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Linking financial development to environmental performance index—the case of Romania

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ABSTRACT

To make steps in society towards a more sustainable future, countries must meet the targets established by the United Nations' Sustainable Development Goals. Thus, factors that could impact the environmental indicators should be analysed. Therefore, this study aims to identify the correlations between financial development and environmental performance in Romania, during the period 1995–2018. Using composite indexes to assess financial development and the Environmental Performance Index (EPI) to express environmental performance, important results are obtained through the Canonical Cointegrating Regression (CCR) method. The explanatory variables used in the study are specific to the evaluation of the financial development of a country: access, depth and efficiency. The results show that, in the case of financial institutions, the access index and the depth index have a negative influence on the environmental performance index, while in the case of financial markets, the negative impact of the access index of financial markets can be observed. The efficiency index, both in the case of financial institutions and financial markets, generates a positive influence on environmental performance in Romania. Financial markets also address positive influences on the evolution of the environmental performance index.

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1. Introduction

The economic and financial crisis has demonstrated the effects that financial system malfunctioning can have on economic development, but also on sustainable economic

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development. Although, important steps have been taken by companies and financial institutions to adopt the sustainability agenda in the last decade, a large part of financial resources are still directed towards polluting economic activities that do not use resources efficiently.

The development of the financial sector contributes decisively to economic growth but, also, to environmental protection through capital accumulation and technological progress due to research and development, as they allow firms to adopt cleaner technologies (Frankel & Romer, 1999; Jalil & Feridun, 2011). Tamazian et al. (2009) concluded that financial development can solve environmental problems by using energy-efficient goods. In contrast, Yasin et al. (2020) observed that financial development has positive effects on the environment, only in less developed economies.

Most countries talk about green financing as a financial plan that leads to increased development while protecting the environment (Tahir et al., 2021). This includes green loans that financial institutions can use in order to ensure environmental protection by financing energy-efficient technology and green investments. To reduce production costs and increase competitiveness, companies are interested in constantly updating production technologies, with financial support from governments or financial institutions. Thus, in order to reduce the degradation of the environment, governments chose various ecological projects that use green energies. These projects are funded by government-supported financial institutions, leading to improved energy infrastructure and reduced carbon emissions (Jiang & Xiaoxin, 2019).

In addition, the interest rate can be used as a tool to protect the environment, through a low interest rate on loans, for the industries that adopt clean technologies. Another element of green financing is represented by the funds that come from financial institutions for research and development in organic farming. The stock markets can also contribute by encouraging environmentally responsible behaviour because, according to their investor information requirements, companies have to present their socially responsible projects, including the use of green technologies, for a good sustainable image (Dasgupta et al., 2001).

A developed financial system can increase the amount of financing given to companies, which can expand their production capacity, without being interested in means of production that do not affect the environment (Haseeb et al., 2018). The development of the banking sector can lead to an increase in consumer credit, which can lead to an increase in the purchase of cars and household appliances, which represent large consumers of energy and fuel, generating more emissions.

The main objective of this study is to identify the existing causal relationships between financial development and environmental performance in Romania.

To achieve this goal, research hypotheses were formulated as follows:

H1. It is possible to calculate financial development by aggregating six indexes, in Romania.

H2. There is a causal relationship between the calculated financial development and the performance in the environmental field, assessed with the help of the Environmental Performance Index in Romania for the period 1995–2018.

H2.1. In the case of financial institutions, the access index and the depth index have a negative influence on the environmental performance index while, in the case of financial markets, the negative impact of the access index of financial markets can be observed.
H2.2. The efficiency index, both in the case of financial institutions and financial markets, generates a positive influence on environmental performance in Romania.
H2.3. Financial markets' depth positively influences the evolution of the environmental performance index in Romania.

Although, there are numerous studies on the relationship between financial development and environment protection, the contribution of this study is significant and innovative for two reasons. Firstly, because this study aims to analyse the relationship between financial development expressed by an index of financial development and, environmental performance expressed by the Environmental Performance Index (EPI) besides carbon emissions, used in analysis in other studies. Secondly, this study is carried out on Romania, for which this relationship has not been studied before, except for regional analysis at EU level or within Central and Eastern European countries.

The paper is structured as follows. In the next section, we present a brief literature overview on the topic. Section 2 describes the applied data and sources, Sec. 3 presents the results of our analysis, Sec. 4 analyses the obtained results and Sec. 5 concludes the paper.

2. Literature review

Most existing research papers analyse the impact of financial development on economic growth, economic stability and economic inequality (Dabla-Norris and Srivisal 2013; Demirgüç-Kunt and Levine 2009; Gyamfi et al. 2022; Levine 2005; Vatavu et al. 2019). Levine (2005) found that financial development leads to: increase in the rate of saving, mobilization of savings; orientation of capital towards productive investments; encouragement of foreign capital flows; increase in the exchange of goods and services. At the same time, great importance has been given to how environmental degradation is driven by rapid economic growth (Al-Mulali and Ozturk 2015; Boutabba 2014; Caglar et al. 2022; Dogan and Turkekul 2016; Farhani and Ozturk 2015; Gokmenoglu and Taspinar 2016).

However, there are many studies that analyse the relationship between financial development and environment. Thus, we have noticed the existence of contradictory results from the analysis of the relationship between financial development and environment. On one hand, several papers have underlined that financial development and economic growth generate negative effects on the environment while, on the other hand, a number of empirical papers show the existence of positive effects. This fact can be explained by different methodologies used in the analysis, indicators used to express the two analysed variables—financial development and environment, size of the data within sample used.

2.1. The financial development generates negative effects on the environment

As stated by many researchers, the study of the relationship between financial development and environment has concluded a negative influence of financial development on the environment (Aufderheide and Rich 1988; Dasgupta et al. 2001; Majeed and Mazhar 2019; Manta et al. 2020; Schmidheiny and Zorraquin 1998). The conclusions of these studies were that financial institutions grant loans without taking into account how these loans will be further used; therefore, the loans could be used to develop energy-intensive production processes and obsolete technologies, thus reducing costs, but increasing emissions. Majeed and Mazhar (2019) found that financial development leads to higher emissions that affect the environment, because financial institutions mainly pursue short-term goals, ignoring the effects on the environment. Aufderheide and Rich (1988) pointed out that World Bank funding did not take into account its effects on the environment.

Furthermore, Shahbaz et al. (2016) observed that financial development negatively affects environment, leading to increased CO_2 emissions, in their work investigating the correlation between these factors, in Pakistan, during the period 1985–2014. The negative effects of financial development on environment were also observed by Ibrahim and Law (2016) who analysed the impact of institutions, financial development and trade on carbon emissions, in the case of 40 African countries, during the period 2000–2010.

Charfeddine and Khediri (2016) identified an inverse U-shaped relationship between financial development and CO_2 emissions so that, the negative effects on the environment are greater in the case of lower financial development, but are reduced in the case of higher financial development.

2.2. The financial development generates positive effects on the environment

According to other studies, financial development improves the quality of the environment by adopting green technologies and promoting research and development, as a result of bank financing, foreign direct investment and stock market investment (Zhang, 2011). Other strands in the literature by Samreen and Majeed (2020), Saud et al. (2019), Park et al. (2018), Katircioğlu and Taşpinar (2017), Tang and Tan (2015) concluded that an increase in financial development leads to an increase in innovation, research and development, together with the development and application of technological innovations in energy sectors, which will further lead to reduced carbon emissions and, thus, to the improvement in quality of the environment. R. Komal and Abbas (2015) considered that financial development contributes positively to the quality of the environment, through the effects it generates on energy consumption, leading to increased energy efficiency. Financial development facilitates investment in cleaner technologies. Thus, investments in renewable energy led to the replacement of the conventional energy sources and, thus, leading to improved environmental quality.

Furthermore, in the study of Saidi and Mbarek (2017), the effects of the level of per capita income, trade, urbanization and financial development on the environment are studied at the level of 19 emerging economies and they concluded that financial development is beneficial for the environment, as it leads to the decrease in CO_2 emissions. Likewise, Al-Mulali et al. (2015), based on a study on the determinants of pollution, within 129 countries, concluded that urbanization, growth and oil consumption had positive long-term effects on CO_2 emissions, but financial development contributes to a decrease in emissions in high-income countries. Ganda (2019) noted that financial development, expressed by the loans granted by banks to the private sector, contributes to the improvement of the quality of the environment.

Charfeddine and Kahia (2019) also emphasized, analysing 24 countries in the MENA region, that financial development influences economic growth, but does not have a significant impact on carbon emissions. In the same view, Seetanah et al. (2019) concluded that financial development does not have a significant impact on carbon emissions.

2.3. Assessing the financial development through composite indexes

An important issue that can influence and determine different results in the analysed studies is the way in which financial development can be quantified. Thus, in numerous empirical studies, financial development was evaluated by two methods: by the ratio between private credit and GDP and by the market capitalization, also as a ratio to GDP (Arcand et al. 2012; Dabla-Norris and Srivisal 2013; Rajan and Zingales 1998). Čihák et al. (2012) and Aizenman et al. (2015) pointed out that large financial systems can also have limited use if the access of the population and companies to them is limited or they may contribute to small economic development if they prove to be inefficient. Thus, the conclusion was that financial development is a multidimensional process and several indicators need to be considered in order to measure it.

Other authors, Abid (2016), Tamazian and Rao (2010), Zakaria and Bibi (2019), and Shah et al. (2019) identified an important factor affecting the quality of the environment, namely the quality of institutions. Thus, these studies concluded that the role of financial development, in terms of emissions, could be moderated by institutions. We consider appropriate to use, as we explain below, an index for assessing the financial development that takes into account the development of institutions and markets.

Thus, Svirydzenka (IMF, 2016), using the method of constructing composite indexes, created an index to assess financial development based on the matrix of the financial system characteristics developed by Čihák et al. (2012). In order to determine the final index of financial development, a series of indexes that assess the level of development of financial institutions and financial markets have been quantified, taking into account their depth, access and efficiency.

Another identified problem is the way to evaluate the performance of the environment, in which the effects of financial development are analysed. Many studies analyse the effects on environmental degradation, using greenhouse gas emissions and CO_2 emissions, as indicators (Al-Mulali and Sab 2012; Bekun 2022; Boutabba 2014; Charfeddine and Kahia 2019; Charfeddine and Khediri 2016; Panayotou 1997; Sadorsky 2010; Shahbaz et al. 2020; Zhang 2011). Although these emissions show a

Table 1. Description of variables included in the model.

Variable	Acronym	Period of time
Environmental Performance Index	EPI	1995–2018
Financial Institutions Access Index	FIA	1995–2018
Financial Institutions Depth Index	FID	1995–2018
Financial Institutions Efficiency Index	FIE	1995–2018
Financial Markets Access Index	FMA	1995–2018
Financial Markets Depth Index	FMD	1995–2018
Financial Markets Efficiency Index	FME	1995–2018

Source: Own work.

picture of how the environment is affected, we still believe that the use of another indicator could lead to different results and better explain the environmental implications. Thus, in this paper, we used environmental assessment (dependent variable) and the EPI Environmental Performance Index, which provides quantitative values, in order to assess the environmental performance, based on 32 performance indicators, from 11 categories of environmental issues (Wendling et al., 2020).

From the presented research, we can emphasize the idea that the influence of financial development on carbon emissions is still debated both theoretically and empirically, the effects identified being both positive and negative, which vary depending on the countries and regions that are analysed. All these aspects lead us to consider that the analysis of this influence is still of interest, because it can provide important information for the elaboration of environmental policies in the country or region under analysis. The study focuses on the analysis of the influence of financial development on environment at the level of a single country, Romania, because we consider that the different results obtained in other works are determined by the diversity of the characteristics of the countries included in the studies and, also, because there are no such studies at the level of this country.

3. Materials and methods

As the main objective of this research is to identify the existing causal relationships between financial development and environmental performance in Romania, the variables used to explain these causal relationships were selected starting from the two components of financial development: financial markets and financial institutions. These components are characterized by three dimensions: access, depth and efficiency, thus resulting in the six variables that define the financial development of a country. Therefore, we used six indexes, three of which are related to financial institutions and the other three are related to financial markets, as attributes of financial development. Furthermore, in total, we used seven indexes to highlight the causal relationships between environmental performance and financial development (Table 1). The environmental performance was assessed using the Environmental performance index.

3.1. Environmental performance index (EPI)

This index provides a quantitative basis for comparing, analysing and understanding environmental performance. According to Wendling et al. (2020), the index is calculated on the basis of 32 indicators, following the algorithm presented in Figure 1.

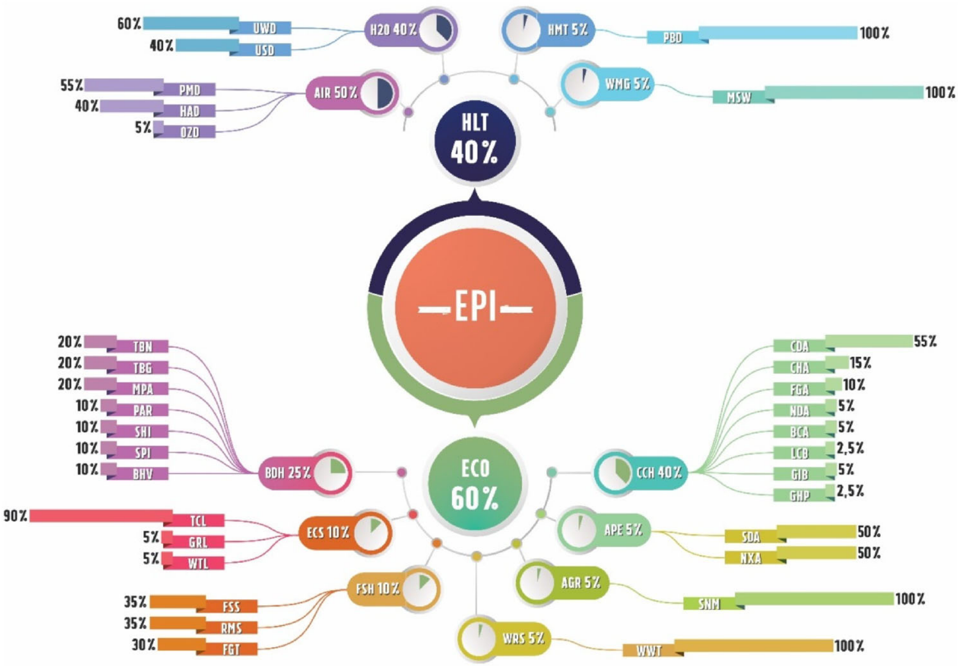

Figure 1. The Algorithm for EPI calculation (components and their share). Source: Own construction.

Thus, EPI is composed of: Environmental Health (HLT) (40%) and Ecosystem Vitality (ECO) (60%). Furthermore, each of the two components is calculated based on other elements. Thus, HLT consists of: Air Quality (AIR) (50%), Sanitation and Drinking Water (H2O), (40% of), Heavy Metals (HMT) (5%) and Waste Management (WMG) (5%).

As for ECO, this consists of: Biodiversity and Habitat (BDH) (25%), Ecosystem Services (ECS) (10%), Fisheries (FSH) (10%), Climate Change (CCH) (40%), Pollution Emissions (APE) (5%), Agriculture (AGR) (5%) and Water Resources (WRS) (5%). Continuing the decomposition of these elements, according to the above algorithm, we reached 32 indicators that formed the basis of EPI determination, during the period 1995–2018.

3.2. Financial development

A good measurement of financial development is essential, in order to assess the development of the financial sector and understand the impact of financial development, on economic growth and poverty reduction. In practice, however, it is difficult to measure financial development, as it is a wide concept and it has several dimensions.

The financial sector comprises two major components: financial institutions (banks, insurance companies, mutual funds and pension funds) and financial markets (stock and bond markets).

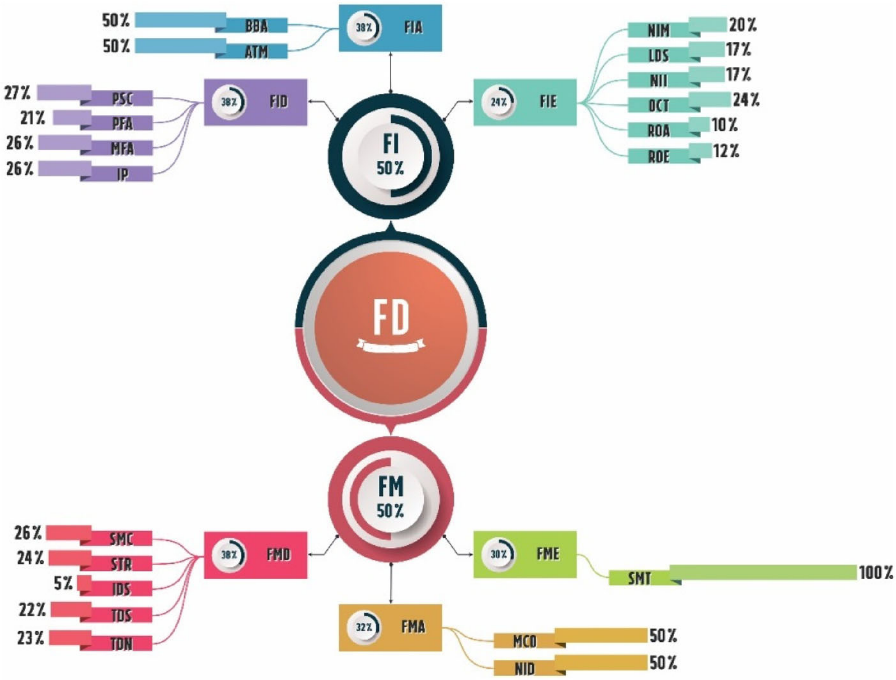

Figure 2. Algorithm to determine financial development indexes. Source: Own construction.

Financial development is defined as a combination of depth (size and liquidity of markets), access (ability of individuals and companies to access financial services) and efficiency (ability of institutions to provide financial services at a low cost and with sustainable revenues, and the level of activity of capital markets).

In this regard, we identified six indexes in order to calculate the degree of financial development, based on 20 indicators. The algorithm to determine these indexes is shown in Figure 2.

The financial institutions development (FI), measured in terms of depth, access and efficiency, is based on three indexes.

- *The financial institutions depth index (FID)* was determined based on the following indicators: Private-sector credit to GDP (PSC), Pension fund assets to GDP (PFA), Mutual fund assets to GDP (MFA) and Insurance premiums to GDP—life and non-life (IP).
- *The financial institutions access index (FIA)* was determined based on the indicators: Bank branches per 100,000 adults (BBA) and ATMs per 100,000 adults (ATM).
- As for the *financial institutions efficiency index (FIE)*, this index was determined based on six indicators: Net interest margin (NIM), Lending-deposits spread (LDS), Non-interest income to total income (NII), Overhead costs to total assets (OCT), Returns on assets (ROA) and Return on equity (ROE).

Financial markets development (FD), measured also in terms of depth, access and efficiency, is determined based on three indexes.

- *The financial markets depth index (FMD)* was calculated in terms of indicators: Stock market capitalization to GDP (SMC), Stock trade to GDP (STR), International debt securities of government to GDP (IDS), Total debt securities of financial corporations to GDP (TDS) and Total debt securities of nonfinancial corporations to GDP (TDN).
- *The financial markets access index (FMA)* was calculated based on two indicators: Percent of market capitalization outside the top 10 largest companies (MCO) and Total number of issuers of debt (NID), including domestic and external, nonfinancial and financial corporations.
- *The financial markets efficiency index (FME)* was calculated based on the indicator: Stock market turnover ratio (SMT) stocks traded to capitalization.

3.3. Model specification

In order to establish the causal relationship exerted by the financial development on environmental performance we will go through the following key steps: establishing the stationary data series (by applying ADF and PP unit root tests), using Canonical Cointegrating Regression to identify whether the variables included in the model are significant and if there is a cointegration relationship between these variables in the long run and, a final step, is the application of the Granger test, in order to establish the causal relationship between the variables.

The mathematical equation used to achieve the objective proposed in this study is the following:

$$lnEPI_t = \beta_1 + \beta_2 lnFIA_t + \beta_3 lnFID_t + \beta_4 lnFIE_t + \beta_5 lnFMA_t + \beta_6 lnFMD_t + \beta_7 lnFME_t + \mu_t \tag{1}$$

where *lnEPI* is the natural logarithm of the environmental performance index, *lnFIA* is the natural logarithm of the financial institutions access index, *lnFID* is the natural logarithm of the financial institutions depth index, *lnFIE* is the natural logarithm of the financial institutions efficiency index, *lnFMA* is the natural logarithm of the financial markets access index, *lnFMD* is the natural logarithm of financial markets depth index, *lnFME* is the natural logarithm of the financial markets efficiency index, $\beta_{(1,\dots,7)}$ are the coefficients associated to the independent variables, μ is the residual term and t is the time period.

4. Empirical results

In order to have a complete frame on the environmental performance and financial development in Romania, descriptive statistics was used for the variables in the model: *ln*EPI, *ln*FIA, *ln*FID, *ln*FIE, *ln*FMA, *ln*FMD, *ln*FME. Skewness measures the asymmetry of a distribution, its values between −1 and 2 indicate an approximate

Table 2. Descriptive statistics of the variables in the model.

	lnEPI	*lnFIA*	*lnFID*	*lnFIE*	*lnFMA*	*lnFMD*	*lnFME*
Mean	55.14242	0.420000	0.102500	0.546667	0.002917	0.040833	0.242083
Median	51.82719	0.470000	0.130000	0.615000	0.000000	0.045000	0.250000
Maximum	65.28786	0.690000	0.170000	0.740000	0.020000	0.080000	0.560000
Minimum	48.30924	0.150000	0.030000	0.250000	0.000000	0.010000	0.070000
Std. Dev.	6.387376	0.228111	0.043464	0.154966	0.006241	0.021042	0.161083
Skewness	0.436120	−0.077027	−0.419877	−0.517835	1.930520	−0.083295	0.956024
Kurtosis	1.547959	1.166948	1.643630	1.865643	5.361190	2.156013	2.734309
Jarque-Bera	2.869224	3.383812	2.544929	2.359376	20.48284	0.740066	3.726515
Probability	0.238208	0.184168	0.280140	0.307375	0.000036	0.690712	0.155166
Sum	1323.418	10.08000	2.460000	13.12000	0.070000	0.980000	5.810000
Sum Sq. Dev.	938.3671	1.196800	0.043450	0.552333	0.000896	0.010183	0.596796
Observations	24	24	24	24	24	24	24

Source: Own work.

bell-shaped curve. Kurtosis measures the peakness or flatness of the distribution, its values between 1 and 5 underline a peaked tendency of the distribution. The Jarque-Bera test was further run. According to the results of probability, the hypothesis of normal distribution was rejected for the variable *ln*FMA. The null hypothesis could not be rejected for the variables: *ln*EPI, *ln*FIA, *ln*FID, *ln*FIE, *ln*FMD, *ln*FME (Table 2).

The first step to be taken in order to analyse the causal relationship between the variables included in a model is to test the stationarity of the data series used. In this study, two-unit root tests, whose equations are presented below, were used—the Augmented Dickey-Fuller test—Eq. (2), and the test proposed by Phillips and Perron—Eq. (3).

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t \tag{2}$$

$$Z(\tau) = \tau\left(\frac{\hat{\sigma}2}{\hat{\sigma}_{sl}2}\right) - \left(\frac{1}{2}\right)\left(\hat{\sigma}_{sl}2 - \hat{\sigma}2\right)T\sqrt{\hat{\sigma}_{sl}2\sum_{t=2}^{T}\left(x_{t-1} - \bar{x}_{T-1}\right)^2} \tag{3}$$

The results of these tests are presented in Table 3. From Table 3, it can be seen that the data series are stationary for all variables included in the model. Therefore, we move on to the econometric analysis of the proposed model, in which we analyse the impact of financial development on the performance of the environment in Romania.

Given the stationary data series obtained previously, we can process the second stage of the analysis, identifying the cointegration relationships between the variables included in the model.

In order to identify cointegration relations, we used Canonical Cointegrating Regression (CCR) proposed by Park's (1992) which is very similar to Fully Modified Least Squares (FMOLS), but instead it applies stationary transformations of the data in order to obtain least squares estimates to remove the long run dependence between the cointegrating equation and stochastic regressors innovations.

Table 3. Unit root tests.

		Intercept		Trend and intercept		None	
		ADF	PP	ADF	PP	ADF	PP
lnEPI	level	−0.3539	−0.4414	−1.8215	−1.9512	1.7023	1.5531
	1st diff	−3.7298**	−3.7298**	−3.6241*	−3.6241*	−3.3929*	−3.3824*
lnFIA	level	−1.3840	−1.0206	−1.7536	−1.2965	−0.1246	0.4798
	1st diff	−1.9817**	−1.9974**	−2.0300**	−1.9432**	−1.9105**	−1.8332**
lnFID	level	−2.0252	−2.2597	−6.7359*	−5.3511*	1.2412	−1.0426
	1st diff	−13.3427*	−13.1569*	−13.0317*	−13.0317*	−12.4649*	−10.5308*
lnFIE	level	−0.6925	−1.0273	−4.2205*	−3.9505**	0.2436	0.0860
	1st diff	−4.7050*	−4.7050*	−4.3141*	−4.3141*	−4.5074*	−4.5264*
lnFMA	level	−0.4206	−0.1744	−1.2185	−1.0654	0.0000	0.3309
	1st diff	−6.1588*	−6.0396*	−6.8662*	−6.8390*	−5.9160*	−5.8113*
lnFMD	level	−1.7618	−1.8040	−1.6251	−1.7222	−0.1519	−0.2042
	1st diff	−4.1581*	−4.1581*	−4.1645**	−4.1645**	−4.1713*	−4.1713*
lnFME	level	−4.0315*	−2.0716	−1.3413	−1.4461	−1.8091**	−1.8661**
	1st diff	−1.7793**	−2.5754**	−2.4225**	−3.0360**	−1.7501**	−2.5366*

Source: Own work.

Table 4. Cointegration relations between the environmental performance and financial development.

Variable	Coefficient	Std. error	t-statistic	Prob.
lnFIA	−7.016936	1.166864	−6.013498	0.0000
lnFID	−115.4783	7.235488	−15.95999	0.0000
lnFIE	73.16374	0.968819	75.51849	0.0000
lnFMA	−79.94041	10.87371	−7.351713	0.0000
lnFMD	59.13240	4.291342	13.77947	0.0000
lnFME	33.33284	0.280471	118.8459	0.0000
C	22.71933	0.340998	66.62603	0.0000

Source: Own work.

Estimates based on the CCR are, thus, fully efficient and have the same unbiased, mixture of normal asymptotic as FMOLS.

We used prewhitened Quadratic-spectral kernel estimators of the long-run covariance matrices to estimate the cointegration relations. The first thing we note is that the VAR prewhitening has a strong effect on the kernel part of the calculation of the long-run covariances, shortening the Andrews optimal bandwidth.

As it can be seen from Table 4, all variables included in the model are statistically significant, given the value of the associated probabilities (p-value is 0.0000 for all the variables). The results emphasize a negative influence on the environmental performance index in the case of financial institutions, from the access index and depth index, while in the case of financial markets, the negative impact of the access index of financial markets can be observed. Moreover, the efficiency index, both in the case of financial institutions and financial markets, is generating a positive influence on environmental performance in Romania. The financial markets depth also positively influences the evolution of the environmental performance index.

Considering that the cointegration relations between all the variables included in the model were identified, we highlighted the causal relations between the variables and their direction, through the Pairwise Granger Causality test, in the last stage. Based on the obtained results, we summarized the relationships identified in Figure 3.

According to Figure 3, the evolution of the Environmental Performance Index (EPI) is influencing the evolution of FME and, at the same time, FIA, FIE, FME and

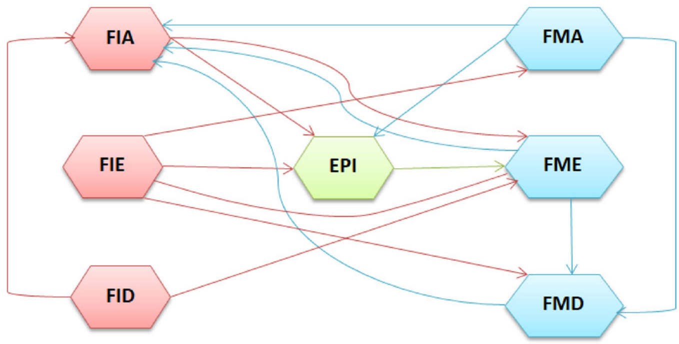

Figure 3. Causal relations between the variables and their direction. Source: Own construction.

FMA have an impact on the evolution of EPI. Also, it can be noted that the financial development indexes have a higher impact on the development of the financial markets' indexes, while the evolution of the financial markets' development is only influencing the development of the Financial institutions access index (FIA).

5. Discussions

Both hypotheses of our research are validated, showing that the financial development of the institutions and markets has a significant influence on the environmental performance, in Romania.

H1. It is possible to calculate financial development by aggregating six indexes in Romania. This hypothesis is validated, showing that significant results could be obtained when using composite indexes, as the development of the financial sector is very complex and, thus, it should be expressed in multiple and diverse forms. The importance of using composite indexes is also highlighted by Čihák et al. (2015) who believe that financial development is a multidimensional process and, several indicators need to be considered, in order to measure it. Moreover, Dasgupta et al. (2001) outlined the important contribution of the stock markets to stimulate an environmentally responsible behavior, as companies have to elaborate and implement social responsibility projects, including those of using green technologies.

H2. There is a causal relationship between the calculated financial development and the performance in the environmental field, assessed by the Environmental Performance Index, in Romania, for the period 1995–2018. This hypothesis is validated, because all variables included in the model are statistically significant, given the value of the associated probabilities (p-value is 0.0000 for all the variables). H2 could be divided into three subsequent hypotheses as follows.

H2.1. In the case of financial institutions, the access index and the depth index have a negative influence on the environmental performance index, while in the case of financial markets, the negative impact of access index of financial markets can be observed. The obtained results suggest that, in Romania, the financial institutions do not implement lending decisions, according to the best environmental policies. Furthermore, these results are in accordance with Aufderheide and Rich (1988), Schmidheiny and Zorraquin (1998), Dasgupta et al. (2001), Majeed and Mazhar (2019), Manta et al. (2020) who concluded that financial institutions grant loans on no environmental basis and this could further lead to the development of energy-intensive production processes and obsolete technologies, with a consequence in reducing costs and, at the same time, in increasing emissions. In the same view, Majeed and Mazhar (2019) outlined that financial institutions mainly pursue short-term goals, ignoring the effects on the environment.

However, this result is contrary to Ganda (2019) who noted that financial development, expressed in loans granted by banks to the private sector, contributes to the improvement of the quality of the environment.

Paradoxically, at first glance, it is the high value of the regression coefficient before the variable FID (Financial Institutions Depth Index). However, this can be explained by the fact that this index is the only variable in the model that defines a company's relationship with vulnerable stakeholder groups, its compliance to the principles of corporate social responsibility, in order to achieve sustainable development in accordance to the environmental policies.

Financing green technologies requires easy access to long-term loans and, in low-income economies, this is correlated with higher risks for the banks. Therefore, it could be difficult and expensive for the banks to always act pursuant to the environmental policies.

H2.2. The efficiency index, both in the case of financial institutions and financial markets, generates a positive influence on environmental performance, in Romania. The result emphasizes that financial institutions from Romania are willing to provide green loans and, thus, achieve sustainable revenues, as long as their performance indicators are increasing. Also, this result is in accordance with Abid (2016), Tamazian and Rao (2010), Zakaria and Bibi (2019), Shah et al. (2019), who concluded that the role of financial development in terms of emissions could be moderated by institutions. Thus, the existence of strong institutions could be a solution for environment protection through financial development by implementing the appropriate legal framework for environmental policies.

H2.3. The financial markets depth also positively influences the evolution of the environmental performance index in Romania. This result suggests that the larger the financial market in Romania is, the more the opportunities to provide resources for financing green technologies, which will further lead to greater environmental performance. Moreover, the results of this study confirm the results obtained by other scholars such as: Samreen and Majeed (2020), Saud et al. (2019), Park et al. (2018), Katircioğlu and Taşpinar (2017), Tang and Tan (2015) who concluded that an increase in financial development leads to an increase in innovation, research and development, together with the development and the application of technological innovations in energy, which will further lead to reduced carbon emissions and, thus, to the improvement of the quality of the environment.

Overall, it can be noted that the countries analysed in the similar studies have mostly emerging economies from the point of view of economic and social development like the analysed country. Therefore, the results obtained are all the more relevant and significant for the policymakers.

6. Conclusions and recommendations

The main findings of the present research reveal the impact of financial development, expressed under the dimensions of its institutions and markets, on the environmental performance in Romania, in order to emphasize the appropriate tools and measures to reduce the environmental degradation.

Although many studies have been conducted on the nexus between financial development and environment, the contributions of this study are innovative from at least two perspectives. Firstly, because the study aims to evaluate the nexus between financial development, expressed by multiple indexes of financial development, and environmental performance, expressed by the Environmental Performance Index (EPI), and not just by carbon emissions, as it was the case in other studies. Secondly, the study was carried out for Romania, for which this relationship had not been studied before, except for the regional analysis at the EU level or within Central and Eastern European countries.

The hypotheses of the study are validated by the obtained results. Thus, the results show that, in the case of financial institutions, the access index and the depth index have a negative influence on the environmental performance index while, in the case of financial markets, the negative impact of the access index of financial markets can be observed. The efficiency index, both in the case of financial institutions and financial markets, generates a positive influence on environmental performance in Romania. The financial markets depth also positively influences the evolution of the environmental performance index.

Furthermore, the evolution of the Environmental Performance Index (EPI) influences the evolution of FME and, at the same time, FIA, FIE, FME and FMA have an impact on the evolution of EPI. Also, it can be noted that the financial development indexes have a higher impact on the development of the financial markets indexes, while the evolution of the financial markets development are only influencing the development of the Financial institutions access index (FIA).

6.1. Theoretical implications

Charfeddine and Khediri (2016) identified an inverse U-shaped relationship between financial development and CO_2 emissions, so that the negative effects on the environment are greater in the case of lower financial development, but are reduced in the case of higher financial development. The findings of our research are useful for researchers, because they can represent a starting point for analysis with composite indexes in other countries, with different levels of economic and social development.

6.2. Practical policy implications

From a practical point of view, our research can help policymakers better understand the importance of defining green strategies to reduce the negative effects of the carbon emissions on the environment. The role of these strategies is also highlighted in many studies (Jiang & Xiaoxin, 2019). Such strategies could determine the governments to choose the use of various ecological projects, through which to achieve an orientation of the industry towards the use of green energies. These would create a foundation for a safer environment, an increased interest for starting green businesses and, also, would ensure an opportunity for an additional income, at least.

Today, the diversity of environmental issues increasingly demands the participation of society, as a whole, with the involvement of both public and private companies. To make technological progress in this regard, policymakers must engage research in universities and corporations and, at the same time, enhance applications in both the public and the private sectors.

Another practical policy implication of our study is that in order to reduce environmental degradation caused by carbon emissions, in a developing country like Romania, policymakers should strengthen the country's institutions and then enable them to function effectively. Furthermore, the efficient functioning of institutions in a country will provide adequate laws and regulations, as well as methods to fight corruption. This will further lead to the decrease in carbon emissions and to the improvement of environmental conditions. Moreover, the adoption of an appropriate legislation could stimulate the consumption of green energy, which has low environmental problems.

Despite the general opinion and according to Wendling et al. (2020), '*many Eastern European countries also exhibit strong climate change performance, in part due to the prominence of nuclear energy and hydropower*'. Also, the authors emphasize the fact that '*Romania, for example, now sources 38% of its electricity from renewable energy and is home to the largest onshore wind farm in Europe*'. Therefore, the future seems to be optimistic and the resources of an Eastern European developing country, like Romania, are endless. Still, it is to be seen whether the policymakers will adopt and implement the appropriate measures on a regular basis to further strengthen the environmental performance.

6.3. Limitations and future research directions

The present research is based on a single country analysis. As there is no other study elaborated so far, the research gap is thus covered and the estimation method used (CCR) is not available in panel settings.

Regarding future research directions, more variables can be added, that impact the degradation of the environment, such as: tax specific reforms, investment policies and corruption control. Additionally, the sample structure could be diversified and could include comparisons of environmental performance in other countries with different levels of economic development.

Disclosure statement

There are no competing interests to declare.

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