

Nitescu, Dan Costin; Murgu, Valentin

Article

Factors supporting the transition to a "green" European economy and funding mechanisms

Amfiteatru Economic Journal

Provided in Cooperation with:

The Bucharest University of Economic Studies

Suggested Citation: Nitescu, Dan Costin; Murgu, Valentin (2022) : Factors supporting the transition to a "green" European economy and funding mechanisms, Amfiteatru Economic Journal, ISSN 2247-9104, The Bucharest University of Economic Studies, Bucharest, Vol. 24, Iss. 61, pp. 630-647,
<https://doi.org/10.24818/EA/2022/61/630>

This Version is available at:

<https://hdl.handle.net/10419/281654>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>

**FACTORS SUPPORTING THE TRANSITION TO A “GREEN”
EUROPEAN ECONOMY AND FUNDING MECHANISMS**Dan Costin Nițescu^{1*}  and Valentin Murgu² ¹⁾²⁾ *The Bucharest University of Economic Studies, Romania***Please cite this article as:**Nițescu, D.C. and Murgu, V., 2022. Factors Supporting the Transition to a “Green” European Economy and Funding Mechanisms. *Amfiteatru Economic*, 24(61), pp. 630-647.**DOI: 10.24818/EA/2022/61/630****Article History**

Received: 3 February 2022

Revised: 8 May 2022

Accepted: 5 June 2022

Abstract

The transition from fossil fuels to fuels from renewable energy sources can lead to decentralisation of the energy systems, causing structural changes in economic and political relations between countries. The economy of the energy transition will change the global economic map. The move to the “new” “green” European Economy can be achieved in a sustainable way, as long as, certain catalysts are identified and appropriate financial support mechanisms are anchored. This research paper addresses the issue of identifying such factors that, being aggregated, can support the complex process of transition to a new economy. The case study of the research proposes a specific methodology for the analysis of exogenous factors: the energy consumption from fossil fuels, the consumption of renewable energy, the number of researchers involved in research and development (generically assimilated to innovation), and the value of domestic credit to the private sector. The influences of exogenous factors on two endogenous factors are analyzed: Gross Domestic Product and exports of goods and services, representative of the economic dimension, at the level of selected countries in the European Union. The results obtained show that all four independent variables significantly influence the economic performance of selected countries in the European Union, analyzed in terms of Gross Domestic Product and exports of goods and services. The significant impact of energy consumption from renewable sources is noticeable. The research also includes a dedicated section to correlate the results of the empirical study with the financial dimension of the instruments developed to support the energy transition.

Keywords: Gross Domestic Product (GDP), exports of goods and services, renewable energy, research and development, financial mechanisms, economy of the European Union

JEL Classification: C23, O11, O47, O52

* Corresponding author, **Dan Costin Nițescu** – e-mail: dan.nitescu@fin.ase.ro



This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. © 2022 The Author(s).

Introduction

One of the main causes of global warming is represented by carbon dioxide emissions, and limiting them has become an assumed goal at the level of states, unions of states, and international organizations, in varying proportions, for the decades to come. Industrialized countries are mainly responsible for the carbon dioxide emissions.

Commitments to decarbonise the global economy, in order to achieve the limitation of global warming to 1.5° C - 2° C annually, involve a complex process of coordination, operational, and financial planning. Along with the climate risks, the context and the consequences of the pandemic are highlighted, the financial aid programs run after 2021 and planned to resume post-pandemic growth, and digital challenges, which are concerns of all stakeholders (authorities, business, private companies).

For all economies, but especially for fossil fuel-dependent economies, solutions for the transition to a “green” economy must include a gradual approach and adequate, controlled steering of the transition process, a good management of transition costs, for avoiding the materialization of social, economic, and political risks.

This complex issue needs to be managed and coordinated by the main actors globally. It is necessary to strategically position the European Union and highlight the competitive advantages over other global players, especially the US and China. An appropriate response to cyber risks and other categories of risks associated with technological innovations, to the risks induced by climate changes, must be supported by appropriate mechanisms for allocating financial resources.

Along with sound risk management at the European Union level, it is necessary to harmonize an economic and financial vision, which supports the “new” “green” economy based on new value chains and production and on new technologies in energy efficiency and on green public procurement (Malatinec, 2021).

The transition from the current economy based on the extensive use of natural resources with a negative impact on the environment (and which implicitly involves the production of waste), to the circular economy is an ongoing concern of the European Commission, the process being likely to lead, in time, to reduce the volume of waste and to maintain a growing and longer-lasting share of products, materials, and resources in the production cycle (European Commission, 2020a). The action plan concerning the circular economy focuses on the transformational change required by the European Green Deal. Reducing the waste and ensuring that the EU has a functioning internal market for high-quality secondary raw materials are key points of this approach.

Managing the life cycle of natural resources, from extraction to product design and manufacturing, as well as, proper waste management, are essential for the development of circular economy from the resources’ efficiency point of view.

The transition to the “new” “green” economy requires new competences, both for new jobs and for existing jobs, which are being transformed. The prepared workforce is the key to ensure the transition to the “new” “green” economy. Deficiencies in competences lead to blockages in certain sectors, such as renewable energy, resource and energy efficiency, building renovation, construction, environmental services, and production (OECD, 2020). The International Renewable Energy Agency (IRENA) estimates that the production of

energy from renewable sources could lead to the employment of more than 40 million people by 2050 and that the total number of jobs in the energy sector could reach 100 million by 2050, compared to about 58 million at present. While the energy transformation is likely to have a net positive overall impact on employment, millions of workers acting in the fossil fuel area will have to find new jobs (OECD, 2020). The policies for a fair transition can facilitate the retraining process of workers working in the field of fossil fuels and at risk of losing their jobs.

The purpose of this study is to identify catalyst factors that aggregate, to be able to support the complex process of transition to a new green economy, simultaneously with the identification of adequate financial support mechanisms.

The paper is structured as follows. The review section of the literature describes the most relevant aspects, regarding the four exogenous indicators and the two endogenous indicators, analyzed in the empirical study. The following describes the research methodology, data sources, results obtained, discussions on the results, and the final part of the conclusions.

1. Review of the scientific literature

Due to the growing importance and focus on environmental issues and the policies needed to reduce greenhouse gas emissions, numerous studies have been conducted to analyze the correlations between energy consumption and economic growth, and respectively, the correlations between exports and economic growth. The studies cited in the article represent the level of knowledge in the field that has been reached at present, a level corresponding to each endogenous or exogenous factor, as the case may be.

Economic growth is the driving force behind the increased energy consumption, but also a cause of CO₂ emissions (Zhang and Cheng, 2009; Hamit-Haggar, 2012). In terms of energy sources, their diversification in order to achieve a less polluting mix can have a significant impact on the economic growth, also directly related to infrastructure and research and development activities (R&D). Renewable energy will play a key role in achieving the EU's energy and climate goals (European Commission, 2020b). A wide range of renewable energy sources are available in the European Union. Investments in this area have the potential to create new jobs, stimulate the new industrial opportunities, increase energy efficiency, and thus contribute to the overall boost of economic activity. Investments in cleaner, less polluting transport and adjacent logistics also stimulate a reduction in dependence on polluting energy sources, creating additional jobs and stimulating research related to more efficient use of renewable energy for economic activities (European Commission, 2020b; National Committee for Macroprudential Supervision, 2021).

In the case of some states, *the increase in the export volume* leads to the improvement of the economic performance (Khaled, 2010), a hypothesis also called “export led growth”, respectively, the capacity of the export to contribute to the economic performance. Another part of the research shows that, in some countries, increasing the volume of imports leads to improved economic performance (Hussain, 2014), a hypothesis also called “import led growth” and designates how the level of imports contributes to economic performance. Other papers show, through their results, that both the level of imports and the level of exports contribute at the same time significantly to economic growth, either in a positive, or in a negative sense (Velnampy, 2013). In their research, Zeng et al. (2019) concluded that foreign

trade, foreign capital, and technological progress have positive effects on reducing the carbon emission.

The use of renewable energy and economic growth are highlighted as major concerns for the sustainable development of the global economy (Androniceanu et al., 2021), given that the sustainability of the economic system depends on the environment and natural resources (Nguyen et al., 2019), in the context in which the natural resources, in general, and fossil fuels, in particular, have been depleted. Other studies (Bilan et al., 2019) conclude that the development of accessible and efficient tools and mechanisms to stimulate the implementation of renewable energy sources is necessary to reduce the impact on the environment (especially, the decrease of CO₂ emissions), without adequately reducing economic growth. According to the results, the variable of gross fixed capital formation has a direct and significant impact on the real economic sector. In other words, if investment increases, GDP grows. This result is consistent with the theory (Bilan et al., 2019).

The use of fossil fuels is the cause of environmental problems, such as global warming and air pollution, which create health problems and affect the quality of life of the population. Lott et al., 2017 concluded that by applying appropriate changes in residential heating technology, the United Kingdom will achieve its decarbonisation targets by 2050. According to the study by Martins et al., 2019, many European countries are still heavily dependent on fossil fuels. The values for the energy consumption indicator based on fossil fuels are higher than 60% for most of the countries analyzed, respectively, for 24 countries out of the 29 European countries included in the study. In addition, a number of 10 countries in the European Union have values higher than 80%, including Germany and the United Kingdom, which are considered leaders in the transition to renewable energy. Thus, although efforts and changes have been made in the energy policies of European countries, they must be continued in order to achieve low-carbon energy systems.

A study by Şahin (2015) concerns *the investment in research and development* that has the effect of increasing economic growth. Of a sample of 15 OECD countries, including the United States, it is estimated that a 1% increase in R&D spending could increase the economy by 0.61%, which means that, as countries invest more in research and development, their economy will grow faster.

The results of the study conducted by Wong et al. (2013) show that the role of research and development in the field of energy should not be overlooked and that research and development in the field of fossil fuels can stimulate economic growth. Wong et al. (2013) show that, while capital stock and fossil fuels are key drivers of economic growth, renewable energy can sustain real production, especially in countries without oil reserves. Regarding the link between trade and innovation, Samargandi (2019) highlights that trade openness and innovation are significant factors in reducing the intensity of energy use. Other authors, Beser and Soyyigit (2019), indicate that the export of high technology has a strong impact on CO₂ emissions in developed economies. Climate and energy researchers have also focused on the speed at which large-scale energy transitions could take place (Grubler, 2012).

The study realized by Faulkender and Petersen (2005) looked at *the impact of green financing* on environmental protection, from the perspective of the leverage effect of capital, for companies. Green financing was considered to allow environmentally friendly companies to raise more capital by allocating funds and promoting production expansion.

D’Orazio and Valente (2018) dynamically simulated the traditional banks, based on the use of an agent model. The results showed that “green” funding plays a positive role for the environment.

2. Research methodology

The research focuses on analyzing the developments of the four relevant exogenous indicators (renewable energy consumption, energy consumption from fossil fuels, number of researchers involved in R & D, the value of domestic credit to the private sector) and their influences on GDP and exports (endogenous indicators). 24 countries from Europe in different stages of economic development were selected, over a period of 13 years, collecting 336 comments on the chosen sample. The methodology used is based on econometric modeling using Stata 16. The data series included in the regression model have an annual frequency, the analysis being performed on the basis of a panel of data from 2007 to 2020, taken from the World Bank database, part of the World Bank’s research on public databases found at <https://data.worldbank.org>. The 24 European countries selected for the empirical study are: Austria, Belgium, Bulgaria, Czech Republic, Croatia, Denmark, Estonia, Finland, France, Germany, Latvia, Lithuania, Italy, United Kingdom, Norway, the Netherlands, Poland, Romania, Serbia, Slovak Republic, Slovenia, Spain, Sweden, and Hungary. In terms of selected countries, a representative number of countries were considered to reflect the European perspective. The founding countries of the European Union were included – Western European countries (Germany, United Kingdom, France, Italy, Spain, Denmark, the Netherlands, Belgium, Sweden, except Austria), as well as Central and Eastern European countries (Poland, Czech Republic, Croatia, Romania, Hungary, Slovak Republic, Slovenia, Serbia, Bulgaria, Lithuania, Latvia).

Furthermore, *the selected time frame* is relevant both for the period before the economic and financial crisis and for the post-financial period (including from the perspective of the beginning of the pandemic crisis). The variables used in the analysis are presented in table no. 1. Because the original variables were expressed in absolute values and were characterized by high heterogeneity, they were transformed using the natural logarithm.

Table no. 1. Variables used in the analysis

Dependent variables	Independent variables
1. <i>GDP</i>	1. Renewable energy consumption
	2. Energy consumption from fossil fuels
2. <i>Exports of goods and services</i>	3. Number of researchers in R&D (per million people)
	4. Domestic credit to private sector

The first two analysis indicators used in the empirical study are the consumption of energy from renewable sources and, respectively, the consumption of energy based on fossil fuels. The debate on energy from renewable sources compared to energy based on fossil fuels has a predominantly strategic component with long-term impact.

The limited nature of fossil fuels (coal, oil, or natural gas) has led global elites to think and plan for a new alternative economy model. With regard to decarbonisation and investment in low-emission or zero-emission energy solutions, the EU target by 2030 for the share of renewable energy in gross final consumption is 32%.

A third indicator taken into account in the empirical study is *the number of researchers in research and development (R&D)* working for the “new” economy to ensure a gradual and sustainable transition. The research and development (R&D) activities and the number of researchers who carry them out, which in general can be assimilated with innovation, contribute to ensuring the transition to a “green” economy, which is a complex process. The European economy is a hub of ideas, and research is key to developing new and innovative products, processes, and services that increase the productivity, industrial competitiveness, and, ultimately, prosperity. Given the diversity of national research and innovation systems across the whole EU area, it is important to identify the main bottlenecks in each of these, with keywords being the coordination of both, ideas and resources (European Commission, 2017).

The domestic credit to the private sector is the fourth indicator considered in the empirical study. In order to support the financing needs of the “green” economy, domestic credit to the private sector must complement the public resources dedicated to environmental measures. Programs developed with the contribution of public resources must be used to mobilize capital from private sources. It is important to identify, measure, and incorporate the climate and biodiversity risks. Financial markets must also be transparent and efficient to ensure investor confidence. In recent years, billions of dollars have been oriented for investments that are valued using ESG Environmental, Social, and Governance criteria (OECD, 2020). Implementing private investment in infrastructure is a key pillar of the low-carbon transition, as reflected in the OECD Sustainable Infrastructure Initiative.

The most widely used indicator of economic growth is the *Gross Domestic Product (GDP)*. *Foreign trade* remains one of the key drivers of economic growth, with both exports and imports contributing to the growth of national economies. According to Zaman and Vasile (2005), the performance of foreign trade is characterized by indicators such as the degree of openness (total trade in goods and services reported to GDP), the exchange rate, or the growth rate of exports over a period of time. However, the relationship between trade and economic growth does not always suggest that the degree of openness of the economy is correlated with the level of economic growth. Other factors, such as the types of products available, the type of market, the degree of economic diversification, and the positioning of quality steps, are also significant in the analysis of the economic growth process. In addition, the reasons why countries differ in terms of export growth and the process of redistributing market shares among competitors are important (Țurlea et al., 2014).

To analyze the level of correlation between the previously defined indicators, we have constructed the following working hypotheses:

- H1. Renewable energy consumption significantly and positively impacts, both the GDP and exports (of good and services) in a positive manner;
- H2. Fossil fuels consumption has a reverse impact on exports and GDP;
- H3. GDP and exports are significantly and directly affecting R&D;
- H4. The financing level of the private sector has a direct effect upon GDP and exports;
- H5. There are significant differences in relationship between the GDP / exports and the considered factors, between the Western European countries and Central and Eastern European countries.

In the first phase, the two main time properties were assessed, namely the stationarity and autocorrelation. While all variables turned out to be stationary, they all presented significant autocorrelation.

Consequently, a dynamic approach is required, as this is able to treat the high autocorrelation in data. Following the work of Dragoş et al. (2019), we opted for the dynamic panel method of Roodman (2009) and estimated the difference and the system GMM (Generalized Method of Moment). The general form of the model is given by equation (1) and the results are presented in table no. 3.

$$Y = \alpha + \sum_k(\beta_k \times Lk.Y_i) + \gamma_0 \times X_i + \sum_m(\gamma_m \times Lm.X_i) + \epsilon_{it} \tag{1}$$

where:

Y is the dependent variable, either the GDP or the exports;

L stands for the lag of the variable;

k is the actual lag of Y and takes values between 1 and 3 (this, because in the estimation process, a maximum lag of 3 (t-3) was required in the model);

m is the actual lag of the factor and takes values of 1 and 2 (this, because in the estimation process, a maximum lag of 2 (t-2) was required for the factor in the model);

ϵ_{it} stands for the error terms, with all the properties given by the methodology.

The correlation analysis revealed significant relationships between most of the factors (Table no. 2). Consequently, they were successively introduced in the models. We finally obtained 8 models, 4 for each dependent variable.

Table no. 2. Correlation analysis for factors

Variable	Renewable energy consumption	Fossil fuel energy consumption	Number of researchers in R&D	Domestic credit to private sector
Renewable energy consumption	1			
Fossil fuel energy consumption	0.732 (0.000)	1		
Number of researchers in R&D	0.343 (0.000)	0.093 (0.088)	1	
Domestic credit to private sector	0.821 (0.000)	0.839 (0.000)	0.467 (0.000)	1

Note: Coef. (p-value).

The difference and system GMM estimation procedure returns the short-term relationship between variables. Further, we computed the long-term coefficients based on the formula in equation (2) and assessed their significance using the non-linear version of the Wald test that follows a Chi² distribution. The results are presented in Table no. 3.

$$Long - run = \frac{\gamma_0 + \sum_m \gamma_m}{1 - \sum_k \beta_k} \tag{2}$$

As the sample is made up of both, Western and Eastern European countries, in the second phase of the analysis we reran the estimations for each of the two subgroups. Results are presented in tables no. 5 and 6.

In the structuring of the empirical study, we considered as a starting point the importance of identifying some relevant factors to support the transition to the green economy, along with the prospect of their integration into future policies and analysis of financial mechanisms.

3. Results

Results presented in table no. 3 show that all four factors significantly influence the economic performance of countries proxied by the GDP and exports of goods and services. Although the consumption of renewable energy, the number of researchers involved in R&D activities, and the size of the domestic credit market positively impact economic performance, the use of fossil fuel energy has a negative impact on economic performance.

This implies that countries that use more renewable energy will have a higher GDP, confirming our 1st working hypothesis (H1). The higher the share of renewable energy used, the higher the GDP growth. H3 is also validated by our analysis, as research and development is also positively impacting the GDP, when proxied by the number of researchers involved in R&D. This is explained by the fact that R&D outputs consist of high-added-value products and services.

These are novelties on the markets, so their selling prices are much higher than similar products and services. It is well known that countries with intensive economies in capital and R&D activities are more developed and more performant than the ones intensive in labour (see, for example, the difference between the Southern part of Europe, more labour intensive, and the Northern part, more oriented towards R&D) (European Commission, 2017).

Table no. 3. Dynamic panel regression results

Factor	Dependent Variable							
	GDP				Exports			
	Ec. 1	Ec.2	Ec. 3	Ec.4	Ec. 1	Ec.2	Ec. 3	Ec.4
L.dep	0.974*** (0.119)	0.717*** (0.067)	0.682*** (0.096)	0.777*** (0.856)	0.376*** (0.082)	0.646*** (0.025)	0.719*** (0.049)	0.855*** (0.066)
L2.dep	-0.448*** (0.080)	0.083 (0.068)	-0.192** (0.067)	-0.258** (0.032)	-0.149 (0.227)	-0.163** (0.035)	-0.245** (0.077)	-0.179** (0.025)
L3.dep	0.301*** (0.089)	0.059 (0.065)	0.371*** (0.057)	0.105*** (0.024)	-	0.241*** (0.066)	0.407*** (0.072)	0.11*** (0.026)
Renewable energy consumption	0.774*** (0.297)	-	-	-	0.755*** (0.289)	-	-	-
Fossil fuel energy consumption	-	-1.104*** (0.169)	-	-	-	-0.496** (0.082)	-	-
Number of researchers in R&D	-	-	1.621** (0.689)	-	-	-	2.155** (0.877)	-
Domestic credit to private sector	-	-	-	0.301*** (0.067)	-	-	-	0.891*** (0.060)

Factor	Dependent Variable							
	GDP				Exports			
	Ec. 1	Ec.2	Ec. 3	Ec.4	Ec. 1	Ec.2	Ec. 3	Ec.4
L.factor	1.234*** (0.255)	1.25*** (0.186)	-1.509* (0.776)	-	-	0.729*** (0.105)	-2.109** (0.943)	-0.752*** (0.076)
L2.factor	-1.800** (0.359)	-	-	-	-	-	-	-
Constant	1.955** (0.942)	1.79** (0.726)	2.7 (1.749)	2.085*** (0.468)	10.66** (4.331)	4.015*** (1.1)	2.644* (1.29)	1.883*** (0.609)
Wald Chi (prob)	9986.16 (0.000)	9292.43 (0.000)	524.56 (0.000)	6529.15 (0.000)	127.33 (0.000)	3611.18 (0.000)	1122.74 (0.000)	8561.12 (0.000)
No. of instruments	15	15	15	15	16	16	16	16
Arellano-Bond AR test prob.	0.183	0.093	0.221	0.879	0.147	0.154	0.066	0.466

Notes: Coef. (robust std. err.); Ec. 1 is equation 1; Ec. 2 is equation 2, etc.; L.dep is the 1st order dependency lag (dep); L2.dep is the 2nd order dependency lag; L3.dep is the 3rd order dependency lag; L.factor is the 1st order lag of the factor; L2.factor is the 2nd order factor lag; ***, **, * significant at 1%, 5% and 10%.

One of the problems that some economies have is underfinancing. That is why, in the analysis, we also introduced the domestic credit to private sector. As hypothesized (H4), the higher the share of the domestic credits in the economy, the higher is the GDP and the export.

The only reverse relationship that we assumed (H2) is also validated. Fossil fuel consumption is reversely causing the GDP and exports. Increased consumption of fossil fuels is characteristic to countries with lower macroeconomic performance.

The high autocorrelation level in data leads to the use of 3 lags for the dependent variable, all highly significant.

But these results are giving the relationship only in the short term. On long term, all coefficients are positive. Table no. 4 reveals that the impact of the number of researchers in R&D is significant only on short-term. In the long-term, both the energy consumption of any kind, as well as the domestic credit, directly impacts the economic performance of the countries in the sample.

Table no. 4. Coefficients and long-term significance

Factor	Dependent variable					
	GDP			Exports		
	Coef.	Wald Chi	Prob.	Coef.	Wald Chi	Prob.
Renewable energy consumption	1.196	134.07	0.000	0.978	65.92	0.000
Fossil fuel energy consumption	1.028	152.74	0.000	0.846	89.58	0.000
Number of researchers in R&D	0.812	2.5	0.114	0.383	0.31	0.576
Domestic credit to private sector	0.800	752.77	0.000	0.652	245.31	0.000

Long-term, the highest impact is attributed to the renewable energy consumption, for both dependent variables. Countries that use more renewable energy have a long-term higher economic performance.

Just as stated in the methodological part, we reestimated the models for each subgroup to test the last working hypothesis H5. With respect to GDP, all coefficients have the same signs in the Central and Eastern European countries. This implies that H1 – H4 are all confirmed in

this subsample (Table no. 5). In Western European countries, fossil fuel consumption changes the sign from negative to positive. So, for the Western part of the sample, energy consumption leads to higher economic performance when proxied by the GDP.

It is interesting to see that on short-term, the renewable energy has the highest impact in the West Europe subsample, while the number of researchers involved in R&D in the East one (Table no. 5). Long-term, the renewable energy consumption, fossil fuel consumption and domestic credit to private sector have significant positive impacts, just as resulted in the global analysis. Similarly, a long-term coefficient was obtained for the Central and Eastern European countries in comparison to the global analysis for the number of researchers in R&D, namely, a lack of long-term impact. It is interesting to see that, for Western European countries, an increase in researchers leads to a long-term decrease in the GDP.

Table no. 5. Dynamic panel regression results for the GDP – Western European countries vs. Central and Eastern European countries

Factor	GDP							
	Western European countries				Central and Eastern European countries			
	Ec. 1	Ec.2	Ec. 3	Ec.4	Ec. 1	Ec.2	Ec. 3	Ec.4
L.dep	1.007*** (0.175)	0.779*** (0.052)	0.812*** (0.088)	0.444*** (0.130)	0.82*** (0.122)	0.880*** (0.038)	0.980*** (0.075)	0.848*** (0.095)
L2.dep	-0.544*** (0.117)	-0.302 (0.088)	-0.237*** (0.070)	-0.094* (0.050)	-0.347*** (0.087)	-0.157*** (0.059)	-0.222*** (0.079)	-0.265*** (0.048)
L3.dep	0.408*** (0.099)	0.242 (0.070)	0.324*** (0.079)	-	0.218** (0.087)	0.91*** (0.029)	0.267** (0.130)	0.135*** (0.036)
Renewable energy consumption	1.292** (0.0.633)	-	-	-	0.428* (0.238)	-	-	-
Fossil fuel energy consumption	-	0.225** (0.103)	-	-	-	-0.077* (0.044)	-	-
Number of researchers in R&D	-	-	0.681* (0.391)	-	-	-	1.382*** (0.877)	-
Domestic credit to private sector	-	-	-	0.601*** (0.111)	-	-	-	0.286*** (0.080)
L.factor	1.084*** (0.408)	-	-0.811* (0.429)	-	1.024*** (0.268)	-	-1.441*** (0.519)	-
L2.factor	-2.280*** (0.716)	-	-	-	-1.083*** (0.233)	-	-	-
Constant	2.146 (3.955)	4.572** (2.162)	3.875 (2.668)	1.311 (1.587)	3.564*** (1.235)	-1.892** (0.949)	-0.186 (2.839)	0.097 (0.326)
Wald Chi (prob)	715.21 (0.000)	1291.3 (0.000)	3532.28 (0.000)	534.28 (0.000)	1331.26 (0.000)	12540.46 (0.000)	1231.82 (0.000)	7205.88 (0.000)
No. of instruments	15	15	15	15	15	15	15	15
Arellano-Bond AR test prob.	0.112	0.949	0.526	0.277	0.792	0.178	0.718	0.900
Long-run coefficients	0.744**	0.802***	-1.288***	0.924***	1.191***	0.67***	2.362	1.017***
Wald (Prob)	4.1 (0.043)	89.59 (0.000)	13.75 (0.000)	116.87 (0.000)	67.7 (0.000)	72.34 (0.000)	0.04 (0.832)	481.51 (0.000)

Notes: Coef. (robust std. err.); Ec. 1 is equation 1; Ec. 2 is equation 2, etc.; L.dep is the 1st order dependency lag (dep); L2.dep is the 2nd order dependency lag; L3.dep is the 3rd order dependency

lag; L.factor is the 1st order lag of the factor; L2.factor is the 2nd order factor lag; ***, **, * significant at 1%, 5% and 10%.

When economic performance is proxied by Exports, results are quite diverse and partially different from the global ones. Renewable energy is not significantly influencing Exports in the Western European countries, just like the indicator number of researchers in R&D. However, both variables are significantly impacting Exports of the Central and Eastern European countries. In the short-term, fossil fuels and creditation, positively impact Exports in both group of countries. However, in the long-term, the economic performance of the West Europe subsample, proxied by Exports, is only impacted by fossil fuels consumptions, in a positive manner, whereas the one of the East group is positively impacted by renewable energy consumption and domestic credit. These differences may be explained by the specificities of the countries in each subsample. There are different macroeconomic structures, and the structure of the goods and services exported is significantly different. (Table no. 6)

Table no. 6. Dynamic panel regression results for exports – Western European countries vs. Central and Eastern European countries

Factor	Exports							
	Western European countries				Central and Eastern European countries			
	Ec. 1	Ec.2	Ec. 3	Ec.4	Ec. 1	Ec.2	Ec. 3	Ec.4
L.dep	0.887*** (0.064)	0.884*** (0.091)	0.867*** (0.054)	0.913*** (0.097)	0.495* (0.260)	0.882*** (0.062)	0.733*** (0.089)	0.756*** (0.060)
L2.dep	-0.254*** (0.031)	-	-0.292*** (0.029)	-0.176*** (0.026)	-	-	-	-0.153*** (0.035)
L3.dep	0.495*** (0.036)	-	0.406*** (0.021)	0.257*** (0.037)	-	-	-	0.079 (0.070)
Renewable energy consumption	-0.049 (0.039)	-	-	-	0.467* (0.268)	-	-	-
Fossil fuel energy consumption	-	0.878*** (0.275)	-	-	-	2.174*** (0.379)	-	-
Number of researchers in R&D	-	-	-0.068 (0.044)	-	-	-	3.77*** (1.409)	-
Domestic credit to private sector	-	-	-	0.799*** (0.073)	-	-	-	0.960*** (0.118)
L.factor	-	0.457*** (0.127)	-	-0.781*** (0.115)	-	-0.767*** (0.291)	-3.923*** (1.498)	-0.665*** (0.106)
L2.factor	-	-1.261*** (0.254)	-	-	-	-1.406*** (0.302)	-	-
Constant	-2.762 (1.862)	2.105 (1.523)	1.655 (1.706)	0.294 (0.857)	7.161* (3.746)	3.042** (1.437)	7.661*** (2.068)	0.690 (0.527)
Wald Chi (prob)	326.75 (0.000)	2910.75 (0.000)	2272.98 (0.000)	22533.97 (0.000)	87.81 (0.000)	605.66 (0.000)	85.32 (0.000)	5095.6 (0.000)
No. of instruments	16	16	16	16	16	16	16	16
Arellano-Bond AR test prob.	0.803	0.165	0.220	0.961	0.266	0.086	0.064	0.310
Long-run coefficients	0.387	0.634***	-1.712	2.68	0.925***	0.007	-0.569	0.925***

Factor	Exports							
	Western European countries				Central and Eastern European countries			
	Ec. 1	Ec.2	Ec. 3	Ec.4	Ec. 1	Ec.2	Ec. 3	Ec.4
Wald (Prob)	2.04 (0.154)	10.85 (0.001)	1.66 (0.198)	0.01 (0.931)	20.78 (0.000)	0.00 (0.982)	0.77 (0.379)	184.17 (0.000)

Notes: Coef. (robust std. err.); Ec. 1 is equation 1; Ec. 2 is equation 2, etc.; L.dep is the 1st order dependency lag (dep); L2.dep is the 2nd order dependency lag; L3.dep is the 3rd order dependency lag; L.factor is the 1st order lag of the factor; L2.factor is the 2nd order factor lag; ***, **, * significant at 1%, 5% and 10%.

As a conclusion, the present study identifies some of the factors that determine macroeconomic performance on a sample of European countries. We show that there are differences in the short – and long-run effects. Additionally, while GDP and Exports have the same determinants on the entire sample, differences arise when we split the sample between the Western European countries and, respectively, the Central and Eastern European countries. These differences are especially encountered when using Exports. Such results are due to the specific characteristics of the national economies with the two subgroups in respect to the type of products and services exported and how they relate to the international markets.

4. Discussions

The indicators analyzed in the empirical study and the results obtained can be used as a support for the planning and implementation of a complex process of transition to a “new” economy.

The transition to a “green” European economy cannot be achieved without the adequate financial support, without the efficient allocation of financial, public, and private resources, without the creative use of financial mechanisms and instruments adapted to the new post-pandemic context. However, the post-pandemic context reflects the need for collective government actions, as global warming contributes to the intensification of extreme weather events related to climate changes, including heat waves, floods, and forest fires.

The UK hosted in November 2021 the COP26 Conference, that represents the United Nations Organisation climate conference, at which 200 participating countries were asked to present their emission reduction plans by 2030, a meeting that was seen as crucial for managing climate change. At the end of the conference, a new agreement was agreed to reduce global warming, with a special emphasis on reducing the use of coal. The climate change agenda can generate great economic opportunity, which provides in particular an impact in various fields: energy, transport, agriculture. Climate changes also create new challenges for central banks, regulators, and supervisors in the integration of climate risk analyzes into monitoring financial stability. Traditional and retrospective risk assessments, as well as existing economic climate models, cannot accurately anticipate the dynamics that climate risks will have. These include the “green swan” component, i.e., potentially extremely financially disruptive events that could be behind the next systemic financial crisis (Bolton et al., 2020). Measures to combat climate change include policies to reduce the carbon price, the integration of sustainability into financial and accounting practices, the search for appropriate policy combinations, and the development of new international financial mechanisms (Bolton et al., 2020).

The stakes of climate change are also high for the banking sector, both in terms of business opportunities and the significant amount of risky assets existing in portfolios. The climate agenda generates important opportunities that could involve an increase in lending.

The demand for financing for the green economy is constantly growing. However, many of the countries that traditionally provide such funding are currently experiencing budgetary constraints, and thus, private funding is expected to play an increasingly important role. In this context, the mobilization of private funds (either entirely from private sources, or from the Public Private Partnership (PPP) mix) plays a key role. The private sector can be the primary source of funding for the growth of the green economy, but it requires profits that must be commensurate with the risks involved.

In order to achieve an adequate risk-benefit balance by the private or public-private financing, public and state intervention is required (through the low-cost financing, by ensuring co-financing, granting subsidized interest). Possible options are to reduce risks by public financial institutions, to provide co-financing from public and private sources, to take over the financing risk, and to improve the investment climate in the host country. The mix of guarantees and risk insurance, attached to the financing packages, is decisive for the proper management of the risk component. Development banks, Export Credit Agencies (ECAs), guarantee and counter-guarantee funds play a particularly important role in the proper functioning of this new financial ecosystem.

Financing solutions start from the granted direct loans (to the small and medium-sized companies, identified as green performers and eco-innovators) through various government programs or through state-owned development banks (France, Germany, Italy, UK), capital contributions to these companies, guarantee schemes granted by the state (Germany, Italy), loans with subsidized interest, financial guarantees offered by state development banks or separate guarantee funds (UN Environment, 2017). The analysis report of the CNSM Working Group to support green financing considers that at the level of the European Union support instruments offered for green financing of SMEs can be implemented, similar to the one provided by the Bpifrance Development Bank (state bank). This will be done in a co-financing scheme with a commercial bank, with low-interest loans and no guarantees for the development of eco-efficient products (National Committee for Macropudential Supervision, 2021).

The regulatory framework and educational efforts are relevant to support financial support initiatives on the transition to the “green” economy:

- the need to formulate a clear set of definitions for the green companies and industries on the basis of which to develop green financing policies and strategies;
- establishing and enforcing banking regulations on the supervision of commercial banks with regard to some practical issues related to green financing;
- creation of databases with information on the environment, as well as, the facilitation of communication between the government and the banking system on the granting of "green" financing;
- educating and creating a public awareness of environmental protection;

- strengthening international cooperation for the implementation of taxonomy, for the standardization of definitions, their adaptation to various national particularities and approaches.

Also, in order to support the green funding by the private sector (in a context where public sector funding sources are limited), government support can also be achieved through subsidies, taxes applied to carbon. The introduction of green certificates (property certificates attesting the production of electricity from renewable energy sources; they can be traded on an organized market in accordance with the law and is the support scheme to promote the production of energy from renewable sources), as well as, the development of a World Bank for carbon can be new financial mechanisms to support this complex transition process, which must be coordinated globally.

Following the Paris Agreement and the orientation towards sustainability, the commercial loan market launched the principles of green loans in early 2018, aligning them with the principles of green bonds launched in 2014. The principles of green lending provide a standardized approach and methodology for evaluating and providing funding for projects that are committed to the environmentally sound use of funds. Although the commercial lending market has adopted the principles of green lending, ECAs do not yet have a standardized approach to investing in green projects.

The creation of such standards could increase the pace for ECAs investments in sustainable projects by providing a project evaluation mechanism based on globally recognized benchmarks. The development and harmonization of the universal principles of structuring a “green” credit, the good practice developed at the level of financial institutions, can also be a starting point for ECAs, for the development of new and varied financing structures for sustainable projects. The new regulatory framework could be based on environmental standards for export credits and World Bank principles adopted by ECAs from the OECD countries in 2003. The ECAs remain strong supporters of fossil fuels, despite OECD moves to encourage the ECAs funding for renewable energy use (Shishlov, 2020).

At the European level, programs have been developed and initiatives taken to support both the European economy and innovation. NextGenerationEU is the EU’s main tool for economic recovery from the coronavirus crisis. The EU has agreed on this instrument as part of a 1.8 trillion EUR relaunch package, which also includes the long-term budget for the 2021-2027 period.

The center element to NextGenerationEU program is the Recovery and Resilience Mechanism – a tool that provides grants and loans to support reforms and investments in the EU Member States totaling 723.8 billion EUR. Over 50% of this amount will support the modernization, through: research and innovation, via Horizon 2020, creating a fair climate and supporting the digital transition, through the Fair Transition Fund and the Digital Europe Program, as well as, training, recovery and resilience, through the facility of recovery and resilience, rescuEU (European Commission, 2020c). Horizon 2020 is a framework program for research and innovation of the European Union, which provides, over the 7-year implementation period, funds of about 80 billion EUR, being the largest project of its kind ever developed by the EU. Part of the program is dedicated to SMEs that have a high potential for innovation. Horizon 2020 is aimed at innovation and the implementation of solutions targeting four main segments: the environment (reduction of carbon emissions and the impact of climate change), the relationship between economy & environment (positive impact of the

circular economy on production processes and carbon footprint), the digitization of services, of various processes and products, as well as the security of the EU (European Commission, 2020c).

The research provides an insight into the factors that can provide adequate support for the transition to the “green” European economy, along with the presentation and analysis of financing mechanisms / programs, “actors” of the financial-banking ecosystem, with a key role for the effective implementation of this particularly complex transition process.

Conclusions

The empirical study highlighted, based on the use of the research methodology, relevant results on the selected indicators, the correlations between them and the opportunities and their integration in the future policies.

The process of transition to the green economy is a complex one; our paper brings a perspective on the effort of analysis and planning to the new economy, by using and correlating quantitative instruments with qualitative, conceptual analysis. We selected important variables, the model analyzed in the research included the following factors that would influence the GDP and Exports of goods and services (expressed as a share in GDP): renewable energy consumption, energy consumption from fossil fuels, number of researchers in R&D (one million people), as well as the value of domestic credit to the private sector.

The results obtained from the research show that all four independent variables significantly influence the economic performance of countries in terms of GDP and exports of goods and services. While the renewable energy consumption, the number of researchers involved in R & D and the size of the internal credit market have a positive impact on economic performance, the use of fossil fuel energy has a negative relationship. But this is only short-term. In the long run, all the coefficients are positive. For both dependent variables, GDP and Exports of goods and services, in the long run, the greatest impact is attributed to the renewable energy consumption. Countries that use more renewable energy have a higher long-term economic performance.

In parallel with the continued focus of part of the European economy on innovation and the green economy, we are witnessing a repositioning of financing mechanisms towards new innovation and the green economy, which could lead to a number of financing opportunities for commercial banks by using combined financing, co-financing, guarantee, and insurance mechanisms that benefit from support and guarantee schemes granted by the state. The transition to the “green” economy will also be based on the involvement of small companies, start-up companies to innovate, on the financial support of financial-banking institutions, by improving access to finance.

References

- Androniceanu, A.-M., Caplescu, R., Tvaronaviciene, M. and Dobrin, C., 2021. The interdependencies between economic growth, energy consumption and pollution in Europe. *Energies*, [e-journal] 14, 2577. DOI:10.3390/en14092577.
- Bilan, Y., Streimikiene, D., Vasylieva, T., Lyulyov, O., Pimonenko, T. and Pavlyk, A., 2019. Linking between Renewable Energy, CO₂ Emissions, and Economic Growth: Challenges

- for Candidates and Potential Candidates for the EU Membership. *Sustainability*, [e-journal] 11, 1528. <https://doi.org/10.3390/su11061528>.
- Şahin, B.E., 2015. The Relationship Between R&D Expenditures and Economic Growth: Panel Data Analysis 1990-2013. In: Ekonomik Yaklasim Association, *EY International Congress on Economics II*. Ankara, Turkey, 5-6 November 2015. S.l.: Ekonomik Yaklasim Association.
- Beser, N.O. and Soyyigit, S., 2019. The effects of high technology export and per capita income on carbon emission: An investigation on G20 countries. *Bus. Econ. Horiz.*, [e-journal] 15, pp.542-559. DOI: 10.5281/zenodo.3970504.
- Bolton, P., Despres, M., Pereira Da Silva, L.A., Samama, F. and Svartzman, R., 2020. *The green swan. Central banking and financial stability in the age of climate change*. [pdf] Bank for International Settlements. Available at: <www.bis.org/publ/othp31.pdf> [Accessed 10 December 2021].
- D'Orazio, P. and Valente, M., 2018. The role of finance in environmental innovation diffusion: An evolutionary modeling approach. *Journal of Economic Behavior & Organization*, [e-journal] 162, pp.417-439. <https://doi.org/10.1016/j.jebo.2018.12.015>.
- Dragoş, S.L., Mare, C. and Dragoş, C.M., 2019. Institutional drivers of life insurance consumption: a dynamic panel approach for European countries. *The Geneva Papers on Risk and Insurance-Issues and Practice*, [e-journal] 44(1), pp.36-66. DOI: 10.1057/s41288-018-0106-3.
- European Commission, 2017. *European semester thematic factsheets. Research and innovation*. [pdf] Brussels. Available at: <https://ec.europa.eu/info/sites/default/files/file_import/european-semester_thematic-factsheet_research-innovation_en.pdf> [Accessed 15 December 2021].
- European Commission, 2020a. *Communication from the Commission to the European Committee and the Committee of the Regions. A new Circular Economy action plan*. [pdf] Brussels. Available at: <<https://eur-lex.europa.eu/legal-content/RO/TXT/PDF/?uri=CELEX:52020DC0098&from=EN>> [Accessed 24 December 2021].
- European Commission, 2020b. *Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions Europe's moment: repair and prepare for the Next Generation*. [pdf] Brussels. Available at: <<https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1590732521013&uri=COM:2020:456:FIN>> [Accessed 22 December 2021].
- European Commission, 2020c. *Horizon Europe*. [online] Available at: <https://ec.europa.eu/info/horizon-europe_en> [Accessed 22 December 2021].
- IEA, 2020. *Sustainable Recovery*. [online] Available at: <<https://www.iea.org/reports/sustainable-recovery>> [Accessed 20 December 2021].
- Faulkender, M. and Petersen, M.A., 2005. Does the Source of Capital Affect Capital Structure?. *Review of Financial Studies*. [e-journal] 19(1), pp.45-79. <https://doi.org/10.1093/rfs/hhj003>.
- Grubler, A., 2012. Energy transitions research insights and cautionary tales. *Energy Policy*, [e-journal] 50(C), pp.8-18. DOI: 10.1016/j.enpol.2012.02.070.

- Hamit-Hagggar, M., 2012. Greenhouse gas emission, energy consumption and economic growth: A panel cointegration analysis from Canadian industrial perspective. *Energy Economics*, [e-journal] 34, pp.358-364. <https://doi.org/10.1016/j.eneco.2011.06.005>.
- Elbeydi, K.R.M., 2010. The Relationship between Export and Economic Growth in Libya Arab Jamahiriya. *Theoretical and Applied Economics*, 1(542), pp.69-76.
- Lott, M.C., Pye, S. and Dodds, P.E., 2017. Quantifying the co-impacts of energy sector decarbonisation on outdoor air pollution in the United Kingdom. *Energy Policy*, [e-journal] 101, pp.42-51. <https://doi.org/10.1016/j.enpol.2016.11.028>.
- Malatinec, T., 2021. Local barriers in the efficient use of Green Public Procurement – case of Slovakia. *Juridical Tribune – Tribuna Juridica*, Vol. 11(3), pp. 524-534. <https://doi.org/10.24818/TBJ/2021/11/3.07>.
- Martins, F., Felgueiras, C., Smitkova, M. and Caetano, N., 2019. Analysis of fossil fuel energy consumption and environmental impacts in European countries. *Energies*, 12, 964.
- National Committee for Macroprudential Supervision, 2021. *NCMO Working Group on supporting green finance*. [online] Available at: <<https://www.cnsmro.ro/en/publicatii/studii-si-analize/grupul-de-lucru-cnsm-pentru-sprijinirea-finantarii-verzi/>> [Accessed 10 December 2021].
- NGFS Climate, 2020. *Scenarios for central banks and supervisors*. S.I: Banque de France.
- Nguyen, T.T., Nguyen, T.-T., Hoang, V.-N., Wilson, C. and Managi, S., 2019. Energy transition, poverty and inequality in Vietnam. *Energy Policy*, [e-journal] 132, pp.536-548. <https://doi.org/10.1016/j.enpol.2019.06.001>.
- OECD, 2020. *Making the green recovery work for jobs, income and growth*. [online] Available at: <<https://www.oecd.org/coronavirus/policy-responses/making-the-green-recovery-work-for-jobs-income-and-growth-a505f3e7/>> [Accessed 3 December 2022].
- Roodman, D., 2009. How to Do xtabond2: An Introduction to “Difference” and “System” GMM in Stata. *Stata Journal*, 9(1), pp.86-136.
- Saaedd, A.A. and Hussain, M.A., 2015. Impact of exports and imports on Economic growth: Evidence from Tunisia. *Journal of Emerging Trends in Economics and Management Sciences*, 6(1), pp.13-21.
- Samargandi, N., 2019. Energy intensity and its determinants in OPEC countries. *Energy*, [e-journal] 186(C). DOI: 10.1016/j.energy.2019.07.133.
- Shishlov, I., Weber, A.-K., Stepchuk, I., Darouich, L. and Michaelowa, A., 2020. *Study on external and internal climate change policies for export credit and insurance agencies*. Germany: Perspectives Climate Group GmbH.
- Țurlea, G., Cojanu, V., Alexoaei, A., Neculau, G. and Petrariu, I.-R., 2014. *Avantajele competitive ale României pe piața internă a UE, Strategy and Policy Studies (SPOS)*. Bucharest: European Institute of Romania.
- United Nations Climate Change Conference, 2021. *COP26 Explained*. [online] Available at: <https://en.wikipedia.org/wiki/2021_United_Nations_Climate_Change_Conference> [Accessed 2 December 2021].
- UN Environment, 2017. *Mobilizing sustainable finance for small and medium sized enterprises reviewing experience and identifying options in the G7*. [online] Available at:

- <<https://www.unep.org/resources/report/mobilizing-sustainable-finance-small-and-medium-sized-enterprises-reviewing>> [Accessed 26 December 2021].
- Velnamy, T. and Achchuthan, S., 2013. Export, import and economic growth: Evidence from Sri Lanka. *Journal of Economics and Sustainable Development*, 4(9), pp.147-155.
- Wong, S.L., Chang, Y. and Chia, W.-M., 2013. Energy consumption, energy R&D and real GDP in OECD countries with and without oil reserves. *Energy Economics*, [e-journal] 40(C), pp.51-60. DOI: 10.1016/j.eneco.2013.05.024.
- Zaman, G. and Vasile, V., 2005. *Evoluții structurale ale exportului în România: model de prognoză a exportului și importului pe ramuri CAEN*. Bucharest: Expert Printing House.
- Zeng, L., Lu, H., Liu, Y., Zhou, Y. and Hu, H., 2019. Analysis of regional differences and influencing factors on China's carbon emission efficiency in 2005-2015. *Energies*, [e-journal] 12(16), 3081. <https://doi.org/10.3390/en12163081>.
- Zhang, X.P. and Cheng, X.M., 2009. Energy consumption, carbon emissions, and economic growth in China. *Ecological Economics*, [e-journal] 68, pp.2706-2712. <https://doi.org/10.1016/j.ecolecon.2009.05.011>.