The Influence of Green Finance on Social Development and Ecoefficiency

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ABSTRACT

This research utilized the Tobit regression model to examine the ecological productivity of Jordan and the influence of green financing on the nation's natural resources. This analysis encompasses several explanatory variables: regional eco-efficiency, availability of natural resources, and green financing. The data in this article were derived via calculations and an analysis of Foreign Direct Investment (FDI) based on the parameters outlined the reserch. To address autocorrelation and multicollinearity, we employed an approach that aggregated the logarithmic values of all variables from 2015 to 2024. The ecological efficacy of a nation exhibits an inverse correlation with resource quantity. A statistically significant inverted U-shaped pattern of resource availability exists in Jordanian regions. The eco-efficiency of the region in Jordan enhances due to foreign direct investment (FDI), contingent upon the consideration of adjustment factors.

Keywords: Ecological Efficiency, Green Finance, FDI, Economic & Social Development.

1. Introduction

According to scholarly literature, the ultimate objective of eco-efficiency is to optimize economic production while simultaneously minimizing ecological imprint and resource utilization. According to Kuosmanen, Bijsterbosch [1], the current focus of eco-efficiency research has shifted towards the improvement of social services rather than solely prioritizing economic considerations. Previous research has predominantly neglected the examination of individuals within the environment. Furthermore, it is worth noting that the scope of indicators used to assess economic, social, and environmental aspects has evolved from a two-dimensional framework to a more comprehensive three-dimensional framework [2, 3]. Current assessments of human productivity have failed to consider essential aspects of the human experience. Gross Domestic Product (GDP) is regarded by scholars as a comprehensive measure of final economic output, notwithstanding the utilization of intermediate indicators within the framework of ecological economics [4]. One of the declared objectives of sustainable development is the enhancement of human well-being [5]. According to Abreu, Alves [6], the swift economic and social advancements in China, along with the

concurrent environmental conservation endeavors, have resulted in an adverse effect on the country's level of living.

The scholarly discourse exhibits a notable lack of attention towards the subject matter of green finance and environmental efficiency. The investigation of most of these topics is often conducted indirectly, with varying levels of effectiveness, due to the interrelatedness of environmental preservation, economic and social advancement, and the modernization of industrial goods. There is a lack of consensus regarding the ultimate outcome of the eco-economic system, as the enhancement of the assessment index system and the expansion of the eco-efficiency domain have not been accomplished. The eco-efficiency of two prominent regions in Jordan has been examined through the utilization of the Tobit regression model over the period spanning from 2015 to 2024.

2. Literature Review

According to the definition provided by Mickwitz, Melanen, Rosenstrom, and Seppala (2006), eco-efficiency serves as a metric for evaluating the effectiveness of sustainable development endeavors that seek to diminish human impact on the Earth's natural resources while maintaining product quality. The response of management to waste issues in contemporary production processes has led to the emergence of eco-efficiency as a prominent approach for organizations aiming to attain sustainable development through measurable methods. The development of eco-indicators is crucial for enhancing human well-being and preserving ecological systems, as it enables a more comprehensive comprehension of the situation and facilitates the decision-making process. In recent years, the establishment of eco-efficiency indicators for products has been imperative in the pursuit of attaining sustainable growth. There exist various challenges to achieving sustainability; however, these can be surmounted by considering the comprehensive economic and environmental ramifications of a product throughout its complete life cycle, incorporating the discounted effects of future activities, and consolidating multiple indices of environmental harm into a unified metric [7].

The relationship between the long-term performance of a corporation and environmental conservation is contingent upon the utilization of eco-efficiency indicators [8, 9]. In contemporary times, enterprises encounter heightened levels of expectation to optimize their societal, economic, and environmental impacts. Enhancing environmental performance constitutes but one element in the broader pursuit of attaining sustainable development. If the Earth as a whole lacks sustainability, then it logically follows that no individual component of it can possess sustainability. Consequently, the efficacy of the indicators will be contingent upon their ability to contribute to sustainable development at a global level. From a sustainable development standpoint, it is imperative to conduct a thorough evaluation of the utilization of eco-indicators. Academics and policymakers, as indicated by [10] and [11], are required to engage in ongoing discussions regarding the integration of eco-efficiency concepts and indicators within their respective fields. The utilization of eco-efficiency analysis as a medium of communication is a highly effective approach that employs a comprehensive and scientifically grounded framework for evaluating environmental impacts [12]. Insufficient or absent data can significantly contribute to the creation of inaccurate judgments. According to [10] and [11],

one potential approach to tackling the issue is the development of a comprehensive framework for systematically assessing environmental, economic, and social factors.

One of the primary obstacles encountered when attempting to assess the environmental performance of a specific region or nation lies in the development of a standardized metric that can effectively measure eco-efficiency. The extant body of literature serves as a valuable resource for this objective. Recent study has focused on examining the definition and significance of eco-efficiency measures. Various approaches have been developed to evaluate eco-efficiency, including energy analysis, index systems, material flow analysis, ecological footprint assessment, and data envelopment analysis ([13-15].

Material consumption encompasses all the acquisitions made by a business, encompassing both purchases and supply of raw materials [16] . The implementation of green production methods results in a reduction in the quantity of resources required for the manufacturing of a product. The objective is to enhance productivity while reducing expenses. Consequently, the output can be enhanced, and resource utilization can be reduced while maintaining the same quantity of raw materials. Energy is an essential constituent as it functions as a facilitator for many processes and acts as a primary provider of both thermal and electrical power. Additional alternative energy sources that warrant investigation are biomass, nuclear power, hydropower, lignite, coal, oil, and gas [17]. When evaluating energy footprints, it is beneficial to consider indicators such as annual energy consumption, energy consumption per unit of production, and energy savings resulting from efficiency initiatives. There are two methods for tracking emissions: on an annual basis and per unit of output. The determination of emissions to the air, water, and soil can be conducted separately. The study conducted by [18] incorporates values pertaining to energy generation, steam generation, and transportation. It is necessary to consider the global warming potential (GWP) of additional greenhouse gases such as O2, SF6, N2O, and CH4 in order to accurately determine the total CO2-equivalent emissions [19] (Van Gerven, Block, Geens, Cornelis, & Vandecasteele, 2007).

2.1 Variable selection

The variable were selected by anlysing the existing publications on the subject matter keeping in view the context of the present reserch and valaiblibity of the data. The details and justification of the variables are provided brefily as under.

2.1.1 Green finance (FinGr):

Economies on a global scale are actively endeavoring to adopt and improve sustainable practices in their operations. The green finance sector in Jordan is seeing growth, with increased investments being allocated towards initiatives aimed at environmental preservation. The green development paradigm encompasses the allocation of societal resources towards ecological building, restoration, and pollution management. Chang, Ji [20], assert that the primary objective of green financing is to expedite the advancement of industries that prioritize environmental sustainability, mitigate environmental risks, and enhance the environmental performance of organizations. According to Inderst [21], the implementation of green investments is crucial in promoting environmentally sustainable manufacturing methods, establishing protected areas for natural preservation, and

mitigating the adverse impacts of water, air, and sewage pollution. With a focus on enhancing ecological efficiency, the financial market serves as a mechanism for directing money into sectors that prioritize ecological construction, pollution reduction, ecological restoration, and overall environmental improvement. The use of green financial solutions in Jordan has experienced a recent surge, as indicated by [22]. Green credit is widely acknowledged as a key and innovative kind of financing within the realm of sustainable economics. According to Zheng, Deng [23], the utilization of green credit can serve as an effective means to accurately represent advancements in green economic development.

2.1.2 Economic social development (recof):

GDP per capita is used as a proxy for economic growth in this analysis. The Retail Price Index (RPI) and 2012 are used as anchor points in the model. To preserve dimensional consistency between the true value of per capita GDP and the eco-efficiency of the regions, the variable is correctly transformed into logarithms [24]. Preserving the co-integration relationship between variables is a goal of efforts to reduce heteroscedasticity in a dataset.

2.1.3 Industrial development (IDEV):

The determination of industrial growth rate is frequently deduced from extant research through the examination of the relative contribution of tertiary industries to the broader process of industrialization. According to Wang and Wang [25], historical data suggests that there has been a variation in the levels of primary, secondary, and tertiary energy consumption, with some periods characterized by lower levels and others by higher levels. Hence, the tertiary level of education offers the most suitable environment for comprehensive examination of industrial progress. The service business has had positive implications from the evolving preferences of customers, which can be attributed to the concurrent increase in disposable incomes. The advancement of state-of-the-art scientific knowledge and the expansion of primary industry both played pivotal roles. As the economy progresses and scientific and technological advancements occur, numerous industrial processes undergo a transition from initial to subsequent stages [26] . This article extensively employs citations from other scholarly research to substantiate its arguments and findings, as its core emphasis rests in examining eco-efficiency within a regional context. According to Berrou, Dessertine [27], while doing a comparative analysis of the environmental impacts associated with various enterprises, it is commonly seen that the secondary sector tends to have the highest level of detrimental effects. The study's emphasis on the stage of industrial development is exemplified by the significance of the secondary sector in contributing to regional GDP. According to Lisha and Abdullah [28], a higher ratio would significantly amplify the environmental impact in either way.

2.1.4 Foreign direct investment (FDI):

Gulf investments substantially enhanced the expansion of Jordan's economy until 2006. The worldwide economic crisis and geopolitical instability have subsequently restricted foreign direct investment. The repercussions of Covid-19 have markedly worsened health outcomes and financial stability. The World Investment Report 2023 by UNCTAD reveals that FDI inflows surged by 82.9%, attaining USD 1.32 billion in 2022, surpassing pre-pandemic levels. In the same period, foreign direct

investment was USD 38.38 billion, accounting for 78.6% of GDP. The Central Bank of Jordan reported that foreign direct investment totaled USD 776 million in the first half of 2023, marking a 20.9% growth from the prior year. The emphasis is on tourism, financial services, and residential/commercial real estate as primary priorities. Revitalizing Jordan necessitates augmented foreign direct investment and an emphasis on sustainable development. The construction, real estate, and oil and gas industries of Jordan have a deficiency in innovation, decarbonization initiatives, and employment generation, despite an FDI stock-to-GDP ratio surpassing 80%. Recent sectoral foreign direct investment seems to correspond with national factor endowments.

The industries of renewable energy, commercial services, finance, health services, transportation and logistics, and ICT in Jordan exhibit a greater ability to attract foreign investment than the manufacturing and construction sectors. These firms possess the capacity to augment production, foster a low-carbon economy, and offer enhanced employment prospects for Jordanian women and youth, especially those with advanced degrees. The advantages of Jordan make high-skilled tradable services, apparel, and chemicals appealing investment prospects. Jordan's sectors attracting foreign direct investment encounter obstacles due to export and investment limitations resulting from a restricted market, a current account deficit, and limited participation in intra-regional trade. The commencement of services may yield benefits for Jordan Vision 2025 and numerous other national programs. International investment can improve Jordan's commercial services, distribution, infrastructure, and tourist sectors, despite current limitations.

To achieve sustainable recovery, foreign firms must concentrate on enhancing their strengths and attracting foreign direct investment into high-potential industries. Throughout the pandemic, Jordan witnessed a markedly reduced rate of permanent closures among foreign enterprises, with the incidence being six times lower than that of domestic businesses. Like other multinational corporations, they swiftly reinstated operations that had existed prior to the outbreak. Jordanian international affiliates demonstrate superior productivity, offer enhanced pay, employ a greater percentage of women, and provide more training than their domestic counterparts, despite receiving a lower bonus for green business performance. The benefits of foreign direct investment spillover are unlikely to be significant. A considerable quantity of tiny, antiquated, and inefficient domestic firms confront challenges from global competition and fail to operate effectively due to inadequate competitive pressure. Reforming competition could significantly diminish the high operational expenses incurred by enterprises in Jordan, especially regarding energy expenditures. Such an action would promote a more dynamic private sector, allowing for a more effective allocation of resources and improving labor mobility to better leverage foreign direct investment spillovers.

Legal and regulatory limitations further restrict the impact of FDI on Jordan's sustainable development. The impact of FDI on Jordan's sustainable development is further restricted by factors such as distortions in high-wage settings, insufficient collective bargaining rights, cumbersome procedures for hiring foreign talent that affect job quality and skills development, protracted startup and financing processes that impede productivity and innovation, legal loopholes that obstruct women's participation in the labor market relevant to gender equality, and land shortages that hinder

renewable energy projects essential for emission reduction. The administration must ensure that the policy framework corresponds with the government's goal of leveraging investment to foster sustainable growth after substantial sector reforms.

Intergovernmental coordination is crucial for enhancing investment structures and promoting sustainable development. Vision 2025 delineates Jordan's meticulously formulated strategies. Sustainable development initiatives often emphasize the significance of private and international investment [29]. Numerous domains of sustainable development require a cohesive strategy. Enact gender equality and productivity legislation autonomously, without consideration of other jurisdictions. Jordan possesses the capacity to augment sustainable investment and stimulate growth. A comprehensive plan and strategic platform must be accessible to all governmental and business stakeholders dedicated to augmenting the sustainable development benefits of foreign direct investment.

There exists a lack of coordination in sustainable investment policy in Jordan. Attaining strategic alignment at the highest political level may require the formulation of specific strategies. The Investment Council of Jordan includes a labor minister within its framework. Entities of a higher order may hold considerable significance. The creation of a Ministry of Investment (MoI) in 2021, responsible for managing all investment-related affairs and entities like the Jordan Investment Commission and the Public-Private Partnership Unit, signifies a crucial preliminary measure to improve coordination and simplify licensing processes. Insufficient coordination and teamwork obstruct sustainable investment initiatives. The Ministry of Investment should improve investor perceptions by collaborating with other authorities to develop and execute policy.

Governments can sustain foreign direct investment by offering strategic financial and technical support, along with information and facilitation services. The predominant mechanisms affect foreign direct investment, employment, and the expansion of small and medium firms, suggesting that Jordan's policy framework is consistent with its goals. Policies encourage investment in renewable energy and offer training for low-skilled industrial jobs [30]. It is recommended that the policy framework be changed gradually in response to new economic opportunities and constraints in Jordan, changes in global foreign direct investment trends, improvements in digital technology, and the effects of climate change . This will help create an economy that is more inclusive, sustainable for the environment, and based on knowledge, with a bigger service sector that can be traded. Tax and financial incentives aim to encourage foreign direct investment in Jordan; nevertheless, their effect on corporate performance is frequently negligible. Changing investment incentives that lead to high carbon emissions or low productivity could make tax breaks more useful by replacing them with criteria that promote sustainability. For example, a new tax incentive was created to encourage Jordanian women to work in the industrial sector. The Ministry of Investment can offer critical insights to domestic and international investors concerning sustainability rules, ethical business practices, and the significance of supply chain due diligence by enhancing the Jordanian National Contact Point [31, 32]. This research presents a comparative analysis of the research conducted by multiple specialists, including [33], utilizing the FDI to GDP ratio as a key metric.

3. Research Design

3.1 Source Data

The data for the present research has been extracted from the "Statistics Handbook Jordan 2015-2024." The scale was constructed using previous research. The details of these are presented in Table 1.

Table 1. Development of Scale for present research

	Indicator	**Sources**	**Unit of measurement**
Indicators for input	Pollution	Water	Sewerage Discharge in thousand KG
		Air	Demand for commercially produced Oxygen in thousand KG
			Cabon-di-Oxide in thousand KG
			Emission of dust in thousand KG
		Solid Waste	Production of Garbage in tones
	Consumption of energy & Utilization of Natural Resources	Water	The net amount of water Utilized measured in (10,000 cubic meters)
		Energy	kilowatt-hours per dollar energy consumption
		Land	Construction land (Km2)
Indicators for output	Economic & Social Development of the country		Gross Domestic Product in a million

4. Results & Discussion

This research employs the variables of green financing (FinGr), natural resource availability (ResNat), and regional eco-efficiency (RECOF) to explain the phenomenon under investigation. In this article, we use the criteria listed in table 1 to get values for DevES, IDEV, and FDI. Taking the log values of all the variables from 2015-2024 helped us get rid of autocorrelation and deal with multicollinearity difficulties. The following is the regression equation that we constructed:

$$\ln CECOF_i = \alpha + \beta 1 \ln FinGr_i + \beta 2 \ln ResNat_i + \beta 3 \ln DEVES_i + \beta 4 \ln IDEV_i + \beta 5 \ln FDI_i + \mu \text{----------} (1)$$

Table 2. Descriptive Statistics

Description of Variables	**Variable Symbol**	**μ**	**σ**	**Minimum**	**Maximum**
Country's Ecological Efficiency	CECOF	0.603	11.022	0.2910	0.2110
Green Finance	FinGr	17203.01	332.22	30.201	1687.02
Industrial Development	IDEV	0.573	1.369	0.102	0.410
Utilisation of natural resources	ResNat	5.003	9.007	0.0000	55.310
Economic & Social Development	DevES	0.562	0.810	1.481	0.1931

Foreign Direct Investment	FDI	0.079	0.301	0.009	0.102

Based on the available data, the average ecological performance is found to be 0.603. There exists a significant disparity in terms of both geographical distribution and temporal progression of green finance development, spanning from the year 17203 to 1687.02. Based on statistical data derived from control variables, it is observed that regional economic and social development exhibits an average value of 0.562. The highest recorded value for this variable is 1.481, while the lowest stands at 0.193. Similarly, foreign direct investment demonstrates an average value of 0.079, with the highest recorded value being 0.301 and the lowest recorded value at 0.009. Lastly, natural resource availability shows an average value of 5.003, with the highest recorded value reaching 55.310 and the lowest recorded value at 0.0000. The industrial development level has a significant disparity, with the highest level surpassing the lowest level by more than threefold. This is evident from the median value of 0.573, which lies between the extremes of 0.410 and 0. 102.

Stricter environmental regulations and green development standards are being implemented in metropolitan districts, as the government places greater emphasis on promoting sustainable and high-quality economic and social growth in these areas, as opposed to rural regions. Consequently, enterprises and governmental bodies in developed economies exhibit a higher propensity to embrace ecologically sustainable manufacturing methods. The deficient economic conditions and social framework prevalent in the region are significant factors that contribute to the diminished ecological efficiency observed in rural areas. The Western tertiary manufacturing sector predominantly relies on internal resources and capabilities.

Improved resource development leads to reduced environmental harm. The proliferation of contemporary agricultural practices, such as the establishment of palm oil plantations in Jordan, has yielded adverse consequences for the overall ecological balance. The prioritization of economic and social growth in the region has resulted in a rise in pollution, emissions, energy consumption, and ecological inefficiency, despite the implementation of stringent environmental regulations.

4.1 Tobit model regression results

Green finance is a financial approach that aims to foster sustainable development, facilitate green economic and social progress, and enhance regional ecological efficiency. The field of green financing is experiencing significant growth. There are impending alterations in regional elements. The present study investigates the eco-efficiency in Jordan by employing the Tobit regression model over the period spanning from 2015 to 2024. Additionally, the study explores the potential impacts of green financing and abundant resources on eco-efficiency.

Table 3. Result of regression model

Variable	**Results for Jordan**
Ln FinGr ^{2}	0.029***
	(4.00)
Ln FinGr	-0.019***

	(-3.96)
Ln ResNat	0.3800***
	(3.87)
LnResNat ^{2}	0.0496***
	(6.00)
Ln DevES	0.069***
	(3.31)
LNFDI	0.0491***
	(6.00)
Ln IDEV	-0.191***
	(3.00)
Constant	-1.9021
	(0.23)

Green finance exhibits a positive, statistically significant quadratic coefficient, but the first-order coefficient is negative and negligible. Time does not enhance efficiency in a linear manner. The U-shaped expansion of non-ecological financing is detrimental to the environment. Green financing will validate premise 1 by enhancing global ecological efficiency. This study corroborates the findings of the environmental Kuznets curve. Green finance diminishes ecological efficiency in eastern Jordan. Green finance is distinguished by notable quadratic and negative first-order coefficients. Two "U" shapes represent the inverse relationship between green financing and ecological efficacy. Inadequate financial resources diminish ecological effectiveness. Upon reaching a crucial threshold, green financing enhances ecological efficiency. Green funding improves the ecological efficacy of the middle class to a greater extent in the West than in the East. Green finance and eastern economies exhibit a U-shaped association characterized by a negative first-order coefficient and a positive quadratic coefficient [34]. First- and second-order variables are inconsequential. Sustainability necessitates more financial investment in environmentally friendly initiatives.

The regression results indicate that the initial term of resource availability is positive, whereas the subsequent term is statistically significant at both the 5% and 1% levels. Jordan's ecological efficiency has a negative relationship with its natural resources. Consolidating resources enhances regional sustainable economic growth and environmental efficacy. The consolidation of resource sectors has resulted in a decrease in ecological efficiency, thereby supporting hypothsis 2. Resources are limited in the East. Robust institutions and industrialization in the East mitigate the resource curse. A reversed U allocates resources in the east. The region's natural resources promote substantial social and economic development. Resource aggregation, however, constrains several resources and impedes regional industrial development. Such an arrangement may result in environmental and social challenges that impede regional economic advancement.

4.2 Results of control variables

The correlation between green financing and national ecological efficiency is nonlinear,

particularly in the central and western areas. The findings of this study diverge from those of others. Investing financial resources in ecologically sustainable practices may enhance regional ecological outcomes. The research methodology may elucidate the subjects' absence of a linear correlation. This study demonstrates a non-linear relationship through the utilization of quadratic term variables. This episode represents a notable deviation from established protocols. Policymakers derive advantages from the examination of nonlinear connections. This research indicates an absence of a causal relationship between ecological efficiency and resource availability. Field [35] investigated the resource curse phenomenon by analyzing resource abundance and economic growth. Scholars have mostly overlooked the nonlinear relationship between resources and ecological efficiency. This attention mismatch is particularly concerning in national-level research. Zhang, Mohsin [36] suggest a non-linear correlation between ecological efficacy and the accessibility of natural resources. Metropolitan regions get 8%–15% from the availability of natural resources. Many at the national level perceive the current situation as unsustainable.

5. Conclusions

The relationship between resource availability and peninsular regions has an inverted U-shaped pattern, which does not extend to eastern locations. Recent studies indicate that augmenting foreign direct investment (FDI) can enhance the eco-efficiency of certain regions in Jordan. The eastern zone exhibits a positive correlation between foreign direct investment (FDI) and ecological efficacy, whereas the middle and western zones have a negative association. Advancing the industrial sector while preserving the environment is an unattainable objective. The reciprocal relationship between regional economic development and environmental preservation is evident. The Eastern regions demonstrate a negative elasticity coefficient in the relationship between GDP per capita and ecological efficiency, whereas the peninsular regions show a positive elasticity coefficient.

The relationship between the national green currency and ecological efficiency is complex. The financial value associated with environmentally detrimental activities in the Midwest and the West has a U-shaped pattern, indicating a negative correlation. It is crucial to acknowledge that ecological effectiveness and cost-effectiveness are not equivalent notions. The statistical insignificance of the first-order coefficient non the eastern green budget indicates it does not meaningfully affect the link between the two variables. Moreover, the relationship between the variables has a U-shaped pattern. A negative link exists between a nation's abundance of natural resources and its environmental performance [34]. A statistically significant inverted U-shaped distribution of resource availability is evident in the central and western regions of Jordan, while this pattern is not present in the eastern areas. The reallocation of foreign direct investment (FDI) in Jordan has favourably impacted eco-efficiency in the area. A strong correlation exists between ecological efficiency and regional economic development.

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Conflicts of Interest

The author confirms that there are no conflicts of interest.

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