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Greenfield Investment as a Catalyst of Green Economic Growth

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Abstract: The intensification of countries' growth causes the depletion of natural resources, biodiversity degradation, ecological imbalances, damage, and disasters. The aggravation of ecological issues requires the development of mechanisms for simultaneous achievement of economic, social, and ecological goals. The energy sector is the core direction of economic decarbonization. Therefore, green economic growth requires economic development due to the extension of innovative technologies for renewable energies and relevant investment for that. The study aims to test the hypothesis on the impact of green field investment on green economic growth. The object of the research was countries in the European Union (EU) for 2006–2020. This study applied the Malmquist-Luenberger Global Productivity Index to estimate green economic growth. It considers the resources available for the production process in the country (labor, capital, energy), the desired outcome (gross domestic product) and undesirable results (emissions to the environment) of this process. The study applied the Tobit model to test the hypothesis. The findings confirm the spatial heterogeneity of green economic growth among the EU countries. The asymmetry in technological efficiency and progress limits the efficacy of green innovations. At the same time, the obtained data confirm the research hypothesis. It is shown that along with green investments, economic openness and the efficiency of public governance have a positive effect on the green economic growth of countries. The findings highlight the importance of attracting green investments to increase green innovations in renewable energy, which boost green economic growth. This study explored the linear and direct effects of green investment on the green economic growth while eliminating the transmission impact of other mediating factors. It should be noted that further research should analyze the nonlinear impact of green investment on the green economic growth and the mediating effect, which could be caused by other variables (corruption, governance efficiency, green innovations, etc.).

Keywords: sustainable development; green investment; green growth; green energy; renewable energy

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1. Introduction

Within the paradigm of sustainable development goals, countries in the European Union (EU) have accepted the green deal policy, which aims to decarbonize economic growth by 2050 [1,2]. Thus, the EU will become the first region with carbon-free economic development. However, although countries in the EU provide coherent policies, the EU has disparities and gaps in reducing carbon emissions and consequently achieving sustainable development goals (SDGs) [3–5].

The concept of "green economic growth" is linked to the paradigm of sustainable development and reflects economic growth considering the rational use of natural capital, prevents and reduces pollution and developed opportunities to improve social well-being due to providing carbon-neutral economy [6–8]. The concept of "greenfield investment" is wider and complex definitions, the scholars [9] define it as the investment on environmental, social and governance projects which aims to achieve sustainable development goals in long-term. Based on the methodology of experts from the Division on Investment and

Enterprise of UNCTAD [10], within this study the green field investment is the value of announced greenfield foreign direct investment projects.

It should be noted that the transition to green economic growth requires green innovations and technologies that reduce environmental degradation, particularly carbon emissions. Scholars [11–15] confirm that green innovations have a statistically significant impact on declining carbon dioxide emissions and boost the achievement of SDGs. At the same time, past studies [16] emphasize that countries with strong institutions and effective implementation of sustainable development principles have higher capabilities for extending green innovations. In addition, new innovations and technologies require additional resources (financial, labor, etc.). Prior studies [17,18] have highlighted the crucial role of greenfield investment in boosting green innovations and technologies. Adeel-Farooq et al. [19] confirmed that greenfield investment negatively affects environmental performance in Asia countries. At the same time, economic growth positively affects environmental performance. However, Neto et al. [20] concludes that economic growth boosts the greenfield investment, however the reverse effect is not confirmed. At the same time, they showed that greenfield investment could have indirect effects on countries economic growth in developed and developing countries. Bayar Y. [21] also showed that greenfield investment promotes the economic growth in EU countries. At the same time, the countries have disparities in attracting external and allocating internal green investment [22]. Consequently, it could restrict the green economic growth of the country. On the other hand, countries with a high level of green economic growth are more attractive for investors. In this case, it is relevant to indicate if the greenfield investment has the direct effect on green economic growth. It should be noted that the scientific community has not accepted universal approaches for assessing green economic growth: (1) approaches based on the world indexes SDG Index, Global Sustainable Competitiveness Index, and Global Green Economy Index [23–26]; (2) approaches based on green GDP [27,28]; and (3) approaches based on desirable and undesirable outcomes [29,30]. This study bridges the theoretical gap in green economic growth by developing an approach that (1) assesses the green economic growth of the EU countries based on the Malmquist-Luenberger Global Productivity Index. It allows considering the input (labor, capital, energy), desirable (gross domestic product) and undesirable output (emissions to the environment); (2) to measure the impact of greenfield investment on green economic growth by using the Tobit model. The novelty of this study is developed approach of assesses the green economic growth, and how greenfield investment effect on which unlike the existing ones consider the desirable and undesirable outputs and based on Malmquist-Luenberger Global Productivity Index and Tobit model. The past studies [31–33] which used the Malmquist-Luenberger Global Productivity Index focused on indicators of the sustainability of individual sectors or industries for the territory and the impact of environmental regulation and green economic growth achievement. While the overall analysis for EU member states and the EU as a whole union are not often investigated. At the existence studies did not consider key indicators for achieving a carbon-neutral economy and the Sustainable Development Goals: emissions to the environment and a share of renewable energy in primary energy consumption. Furthermore, for a deeper understanding of the countries' green growth progress, this study evaluates the effectiveness of the relevant policies of EU countries. The findings of Tobit model are basis for policies suggestions within increasing green growth in the EU.

This study has the following structure: the Literature Review analyses the theoretical landscape of green economic growth and its core dimensions; the Materials and Methods section explains the variables and sources, methods and instruments to test the hypothesis of the research; the Results explain the empirical results of hypothesis testing; the Discussion and Conclusion summarize the findings, compare the analysis of the obtained results with the previous studies, limitations and further directions for investigations.

2. Literature Review

2.1. Assessment of Green Economic Growth

The results of the theoretical background on green economic growth show that most authors analyze it as a synergistic effect on simultaneous economic and ecological development [11,15,28–33]. Scholars [31] use SO_2, wastewater and smoke–dust emissions to measure green economic growth. At the same time, they confirm that innovations could boost green economic growth. The study [32] applies energy efficiency and stochastic frontier techniques to estimate green economic growth. Based on these findings, they conclude that reforms in Chinese energy sectors were effective and caused an increase in energy efficiency, which boosted green economic growth. Dizon K. E and Norona M. [34] confirm that a country's green economic growth depends on SMEs' green development. Thus, using the structural equation model, they define green economic growth as the latent variable with the following constructs: intra- and intergenerational equity; equity and inclusiveness; job creation and economic diversification; environmental integrity; efficiency; and green technological advancement [34]. Considering the findings, they conclude that environmental integrity has the highest statistically significant load on green economic growth. At the same time, scholars [34] emphasize that initialization plays the core role in providing green economic growth. Gao X. [35] applies spatial clustering and blockchain techniques to identify the abnormal and pic points of green economic growth of the country, and based on the findings, the scholarly cluster region depends on green economic growth. It should be noted that green economic growth is analyzed within the productivity of green factors and the efficiency of green economies. A similar approach to estimate green economic growth is used by [33]. Thus, scholars apply the green total productivity factor as a long-term reference-point to achieve sustainable development goals. Guo S. and Diao Y. [36] estimate the green economic growth of regions of the Yangtze River economic belt. They construct an integrated index that consists of economic quality, green growth, green industry, and green benefits. Based on the entropy method, scholars conclude that the Pan-Yangtze River Delta urban agglomeration has the highest value of green economic growth, which is caused by coherent ecological and economic policies. Kuang Y. and Lin B. [37] applied the quasi-difference–in-difference method for the assessment of green economic growth. Scholars [37,38] used an integrated index constructed from energy efficiency, economic productivity, and emissions reduction. A previous study [39] developed an index to estimate green economic growth that merges three dimensions: environmental efficiency (wastewater, SO_2 and industrial smoke emissions), resource efficiency (water and electricity consumption) and governance capacity (scale of greening, recycling of domestic waste, and cost for eliminating industrial pollution). Contrary to the abovementioned research, scholars [40] calculate green economic growth based not only on economic (GDP, GDP per capita, and share of tertiary industry in GDP) and ecological (green urban area, forest area, and green park) indicators but also on social (population growth rate, unemployment rate, and income per capita) indicators.

2.2. Greenfield Investment and Green Economic Growth

The results of the analysis of the theoretical landscape of green economic growth show that researchers have identified a vast range of indicators that catalyze green economic growth: fiscal decentralization [41,42]; digitalization and artificial intelligence [43–47]; good governance [48]; green innovations [49–53]; environmental regulation [54–57]; green finance [58–61]; renewable energy [62–68]; green consciousness, education and awareness [69–76]; and investment and business climate [77–82].

Scholars [33] applied FMOLS and DOLS techniques to empirically justify the statistically significant impact of innovations, green policies, government efficacy, and renewable energy consumption on green economic growth. In addition, they highlight that the implementation of green innovations requires greenfield investment. Studies [41,42] show that in China, fiscal decentralization could differentially impact green economic growth depending on the efficacy of environmental regulations and green innovation implementation. At the same time, researchers [43] confirmed that Big Data, cloud computing, and artificial intelligence could enhance green economic growth in China. However, they confirm that the government should actively develop digital infrastructure and improve the country's digital capabilities. Prior studies [47,48,52] prove that digital technologies positively affect enhancing green economic growth. However, the innovation effect on green economic growth is not statistically significant in China. Furthermore, green economic growth is positively conducive to innovation in the long term, and this effect is not confirmed in the long term. Controversial conclusions have been confirmed by researchers [83]. Considering the results of two-step GMM techniques, they conclude that R&D expenditures positively promote green economic growth in the long term, and this impact does not conform in the short term.

Green finance is a core determinant of greenhouse gas emissions, which is the core dimension of green economic growth [59,60,63,81] Studies [59,60,63,81] confirm that green finance promotes innovation and technologies that allow the decline of environmental degradation, a safe economic growth rate and the achievement of green development. The pool of researchers [74,76,82] proves the positive statistically significant effect of renewable energies on green economic growth. However, scholars [83] confirm the inverted N-shaped relationship between renewable energies and green economic growth for 27 EU members from 2008 to 2017. Thus, based on the results of the SBM-GML technique, researchers show that the growth of renewable energy in the interval of 0.67%–10.87% is conducive to green economic growth; in other cases (less than 0.675 or higher than 10.87%), it causes a decline [83]. In addition, they use the following control variables: population density, government expenditure and unemployment rate. Based on the meta-analysis of the investigation on green finance and green economic growth, Desalegn G. and Tangl A. [84] theoretically justify that green investment promotes a country's green economic growth. The authors of [85] applied the ARDL model to check the long- and short-term effects of green investment on green economic growth. Considering the findings for Asian countries, scholars indicate that green investment positively impacts green economic growth in the long term. It should be emphasized that the accepted agreement between China and the EU on the Comprehensive Agreement on Investment [85] allows for achieving the common goals of decoupling carbon emissions and intensifying green economic growth. This is also confirmed by previous studies [86–88]. Furthermore, scholars [88] underline that green investment could be effective if the government provides effective environmental policies and planning and control mechanisms for environmental investments, expenditure, and projects. Past studies [89–98] have analyzed the impact of green investment at the local or company level. Based on empirical findings, scholars [89–98] show that green investment is conducive to a company's green performance, which is the core element for a country's green economic growth.

Considering the abovementioned analysis of the theoretical framework of green economic growth and core dimensions, this study aims to test the following hypothesis:

Hypothesis: *Greenfield investment positively affects the green economic growth of the country.*

3. Materials and Methods

3.1. Assessment of the Green Economic Growth

Similar to prior studies [99–101], green economic development is estimated by the Malmquist-Luenberger productivity index, which is based on the nonparametric method of data envelopment analysis (DEA) [102,103]. This approach allows exploring the cost efficiency of the EU countries for green economic development. One of the advantages of DEA is that there is no need to establish a functional relationship between explanatory and dependent variables. It eliminates inadequate results due to the application of an irregular form of the function. Moreover, compared withthe traditional approaches for assessment of green economic growth, the Malmquist-Luenberger productivity index compares countries by transmissibility and cyclical accumulation of the index during the analysis.

Considering this approach, each decision-making unit (DMU) consumes the input resources to achieve the targeted goals. Specifically, according to neoclassical theory, the maximum volume of the manufactured product in a country (Y) depends on the production costs associated with the purchase of production factors:

$$Y_i(t) = F_i(K_i(t)L_i(t)) \tag{1}$$

where F is a function that reveals the maximum volume of GDP that i-country could produce for a relevant combination of input resources: labor force (L) and gross capital formation (K).

The sustainable social–economic development of the country is the core dimension of the world economy. The European Union also analyses these issues as priority tasks to overcome issues on declining the heterogeneity of the development between member states. The EU has already accepted strategic documents that contain general and specific goals of sustainable social-economic development and relevant mechanisms. Furthermore, it aims to decrease CO_2 emissions and enhance the consumption of renewable energy [104,105]. Thus, EU countries aim to reduce CO_2 emissions by 80–95% until 2050 compared to 1990 [2,45,46,106]. The energy sector is the core generator of CO_2 emissions. Thus, the achievement of the declared goal on decarbonizing countries' development could result in a huge pressure on the energy sector [45,46,106]. In this case, energy consumption from renewable energy is the core determinant for improving people's well-being and the country's competitiveness. In addition, it could be a driver for the transition to carbon-free development and sustainable development. The green economy concept, as the pragmatic approach for achieving sustainable development, is conducive to the country's well-being simultaneously with providing effective use of available resources and reducing environmental degradation. Considering the factors mentioned above, the study applies the following parameters of the model for the assessment of green economic growth:

- Input variables (x^t): labor force (L), gross capital formation (K), share of renewable energy in primary energy consumption (E);
- Output variable (y^t) GDP per capita;
- Undesirable consequences from production in countries that should be minimized (b^t): carbon dioxide emissions CO_2:

$$Ged_t^{t+1} = \left[\frac{1 + D_i^G(x^t, y^t, b^t)}{1 + D_i^t(x^t, y^t, b^t)} \times \frac{1 + D_i^{t+1}(x^{t+1}, y^{t+1}, b^{t+1})}{1 + D_i^G(x^{t+1}, y^{t+1}, b^{t+1})}\right] \times \frac{1 + D_i^t(x^t, y^t, b^t)}{1 + D_i^{t+1}(x^{t+1}, y^{t+1}, b^{t+1})} \tag{2}$$

where D_i^t and D_i^{t+1} are the distance functions of the decision-making units at times t and t + 1 in country i, respectively.

The study applies Equation (3) to estimate the efficacy of the policy for green economic growth provided by the EU countries compared with other determinants (share of renewable energy in primary energy consumption and carbon dioxide emissions):

$$Ef_t^{t+1} = \frac{\left[\frac{1+D_i^G(x^t, y^t, b^t)}{1+D_i^t(x^t, y^t, b^t)} \times \frac{1+D_i^{t+1}(x^{t+1}, y^{t+1}, b^{t+1})}{1+D_i^G(x^{t+1}, y^{t+1}, b^{t+1})}\right] \times \frac{1+D_i^t(x^t, y^t, b^t)}{1+D_i^{t+1}(x^{t+1}, y^{t+1}, b^{t+1})}}{\frac{D_i^{t+1}(w^{t+1}, y^{t+1})}{D_i^t(w^t, y^t)}} \tag{3}$$

where w^t, w^{t+1}—the input parameters (labor force (L), gross capital formation (K)) of the production function (without consideration of ecological parameters of production) in country i at times t and t + 1, respectively.

The assessment of green economic growth involves three closely interrelated aspects: economic, social, and environmental. Thus, if Equation (3) is higher than one, it means that countries provide an effective policy based on a new paradigm of social and economic development grounded in two core postulates: fixed capital (and labor for production development is interchangeable and complementary; protection of ecosystems and natural resources plays a core significant role in green economic growth and provides equality between generations. From an ecological point of view, demand for human capital and productive and natural resources should be quantitatively limited, whereas ecosystem integrity and species diversification should be maintained. In this study, the countries are classified into three groups depending on the green economic growth:

1. High level (Green group)—$\mathrm{Ef}_t^{t+1} < \overline{\mathrm{Ef}_{it}^{t+1}} + S_{\mathrm{Ef}_t^{t+1}}$, where Ef_{it}^{t+1} is the average value of green economic growth and $S_{\mathrm{Ef}_t^{t+1}}$ is the standard deviation.
2. Average level (Yellow group)—$\overline{\mathrm{Ef}_{it}^{t+1}} - S_{\mathrm{Ef}_t^{t+1}} \leq \mathrm{Ef}_t^{t+1} < \overline{\mathrm{Ef}_{it}^{t+1}} + S_{\mathrm{Ef}_t^{t+1}}$.
3. Low level (Red group)—$\mathrm{Ef}_t^{t+1} < \overline{\mathrm{Ef}_{it}^{t+1}} - S_{\mathrm{Ef}_t^{t+1}}$.

3.2. Assessment of the Greenfield Investment Effect on the Green Economic Growth

Compared with the FMOL, DOLS, GMM and SBL-GML methods, which were used by [33,83–86,98] to estimate the greenfield investment effect on green economic growth, within this investigation, the truncated regression method Tobit model with the random effect are applied as the observed range of the dependent variable (Ged_t^{t+1}) is censored.

$$Ged_{it}^* = \beta_1 GI_{it} + \beta_2 X_{it} + v_i + \varepsilon_i$$
$$Ged_{it} = \begin{cases} Ged_{it}^*, \ Ged_{it}^* > 0 \\ 0, \ Ged_{it}^* \leq 0 \end{cases} \tag{4}$$

where $\alpha_0, \ \beta_1, \ \beta_2$ are the searching parameters of the model; GI_{it} is greenfield investment in a country i at time t; Ged_{it}^* – latent variable that is subject to truncation; X_{it} is a range of the control variables; v_i is a between-entity error; ε_i is a within-entity error.

Compared with the fixed effect model (which is biased and inconsistent), the Tobit model with the random effect allows the consideration of the marginal effects. In addition, the study applies the control variables that relate to the institutional and economic climate in the countries. The control variables are included because effective institutes are conducive to economic development [107,108], particularly within attracting investment [109–111]. From this point of view, the economic openness and effectiveness of government institutions are added to the model.

3.3. Data and Source

The object of research is the EU countries for 2006–2020. The data are compiled from open statistical databases and analytical reports from the World Data Bank [112], the United Nations Conference on Trade and Development (UNCTAD) [10] and Eurostat [113]. The variables, symbols, sources, and descriptive statistics of the selected variables are presented in Table 1.

The panel data for analysis contain 405 observations, and all panel data are logarithmic.

Table 1. Variables, source, and descriptive statistics.

Variables	Symbols	Source	Obs.	Max	Min	Mean	Std. Dev.
Input parameters:							
Labor	L	World Data Bank [112]	405	4.44×10^7	165,493	7,892,890	1.04×10^7
Capital	K		405	8.41×10^{11}	1.52×10^9	1.17×10^{11}	1.82×10^{11}
A share of renewable energy in primary energy consumption	E		405	242,094.8	0	28,102.99	41,039.27
Output parameters:							
Gross Domestic product per capita	GDP	World Data Bank [112]	405	123,678.7	4523.051	33,172.39	22,536.45
CO_2 emissions	CO_2	Eurostat [113]	405	814,410	1350	114,751.3	164,862

Table 1. *Cont.*

Variables	Symbols	Source	Obs.	Max	Min	Mean	Std. Dev.
Influential factor:							
Greenfield investment	GI	UNCTAD [10]	405	84,826	3	9216.23	15,693.69
Control variables:							
Economic openness	TO	World Data Bank [112]	405	380.104	45.419	125.820	65.641
Effectiveness of government institutions	WGI		405	1.889	0.087	1.036	0.488

4. Results

Considering the empirical results (Table 2) among EU countries, the highest values of green economic growth were found in the following countries: Cyprus—in 2012, the value was 1.072; Ireland—1.0527 in 2015; Luxembourg—1.0456 in 2006. The lowest value is in Malta —0.7419 in 2015 (Table 2). In addition, Cyprus and Malta have the most uneven values of green economic growth among all the analyzed countries. The coefficients of the variation *Ged* for Cyprus and Malta are 0.10 and 0.08, respectively.

Table 2. The empirical results of *Ged* and Ef.

Variables	Ged						Mean		CV		Level
	2006	2009	2012	2015	2018	2020	Ged	Ef	Ged	Ef	
Austria	0.999	0.984	0.987	0.972	1.013	0.981	1.000	1.012	0.01	0.03	Green
Belgium	1.003	0.982	0.988	0.975	1.013	0.981	1.000	1.008	0.01	0.03	Yellow
Bulgaria	1.003	0.999	0.998	0.996	1.005	0.999	1.002	0.980	0.00	0.09	Red
Croatia	1.006	0.992	0.993	0.992	1.007	0.992	1.001	0.991	0.01	0.06	Yellow
Cyprus	1.000	0.862	1.072	1.022	1.017	0.988	0.968	0.981	0.10	0.13	Red
Czech Republic	1.009	0.985	0.990	0.991	1.012	0.991	1.002	1.004	0.01	0.04	Yellow
Denmark	1.017	0.972	0.980	0.959	1.014	0.972	0.999	1.012	0.02	0.06	Green
Estonia	1.012	0.977	0.998	0.980	1.013	0.988	1.003	1.006	0.01	0.13	Yellow
Finland	1.017	0.979	0.982	0.978	1.013	1.000	1.001	1.012	0.02	0.04	Green
France	1.006	0.983	0.988	0.975	1.010	0.993	1.000	1.010	0.01	0.03	Yellow
Germany	1.007	0.982	0.989	0.973	1.011	0.996	1.002	1.013	0.01	0.02	Green
Greece	1.010	0.989	0.986	0.983	1.005	0.988	0.998	0.968	0.01	0.11	Red
Hungary	1.001	0.989	0.995	0.994	1.006	0.995	1.001	1.009	0.01	0.08	Yellow
Ireland	0.984	0.899	0.990	1.051	0.977	0.820	0.985	0.979	0.06	0.15	Yellow
Italy	1.006	0.983	0.986	0.980	1.008	0.987	0.999	0.995	0.01	0.03	Yellow
Latvia	1.011	0.981	1.002	0.991	1.011	0.994	1.003	0.986	0.01	0.14	Yellow
Lithuania	1.007	0.985	1.000	0.989	1.011	0.997	1.004	0.992	0.01	0.11	Yellow
Luxembourg	1.046	0.979	0.965	0.957	1.038	0.972	0.994	1.002	0.03	0.03	Yellow
Malta	1.020	1.000	0.974	0.742	0.995	0.974	0.994	0.999	0.08	0.06	Red
Netherlands	1.010	0.978	0.982	0.971	1.014	0.982	1.001	1.012	0.02	0.08	Green
Poland	1.005	0.989	0.996	0.993	1.007	0.997	1.002	0.995	0.01	0.07	Yellow
Portugal	1.004	0.992	0.991	0.988	1.007	0.989	1.001	0.990	0.01	0.06	Yellow
Romania	1.005	0.991	0.998	0.996	1.007	0.998	1.002	1.005	0.01	0.13	Yellow
Slovak Republic	1.007	0.990	0.995	0.989	1.008	0.998	1.002	0.987	0.01	0.08	Yellow
Slovenia	1.008	0.984	0.987	0.984	1.012	0.990	1.002	0.988	0.01	0.07	Yellow
Spain	1.007	0.985	0.986	0.986	1.009	0.983	0.999	0.990	0.01	0.06	Yellow
Sweden	1.010	0.966	0.989	0.971	1.002	0.994	1.001	1.019	0.02	0.04	Green

In 2010, the EU countries identified five goals of the development policy: employment, innovation, education, social inclusion, and climate change/energy. Within each goal, all countries have accepted the national indicative targets. Considering the findings of *Ged* and Ef, the following countries are involved in the Green Group: Austria, Denmark, Finland Germany, Netherlands, and Sweden. Countries from the Green Group provide an effective policy on the reduction in CO_2 emissions, increasing energy from renewable sources and improving social and economic development. The Yellow Group includes Belgium, Croatia, the Czech Republic, Estonia, France, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Poland, Portugal, Romania, the Slovak Republic, Slovenia, and Spain. The Red Group contains Bulgaria, Cyprus, Greece, and Malta. It should be noted that countries from the Red Group are far from the achievement of the national indicative targets, particularly SDG7: Affordable and Clean Energy (CO_2 emissions from fuel combustion per total electricity output), SDG12: Responsible Consumption and Production (electronic waste, production-based SO_2 emissions, SO_2 emissions embodied in imports), and SDG13: Climate Action (CO_2 emissions from fossil fuel combustion and cement production, CO_2 emissions embodied in imports, CO_2 emissions embodied in fossil fuel exports).

The study applies the panel Tobit regression model with random effects to assess the dimension's impact on green economic growth. In the first stage, all data are checked for stationarity by applying Levin–Lin–Chu, Im–Pesaran–Shin, augmented Dickey–Fuller, and Harris–Tzavalis tests (Table 3).

Table 3. The finding of stationarity of the selected variables.

Variables	Levin–Lin–Chu		Im–Pesaran–Shin		Augmented Dickey–Fuller		Harris–Tzavalis	
	Statistic	*p* Value	Statistic	*p* Value	Statistic	*p* Value	Statistic	*p* Value
At level								
Ged	−14.269	0.000	−7.258	0.000	216.587	0.000	0.182	0.000
GI	−7.891	0.000	−7.007	0.000	275.892	0.000	0.370	0.000
TO	−2.862	0.002	−0.853	0.197	56.876	0.369	0.796	0.328
WGI	−1.627	0.052	0.223	0.588	49.078	0.664	0.811	0.478
At First difference								
Ged	−18.938	0.000	−10.181	0.000	489.103	0.000	−0.259	0.000
GI	−15.528	0.000	−10.551	0.000	732.726	0.000	−0.202	0.000
TO	−9.509	0.000	−7.659	0.000	250.627	0.000	−0.032	0.000
WGI	−6.845	0.000	−9.026	0.000	421.071	0.000	−0.128	0.000

The values and *p*-value (Table 3) within the Levin–Lin–Chu test show that all data are stationary. However, the findings of the Im–Pesaran–Shin, augmented Dickey–Fuller, and Harris–Tzavalis tests allow rejecting the null hypothesis on the existence of a unit root for TO and WGI, and their minimal probability (*p* value) and non-stationarity are 19.0% and 47.8%, respectively. This means that TO and WGI are non-stationary at this level. However, at the first difference, all data within all tests are stationary.

The variance inflation factor (VIF) allows for checking multicollinearity. It shows the coefficient regression's impact on standard error for all independent variables. The square root of VIF indicates how much larger the standard error is compared with if the variable were uncorrelated with all other independent variables in the regression. The findings of multicollinearity are shown in Table 4. The VIF values for all variables are less than 10, which confirms the absence of multicollinearity.

Table 4. The empirical results for the variance inflation factor (VIF).

Indicator	GI	TO	WGI	Mean VIF
VIF	2.20	2.05	1.70	1.98

The findings of the impact of greenfield investment on the green economic growth for all countries and separate groups depending on the efficacy of the policy for green economic growth are shown in Table 5. Columns (1), (3), (5) and (7) in Table 5 contain the results with 9 considering only one explanatory variable in Model (4). Columns (2), (4), (6) and (8) show the results considering all control variables. The study provides a likelihood-ratio test to identify the reliability of using the panel regression method. The *p* values for all countries and the green, yellow and red groups are less than 1%. This means that at least one of the regression coefficients in the model is not equal to zero. The impact of GI on green economic growth is positive and statistically significant for all types of samples. The addition of explanatory variables TO and WGI does not change the sign and statistical significance of the GI's effect on Ged. This shows that in the EU, the tool for green structural changes and development is the intensification of green investments aimed mainly at technologies and equipment to increase renewable energy sources and reduce environmental pollution.

Table 5. The findings of the Tobit model within the countries' group.

Variables	Total				Green				Yellow				Red			
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	Coef	**Prob**	**Coef**	**Prob**	**Coef**	**Prob**	**Coef**	**Prob**	**Coef**	**Prob**	**Coef**	**Prob**	**Coef**	**Prob**	**Coef**	**Prob**
GI	0.017	0.000	0.015	0.000	0.035	0.000	0.026	0.000	0.003	0.000	0.004	0.003	0.017	0.014	0.019	0.006
TO	–	–	0.180	0.000	–	–	0.148	0.000	–	–	0.071	0.000	–	–	0.178	0.000
WGI	–	–	0.002	0.828	–	–	0.116	0.014	–	–	−0.009	0.167	–	–	0.021	0.498
sigma_u	0.871	0.000	0.085	0.000	0.667	0.002	0.032	0.002	1.020	0.000	0.634	0.000	0.888	0.005	0.103	0.022
sigma_e	0.031	0.000	0.033	0.000	0.016	0.000	0.015	0.000	0.032	0.000	0.020	0.000	0.060	0.000	0.061	0.000
rho	0.998		0.873		0.999		0.819		0.999		0.999		0.995		0.739	
Wald chi2	338.10	0.000	2702.05	0.000	5211.21	0.000	4728.29	0.000	35.55	0.000	4114.29	0.000	6.08	0.014	344.31	0.000
LR test	1476.40	0.000	414.63	0.000	209.90	0.000	99.42	0.000	1179.12	0.000	445.31	0.000	147.32	0.000	12.16	0.000

LR test—likelihood-ratio test.

Targeted energy, environmental protection, and social policies could become important stimulators of green economic transformations, providing new sources of growth due to "low carbon" technologies and developing new markets, industries, and jobs. It should be noted that the quality of institutions plays a core role in providing green economic growth due to direct and/or indirect effects. Thus, an effective government policy based on financing green transformation, spreading green technologies, enhancing research and development, and promoting green products and services is conducive to green economic growth. Considering the empirical results, WGI (quality of institutions) has had a statistically significant effect on the green economic growth for countries from the Green Group. Thus, the growth of WGI by one point led to Ged growth by 0.116. At the same time, for countries from the yellow and red groups, WGI does not have a statistically significant impact on green economic growth. In addition, trade openness has statistically significant impacts on green economic growth for all country groups. The intensification of the goods and capital movement among countries along with the corresponding targets for achieving the SDGs is a kind of incentive for changing the behavior of producers and consumers to use resources more effectively, considering the consequences for the environment. The findings of the analysis of the relationship between greenfield investment and green economic growth for each country are summarized in Table 6.

Countries within the EU have tried to improve the quality of the environment by improving renewable energy sources and extending green technology. However, the green economic growth differs from country to country. GI has a positive statistically significant impact on the green economic growth in Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Malta, the Netherlands, Portugal, Slovakia, Slovenia, Spain and Sweden. This means that the growth of green investment develops the appropriate conditions for the green economic growth due to developing new workplaces and increasing the efficiency of production. In this case, the government of the country from the Yellow and Green Group should enlarge investment in green projects and technologies that aim at extending renewable energy. In addition, the positive statistically significant impact of trade openness on the green economic growth justifies the necessity to develop common international projects to enhance collaboration between countries in spreading renewable energy. Furthermore, it is necessary to improve the quality of institutions that allow for the development and implementation of effective strategic decisions that meet the demands in the energy sector, improving the qualifications of the workforce, update the fixed capital to reduce the anthropogenic impact and increase the competitiveness of countries.

Table 6. The findings of the Tobit model for each country.

Variables	GI		TO		WGI		LR Chi2		Group
	Coef	Prob	Coef	Prob	Coef	Prob	Coef	Prob	
Austria	0.005	0.002	0.010	0.000	0.099	0.098	71295.280	0.000	Green
Belgium	0.017	0.063	0.165	0.000	0.080	0.155	39220.780	0.000	Yellow
Bulgaria	−0.011	0.062	0.222	0.000	0.003	0.855	18817.31	0.000	Red
Croatia	0.002	0.742	0.192	0.000	−0.156	0.223	16634.88	0.000	Yellow
Cyprus	0.017	0.603	0.174	0.005	0.111	0.485	603.88	0.000	Red
Czech Republic	0.012	0.147	0.182	0.000	−0.245	0.195	16207.23	0.000	Yellow
Denmark	0.024	0.055	0.236	0.000	0.219	0.028	19680.29	0.000	Green
Estonia	0.009	0.043	0.192	0.000	−0.075	0.246	18422.69	0.000	Yellow
Finland	0.002	0.817	0.243	0.000	0.058	0.087	29022.29	0.000	Green
France	0.026	0.030	0.173	0.000	0.106	0.064	42010.36	0.000	Yellow
Germany	0.043	0.004	0.113	0.005	0.067	0.070	31905.27	0.000	Green
Greece	0.015	0.010	0.224	0.000	0.027	0.102	7924.02	0.000	Red
Hungary	0.002	0.317	0.196	0.000	0.019	0.040	114576.77	0.000	Yellow
Ireland	−0.011	0.742	0.171	0.004	0.473	0.136	1348.89	0.000	Yellow
Italy	0.027	0.001	0.200	0.000	0.113	0.010	62362.44	0.000	Yellow
Latvia	0.012	0.045	0.191	0.000	−0.107	0.152	14730.92	0.000	Yellow
Lithuania	0.002	0.668	0.197	0.000	−0.114	0.003	21083.59	0.000	Yellow
Luxembourg	−0.008	0.704	0.178	0.002	0.047	0.926	4095.12	0.000	Yellow
Malta	0.033	0.012	0.145	0.000	0.248	0.104	1452.72	0.000	Red
Netherlands	0.038	0.001	0.080	0.056	0.456	0.016	17727.70	0.000	Green
Poland	0.020	0.185	0.189	0.000	−0.015	0.706	7843.09	0.000	Yellow
Portugal	0.019	0.002	0.197	0.000	−0.077	0.321	21070.61	0.000	Yellow
Romania	0.004	0.607	0.205	0.000	0.053	0.702	11252.12	0.000	Yellow
Slovak Republic	0.005	0.027	0.201	0.000	0.171	0.000	55057.52	0.000	Yellow
Slovenia	0.010	0.041	0.192	0.000	0.151	0.178	19712.07	0.000	Yellow
Spain	0.039	0.000	0.151	0.000	0.080	0.310	41140.60	0.000	Yellow
Sweden	0.011	0.007	0.180	0.000	0.076	0.024	20277.41	0.000	Green

Note: LR chi2 is the likelihood ratio (LR) chi-squared test.

5. Discussion and Conclusions

The concept of the green economic growth is the most important element of development strategy for the EU countries. This meant promoting the most resource-effective, ecological, and competitive economy. In addition, EU countries actively consider ecological issues under industrial production, and attracting greenfield investment and renewable energy consumption are conducive to the green economic growth. At the same time, the EU countries have disparities in achieving green economic growth. On the one hand, it is caused by the differences in macroeconomic conditions (labor, capital, gross domestic product); on the other hand, it is the result of targeted implementation of the sustainable development goals.

This study contributes to the theoretical framework on green economic growth within sustainable development goals by developing an approach to estimate the green economic growth of the EU countries which are in contrast to the existing ones based on the Malmquist-Luenberger Global Productivity Index and consider the gross domestic product (as the desirable output) and emissions to the environment (as the undesirable output). Moreover, this investigation contributes to the field of green investment within the developed approach (which the Tobit model is based on) for assessment of the impact of greenfield investment on green economic growth.

The empirical findings confirm that GI, TO and WGI impact differences in achieving green economic growth, which is consistent with prior studies [27,45,48,54]. Thus, GI, TO and WGI positively affect Ged. Thus, the growth of GI, TO and WGI by one point led to an increase in Ged by 0.015%, 0.180% and 0.002%, respectively. However, despite the differences in the green economic growth, the obtained findings are similar to those of the studies referenced in [34,41,47], indicating that the universalization mechanism of green economic growth is based on a formula that includes the need to increase green investments, the quality of institutions and openness of the economy.

It should be noted that GI has a positive and statistically significant effect on the green economic growth for all types of models, considering the explanatory and control variables. From a quantitative point of view, after including the control variables and other equal conditions , the growth of GI by one point led to improvement in green economic growth by 0.026%, 0.003% and 0.019% for the green, yellow and red groups, respectively. These results are coherent with previous studies [84–86], which showed that greenified investment is conducive to green economic growth in the long term. At the same time, the obtained findings are opposite to those from past studies [19,20], which prove that greenfield investment could not lead to green economic growth.

Considering the abovementioned results, the following policy implications could be developed:

- The EU countries should enhance the common green innovative projects which boost the sharing of the best knowledge and practices, and the development of the network of green investors. Moreover, it allows increase the openness of economy within circulation not only capital and resources but also knowledge and technologies.
- The EU commission should provide the obligatory response to publish non-financial statements at all levels (companies, local authorities, etc.). It will increase the transparency and accountability of the greenfield investment during the entire cycle.
- It should continue to provide the digitalization of state services which simplify the communication between green investors, business, and authorities during the realization of green projects. Moreover, it allows for a decline in corruption, and increased transparency and trust in the government.
- It should improve the legislation base for the circulation of green bonds, which attract new investors to the country. Consequently, it promotes the appropriate climate for developing green innovation projects which act as a catalyst for the green economic growth of the country.
- It should continue to intensify the fiscal incentives for green investors minimal loan rates, preferential taxation of green projects, etc.
- It should promote green education and implement targeted programs to promote green consciousness and awareness among green investors, businesses, local community, and government.

It should be noted that this research could be further advanced from the following aspects. First, this study explored the linear and direct effects of green investment on the green economic growth while eliminating the transmission impact of other mediating factors. Thus, further research should analyze the nonlinear impact of green investment on the green economic growth and the mediating effect, which could be caused by other variables (corruption, governance efficiency, green innovations, etc.). Second, this study focuses on the analysis of the EU countries for the period 2006–2020, which limits comparisons with other countries (the USA, China, India, etc.). In this case, the next stage of research should enlarge the number of countries for analysis. Third, it is necessary to analyze whether digitalization allows the promotion of green investment in the countries with sustainable development goals. Furthermore, past studies [45] confirmed the positive effect of crypto trading on renewable sources of energy, which is the basis of green economic growth. Moreover, crypto currency could be an additional financial resource for green innovation.

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