

Measuring the impact of green finance on poverty reduction: Project of an empirical method

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Abstract: - The paper aims to determine the impact of green finance on poverty reduction in selected countries of the CEE region (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Poland, and Serbia), from 2016 to 2020. Linear regression analysis was used to determine the impact. The results showed a significant positive impact of the economic and financial green finance development dimensions on poverty reduction, while the impact of the environmental dimension was significantly negative. In addition, based on the findings, green finance has a significant and positive impact on poverty reduction. The paper points out that raising the degree of green finance development can help reduce poverty.

Key-Words: -Consumption expenditure, Green finance, Inflation rate, Linear regression, Renewable energy, Reduction poverty.

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1 Introduction

Basically, the green economy implies bringing ecology into all aspects of life, from basic elements such environmentally friendly clothing to environmentally friendly shoes and environmentally friendly building materials, all of which are components of stability. "Sustainability is understood as a dynamic balance in the economic, environmental and social spheres to meet all human needs for all generations at all times" [1]. "Sustainability is a relatively new concept that has gained widespread recognition and support in recent years, and this trend is likely to continue" [2]. It is critical to evaluate the benefits of implementing an environmentally friendly economy, and by implication sustainable finance, in humanity as well

as its many benefits to environmental protection, ranging from increasing quality of life to creating profits, as a means to reach the sustainability criterion. Although humans are getting becoming more mindful of a variety of environmental and social concerns, habits haven't altered dramatically [3]. The UN projects that expenditures in the energy industry will top \$300 billion over the course of twenty years (by 2050), highlighting the need of implementing environmentally friendly programs. According to various projections, the green economy could bring about among twenty and sixty-five million additional jobs [4]. Currently, little over fifteen million individuals engage in one of the European Union's member states in professions that are directly or indirectly related to the sustainable

economy. Based to these data, every nation must provide the circumstances for the expansion of the sustainable economy and sustainable finance, since these ideas will become a requirement instead of an option in the years to come [5]. It is the producer's obligation to incorporate the expenses of resource usage into the total price of manufacturing by pricing natural resources that are renewable, regardless of how this affects earnings slightly. The term "green economy" originated in the late 1980s that relates to the conservation of the environment in all aspects of human growth. It gradually gained significance, particularly in the 2030 Strategy for a Sustainable Development. Meeting the agreed Sustainable Goals, that seek to encourage decent job opportunities, an economy that is equitable, and other features that might contribute to an improved society, is critical for many financially developing nations [6]. The green economy is a step forward because it is an achievable and flexible method that may assist to achieve sustainable growth in all of its elements, including preservation of the environment through reusing and its beneficial effects on hiring and poverty reduction (via job creation) [7]. The environmentally friendly economy should not be a barrier to financial growth, instead being a fresh motivation, a source of high-quality employment opportunities, and an important weapon in the battle against inequality. Many academics, practitioners, and policymakers have advocated for sustainable development through debates regarding the disagreements between the environment and economic expansion, in addition to the three primary elements that make up sustainable development - preservation of the environment, inclusion in society, and economic expansion - and the five principles - people, prosperity, planet, partnership, and peace - which are central to the 2030 Agenda [8]. Yet there are additionally assertions that improving the economy may not only result in a fall in revenue but also fail to reduce unemployed people, notably because the goals of sustainable development and economic growth are contradictory [10].

In the opinion of Jiang et al [11], there is a dearth of research into the connection between financial growth and poverty elimination. The contributors of this article wished to undertake an identical research project for the same objective. The study aims to assess the influence of green money on poverty alleviation. As a result, the purpose of this study is to look at how green financing influences poverty reduction in six CEE countries (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Poland, and Serbia). To do credit to the purpose of the study, the thesis was created such that after the opening presentation,

in which the object and aim of the research were defined, the research technique is detailed in the second portion. The third section covers the study's results and an examination of the findings. The last section of the paper discusses the major results of the study and practical consequences, highlights some limits, and gives recommendations for further research on this issue.

1.1 Literature review

The United Nations Environment Programme (UNEP) describes environmentally friendly finance as a rise in cash flows (from financial institutions, micro lending, insurance, and expenditures from the public, private, and non-profit sectors) that are consistent with the objectives of the Sustainable Development Goals [12]. The main aim is to more effectively manage social and environmental hazards by capturing opportunities that provide high rewards, environmental benefits, and improved responsibility [13]. Simply expressed, sustainable finance is the use of current capital markets to create and distribute a wide range of financial products and services that make refunds, are investable, and have a beneficial environmental impact. To encourage ecologically good investments while discouraging environmentally detrimental ones, environmental externalities must be internalized and risk perceptions changed. Green finance can be preferred over traditional investments that contribute to harmful patterns of growth by promoting green financing on a large and financially viable scale. The emphasis might be on greening existing infrastructure investments or encouraging new investments in critical sectors such as renewable energy, environmentally friendly transportation, managing natural resources, the environment, sustainable tourism, ecosystem services, and pollution prevention and control. To accommodate the increased demand, fresh financial entities such as green banking institutions and environmental funds, as well as new financial products including carbon trading instruments and green debt, are being developed. These organizations and tools serve as green finance in their totality. Green finance can be supported through increased investment in clean and green technologies, changes to national regulations, integrated public financial incentives, more green financing from various sectors, funding for an environmentally friendly economy that is based on natural resources, and a low-carbon economy. The assessment of sustainable finance is a major problem, as evidenced by the related research. A review of the literature in this field reveals that some research

assess the green finance index [14]; others replace additional indicators [15]; and a third study investigates the global structure using sophisticated network architectures [16][17]. Jiang et al. [11], for example, employ the entropy weighting approach to evaluate the growth of green financing in 25 Chinese provinces and districts. The scholars cited above underline the relevance of all three elements of sustainable finance (financial, monetary, and environmental) in developing green economy indicators. It may be stated that there are now insufficient criteria to allow effective monitoring of the growth of green financing, which may make it hard to adopt appropriate legislation. When investigating the impact on environmental finance, however, researchers adopt two approaches. The first line of study investigates how certain variables have influenced green finance [11][18-22], whereas the second line of research investigates how green money has impacted certain factors [16][23]. The financial system is crucial to economic growth because it enables a large number of financial transactions [24]. Poverty alleviation is an important concern for all nations, particularly growing economies, and international agencies like the World Bank and the International Monetary Fund have included reducing poverty goals into the majority of their development initiatives [25]. In accordance with theoretical terms, there are two manners in which financial advancement might effect poverty. The first approach demonstrates how economic growth impacts poverty by increasing the availability of banking services for the poor [26][27]. The second approach contends that when the banking sector boosts levels of investment, it indirectly decreases poverty by increasing economic growth [28]. Previous study appears to be predicated on the implicit notion that poverty naturally reduces as financial development fosters growth. However, some say that financial development leads to crises in finance and an unstable socioeconomic surroundings, both of which are detrimental to the poor [15][29]. Previous study appears to be predicated on the implicit idea that as financial development accelerates growth, poverty would inevitably decline. However, some contend that financial progress is linked to crises in finance and a volatile socioeconomic surroundings, the two of which are detrimental to those in poverty [30]. On the whole, theoretically poverty analysis indicates a somewhat ambiguous link between economic expansion and poverty alleviation. A survey of the relevant literature

finds that only a few articles, including Jiang et al [11] and Hafner et al [15], investigate the link between green financing and poverty alleviation. According to the authors (Jiang and Hafner), there is a good relationship between green financing and poverty reduction. However, as previously stated, there are additional studies looking into the connection among economic growth and poverty alleviation, with certain academics reaching various conclusions about the effect of monetary growth on lowering poverty rates based on the sort of example and statistical techniques used. One set of academics emphasizes the beneficial effects of economic growth on poverty alleviation [31][32]. Another set of research suggests a negative correlation between economic growth and poverty alleviation [33][34]. The third set of experts suggests a nonlinear correlation among economic growth and poverty alleviation [35][36]. Furthermore, Claessens and Perotti [37] and Naceur and Zhang [38] argue that financial progress may have a detrimental influence on poverty alleviation. As a result, there is no consensus among academics on how economic growth helps alleviate poverty, and there is little research to determine how sustainable finance could affect the decrease in poverty.

2 Problem Formulation

The paper used a similar method to the Jiang et al. [11] method. In the first step, the mentioned authors calculate the green finance development indicator, and in the second step, they measure the impact of that development on poverty reduction. The indicator of the development of green finance is considered in the paper as a multidimensional construction, which includes economic, financial, and environmental dimensions. For the configuration of the green finance development indicator, seven indicators were used, namely two indicators for economics, three indicators for financial, and two indicators for the environment. For comparability, the data was standardized using the Z-score method. The green economy indicator is calculated as the arithmetic mean of the mentioned three dimensions of green finance development. This methodology was also used in earlier research on the green economy and related concepts [39-42]. For research purposes, data from various sources were used. Dimensions, indicators, attributes, and data sources are shown in Table 1. The dependent variable in the model is the poverty level. Due to the availability of data, for the observed group of countries i.e. selected countries of the Central and Eastern Europe (CEE) region:

Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Serbia, and Poland), the indicator households and Non-Profit Institutions Serving Households (NPISHs). Final consumption expenditure per capita was used as a proxy for the poverty level variable. The independent variables in the first model are the economic, financial, and environmental protection dimensions, and in the second model the indicator of the development of green finance. Due to the availability of data, the selection of data refers to the period 2016 - 2020. The total number of observations is 30.

Table 1. Description of research variables, attributes, and data sources

Dimension	Indicator	Attributes	Source
Economics	GDP per capita (current US\$)	+	The World Bank
	Inflation rate	-	World Data.info
Finance	Number of banks	+	Raiffisen research (2020);
	Loans	+	Delloite (2022)
	Deposits	+	
Environment	Renewable energy consumption (% of total final energy consumption)/(Loans + Deposits)	-	The World Bank
	CO ₂ emissions (metrics tons per capita)/(Loans + Deposits)	-	The World Bank
Poverty reduction	Households and NPISHs Final consumption expenditure per capita (constant 2015 US\$)	+	The World Bank

Source: The World Bank, Raiffeisen research

The descriptive statistics for the research's variables are displayed in Table 2. The largest dispersion of results was recorded in the variable number of banks, and the smallest in the consumption expenditure.

The mean value of variable loans is 53.0567, variable deposits 66.2667, variable GDP 10.006.7, inflation rate 1.9670, renewable energy consumption 26.0770, CO₂ emission 5.5367, and variable consumption expenditure around 5.477. More detailed information is shown in Table 2.

Table 2. Descriptive statistics

Variable	Min.	Max.	Mean	Std. Deviant
Loans	31.6	82.20	53.0567	11.9071
Deposits	41.7	88.60	66.2667	14.3786
GDP	4.53	18.000	10.006,7	4.43242
Inflation	-1.05	5.06	1.9670	1.18447
Renew. energy consume.	11.1	44.58	26.0770	9.62027
CO ₂ emission	1.50	8.20	5.5367	2.09655
Consume. Expend.	3.26	8.8190	5.47703	1.94541

Source: authors research

Multiple linear regression was used to determine the impact of green finance development dimensions on poverty reduction, in the form (equation 1):

$$Y_i = \alpha + \beta_1 X_{1,i} + \beta_2 X_{2,i} + \beta_3 X_{3,i} + e_i, \quad i = 1, 2, 3 \dots, n \quad (1)$$

where: Y_i – dependent variable (poverty reduction), α – constant, β – coefficient for the corresponding independent variables: X_1 - economic dimension, X_2 - financial dimension, X_3 - environmental dimension, e .i. – deviation from the functional relationship; n – sample size.

Simple linear regression was used to determine the impact of green finance development indicators on poverty reduction, in the form (equation 2):

$$Y_i = \alpha + \beta_1 X_{1,i} + e_i \quad (2)$$

where: Y_i – i-th dependent variable (poverty reduction), α, β - unknown parameters are called regression parameters, $X_{1,i}$ - independent variable (green finance development indicator).

3 Problem Solution – Empirical results and discussion

The findings, presented in Table 3, indicate that the observed group of countries' progress in green finance during the observation period from 2016 to 2020 has been inconsistent. With a positive average value for the study period of 0.86, Croatia had the

best performance, followed by Bulgaria (0.38) and Poland (0.32). Serbia (-0.65), Albania (-0.55), and Bosnia and Herzegovina (-0.3) all had negative mean values for the observed indicator. Notably, the EU member states achieved better performance of the observed indicator, compared to non-EU states. These results are not shocking, considering that the EU's member states have (mostly) stronger economies than less developed nations like Serbia, Albania, and Bosnia and Herzegovina, which allows the economy stronger countries to participate in sustainable development for longer.

Table 3. Indicator of the development of green finance, for the observed group of countries, in the period 2016-2020

Country	2016	2017	2018	2019	2020
Albania	-0.39	-0.32	-0.52	-0.86	-0.68
Bosnia and Herzegovina	-0.40	-0.31	-0.34	-0.47	0.02
Bulgaria	0.35	0.43	0.41	0.24	0.48
Croatia	1.12	1.01	0.69	0.53	0.95
Poland	0.03	0.13	0.13	0.32	0.70
Serbia	-0.64	-0.75	-0.80	-0.77	-0.30

Source: authors research

Multiple linear regression was used to determine the impact of each of the dimensions of green finance development indicators. The dependent variables in the model are the economic, social, and environmental dimensions of the green finance indicator, and the independent variables are the logarithmic value of consumption expenditure. According to the value of the coefficient of determination (Adj. R²), the first model explained about 48% of the dependent variable, the second model about 73%, and the third model about 81% of the dependent variable. In addition, the values of the F statistic indicate the significance of all three models (p < 0.05).

Table 4. Multiple regression results

Variable	Model 1	Model 2	Model 3
Economics	.705(5.255) ***	.503 (4.841) ***	.300 (- 2.795)**
Finance		.542 (5.214) ***	.729(5.635) ***
Environment			-.619(- 3.355)***

Adj. R ²	.479	.731	.805
F	27.616	40.316	40.838

Note: *** - p < 0.01; ** - p < 0.05

Source: authors research

The results of multiple linear regression (Table 4) show that all three dimensions of green finance development indicators are significant determinants of poverty reduction. Namely, the economic and financial dimensions significantly and positively influence poverty reduction, while the impact of the environmental dimension is also statistically significant, but negative. The obtained findings cannot be compared with the findings of other studies, because, as far as the authors are aware, based on the review of the relevant literature, other studies did not deal with issues of the relationship between poverty reduction and green finance development indicators at a dimensional level.

The impact of green finance development indicators on poverty reduction was examined using simple linear regression. The dependent variable in the model is the logarithmic value of consumption expenditure, and the independent is an indicator of the development of green finance. According to the value of the coefficient of determination (Adj. R²), the model explained about 54% of the dependent variable. In addition, the values of the F statistic indicate the significance of the model (p < 0.05).

Table 5. Simple linear regression results

Variable	Adj. R ²	F	β	t
Green finance development indicator	.543	35.463***	.748	5.955***

Note: *** - p < 0.01

Source: authors research

The results of the linear regression (Table 5) indicate a statistically significant positive impact of indicators of green finance development on poverty reduction (β = 0.748; p < 0.05). The observed results of the authors are consistent with those of the study by Jiang et al. [10], who found a strong and positive link between the development of green finance and the reduction of poverty.

4 Conclusion

The paper aimed to determine the impact of green finance development indicators on poverty reduction in selected countries of the CEE region, in the period

from 2016-2020. For the research, an indicator of the development of the green economy was constructed. Based on the value of the obtained indicator, it can be concluded that the development of green finance in the observed group of countries is uneven, with Croatia having the best score, while Serbia is in last place. The obtained results indicate that the economic and financial dimensions have a statistically significant and positive impact on poverty reduction, while the impact of the environmental dimension is significant and negative. In addition, the results showed that the green economy development indicator has a significant positive impact on poverty reduction.

Since the research results indicate a positive and significant relationship between the level of green finance development and poverty reduction, which means that higher levels of green finance lead to greater poverty reduction, financial institutions should work to further develop financial innovations, such as green loans or green finance bonds. Empirically, this study contributes to existing knowledge related to the measurement of green finance development and the relationship between dimensions of green finance development indicators and poverty reduction.

The lack of current data, which makes it impossible to examine recent performance and trends in the advancement of the green finance development indicator, is a limitation of the current study. In this sense, further research on this topic is needed, which would include more recent data, but also more indicators of the development of green finance, such as green credits, green insurance, or green securities. Additionally, the current research covers only selected countries in the CEE region, while future research could cover more countries, both developing and developed and compare their results with the results of the current research. By examining specific green finance laws and actions at the level of individual countries, as well as closely monitoring the performance of green finance over time, more analysis can be conducted in this area to determine the precise causes of observed disparities between countries.

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