	0	0.09	-0.25	0.67	=	-5.31×10^{-16}
5	">150" GDP/capita	0	0	0	0	-0.67	=	0
eigenvalues		0	0.717	0.208	0.075	0	=	1
		engine		Nonlinear GRG		Solver Problems for slightly nonlinear problems		

Source: calculation was computed by the authors in SPSS.

Figure 2 illustrate the counties distributed by the probability transitions by the 5 income classes over the period 2010–2018 and highlight the predominance of the 29 counties with a stationary regime. In the map shown, 17 counties fall into Class 2, marked with a very dark orange color. These counties are predominantly rural, indicating that their economies have specific, predominantly agricultural and agrarian, characteristics. There are also 6 counties classified in the 3rd class, marked with a dark orange color. This suggests that these counties are in a stationary regime with some specific economic characteristics, but different from those in Class 2 and 4. Specific details on the economies of these counties may be relevant to better understand their dynamics and the challenges they face in terms of economic development. The 6 counties classified as Class 4, marked with a

light orange color, represent a distinct steady state within the map. These counties have specific economic characteristics that differentiate them from those in Classes 2 and 3. Detailed analysis of the economies of these counties could provide valuable insights into their evolution and provide understanding of the unique aspects of economic development in these regions. This information may be relevant to the design of specific economic development and support policies and strategies in each of these counties.

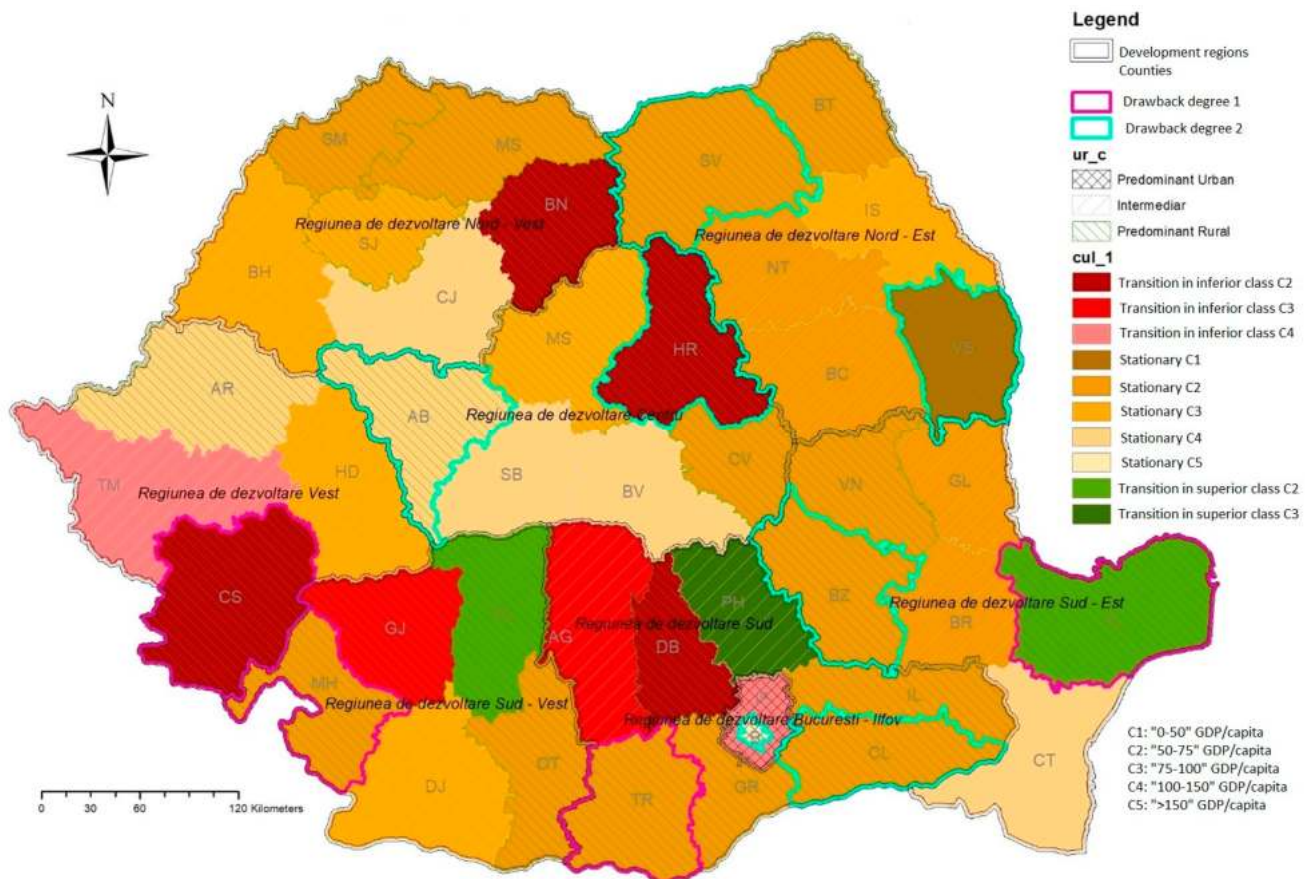


Figure 2. Map of Natural Jenks intervals: Markov transformations according to the share of GDP/national average capita in the period 2010–2018 at the county level. Regions affected by a Grade 1 and Grade 2 drawback and the type of urban/rural county.

Observing extreme counties, such as Vaslui and Bucharest, is particularly relevant for economic research. Their detachment suggests that these counties have specific economic characteristics and fall into distinct stationary regimes compared to other counties. In the case of Vaslui county, represented by the very dark orange color and persisting in class C1, it can be inferred that its economy has notable features that differentiate it from the other counties and place it in a specific stationary regime. On the other hand, Bucharest, marked with very light orange and persisting in class C5, shows that the economy of this capital county presents distinct economic features and falls into a different stationary regime than most other counties. These significant differences may be of particular interest to economic researchers as they can provide insight into unique aspects of economic development in these regions. Detailed analysis of the economies of these counties could provide valuable information for identifying challenges and formulating specific strategies to promote sustainable and balanced development in the region.

The second most common regime identified in the analysis is that of negative transitions, where counties move from a higher income class (C3) to a lower income class (C2). These transitions are marked in dark red and affect four counties: Bistrita-Nasaud, Caras Severin, Dambovita, and Harghita. The transition from class C4 to class C3, marked with

moderate red color, applies to two counties: Argeş and Gorj. These counties have been characterized as intermediate profile, which means that they are in an intermediate position in terms of income level and economic characteristics.

The negative transition from Class C4 to Class C3 may suggest a change in economic dynamics in these counties, with potential effects on their income and development. Careful identification and analysis of these transitions can be useful for understanding the reasons and factors leading to these changes and for developing specific strategies to promote economic convergence and improve financial sustainability in these counties. Understanding the economic particularities of these intermediate counties and the factors affecting their transitions from one income level to another can contribute to the formulation of tailor-made policies and measures to foster sustainable and balanced development in these regions.

Marked with a light red color, the transition from class C5 to class C4 applies to two counties: Ilfov (with urban profile) and Timiș (with intermediate profile). These negative transitions from class C5 to class C4 may indicate changes in the economic dynamics of these counties, with potential effects on their income levels and economic development. Ilfov county, with an urban profile, and Timiș county, with an intermediate profile, move from a higher income class (C5) to a lower income class (C4). This may be due to various factors, such as changes in the economic structure, changes in economic policies, or the impact of external events.

The third most common regime identified in the analysis is that of positive transitions, where counties move from a lower income class (C3 and C2) to a higher income class (C4). The transition from C3 to C4, marked with dark green color, applies to four counties, among which we mention Prahova. These counties are characterized as having an intermediate profile, and the positive transitions suggest an increase in income and an improvement in economic dynamics in these regions. The transition from class C2 to class C3, marked in very dark green, applies to two counties: Tulcea and Valcea, predominantly rural counties. These positive transitions indicate that the income and economic development of these counties have improved from lower to higher income levels. These positive transitions may be a sign of economic development and convergence in these counties. Detailed analysis of these transitions and the specific economic features of the counties involved can provide insight into the reasons leading to these improvements and can be useful for the formulation of sustainable development strategies and policies in these regions. These transitions can also be considered to encourage balanced and sustainable economic development across the country.

From this research, we can conclude that Hypothesis 1 is relevant and topical, given the importance of increasing economic resilience and ensuring sustainable financing in the context of economic fluctuations and global challenges such as climate change and the transition to a green economy. Economic resilience refers to an economy's ability to cope with shocks and recover quickly from downturns. Improving economic resilience can help reduce economic and social vulnerabilities and ensure long-term stability. There is also a strong link between economic resilience and sustainable financing, as investment in sustainable projects can increase resilience to economic shocks. Confirming this hypothesis has significant benefits for regional development. The existence of a positive relationship between economic resilience and sustainable finance states that investment in sustainable development and strengthening the capacity to cope with economic change contributes to attracting sustainable financial resources to counties in Romania.

Research into Hypothesis 2 proves to be of overwhelming importance, given Romania's diverse character, with economically, socially, and geographically distinct regions. These counties differ significantly in terms of their levels of economic development, infrastructure, natural resources, and ability to attract investment. Conducting a thorough analysis and identifying significant variations in economic resilience and sustainable financing between counties is an essential step in the development of regional development policy and strategies. These variations provide crucial information on the vulnerabilities

and opportunities of individual counties, providing valuable guidance for the effective allocation of resources and investments. The results of this research become fundamental tools for the formulation and implementation of public policies at the regional and national levels. Identifying counties with stronger economic resilience or more robust sustainable financing can guide budget allocations and government support to develop and upgrade infrastructure, promote innovation, and generate new economic opportunities in less-developed regions.

These results are in line with previous research that has highlighted significant variation in economic performance between counties and regions. They also bring to the forefront a detailed analysis of each region's economic performance, allowing for a deeper understanding of the unique characteristics and challenges faced by each county. The research provides new data and relevant information on the significant variations among counties in economic resilience and sustainable financing. By investigating these issues, this study contributes to the development of more effective and tailored policies for individual counties.

Thus, the results obtained are in line with the literature and underline the importance of the differentiated approach in promoting economic development and financial sustainability at the regional level. Finally, this study makes a significant contribution to the understanding of Romania's economic and regional complexity and can serve as a solid basis for developing more effective strategies towards balanced and sustainable development of the country's regions.

6. Theoretical and Practical Implications and Limits of the Study

Economic resilience and sustainable finance have significant implications, both theoretically and practically, for development and convergence in counties in Romania or any other region.

The concepts of economic resilience and sustainable finance require a detailed understanding of the complex interactions between economic, social, and environmental factors. Theories and theoretical models can help us to understand how these interactions can influence long-term development.

Addressing resilience and sustainability also requires systems thinking, considering not only economic impacts but also social, environmental, and institutional aspects. This can lead to the development of more holistic approaches and the identification of subtle links between different aspects of development.

To assess economic resilience and financial sustainability, it is necessary to develop relevant indicators and metrics. Defining these theoretical measures can help us to obtain a clearer picture of the economic state and progress towards development and convergence.

Analysis of revenue as a share of GDP per capita can help identify the key factors influencing economic development in different counties. By understanding the relationship between income and GDP, research can reveal structural, environmental, or institutional factors underlying economic disparities between regions. This can help understand how less-developed regions can catch up with more-developed ones, contributing to better regional development policy planning.

By applying these theoretical implications in practice, counties in Romania can develop stronger and more targeted strategies to achieve economic development and convergence. These approaches can contribute to increasing economic competitiveness, improving the quality of life of citizens, and creating a more sustainable and resilient future.

In terms of practical implications, we can say that implementing economic resilience and sustainable finance requires the development of long-term strategies and plans. This may involve identifying and prioritizing key economic sectors, promoting innovation, and developing the necessary infrastructure.

For development and convergence, diversification of the economy can play a crucial role. Promoting different sectors and industries can help reduce vulnerability to economic shocks and increase the resilience of counties.

By promoting economic resilience, counties can become better prepared to cope with risks and shocks such as economic crises or natural disasters. This can involve creating reserve funds, insuring against risks, and developing crisis response mechanisms.

Sustainable finance can encourage investment in infrastructure and technology that supports sustainable development and reduces environmental impacts. This can include the development of renewable energy sources, efficient transport infrastructure, and other green initiatives. Analysis of income as a share of GDP can help local and national authorities identify investment priorities in regions. If some counties have a low share of income in GDP, this may suggest the need to invest in sectors with growth potential to boost economic development and improve convergence.

Development and convergence must not be limited to economic aspects alone. The practical implications of resilience and sustainability can include efforts to reduce poverty, promote access to education and health services, and improve the quality of life for all citizens. If some counties have a low share of income in GDP, this may suggest the need to invest in sectors with growth potential to boost economic development and improve convergence.

The practical implications of resilience and sustainable finance can include collaboration between different stakeholders, such as local governments, non-governmental organizations, the private sector, and local communities. Strong partnerships can support effective implementation of development initiatives.

The study of economic resilience and sustainable finance as part of the path to development and convergence in Romanian counties may face various limitations and obstacles, which may affect its results and interpretation. Access to accurate and complete data can be difficult, especially for smaller or less-developed counties. Insufficient or poor-quality data may affect the ability to assess economic resilience and financial sustainability.

Economic resilience and financial sustainability are influenced by a multitude of interconnected factors, such as politics, economics, environment, society, and technology. Addressing and analyzing all these factors can be challenging and may require complex and interdisciplinary models.

The economy and finance are closely linked to global developments. The impact of external factors can be difficult to anticipate or control at the regional or county levels. They are constantly changing, which can make it difficult to assess long-term resilience and sustainability, and unforeseen events can significantly affect the economic and financial situation.

Another limitation of the research is that counties in Romania have different economic, social, and geographical characteristics. This variation may make it difficult to generalize the results of the study to the national level and may require region-specific analyses. Even social, human, and cultural aspects can play a significant role in economic development and financial sustainability, but they may be more difficult to measure and quantify compared to economic aspects.

Addressing these limitations may be key to conducting the most comprehensive and accurate research on economic resilience and financial sustainability in Romania's counties.

7. Conclusions

This analysis provides an interesting insight into economic convergence and divergence in Romania's counties between 2010 and 2018, by GDP/capita. Convergence was recorded in about 70% of the counties with GDP/capita below 80%. This suggests that the less-developed regions have tended to move closer to the national average in terms of GDP/capita. This suggests that regions with lower levels of GDP per capita, i.e., the less-developed ones, have experienced significant convergence over the period analyzed. This convergence is manifested in the fact that these regions have tended to move closer to the national average in terms of GDP per capita. This trend may be the result of regional development policies or resource allocations that have been directed towards less-developed regions to stimulate their economic growth and reduce economic disparities between re-

gions. By implementing specific measures, such as investment in infrastructure, education, and research and development, the government can encourage economic development and convergence between different counties. However, it is important to note that this statement only refers to regions with GDP/capita below 80%, which means that there are also regions with a higher GDP, which may develop differently. Overall, the analysis of economic convergence in a country can provide valuable information for economic policy and regional development, allowing the identification of regions that need additional support to accelerate economic and social development.

A significant proportion (89.5%) of regions that were in the 50–75% GDP/capita class in 2010 remained in the same class in 2018. This indicates some stability in this income class. This observation suggests that most regions with a medium income level in 2010 maintained the same relative position in terms of GDP/capita in 2018. This stability may be due to various factors, such as the structure of the regional economy, the level of investment, and the economic policies applied in these regions. However, it is important to look in more detail at the 10.5% of regions that experienced changes in the ranking, as these can provide important clues about the factors that influenced their economic convergence or divergence during the period under review. Also, a significant proportion (54.5%) of the regions that were in the 75–100% GDP/capita class in 2010 remained in the same class in 2018. This observation indicates that more than half of the regions with a higher income level in 2010 continued to have the same relative position in 2018. This may indicate some stability among the higher income regions. However, detailed analysis of the remaining 45.5% of regions that experienced changes in ranking can provide important insights into the factors that have driven their level of development up or down over this period. In other words, these observations underline the importance of analyzing economic stability and convergence within regions in Romania and can provide valuable information for the development of effective and appropriate economic and regional policies.

The conclusion on the trend towards the polarization of counties, especially in terms of lower income classes (below the national average), may indicate a situation where less-developed regions have found it difficult to achieve significant increases in GDP/capita and to catch up with the national average. This may indicate an increasing gap between more- and less-developed regions, which may lead to economic polarization within the country. This polarization may be caused by several factors, such as poor infrastructure, reduced access to investment and resources, low levels of education and human development, or the economic and industrial specificities of each region. Regional differences in economic and development policies can also influence this phenomenon. Economic polarization can have significant consequences for the social and economic cohesion of the country. In low-income regions, poverty and lack of development opportunities can be perpetuated, and social and economic disparities can create tensions and inequalities in society. In the context of this situation, it is important for the government and local authorities to identify and address the factors leading to polarization and to develop economic and regional policies that promote balanced and sustainable development in all regions of the country. Implementing appropriate measures to support less-developed regions and to encourage investment and growth in these areas can help reduce regional disparities and promote more equitable economic convergence.

In terms of the instability of the income distribution, calculated as a function of GDP/capita, and the need for two periods (18 years) to reach a steady state, it suggests that the process of convergence and adjustment of incomes between counties has taken place at a slow pace and that more time may be needed to reach a stable equilibrium. This instability may be the result of complex economic, social, and political factors influencing the development of different regions over the period under analysis. Regional differences in infrastructure, access to resources, level of education and human development, and economic and development policies adopted in the regions may play an important role in determining the pace of convergence. To achieve a stable balance and real convergence between counties, it is important that government and authorities develop long-term eco-

conomic and regional policies that address the specific challenges of each region and support sustainable economic and social development. Investment in infrastructure, education, research and development, and the promotion of business and innovation can play a key role in this.

In the period 2010–2018, many counties (75.6%) had a stationary regime, i.e., remained in the same income class, while a small number of counties (7.4%) experienced positive transitions to higher income classes, and others had negative transitions to lower income classes, highlighting the different dynamics of economic development in Romania's counties. This diversity of situations may be the result of complex and region-specific factors. Counties that have been stationary may have been influenced by factors such as economic stability and constant investment, which have contributed to keeping them in the same income class. Conversely, counties that have experienced positive transitions to higher income classes may have benefited from major investments, prosperous industrial or sectoral development, and effective economic policies. At the same time, counties that have experienced negative transitions to lower income classes may have been affected by factors such as decline in local industry, loss of jobs, or lack of investment. These negative transitions can impose significant economic and social challenges on these regions.

All these conclusions can provide guidance for the formulation of policies and strategies for sustainable economic development and regional convergence in Romania. This analysis of economic resilience and sustainable finance can help us to identify factors influencing regional development and to take appropriate measures to promote a more robust and equitable economy at county level.

8. Further Developments

Future developments in research on economic resilience and sustainable finance within the path to development and convergence in Romanian counties may bring several changes and innovations to address the specific challenges and opportunities of this context. Blockchain technology can bring increased transparency and security in financial management and supply chain monitoring. The use of blockchain can help fight corruption, ensure data integrity, and improve efficiency in local financial and economic systems. In the context of an emphasis on sustainability, research can explore how the deployment of green energy technologies, such as solar or wind power, can help increase economic resilience and reduce operating costs in counties.

Collaboration between the public and private sectors can play a crucial role in sustainable development and promoting economic resilience. Research can explore ways to promote and facilitate these partnerships to generate investment and innovation in counties. Future developments may place greater emphasis on assessing the social and environmental impacts of economic and financial decisions. Integrating sustainability assessments can help us to make better informed decisions and promote balanced development.

Research can further explore the potential of the circular economy in local development. This may involve looking at waste management strategies, resource efficiency, and innovation in production. Future developments can encourage active involvement of the local community in development and financial decision-making. Research can explore ways to stimulate public participation and increase awareness and accountability.

Future developments in research on economic resilience and sustainable finance in Romanian counties will be influenced by socio-economic dynamics and national and regional priorities. By adopting innovative and collaborative approaches, research can make significant contributions to sustainable development and the achievement of convergence objectives in these regions.

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