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The Bioeconomy and Foreign Trade in Food Products—A Sustainable Partnership at the European Level?

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Received: 10 February 2020; Accepted: 17 March 2020; Published: 20 March 2020

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Abstract: This research addresses the problem of the synergistic relationship between the sustainable development of the green economy (bioeconomy) at the European level and the commercial flows with food. Mainly, two components were analyzed and integrated: A qualitative one, on the perspective of the development of the bioeconomy at the European level, and a quantitative one, on the study of the nature of the inter-correlation between the exogenous indicators of foreign food trade (exports and imports) and the relevant endogenous indicators (the labor force, gross added value of agriculture, forestry and fisheries, research and development expenditure, forest area, fossil fuel energy consumption, and renewable energy consumption), for 24 European countries over a 22 year period. Exports and imports of food products are positively influenced by the added value of the agricultural sector and by the share of research and development expenditures, both in the short and long term. Renewable energy consumption influences exports in the short term, but in the long term, the forest area has a significant positive impact. Imports are negatively influenced by renewable energy consumption. The findings of this research can provide support for the future mix of policies.

Keywords: sustainability; bioeconomy; foreign trade in food products; agriculture; labor force; research and development; renewable energy; European Union

1. Introduction

Due to the technological developments, behavioral changes, and the recent orientation towards "green" projects and sectors, currently, the European economy is facing significant changes. In this context, the production, commercialization, and trade of food products at the level of the European countries, interconnected with the renewable energy resources used for food production, together with their transport and distribution routes, create the premises for development of sustainable communities.

Sustainability (sustainable development) is not a new concept. In 1987, the World Commission on Environment and Development (WCED) published the report "Our Common Future" [1], which developed the concept of sustainable development, which involves people's relations with the environment and the responsibilities of present generations to future generations. At the European level, investment programs have been developed to support innovation and research and to provide solutions to the challenges facing national and global food systems, with respect to food consumption and ensuring food security. An overall deterioration of the state of food security at the global level is being witnessing, generated by the emergence of major risk factors, both structural (increasing world population, global warming, degradation of water resources and land with agricultural potential, etc.), and short term (adoption of inadequate policies, erosion of the political–economic role of the states, proliferation of poverty, etc.). To the extent that the current manifestation trends do not change, there are premises for a serious global food crisis, which entails adverse implications for all of the coordinates of global and, implicitly, national and individual security [2]. The gradual transition from linear economy to bioeconomy (the bioeconomy encompasses those parts of the economy that use renewable resources from land and sea, such as crops, forests, fish, animals, and microorganisms, to produce food, materials, and energy [3]) is a strategic goal at the European level. The notion of bioeconomy has grown in importance, both in the research environment, in the public debate, and at the level of political decision-makers, as it is considered as an alternative solution for a different set of problems; strategies/studies were developed as a basis for the construction of a unitary vision on the development, sustainability, and implications of the transition to the bioeconomy. From the European Commission's perspective, the bioeconomy represents an "economy that includes the production of renewable biological resources and their transformation into food, biological, and bioenergy products. This includes the gross added value of agriculture, forestry and fisheries, food, cellulose, and paper production, as well as parts of the chemical, biotechnological, and energy industry" [4]. Other considerations of the bioeconomy are highlighted in certain sectors (e.g., biofuels [5]; biotechnologies [6]; reduced emissions and use of fossil fuels [7]). The studies that were conducted synthesize some views on the bioeconomy, which are included in the following table (Table 1).

Table 1. Key features of the visions regarding the bioeconomy.

	The Vision of Bio-Technologies	The Vision of Bio-Resources	The Vision of Bio-Ecology
Purposes and goals	Economic growth and job creation	Economic growth and sustainability	Sustainability, biodiversity, conservation of ecosystems, avoiding soil degradation
Creation of value	Applications of biotechnology, commercialization of research and technology	Conversion and upgrade of bioresources (process orientation)	Development of integrated production systems and high-quality products with territorial identity
Catalyst and mediators of innovation	Research and Development, patents, Technology Transfers Officers, research and funding councils (focus on science, linear model)	Interdisciplinarity, optimization of land use, inclusion of degraded land in biofuel production, use and availability of bioresources, waste management, engineering, science and market (interactive and network production mode)	Identification of favorable organic agro-ecological practices, ethics, risk, interdisciplinary sustainability, ecological interactions, re-use and re-circulation of waste, land use (circular and self-sustainable production mode)
Space focus	Global clusters/central regions	Rural/ peripheral regions	Rural/ peripheral regions

Source: [8].

The remaining part of this paper is structured in five sections. Section 1 provides a literature review on bioeconomy and foreign trade in food, focusing on EU countries. Section 2 explains the research methodology of the calculation and presents the econometric methodology, specifically the database, variable, and quantitative methods. The third and fourth sections show the discussion and results of the quantitative findings of the study, and the final section provides concluding remarks and policy recommendations.

2. Literature Review

The European Organization for Cooperation and Development (OECD) emphasizes a vision based on bio-technologies (reflected in the vision on bioecology-focused bioeconomy) [9]. From the perspective of the European Commission (2017), a significant variety of research and innovation priorities related to the bioeconomy at the level of the European regions/countries have been identified. Most countries/regions use a mix of thematic areas, from the perspective of both the focus on bioresources and the orientation towards energies obtained from bioresources. At the European level [10], several bioeconomic development initiatives, including with regional orientation, have been identified. The need for each nation to build a competitive advantage (supported by a localized territorial process and allowing it to differentiate from the other nations) has allowed the emphasis on the competitiveness of a nation through its ability to innovate and on the ability to create and assimilate knowledge [11]. Other approaches [12] consider that the focus on the bioeconomy stems from the need to cover the food requirements of a growing population, related to lower yields of agricultural production, or from the need to ensure energy and food security as well as economic prosperity in the face of some new challenges—climate change. The transition to the bioeconomy involves concerted efforts, both on the part of the authorities and on the part of the society, as such a transformation involves substantial changes in the market through the impact of technological development on industrial processes, ultimately affecting the production and consumption patterns. The success of the bioeconomy is dependent on the active involvement of the authorities in the creation of an adequate legislative framework, taking into account that the advanced bioeconomy will become a reality only if the intensification of the research and development efforts will be reflected in the subsequent implementation of the technologies. The bioeconomy can reflect the direct link between innovation and economic growth [10], in the sense that increasing productivity by maximizing the efficiency of the resources used in counterpoint with limiting the impact on the environment can be achieved only through technological research and development. It is worth mentioning that innovation must be accepted by each participant in the economic chain as well as by the society as a whole. Identifying the stimulating factors of the transition to the bioeconomy is a difficult and complex process, given their diversity. The analysis carried out in 2018 by the FAO (Food and Agriculture Organization, a specialized agency of the UN, with the aim to eliminate world hunger, as well as to improve the food, by coordinating the activities of the governments in the field of agriculture, forestry, and the fishing industry [13]) reflects the contribution of the bioeconomy to a country's economic growth. Although the implementation of this concept requires a harmonization with the particularities and priorities of each state, in a general framework, however, certain aspects essential to the development of the bioeconomy can be identified (see Figure 1).

Figure 1. Essential factors for the development of a sustainable bioeconomy. Source: [13].

An empirical study [14] on the EU component states has shown that Finland and Sweden have the lowest levels of environmental pollution due to the rigorous ecological awareness of the population; the focus in these countries is on education and vocational training, with a basis of solid knowledge. In addition, the two states are among the most innovative countries in the EU and are based on rich and diverse natural resources. Denmark, Ireland, the Netherlands, and the UK have similarities in terms of innovation capacity supported by a developed economy, but natural assets are narrower than in the two Nordic countries (much of the countries' areas are used for agriculture, as forests are restricted as a surface), and the quality of the environment is above average. At the opposite end, these states are noted: Bulgaria, Croatia, Cyprus, Czech Republic, Greece, Hungary, Italy, Latvia, Lithuania, Poland, Portugal, Romania, Slovakia, and Spain. Although they have the largest agricultural sectors, innovation activity is relative low, which results in a low employment rate in the technological field. In these countries, the public authorities are less dedicated to education and training, and the population is not so concerned about the environment. According to the studies, the historical, geographical, and cultural factors influence the pro-bioeconomic behaviors adopted by the citizens. The size of the socio-economic context highlighted the most visible differences between countries, leading us to the conclusion that the countries of Central and Eastern Europe are in different stages of development [15].

The economic literature has developed progressively, encompassing the issues of bioeconomy and sustainability, as well as the determining elements that influence the economic growth.

In this section of the research, relevant aspects of some studies and research were analyzed, which include the issue of the sustainability of economic growth, the analysis of its components, analysis of the developments of bioeconomy at the European level, research on the six macroeconomic indicators included in the empirical study, and their correlations. Foreign trade, both export and import, continued to be one of the fundamental factors of economic growth contributing to the growth of national economies. The value of foreign agri-food trade is relevant, considering that, in 2018, the EU maintained its position as a world leader in the global export of agri-food products, with EU exports reaching 138 billion EUR in 2018. The top five destinations for food products exported by the European Union continue to be the United States, China, Switzerland, Japan, and Russia, which account for 40% of EU exports. The EU's common agricultural policy has become increasingly market-oriented, thus contributing to the EU's success in agricultural trade [16]. In 2018, the EU became the second largest importer of agri-food products in the world, the value of its imports amounting to 116 billion EUR, bringing the EU trade balance for this sector to a net positive result of 22 billion EUR. The EU mainly imports three types of products: Products not produced in the EU (or are produced only to a small extent, such as tropical fruits, coffee, and fresh or dried fruits), representing 23.4% of EU imports, products that are intended for animal feed (accounting for 10.8% of EU imports), and products used as ingredients in further processing [16]. Although agri-food trade is shown to benefit from a positive global climate assessment from 2019 [16], substantial future risks remain for trade developments [16]. The biggest threats to trade developments include protectionist political approaches (which are increasingly important for economies), more frequent trade disputes, and possible trade unrest linked to Britain's decision to leave the EU. On the positive side, global demand for food is likely to increase, correlated with population growth, income growth, middle-class expansion, and changes in consumer preferences [17].

Figures 2 and 3 respectively show the evolution of exports and food imports at the level of the 24 countries included in the empirical study, highlighted distinctly by the two groups (countries of Western and Northern Europe, considered countries with developed economies, and countries of Central and Eastern Europe, considered countries with emerging/developing economies).

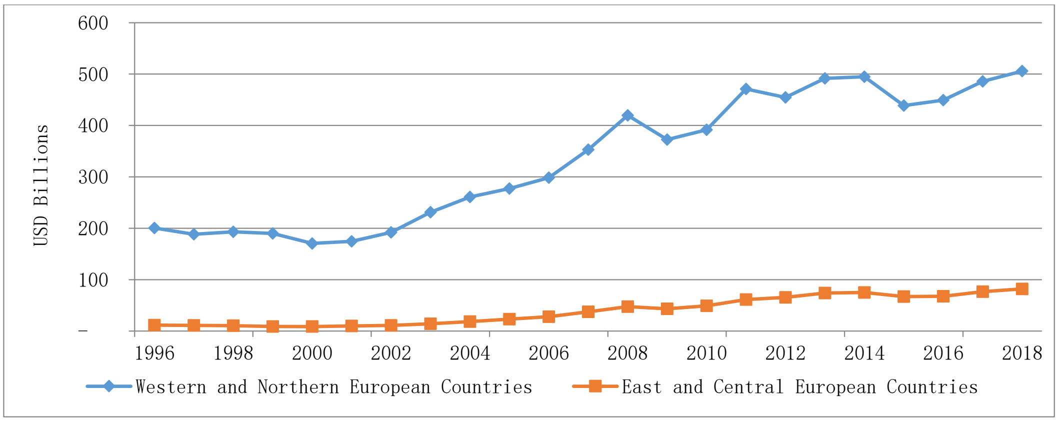

Figure 2. The evolution of total food exports in the countries included in the empirical analysis. Source: Own processing, data are sourced from the World Bank database [18].

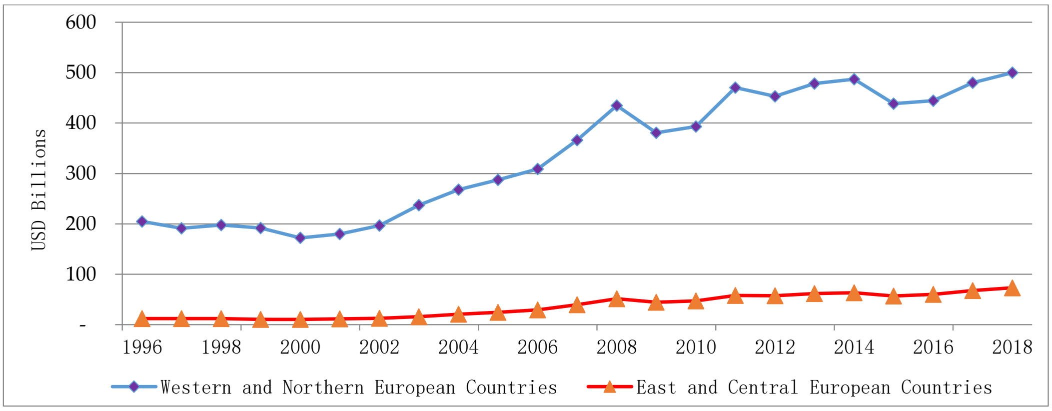

Figure 3. The evolution of total food imports in the countries included in the empirical analysis. Source: Own processing, data are sourced from the World Bank database [18].

Thus, it is observed that, in the case of countries with emerging/developing economies, the variations of exports and imports are more pronounced compared to those registered with the countries with developed economies, which can absorb the impacts of the influence factors. The economic literature analyzes the effects of imports and exports on private research and development expenditures in the food-processing sector. The empirical results [19] reflect that increasing the level of import intensity leads to reductions in private spending on research and development, while increasing the level of export intensity promotes higher private spending on research and development. These results imply that the effects of reducing the research and development activity of imports offset the effects of improving export research and development. Other studies examine the impact of EU enlargement on export performance of agri-food products in 12 new EU Member States and five new independent states on EU markets, covering the period 1999–2007 [20]. A longer duration for agri-food exports from the new EU member states was identified. The results confirm the gains from the eastern enlargement of the EU in terms of export growth and a longer duration for the export of specialized foods, with a higher added value for consumers and more competitive niche agri-food products [20].

3. Materials and Methods

This research applies scientific tests, uses specific estimators and statistical–econometric techniques, investigates data sets and collections, and assesses the most appropriate methods of investigation in order to provide accurate results. The activity of foreign trade in foodstuffs, transposed in the external balance of a country, can make a significant contribution to the economic (sustainable) growth of the respective country. Especially in the context of the transition to the green economy, a strategic vision must include the factors that achieve a significant influence. It is also necessary to integrate and study the behavioral evolution, habits/preferences and attitudes of consumption, and the degree of adoption and use of technologies along the value chain from plant culture/animal growth to food processing/distribution.

As regards the selected countries (presented in Table 2), on the one hand, the founding countries of the European Union were included; on the other, countries in Central and Eastern Europe, representative in terms of structural changes in the economy, were also included. The countries in Central and Eastern Europe are affected by processes of transition from a centralized economy to a market economy, or are even in the early stages of reforms, such as in Macedonia, Former Yugoslav Republic (FYR), a candidate country for EU accession. The authors opted for a split into two groups of countries based on the criteria: Geographical and economic development. The division into two groups of countries based on their level of development was made taking into consideration similar approaches to be found in the field’s literature, such as the ones cited in this article. Additionally, a division into three groups would make the groups very unequal with respect to the volume of the sample, with advanced economies having much more representation than the developing or the emerging ones; consequently, the representativeness of such results would be far lower than in the present situation (lower accuracy). Similar divisions of the European countries are to be found in [21,22]. With respect to the criteria of economic development, in practice, international bodies also operate with the same classifications: 1. economically advanced countries and developing and emerging countries [23]; 2. developed markets, emerging markets, and border markets [24]; 3. developed economies and economies in transition [25].

Table 2. List of countries according to their grouping by level of development.

	Western and Northern European Countries Advanced Economies	East and Central European Countries Emerging and Developing Economies
1	Austria	Bulgaria
2	Belgium	Croatia
3	Denmark	Czech Republic
4	France	Estonia
5	Germany	Hungary
6	Italy	Latvia
7	Luxemburg	Lithuania
8	Holland	Macedonia, Former Yugoslav Republic (FYR)
9	Norway	Poland
10	Spain	Romania
11	Sweden	Slovak Republic
12	United Kingdom	Slovenia

Source: Authors' own processing.

In the empirical study, to determine the inter-correlation with the exogenous indicators of foreign food trade, six relevant endogenous indicators were selected, including from the perspective of the bioeconomy/sustainable development: Labor force, added value of agriculture, forestry and fisheries, research and development expenses, forest area, fuel consumption based on fossils, and renewable energy consumption:

- *Labor force* includes all persons who are available to provide labor for the production of goods and services over a certain period of time, whether they are employed or unemployed. In emerging countries, the problem of disguised unemployment (includes low productivity, poorly paid jobs) can be solved by transferring the labor force affected by this phenomenon to the industrial sector in order to support production and, implicitly, export development. [18]. The economic literature shows a statistically significant reduction in employment in the forestry sector and a simultaneous increase in labor productivity due to the increasing use of technological equipment [26]. The analysis focused on the Czech Republic, but the results can be applied to other European countries as well [26]. A significant decrease in employment leads to instability in the forestry sector.
- *Added value from agriculture, forestry, and fisheries.* This is represented by the net production of a sector after all of the results have been gathered and the intermediate inputs have decreased. It is calculated without making deductions for the depreciation of manufactured assets or the depletion and degradation of natural resources. [18];
- *Expenditure on research and development*, a notion aimed at a marketable application in practice of an invention or an integration of the invention into the economic–social practice. The usual method of measuring innovation is based on the use of indirect indicators: Data on research and development (that measure parts of the inputs to the innovation process, indicate resources

spent) and data on patents for invention (granted for inventive technologies with marketing prospects) [18].

- *The forest area,* which is represented by the land under natural trees or under planted trees, but excludes tree stands from agricultural production systems and trees from urban parks and gardens [18].
- *Fossil fuel energy consumption.* Fossil fuels are non-renewable resources from coal, oil, and oil and natural gas products; they take millions of years to form and reserves are depleted much faster than new ones are made [18].
- *Renewable energy consumption* is calculated as the share of renewable energy in the total final energy consumption [18]. Accordingly [26], the large-scale renewable energy implementation plans should include strategies for integrating renewable sources into coherent energy systems influenced by energy saving and efficiency measures. In the case of Denmark, the authors of [27] discussed the problems and prospects of converting the current energy systems into a 100% renewable energy system. Renewable energy sources are used in the context of further technological improvements; the renewable energy system can be implemented in a sustainable manner.

Through a quantitative mix of instruments, the nature of the inter-correlations between these indicators was studied in order to provide certain answers to the fundamental question of this research: Which of the indicators analyzed at the level of the 24 European economies, over a period of 22 years, has a positive impact on the determination/influence, in a relevant way, of the evolution of food exports and imports? To answer this question for the present analysis, a series of six working hypotheses has been constructed, which will be tested using the multiple regression model; the first of these is methodological in nature:

- *H1. The Pooled Mean Group (PMG) estimator is best suited for modeling the relationships between variables.* Judging from the fact that the countries included in the panel belong to the European area, it is expected to be characterized by a common long-term trend, but at the same time, to present short-term differences, considering the internal conditions specific to each state.
- *H2. The labor force directly impacts both exports and imports.* This hypothesis is because exports contribute to economic growth, and one of the most important sources of economic growth is the labor force. Thus, a direct relationship between the two variables is expected. The more the labor force is developed, the greater the ability of a country to export. As for imports, if the labor force grows, the availability of money on the market will increase, as well as its remuneration. Thus, the demand for products will increase, some of them being covered by imports; their value will also increase.
- *H3. The added value of the agricultural sector positively influences exports, but negatively influences imports.* A high added value in the agricultural sector implies a high productivity, which will increase the value of exports. Moreover, increasing productivity in the agricultural sector will lead to better coverage of domestic needs from their own production, which will decrease the value of food imports.
- *H4. Research and development expenditure leads to an increase in the value of exports, but also of imports*. Rising spending on research and development implies a development of this sector, which will increase the added value of the economy. This is because the final product of innovation is one with high gross added value, as it is intensive in innovation, knowledge, and capital. Thus, if part of the innovation process is carried out in the food sector, it will lead to an increase in exports of this sector. As in the case of the labor force, the increase of the expenditure with the research and development brings financial resources to the society, which positively impacts the imports.
- *H5. Energy consumption is higher in countries with higher food exports and lower in countries with higher imports.* Countries with large exports consume more energy, while importing countries will consume less energy;

- *H6. Renewable energy consumption is inversely correlated with food exports and directly correlated with imports.* Countries with important renewable energy sectors are more developed countries, which export products other than food, but mainly import this type of product because they do not have a highly developed agricultural sector.

The purpose of the present research is to link the foreign trade of foodstuffs, estimated both by exports (EXP) and by imports (IMP), with the following factors:

- labor force (LABOR),
- the gross added value of agriculture, forestry, and fisheries (AGRI),
- expenditure on research and development (RD).

In the preliminary stage of the actual modeling of the relation between the dependent variables and the main determinants considered in the present analysis, it is necessary to investigate the statistical properties of the series of variables. Following this examination, the most appropriate statistical–econometric techniques are decided to model the link between the variables included in the study. Moreover, before the start of the statistical analysis, all of the variables considered were respectively logarithmized for a possible normalization of their distribution for an easier interpretation of the associated coefficients in the form of elasticities. To determine whether the series of variables are stationary in the level or first difference, the Fisher–Phillips Perron unit root test developed by Choi [28] was applied. The main advantage of this test is that it can be applied to both balanced and unbalanced panel data. Thus, considering the series of our variables that sometimes have missing values, it was considered that the application of this test is the most appropriate. First, in the analysis of stationarity for the level of variables, it was included in the equation for both the constant and the trend. Considering that series of macroeconomic variables most often have a certain tendency, including the trend in the equation increases the accuracy of the results. Secondly, for the first difference of the series, only the constant in the equation was included, since the differentiation of the series leads, in most cases, to the elimination of a possible tendency. Moreover, to correct for potential data persistence, both equations are aggregated with a lag.

The results of the stationarity test presented in Table 3 suggest that both dependent variables, i.e., exports and imports, have a unit root (they are integrated with an order of one - I (1)); the p-value associated with the statistics calculated for the level of the variables is higher than the significance thresholds of 1% and 5%, thus leading to the acceptance of the null hypothesis that the series are characterized by the unit root. In contrast, for the first difference of the variables, the p-value associated with the calculated statistics is lower even than the significance thresholds of 1%, leading to the rejection of the null hypothesis and the acceptance of the alternative one, according to which the series are stationary.

Regarding the exogenous (independent) variables, the results are mixed, as the variables are both integrated by the first order and stationary at the level. Taking into account the characteristics of the series of variables included in this analysis—namely that the dependent variables are I(1), and the independent variables are both I(1) and I(0)—for modeling the relation between them, a dynamic model was considered, namely an ARDL (Autoregressive Distributed Lag) data panel. The mathematical form of the dynamic model for the ARDL panel data (p, q_1 … q_k) [29] is as follows:

$$Y_{it} = \sum_{j=1}^{p} \partial_{ij} Y_{i,t-j} + \sum_{j=0}^{q} \gamma'_{ij} X_{i,t-j} + \mu_i + \varepsilon_{it}, \tag{1}$$

where $i = \overline{1, N}$ represents the countries analyzed, and $t = \overline{1, T}$ denotes the number of years included in the study (the period analyzed). Y_{it} is the dependent variable, and X_{it} $(k \times 1)$ represents the vector of explanatory variables with the vector of associated coefficients $\gamma_{ij}(k \times 1)$.

Table 3. Test of stationarity (unit root).

Test/ VAriable	Fisher-Type unit-Root Test			
	Level (Constant and Trend)		Δ (Constant)	
	Inverse Chi-Square	p-Value	Inverse Chi-Square	p-Value
Dependent variable				
EXP	22.9662	(0.9992)	260.7056 ***	(0.0000)
IMP	16.6480	(1.0000)	272.1349 ***	(0.0000)
Independent variable				
LABOR	31.0687	(0.9724)	356.7083 ***	(0.0000)
AGRI	87.9761 ***	(0.0004)	-	-
RD	10.4846	(1.0000)	250.6373 ***	(0.0000)
FOREST	67.7993 **	(0.0314)	-	-
ENG	70.6167 **	(0.0184)	-	-
RENEW	72.9023 **	(0.0117)	-	-

Source: own processing. Note: The null hypothesis (H0): All panels contain unit roots, and the alternative hypothesis (H1): At least one panel is stationary. For the stationary variables at a level of significance of 1% and 5%, the first difference of the series was not analyzed. *** and ** indicate statistical significance at a threshold of 1% and 5%. In the above table, the following abbreviations were used: Exports (EXP), imports (IMP), labor force (LABOR), gross added value of agriculture, forestry, and fisheries (AGRI), expenditure on research and development (RD), forest area (FOREST), fossil fuel energy consumption (ENG), and renewable energy consumption (RENEW).

In our case, the dependent variable is represented by the exports; the imports of food products, and as their main determinants, the labor force, the added value of agriculture, forestry and fisheries, and the expenditure for research and development were respectively considered. Moreover, μ_i and ε_it indicate the country-specific fixed effects and the error term, respectively.

The above Equation (1) can be rewritten in the form of a panel data error correction model if it is assumed that the variables are non-stationary and co-integrated. Thus, the equation incorporating both long-term and short-term coefficients, together with the error correction term Equation (2), has the following form:

$$\Delta Y_{it} = \phi_i\left(Y_{it-1} - \lambda_i' X_{it}\right) + \sum_{j=1}^{p-1} \partial_{ij}^* \Delta Y_{it-j} + \sum_{j=0}^{q-1} \gamma_{ij}'^* \Delta X_{it-j} + \mu_i + \varepsilon_{it} \quad (2)$$

where:

$$\phi_i = -(1 - \sum\nolimits_{j=1}^{p} \partial_{ij}),$$

$$\lambda_i = \sum\nolimits_{j=0}^{q} \gamma_{ij} / \left(1 - \sum\nolimits_{k} \partial_{ik}\right),$$

$$\partial_{ij}^* = -\sum\nolimits_{m=j+1}^{p} \partial_{im},$$

$$\gamma_{ij}^* = -\sum\nolimits_{m=j+1}^{q} \gamma_{im},$$

and Δ represents the difference operator.

In order to confirm the long-term relationship between the variables, the coefficient associated with the error correction term, namely ϕ_i must be negative and statistically significant, and its values must be between [−1; 0]. Moreover, it helps us evaluate whether the model is specified correctly and to determine the speed of adjustment of the system to long-term equilibrium following an exogenous shock. First, it should be noted that one advantage of the ARDL technique on panel data is the accuracy (consistency) of the estimated coefficients when the dependent variable is I(1) and the independent variables have different integration orders of (I(0) and I(1)). Secondly, another advantage is given by the flexibility of the estimated coefficients, in the sense that it allows us to evaluate the influence of the independent variables on the dependency in both the long term and in the short term.

Considering all of the results related to the evaluation of the characteristics of the analyzed variables, an ARDL model (1.1) was estimated, including one lag for the dependent variable and, respectively, one lag for the independent ones. The decision to include a lag in the model is closely linked to the value of the Akaike Information Criterion (AIC) and the total number of panel-level observations. Considering that N = 24 and T = 21 (N ∗ T = 504), the inclusion of several lags in the model significantly reduces the number of observations; the ARDL model is sensitive in this respect. It should be mentioned that the main analysis was started for a group of 24 countries in Europe (Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, France, Germany, Hungary, Italy, Latvia, Lithuania, Luxembourg, North Macedonia, Netherlands, Norway, Poland, Romania, Slovak Republic, Slovenia, Spain, Sweden, and United Kingdom) for the period 1996–2017. The choice of the analysis period was strictly determined by the availability of data and, respectively, by the variable of expenditure on research and development, for which the values stop in 2017. The ARDL model (1.1) is estimated using three specific estimators, namely the Dynamic Fixed Effects (DFE), Pooled Mean Group (PMG), and Mean Group (MG). Then, the Hausman test helps us determine if the PMG estimator or the MG is best suited to model the evaluated data. It should be noted that the DFE estimator considers that both the short-term and long-term coefficients, together with the error correction term, are identical for all panel members (for the analyzed countries) only the constant is different, depending on the country. On the other hand, the MG estimator assumes the exact opposite (the short-term and long-term coefficients, together with the error correction term, are different for all panel members), and the PMG estimator is the intermediate version between the two, considering a common long-term trend for all countries, with a respective short-term heterogeneity between coefficients. The final step in the analysis was the validation of the final models by evaluating their robustness. For this purpose, three variables (related to both the agricultural sector and the size of sustainable development) were introduced in the analysis, taking into account the continuous discussions at the international level related to the problem of natural resources and their diminution. For the present analysis, the following variables were considered as control variables:

- forest area (FOREST),
- fossil fuel energy consumption (ENG), and
- renewable energy consumption (RENEW),

These were used to check if the relationships found in the main regressions remain stable in the presence of environmental and long-term sustainability factors, i.e., FOREST, ENG, and RENEW.

4. Results

Hypothesis H1 was first evaluated in order to determine the appropriate final model for the data sample used. In Tables 4 and 5 are presented the estimations of the ARDL model (1.1) through the three estimators for exports (EXP) and imports (IMP). In the basic vector, the variables of labor force (LABOR), the added value of agriculture, forestry, and fisheries (AGRI), and the expenditure of research and development (RD) were considered as factors influencing the exports/imports.

Table 4. Estimation of the Autoregressive Distributed Lag (ARDL) model (1.1) for exports.

	DFE	**PMG**	**MG**
The dependent variable: ΔEXP			
Long-term coefficients			
LABOR	−2.7674 ***	−1.6328 ***	−9.7459
	(0.7793)	(0.2483)	(10.1587)
AGRI	0.7217 ***	0.1591 ***	0.5002 **
	(0.2761)	(0.0881)	(0.2095)
RD	1.0087 ***	1.1345 ***	1.3584 **
	(0.1336)	(0.0448)	(0.6856)

Table 4. *Cont.*

	DFE	PMG	MG
Short-term coefficients			
ECT	−0.1297 ***	−0.1882 ***	−0.4012 ***
	(0.0189)	(0.0404)	(0.0506)
ΔLABOR	0.2795	−0.0688	−0.6799
	(0.3959)	(0.4027)	(0.4416)
ΔAGRI	0.2634 ***	0.2589 ***	0.0813
	(0.0392)	(0.0463)	(0.0719)
ΔRD	0.2762 ***	0.3132 ***	0.2191 ***
	(0.0459)	(0.0680)	(0.0754)
Constant	3.5616 **	3.7360 ***	−14.6986 **
	(1.4659)	(0.8157)	(6.3261)
Log Likelihood	-	637.0791	-
No. of countries	24	24	24
No. of observations	493	493	493

Source: own processing. Note: Hausman test: MG vs. PMG: Since the p-value = 0.4865 is greater than all significance thresholds, the null hypothesis that the PMG estimator is the preferred model to form the relationship between variables was accepted. *** and ** indicate statistical significance at a threshold of 1% and 5%. In the above table, the following abbreviation were used: Dynamic fixed effects (DFE), pooled mean group (PMG), mean group (MG), exports (EXP), labor force (LABOR), gross added value of agriculture, forestry, and fisheries (AGRI), expenditure on research and development (RD), and error correction term (ECT).

Table 5. Estimation of the ARDL model (1.1) for imports.

	DFE	PMG	MG
The dependent variable: ΔIMP			
Long-term coefficients			
LABOR	−0.6142	0.2027	1.9127
	(0.7179)	(0.1405)	(1.9953)
AGRI	0.4032	0.3155 ***	0.5320 **
	(0.2708)	(0.0366)	(0.2155)
RD	0.8464 ***	0.8605 ***	0.5569 ***
	(0.1303)	(0.0211)	(0.2047)
Short-term coefficients			
ECT	−0.1073 ***	−0.2529 ***	−0.4740 ***
	(0.0202)	(0.0547)	(0.0515)
ΔLABOR	0.3294	−0.0733	−0.4728
	(0.3281)	(0.3773)	(0.4393)
ΔAGRI	0.2559 ***	0.1876 ***	0.0570
	(0.0325)	(0.0485)	(0.0479)
ΔRD	0.3688 ***	0.3607 ***	0.2765 ***
	(0.0376)	(0.0701)	(0.0616)
Constant	0.5509	−1.5650 ***	−9.0339
	(1.2108)	(0.3585)	(5.4557)
Log Likelihood	-	702.2978	-
No. of countries	24	24	24
No. of observations	495	495	495

Source: own processing. Note: Hausman test: MG vs. PMG: Since the p-value = 0.7162 is greater than all significance thresholds, the null hypothesis that the PMG estimator is the preferred model to form the relationship between variables was accepted. *** and ** indicate statistical significance at a threshold of 1% and 5%.In the above table, the following abbreviation were used: Dynamic fixed effects (DFE), pooled mean group (PMG), mean group (MG), imports (IMP), labor force (LABOR), gross added value of agriculture, forestry and fisheries (AGRI), expenditure on research and development (RD), and error correction term (ECT).

First of all, it was noticed that the Error Correction Term (ECT) is negative and strongly significant for all models. Thus, the modeling technique is justified and the specification of the models is validated. Moreover, for the export equation, the associated coefficient varies between about 0.13 and 0.4, suggesting a low adjustment rate (similarly to the case for the import equation, where the adjustment rate varies between about 0.11 and 0.47). Second, the Hausman test, by which we discriminated between the estimator MG and PMG, suggests that the most appropriate of these is the PMG estimator for both the dependent variable exports and imports (p-value = 0.486 for exports, p-value = 0.716 for imports). Consequently, the working hypothesis H1 is accepted: The PMG estimator is the preferred one for modeling the relationships between variables. Countries have a common long-term tendency with respective short-term heterogeneities. The common long-term trend can be explained by the efforts of all states to increase trade openness, ultimately stimulating the economic growth. For example, at the European Union level, trade policies focus on coordinating states towards a common trajectory, which involves increasing the trade flow. In tandem, the heterogeneities in the short term can be given by the differences in the commercial structures of the countries, both in terms of exports and imports of food products, or respectively of the national macroeconomic policies. As stated in the methodological section, to evaluate the validity of the other working hypotheses, the results of the PMG estimator were analyzed. Regarding the export model, the following were observed:

1. The labor force has a negative long-term and strongly significant effect on the value of food exports in the countries analyzed. Thus, with an increase of 1% of the labor force, the value of exports decreases by approximately 1.6%. The second working hypothesis, H2, is invalidated for exports.
2. Both the added value of agriculture, forestry, and fisheries and the expenditure on research and development positively influence the value of exports in the long term. Moreover, as with the labor force case, the associated coefficients are strongly significant at a significance threshold of 1% (p-value < 1%). In addition, the magnitude of the coefficients suggests that an increase of 1% in the added value of agriculture, forestry, and fisheries and in expenditure on research and development causes an increase of approximately 0.16% and 1.13%, respectively, in the value of exports. The working hypotheses H3 and H4 are accepted for exports.
3. In the short term, the variable LABOR does not have statistical significance, and AGRI and RD contribute significantly to increasing the value of food exports in the analyzed countries.

The results of the import model show the following:

1. The labor force does not have a statistically significant impact on the value of food imports because of the lack of significance of the associated coefficient. This result invalidates H2 on the import side, as there is no relationship between the two variables.
2. On the other hand, as in the case of exports, the added value of agriculture, forestry, and fisheries and the expenditure on research and development help to stimulate the value of imports. The difference that appears is related to the magnitude of the coefficients associated with these variables compared to those of the export model. For example, the coefficient associated with the variable AGRI is approximately double for the model of imports, and suggests that, with a 1% increase in the added value of agriculture, forestry, and fisheries, the value of imports increases by about 0.32%. On the other hand, when the RD increases by 1%, the value of the imports of food products increases by about 0.86% (the magnitude of the coefficient being smaller in comparison with that of the expenditure for research and development in the case of the export model). The results invalidate H3 on the import side and accept H4.
3. In the short term, the coefficients associated with the variables AGRI and RD are statistically significant, having a positive impact on the value of food imports.

The robustness analysis of the basic model of exports and imports was made by introducing the three additional variables closely related to the concept of sustainable development (environmental quality); namely, the forest area (FOREST), the energy consumption of fossil fuels as a share of total energy (ENG), and the renewable energy consumption (RENEW). Considering that the ARDL technique provides consistent results for mixed independent variables (i.e., first order (I(1)), as well as stationary (I(0)), no prior analysis of the stationarity of these factors (additional ones included in the study) is required. However, it should be mentioned that due to the availability of data, the analysis period of the models that include the FOREST variable is 1996–2016, and for the other two variables, the analyzed period is 1996–2015. The results of the models estimated through the PMG estimator are presented in Tables 6 and 7. The additional independent variables were included one at a time in the vector of the basic variables, so that finally, in the last column (column (4)) of the two tables, all of the independent variables are considered. On the one hand, for the export model, it was observed that ECT is negative and strongly significant in all models, validating once again the chosen technique and specification of the models. Moreover, its magnitude is comparable from one model to another, also indicating a relatively low rate of adjustment to long-term equilibrium (see Table 6). Regarding the independent variables, overall, it can be observed that the statistical significance and the signs of the coefficients of the variables in the basic vector do not change with the inclusion of the additional factors. Moreover, if the last model, where all of the exogenous factors were included (see column (4) of Table 6), is considered, it is to be noticed that the additional factors have a positive impact on exports in the long term. In contrast, in the short term, it is to be mentioned that only the consumption of energy and renewable energy significantly influences exports, the first variable in the positive sense and the second in the negative sense. Hypothesis H5 is accepted for exports in both the short and long terms. Hypothesis H6 is invalidated at the level of the analyzed sample, highlighting a direct link between the renewable energy consumption and exports. On the other hand, for the model of imports, the associated coefficient of ECT is also strongly statistically and negatively significant, suggesting once again that the model is well specified and has a high accuracy. Contrary to the main model, it is observed that the inclusion of the variable of forest area or the inclusion of all variables in the equation (see column (1) and column (4) of Table 7) brings a significant gain to the long-term coefficient associated with the variable of labor force (the sign of the associated coefficient is positive). In addition, if the most complete model is analyzed (see column (4) in Table 7), it must be noted that the variables of the main vector (AGRI and RD) keep their positive sign for the associated coefficient and, respectively, the high statistical significance. In addition, the FOREST variable has a positive influence on imports, while RENEW has a negative impact on the value of imports. For the ENG variable, the associated coefficient does not have statistical significance. In the case of imports, both working assumptions related to sustainability factors are rejected (H5 and H6). The short-term coefficients are statistically significant for the variables AGRI, RD, and ENG, and the positive sign illustrates that all of these macroeconomic factors contribute to the increase of the value of imports. In total, for the models of both exports and imports, the inclusion of additional factors in the main equation does not significantly affect the results of the initial models, so it can be said that that they have a high robustness.

Table 6. Estimation of the ARDL model (1.1) for exports—robustness analysis.

The Dependent Variable: ΔEXP	(1)	(2)	(3)	(4)
Long-term coefficients				
LABOR	−2.6293 ***	−4.2200 ***	−2.3602 ***	−1.8319 ***
	(0.3809)	(0.5559)	(0.2952)	(0.3317)
AGRI	0.4649 ***	0.6135 ***	0.4354 ***	0.7151 ***
	(0.0988)	(0.0534)	(0.1098)	(0.0625)
RD	0.8934 ***	0.9876 ***	1.0177 ***	0.8004 ***
	(0.0574)	(0.0314)	(0.0611)	(0.0438)
FOREST	1.8069 ***			2.5942 ***
	(0.4867)			(0.6370)
ENG		0.9073 ***		1.3878 ***
		(0.1266)		(0.1590)
RENEW			0.0567	0.2954 ***
			(0.0417)	(0.0518)

Table 6. *Cont.*

The Dependent Variable: ΔEXP	(1)	(2)	(3)	(4)
Short-term coefficients				
ECT	−0.2266 ***	−0.1782 ***	−0.2105 ***	−0.2935 ***
	(0.0514)	(0.0443)	(0.0447)	(0.0554)
ΔLABOR	0.0867	0.1496	−0.2014	0.5162 ***
	(0.4107)	(0.4242)	(0.4082)	(0.3156)
ΔAGRI	0.1939 ***	0.1716 **	0.1965 ***	0.0851
	(0.0551)	(0.0683)	(0.0556)	(0.0705)
ΔRD	0.2766 ***	0.2951 ***	0.3284 ***	0.2001 **
	(0.0843)	(0.0984)	(0.0689)	(0.0851)
ΔFOREST	13.5043			3.0714
	(13.2621)			(13.6067)
ΔENG		0.3288 **		0.3317 **
		(0.1293)		(0.1574)
ΔRENEW			0.0250 ***	−0.0966 **
			(0.0515)	(0.0479)
Constant	3.2907 ***	7.1126 ***	5.6302	−8.7431 ***
	(0.7605)	(1.7842)	(1.2187)	(1.5790)
Log Likelihood	633.3564	606.3407	586.0194	656.261
No. of countries	24	24	24	24
No. of observations	468	441	447	439

Source: Own processing. Standard error in round brackets. *** and ** indicate statistical significance at a threshold of 1% and 5%. In the above table, the following abbreviation were used: Exports (EXP), labor force (LABOR), gross added value of agriculture, forestry, and fisheries (AGRI), expenditure on research and development (RD), forest area (FOREST), fossil fuel energy consumption (ENG) and renewable energy consumption (RENEW), and error correction term (ECT).

Table 7. Estimation of the ARDL model (1,1) for imports—robustness analysis.

The Dependent Variable: ΔIMP	(1)	(2)	(3)	(4)
Long-term coefficients				
LABOR	0.2607	−0.0293	−0.0791	0.6177 **
	(0.1406)	(0.2018)	(0.1831)	(0.2443)
AGRI	0.3826 ***	0.3961 ***	0.3964 ***	0.6869 ***
	(0.0472)	(0.0434)	(0.0438)	(0.0655)
RD	0.8105 ***	0.8556 ***	0.8561 ***	0.7026 ***
	(0.0277)	(0.0242)	(0.0246)	(0.0409)
FOREST	0.8985 **			5.7577 ***
	(0.3789)			(1.2851)
ENG		−0.1517 **		0.0036
		(0.0724)		(0.1189)
RENEW			0.0104	−0.2249 ***
			(0.0195)	(0.0626)
Short-term coefficients				
ECT	−0.3123 ***	−0.2799 ***	−0.2897 ***	−0.2591 ***
	(0.0566)	(0.0568)	(0.0515)	(0.0498)
ΔLABOR	−0.1696	−0.2139	−0.5791	−0.4609
	(0.4113)	(0.4697)	(0.4352)	(0.5869)
ΔAGRI	0.1445 ***	0.1438 ***	0.1394 ***	0.0861
	(0.0504)	(0.0518)	(0.0477)	(0.0461)
ΔRD	0.3153 ***	0.3636 ***	0.3853 ***	0.4164 ***
	(0.0737)	(0.0846)	(0.0714)	(0.0943)
ΔFOREST	−1.4857			−12.5173
	(13.4565)			(17.9804)
ΔENG		0.2821 ***		0.3724 ***
		(0.0911)		(0.1224)
ΔRENEW			0.0393	0.0239
			(0.0726)	(0.0701)
Constant	−5.1475 ***	−0.6655 ***	−1.0976 ***	−18.8824 ***
	(0.9681)	(0.1670)	(0.2242)	(3.7615)

Table 7. *Cont.*

The Dependent Variable: ΔIMP	(1)	(2)	(3)	(4)
Log Likelihood	695.4414	663.4577	660.5005	706.2197
No. of countries	24	24	24	24
No. of observations	470	443	449	441

Source: Own processing. Standard error in round brackets. *** and ** indicate statistical significance at a threshold of 1% and 5%. In the above table, the following abbreviation were used: Imports (IMP), labor force (LABOR), gross added value of agriculture, forestry, and fisheries (AGRI), expenditure on research and development (RD), forest area (FOREST), fossil fuel energy consumption (ENG) and renewable energy consumption (RENEW), and error correction term (ECT).

5. Discussion

The analysis identified and presented, mainly within the literature review section, a significant variety of research and studies related to the bioeconomy, reflecting the complexity of the transition process and its substantial transformations. Several studies approached a smaller number of countries for a shorter period of time. The focus within those studies was on one or two indicators. A study on bioeconomy [13] reflected the essential factors for the development of a sustainable bioeconomy, describing and linking economic factors, socio-economic factors, and ecological factors. The present analysis selects factors from each of the three mentioned categories, as per the study [13], identifies data, uses instruments to research the inter-linkages between the factors, tests hypotheses, and provides conclusions.

This study advances the reader's understanding of the research problem by considering for analysis a larger number of countries over a longer period of time. The focus of the study is on six indicators, significantly larger than in other related studies.

At the level of the sample of analyzed European countries, there is a tendency of long-term convergence in this area. The estimated models highlight the existence of a significant common long-term trend and an adjustment speed. These characteristics are due to the economic policies that exist not only at the level of the European Union, but also through the economic treaties it has with other European countries, which are meant to open up the trade and trade flows. Obviously, in the short term, heterogeneities are highlighted because they depend on the internal conditions and the structural specificity of the national economy of each country in the sample.

The study advances the reader's understanding by presenting the diversity of financial instruments, explaining the importance of financial mechanisms and financial resources as well as their risks and vulnerabilities, and the connection with bioeconomy and with the analyzed factors.

Considering the results of the empirical study, it is necessary to anchor them in the context of allocating/ensuring adequate financial support. In order to strategically orient the European economy towards the bioeconomy, there are needed financial resources, allocated through European programs, but also alternatives: Private and public financial resources to co-finance and support this transition process, the results of which will be reflected in the long term. The bioeconomy, by building a strategic vision and translating it at the regional level, can be the driving factor of societal changes. According to the European Commission [10], 67% of regions used European Structural and Investment Funds (ESIF) as a source of funding to support bioeconomic activities and access cooperation programs (for cooperation between regions: Joint Programming Initiatives; for other programs to promote the bioeconomy: Interreg, LIFE +, CIP/COSME, ERASMUS+, Intelligent Energy Europe) [10]. Specific mechanisms for granting ESIF funds to synergistic projects have been developed at the levels of several countries and regions (Italy, Czech Republic, Spain, France) together with public–private partnerships for the diversification of funding sources. The investment dimension is significantly larger than the capacity of the public sector. The European Commission estimates an additional annual investment requirement to reach the current targets set for 2030, in terms of climate and energy, of approximately 260 billion EUR, or, respectively, 1.5% of the GDP of 2018 [30]. It is also necessary to mobilize national budgets and private capital. In order to support the bioeconomic processes, it is appropriate to approach the issues related to sustainability, the sustainable financing of the European economy, and sustainable banking activities at European level in a convergent way.

Among the risks and uncertainties that may affect the bioeconomic processes, the following must be mentioned:

- the short-term orientation, the need for short-term financial results;
- non-integrated financial instruments/programs to provide the financing;
- the low degree of educational promotion/transparency regarding the sustainable impact of investments in bioeconomic activities, including for retail customers who could buy "green bonds" (EU Green Bonds) [31];
- the limited contributions of banks, insurance companies, institutional investors on the capital market, and entrepreneurs for re-orienting financial resources towards bioeconomic activities;
- the reduced promotion of scoring systems/standards accepted at the level of funders for better scoring of projects that support the bioeconomy;
- the low degree of connection of financial programs/resources offering specialized consultancy for the support of bioeconomic activities;
- the low level of education of the participants and lack of information and understanding about the impact of bioeconomic activities for each individual and for the European society as a whole.

The European Commission has set up a High-Level Expert Group (HLEG on Sustainable Finance) [32] with a mandate to propose changes to the investment chain in order to build a sustainable financing strategy for the European Union economy (to "achieve economic prosperity in the long term, increasing social inclusion and reducing dependence on the exploitation of finite resources and the natural environment" [10]). The objective proposed by the mandate is ambitious, but realistic: Transforming Europe into the main pole for low-carbon global investments, resource efficiency, and circular economy; in conjunction with this are the two strategic objectives: The adoption of the 2030 Agenda for Sustainable Development [33] and the Paris Agreement 2015/16, which regulates measures to reduce carbon dioxide emissions [34].

At the European banking level [35] a number of proposals have been formulated that will stimulate and contribute to the debate of European institutions, regulators, and banks on how to increase sustainable activities, mobilize and redirect private financial flows to support such activities, develop new tools, and increase the number of eligible projects. A specific element in the proposals made is the recommendation of the development of a "sustainable finance support factor" [33,36] as part of the legislation on bank capital requirements in the European Union. It has been proposed that the EBA (European Banking Authority) should explore the possibility of introducing a justification factor for certain assets that are classified as sustainable under the EU taxonomy. Europe has identified an annual financial gap of over 180 billion EUR to finance the policies and investments needed to maintain global temperatures [33] in line with the objectives of the Paris Agreement. It is more than obvious that, without the private sector, this funding gap cannot be closed. Because about two-thirds of the European economy is bank-financed, banks play—and will continue to play—a key role in the transition to a sustainable future, acting as investors, capital providers, and capital intermediaries for "green packaging" of some projects, in order to be eligible for funding through:

- Bank financing for "green projects" with the development of specific indicators or rating models. Due to the consistent role of the banking system in financing the European economy, in accordance with the results of the empirical study and with the theme of research—bioeconomy and foreign food trade—some relevant considerations from the perspective of sustainable banking activities were added. According to the report by the GABV (Global Alliance for Banking on Values) [36], sustainable banks consistently deliver products, services and social, environmental, and financial "profits" to support the real economy. The focus of sustainable banks is simultaneously on three components: People, environment, and prosperity. They are anchored in the communities in which they operate, establish long-term relationships with customers, and manage long-term risks.

The products and services of sustainable banks are mainly oriented toward supporting small- and medium-sized enterprises (SMEs) and microfinance, agriculture (food production, organic farms, rural, and agro-finance), financing energy efficiency (green energy, innovative technologies, alternative energy), financing eco-housing and social housing, and financing of educational and cultural programs (schools, kindergartens, theatres, museums). It is to be mentioned that the development and knowledge of activities/principles promoted by sustainable banks, together with other alternative financing instruments and mechanisms (crowdfunding platforms [37], specialized private energy investment funds, innovative institutional investors specializing in innovative products) could contribute synergistically to the developed programs of authorities and the orientation of financial and educational resources towards supporting bioeconomy at the European level.

- The technical support offered to obtain financing through capital markets, through the issuance of variable/fixed income securities for the financial support of "green projects".

Associations between international financial institutions, development banks, international banks, and local banks in the form of international networks—for example, the SBN (Sustainable Banking Network) operating in over 38 countries, with members of financial-banking institutions with assets of approximately 43 trillion USD [38]—lead to the promotion of sustainable financing as a global priority and to the transformation of the financial sectors/markets in which they operate. In addition, the efforts of coagulation and convergence in order to support the gradual transition to the bioeconomy were also made at the level of central banks, regulators, and supervisors. The Network for Greening the Financial Sector (NGFS) [39], which includes 46 members—central banks and financial supervisory authorities—emphasizes, at the level of the portfolios held, making socially responsible investments, managing the ESG risks (Environment, Social, Governance) related to the transition to the bioeconomy, and the development of scoring systems/new indicators that reflect the transition to a sustainable economy. The partnership between the bioeconomy and foreign trade with food products within the "green economy", together with the entire value chain that contributes to obtaining food, harmonized with the new technological context, must also be supported at the microeconomic level. Regional cooperation, especially in the agricultural field, between investment funds and small entrepreneurs, family associations, and authorized individuals contributes to the transformation of life and work, enhancing the connection between them, increasing the degree of innovation, and increasing social inclusion [40].

The future evolution of the bioeconomy will influence and will be influenced by public support and attitudes in the process of change [41]. The synergistic co-interest of all "actors" through harmonized, individual, and collective contributions can lead to the implementation and realization of this complex process of transition from the linear economy to the bioeconomy at the level of Europe.

This study adds to the existing literature by connecting the analysis of macroeconomic policies with the results of the empirical study and with potential guidelines for future policies. The study presents results and various influences between the analyzed factors in the short term, providing explanations and correlations for the long term trends as well.

This study advances the understanding in the complex topic of bioeconomy, providing an integrated approach for the reader. The approach explains and presents the relationships between the components of foreign trade in food products and macroeconomic variables, the various forms of financial support and mechanisms, and the newest established networks of financial institutions, focused on supporting the development of bioeconomy and its essential factors. Those correlations, together with the presentation of risks that may affect bioeconomic processes, offer a better understanding of the future mix of policies developed by authorities. The references included in the study offer a broad, up-to-date perspective with high relevance for the object of the research.

6. Conclusions

This research aimed to identify the factors with the highest capacity to stimulate the trade in food products, starting from a data panel over a limited time horizon (1996–2017), which included 24 European countries. The econometric results, statistically relevant, together with the qualitative aspects presented, highlighted that the bioeconomy and foreign trade in food products are in a sustainable partnership at the European level. All six independent variables analyzed act positively on the dependent variables; the main direct influencers of foreign food trade are the gross added value of the agricultural sector and the research and development expenses, both in the short and long term.

Sustainable bioeconomy can represent a strategic catalyst for economic growth at the European level and a beneficiary thereof; for all three visions of the bioeconomy included in the research, the main objectives are growth and sustainability. For future research, it is necessary to study the consumption habits, the behaviors regarding the food products, the modalities of their distribution at the regional level, and the connection with financing solutions, which will ensure the entire value chain necessary for the production, marketing, and promotion of the food products. A key point is to gather the cooperation and contributions of authorities, regulators, academic environment/researchers, investors, and financial-banking actors to harmonize the instruments in order to support the transition to the bioeconomy and make the partnership sustainable in the long term.

Author Contributions: D.C.N. and V.M. designed and implemented the research, analyzed the data and the results, and wrote and revised the manuscript together; both authors contributed equally (50%) for each task. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

Abbreviations

The following abbreviations are used in this manuscript:

EU	European Union
WCED	World Commission on Environment and Development
OECD	European Organization for Cooperation and Development
FAO	Food and Agriculture Organization
UN	United Nations
ARDL	Autoregressive Distributed Lag
PMG	Pooled Mean Group
DFE	Dynamic Fixed Effects
MG	Mean Group
ECT	Error Correction Term
EXP	Food exports
IMP	Food imports
LABOR	Labor force, total
AGRI	Agriculture, forestry, and fishing, value-added
RD	Research and development expenditure
FOREST	Forest area
ENG	Fossil fuel energy consumption
RENEW	Renewable energy consumption GDP Gross Domestic Product
ESIF	European Structural and Investment Funds
HLEG	High Level Expert Group
EBA	European Banking Authority
GABV	Global Alliance for Banking on Values
SME	Small- and medium-sized enterprises
SBN	Sustainable Banking Network
NGFS	Network for Greening the Financial Sector
ESG	Environment, Social, Governance

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