Green finance and its impact on achieving sustainable development

Mohammad Abdel Mohsen Al-Afeef[a*], Baliira Kalyebara[b], Nawaf Abuoliem[c], Amer N. Bani Yousef[c] and Mahmoud Abdel Muhsen Irsheid Alafeef[d]

[a]Full Professor, Department of Banking and Finance, Faculty of Business, Jerash University, P. O. Box 26150, Jerash, Jordan
[b]American University of Ras Al Khaimah, United Arab Emirates
[c]Department of Banking and Finance, Faculty of Business, Jerash University, P. O. Box 26150, Jerash, Jordan
[d]Assistant Professor, Marketing Department-Al Baha, University, Saudi Arabia

A B S T R A C T

This study aims to investigate the impact of green finance initiatives on achieving sustainable development goals in Jordan, with a specific focus on evaluating the effectiveness of green finance strategies in promoting environmental sustainability. The research applies the Autoregressive Distributed Lag (ARDL) method and assesses the connection of green finance, taken as the number of banks who increase the loan activity on ecology projects, and sustainable growth, given by the records of carbon releases. Relevant control variables involved in this consideration include income level, population, trade openness, and urbanization in addition to other factors that could otherwise cause a deviation which would generate biased results. The statistical tests show that green finance positively contributes to sustainable development in Jordan, and in the short- and long-term perspectives. Green finance and sustainable development have been a tightly connected two-way causality between them according to Dik and Panchenko's test, which implies that a virtuous cycle exists here. The results give extra weight and brilliant examples of the crucial role that green finance plays in the implementation of the sustainable development goals. It is this role that mainly enables reduction of carbon emissions in the world and mitigation of the negative consequences of climate change. They touch on the main issue of shaping the suitable conditions for green investment options and to create the interest for investing in sustainable development projects. This has become part and parcel of the green finance and sustainable development literature through the manifold of envisaged adjustments to our research design, a wide array of relevant control variables considered, and fully developed elaborated econometrics. It offers a direct response to the research gap by unfolding how becoming green finances takes place. This empowers the sustainable development outcomes in Jordan.

1. Introduction

The urgency of addressing environmental challenges has gained unprecedented momentum in recent years, propelled by the mounting evidence of climate change, resource depletion, and ecological degradation. The Paris Deal of 2015 was the revolutionary moment that the states parties globally accepted to step up with the stringent commitments to fight climate change and associated side effects (United Nations, 2015; Alghizzawi et al., 2023). Nonetheless, for attainment of such objectives, we need to have a radical new conception of economic development and life that will change our present way of regarding economic growth to relocate it to a sustainable development paradigm that in the same way works to balance economics and environment. Jordan, a small country located at the core of the Middle East, unlike many other countries, is not left alone facing global environmental issues. The rise in population, risky urbanization, and overwhelming reliance on energy practically produced overseas have been the main causes of the issues including water scarcity, air pollution and make

usage of natural sources go down (Al-Zu'bi et al., 2019). Awareness of these conflicts, and the reasons why they exist, is that Jordan has taken the proactive approach to incorporate the sustainable development principles through the adoption of the Jordan Renewable Energy and Energy Efficiency Law in 2012 and establishment of the Ministry of Environment in 2003 (Ministry of Environment, 2023). Green finance is now one of key factors in shifting the direction of societies towards more environmental patterns. Climate finance may stimulate the redirection of capital flows to environmentally sustainable investments and could create an incentive for the want of eco-friendly practices, being therefore a powerful tool for catalyzing positive change (Atan et al., 2022a). This approach covers the whole range of budgetary products such as green bonds, funds of sustainable investments, carbon pricing tools and innovative financing resources which are designed to consider environmental perspectives (Lian et al., 2021a). Although green finance attracts high interest budgeting because it can propel the cause of sustainable development, there are still some issues and barriers that are holding it back as far as more wide use and relevance go. With few financial resources or investment capital to cater to green projects, developing countries like Jordan and others face the danger of not meeting the desired targets. One of the biggest hurdles faced by nations in financing environmental sustainability projects is such that not many countries are able to secure enough funds and end up allocating them to the wrong projects, hence hindering eco-friendliness activity of the economy (Alawneh et al., 2021). Additionally, having vigorous regulatory and policy policies aimed at supporting and bolstering the green finance practices is also one of the major concerns. Without these guidelines, standards, accountability measures, money institutions and investors will often tend to shy away from greening their company, considering the investments as risky or uncertain (Muñoz-Torres et al. 2022a). In addition to this, the inadequate data and non-existent reporting system limit evaluation of the environmental impact and success of green finance initiatives as it is difficult to make informed decisions and it becomes difficult to align investment strategies. To add to this, economical barriers and cultural factors could be amongst the top obstacles for the prevalence of green finance. In some cases, there wouldn't be the sense of action or the cognizance of what is sustainable development as well as green finance to create it (Obaid et al., 2022a). Well-settled beliefs and adherence to changing new methods are vital to acceptance of and using financial instruments and schemes that are environmentally friendly. The training and knowledge development process which is experienced also has significant challenges. It is worth noting that the successful translation of financial green ideas into effective practical solutions in many developing countries may face the limitations of the lack of the relevant technical or specialized expertise (Mghnam & Rahman, 2021; Al-Smadi et al., 2023). Addressing such a dealing of knowledge based on training, education and experience sharing is to be given great consideration for the proper use of green finance tools. For instance, green finance measures in themselves, due to systemic and complicated environmental, economic, and social relationships, are almost impossible to determine the cause-and-effect relationship. Complexity inherent in green finance, therefore, presents major challenges in the identification and assessment of strategies effectiveness undoubtedly, which in turn severely hinders the informed decision-making and policy development. The primary purpose of this study is to investigate the impact of green finance initiatives on achieving sustainable development goals in Jordan, with a specific focus on evaluating the effectiveness of green finance strategies in promoting environmental sustainability, economic growth, and social progress.

2. Literature Review

2.1 Sustainable Development in Jordan

The Kingdom of Jordan has borne remarkable fruits in the domain of sustainable development and responsible governance it pursues by virtue of devising various plans in the space of ecological preservation, economic prosperity, and social welfare. Although the country experienced significant progress in addressing some of the challenges that undermine the achievement of the Sustainable Development Goals (SDGs) set up by the UN, it still must cope with numerous issues that stagnate its development (Obaid et al., 2022b). It is not any secret that the key problem is the dearth of water resources, which is increasingly aggravated by climate change and population boom. Jordan is amongst top countries of the world striving with water stress having water resource renewable per capita ranked one the lowest on global scale (Al-Zu'bi et al., 2019). This breadth gazes over agriculture, industry, and to the domestic consumers' needs, which is highly risky for the environmentally friendly development. Energy security and shifting to 'green energies', among other issues, pose critical challenges to Jordan. The implementation of the Renewable Energy and Energy Efficiency Law in 2012 failed to transition towards a greener economy, due to the country's reliance on fossil fuels, which is one of the main sources of greenhouse gas emissions and environmental degradation (Alawneh et al., 2021). The main task is to decrease the use of non-renewable sources of energy, to promote energy efficiency and follow the line about sustainable development. Besides, Jordan faces quandaries in authorities and circular economy influencing. Unplanned rapid urbanization and population growth have resulted in the waste generation rise, which leads to the inability of the country to efficiently deal with waste, causing environmental and public health issues (Mrayyan & Hamdi, 2022a; Abuoliem et al., 2024). Enviable steps for treatment of waste, recycling and waste-to-energy technologies must be promoted to bring about the shift in direction to create a more sustainable and resilient economy.

2.2 Green Finance

The evolution of green finance has developed as an important lever for accelerating the environmentally friendly development of all aspects of the financial sector by linking money and financial systems with environmental issues. This refers to a set of

innovative financial tools and strategies that is created to finance environmentally responsible ventures and adventures, hence green bonds, sustainability linked loans, carbon pricing, and sustainable investment funds (Lian et al., 2021b). The phenomenon of green bonds has precisely experienced the brunt of a recent wind of transformation, with an increase in bond issuances whose purpose is to raise funds to execute projects that aim at the environment conservation. The bonds are in turn issued in the form of the government, corporate, and the financial institutions, with its borrowings used for projects relating to renewable energy, energy efficiency, sustainable transport, and other environmental sustainability objectives (Atan et al., 2022a) The loans that are known as sustainability linked are instead tied-up with the interest rates or lending terms of the borrower in relation to his/her capacity to achieve the previously determined sustainability outcomes of targets or performance indication. Through this mechanism the likelihood of borrowers having sustainable practices adopted and ensuring they are aligned to the principles of environmental, social and governance (or ESG) increases (Munoz-Torres et al., 2018). Another element in the picture of green finance is the carbon pricing ecosystem, which involves cap-and-trade systems on emissions and carbon taxes. The price mechanism being leveraged on carbon emission coupling with other climate policies are designed to reward compliant businesses and industry while punishing offenders by giving tax incentives to the former and imposing a tax on the latter for their carbon footprint (Adeleye et al., 2022).

2.3 Empirical Literature Review

Empirical studies create discussions about the contribution from green finance, sustainable development, and their operations to social and economic development that offer a complex picture of this issue. Nevertheless, the outcomes were conflicted. And the details underlying the context and the methods used are known to have a meaningful impact in the results obtained. An article written by Atan et al. (2022a) analysed the role of green finance for this area by using panel data for this purpose. They became positive and substantial about the relationship between the green finance factors (such as green bond issuance and green investment) and sustainable development outcomes (as reflected by the carbon emission and renewable energy consumption). The study has demonstrated the role that green finance played in environmental conservation and the prospect of improving the conditions of emerging economies. Green loans promote sustainable development in BRICS countries (news: Brazil, Russia, India, China and South Africa) is explored by Adeleye et al (2022) through different econometric techniques. The data from the research team indicated that implementation of environmentally friendly financing programs, i.e., green bonds and carbon pricing systems, is really the proper solution to promote sustainability performance. This includes increasing renewable energy consumption and improving the environment. The results, nevertheless, also suggested that the efficiency of green finance was not necessarily consistent among the BRICS countries, which revealed that some country-specific factors and policies could be the disparity. Reflecting on the Jordan evidence: Mghnam and Rahman (2021) carried out an experimental analysis examining the effect of green finance on sustainable development. Employing time-series data and the Autoregressive Distributed Lag (ARDL) procedure they have discovered that green finance indicators, for example, green investments and environmental taxes are highly linked to sustainable development indicators of renewable energy consumption and CO2 emission in Jordan. According to the research, green finance has been acknowledged by the researchers as a solution capable of mitigating environmental problems and leading to sustainable development in the context of Jordan. What Alawneh et al. (2021) underline in their research is that green bonds particularly help achieving sustainable development in developing countries. To support their stand, Jordan is taken as a case study. Consequently, they found that the application of green bonds was associated with higher sustainable development parameters e.g. renewable energy consumption and environmental performance indicators. This research highlights the pivotal role of implementing a big green bond market including green finance tools to help the cause of sustainable development in the developed world. Nevertheless, the introduction of green finance does have certain challenges and obstacles as the degree to which it supports sustainable development may vary. The Obaid et al.'s study (2022a) focuses on the challenges and prospects of green financing in Jordan, and obstacles that may seem to be outside the radar of good green finance include unawareness, the absence of policy frameworks, and capacity shortages. The study spelled out the importance of holistic measures, capacity building especially of the private sector, and joint efforts by all stakeholders to fully realize green finance suitability for sustainable growth. Using a bibliometric methodology, Muñoz-Torres et al. (2022b) revealed that there was a rise, but a spotty, in the green financing in emerging states, and this mostly means a limited collection of evidence on that matter. Research has shown that there are existing gaps related to green finance instruments even though initiatives have been put in place. There is a dearth of information regarding the role of governance and institutional frameworks in support and promotion of environmental finance practices (Al-afeef et al., 2023). Although the current papers analyzing the connection between green financing and ecological development yield a lot of important information regarding the issue, there are a few research gaps in literature which can serve as the basis for more vigorous studies. One noticeable absence is the lack of the commission special dedicated research targeting Jordanian context especially these reassuring practices are based on considerable methods such as econometrics approach and other relevant variables (Al-Obaidani et al., 2023; Bobinaite et al., 2022). There are several studies evaluating either the Greenness of finance within a particular region or world or sustainable development studies dealing with a single aspect only. It is important that wider and interdisciplinary research be conducted with the aim of creating a context-related framework that features the local circumstances of such issues as challenges, prospects, and economic background of the country. It is also about considering factors like income levels, demographic growth, population, trade openness and urbanization which have a direct bearing on how green finance initiatives can be implemented and the impact they will have (Afzal et al., 2021; Shabaz et al., 2020). As the current research is predominantly directed toward the role of green financing in the sustainability of environmentally relevant indicators including carbon emissions, renewable energy consumption and

environmental quality, the role of in financial sector in the overall economic performance and the importance of this role in the economy of the future, therefore, needs to be explored as well. Nevertheless, sustainable development is a set of interacting dimensions such as economic development, society, and women's opportunities, (Alshamari et al., 2021). It would be advantageous to have studies which examine the links between green investments and economic performance, for indicators such as employment, innovation and sectoral diversification, and social performance, for indicators like access to basic services, income inequality, and quality of life Moreover, ample of literature on this subject previously focused on the association between green finance and sustainable development but a research which investigates causal channels and pathways via which green finance interventions impact sustainability outcomes is scanty (Ullah et al., 2021). Furthermore, comprehending these causal channels will allow policymakers and other stakeholders to obtain insights that can contribute to the development of green financial measures and interventions that will be specific to the problems and the context of Jordan.

2.4 Theoretical Background

The demands for green finance could be found in various theories or reports codifying the potential of green finance in achieving sustainable development. For example, there is the stakeholder theory (Adeleye et al., 2022), sustainable development concept (Brundtland Report, 1987), market failure theory (Atan et al., 2022b), the principle of circular economy and resource efficiency (Mgh A level of income is one of the key aspect which contributed to the sustainability development and adoption of green finance as a given by the idea of Environmental Kuznets Curve reflects in the works of Grossman and Krueger (1991) and Sarkodie and Strezov (2019). The rise in population puts immense strain on resources and infrastructure, which may hinder sustainable development or worse if funds meant for silver projects are diverted as a result (Obaid et al., 2022a; Mghnam & Rahman, 2021; Alawneh et al., 2021). Free trade could boost the transfer of green technologies, knowledge, and practices and could bring in the foreign investments into sustainable culture. Yet, it can create more resource exploitation, manufacturing, and transportation which eventually are hazardous to the environment, resulting in environmental degradation (Muñoz-Torres et al., 2022a; Adeleye et al., 2022). Urbanization may give birth to the use of scales hampering economies, usage efficiency among the resources and the effect of in line with green transportation and wastage management approaches (Al-Zu'bi et al., 2019; Mrayyan & Hamdi, 2022b). Besides that, if the rapid and haphazard urbanization is not managed well, it would be an extra problem in the way of preserving the ecosystem and the achievement of development goals (Obaid et al., 2022b; Alawneh et al., 2021). At the same time, whether the greenery and the sustainable development and uptake of green finance by cities depend on the issues of urban planning, governance and investments in green urban infrastructure or not is also an important factor.

3. Research Methodology

3.1 Conceptual Model

The conceptual model for this study is grounded in the theoretical framework of sustainable development and the potential impact of green finance initiatives on achieving environmental sustainability goals. The model takes the full view of sustainable development and it by itself is focused on the environmental part of that regard. The amount of banking institutions issuing loans for green environment projects is used as the function of green finance (He et al., 2023), in which we measure the variable. Failing to reach the green finance goal, shareholders and other market participants may find an increasing change in their investment portfolios, since sustainability is the priority. Carbon emissions (kts) do double duty, first as determinant for environmental sustainability and then as assessor of sustainable development in our model (He et al., 2023). The low carbon emissions are one of the signs of economic progress as it shows a decline in the overall pollution levels to the planet and a shift from the mindset of the old times towards sustainable development. The model includes control factors that consider other factors besides sustainable development outcomes, which can be an unintended cause of carbon emissions. These are the control variables which include income level at different stages (example GDP per capita), population growth, trade openness and urbanization. This model comprises the variables which in turn makes the model look at the effects of green finance on carbon emissions and environmental preservation while eliminating possible confounders. The income level, to what extent it affects the outcomes of the study on environmental conservation through economic development, is stipulated as a control. Increased investment in renewable technologies and sustainable practices can play an important role in climate change mitigation for wealthier people, yet they could also result in a higher level of energy consumption and resource use, contributing to carbon emissions growth. Population growth is also another factor that should be under one's attention because natural resources might get used, pollution might increase, and consequently fossil fuel energy demand might rise. Trade openness is the second source of channeling in which the effect of international trade on carbon emissions is enclosed when it can cause the flow of ecological technologies and practices while resulting in an increase of the transportation of goods and services. Urbanization serves as the control variable which is very much complicated because it has both the positive and negative aspects with respect to environmental sustainability. The size, density, environment, and amenities in cities come out as the primary rationale for individuals' choice to settle in urban areas, but if there is constant growth and unplanned urbanization, the cities are more likely to consume more energy, produce pollution and lose green spaces. Modeling green finance effects on carbon emissions, incorporates the control variables that are in line with the thesis and allows for the understanding of the relationship between the variables while accounting for the confounding effects of the social and

economic factors. This method offers the possibility of making up a more comprehensive analysis of the contribution that green financing measures produce to environmental sustainability, realizing the aspiration of SDGs.

3.2 Empirical Model

This research uses the ARDL model that is appropriate for the empirical analysis that involves not only short-term and long-term relationships between variables, but also whether or not the variable is stationary. The empirical model evaluates the efficiency of environmental financial instruments (GFF) for sustainability (SD) in the context of Jordan's case while strictly accounting for effects of income level (EG), population (PO), trade openness (TO), and urbanization (UR). The model is calculated to produce both short run with long run estimates and an adjustment speed toward an equilibrium. The ARDL model can be represented as follows: The ARDL model can be represented as follows:

$$SD_t = f(GF_t, EG_t, PO_t, UR_t, TO_t) \tag{1}$$

The model is re-written in Eq. (2) below:

$$SD_t = \alpha_0 + \varphi_1 GF_{t-1} + \varphi_2 EG_{t-1} + \varphi_3 PO_{t-1} + \varphi_4 UR_{t-1} + \varphi_4 TO_{t-1} + \mu_t \tag{2}$$

where, SD_t is sustainable development, GF_t is the green finance, EG_t is the economic growth, PO_t is the population, UR_t is the urbanization, TO_t is the trade openness, μ_t is the error term t is the time.

3.3 Data

This study utilizes secondary data from various reliable sources to construct the required variables for the analysis. The data was collected for Jordan, covering the period from 1970 to 2022, allowing for a comprehensive examination of the relationship between green finance and sustainable development over an extended timeframe. The data for green finance indicators was obtained from the National Bureau of Statistics (2024). This source provides information on the number of banking institutions creating loans for green environmental projects in Jordan, which was used as a measure of green finance. Sustainable development sourced from the World Development Indicators (2024) database, published by the World Bank. This indicator serves as a proxy for environmental sustainability, with lower carbon emissions representing progress towards sustainable development goals. Data on control variables collected from the World Development Indicators (2024) database. The level of income measured by GDP per capita (in current USD), population data represented by the total population, and urbanization measured as the percentage of the population residing in urban areas. Trade openness, another control variable, calculated as the ratio of the sum of exports of goods and services and imports of goods and services to GDP (in current USD), with the necessary data obtained from the World Development Indicators (2024).

4. Econometric Estimation

4.1 Unit Root Tests

Before estimating the ARDL model, it is essential to determine the order of integration of the variables to ensure the validity of the ARDL approach. Three widely used unit root tests were employed. The Augmented Dickey-Fuller (ADF) test, the Phillips-Perron (PP) test, and the Kapetanios and Shin Unit Root (KSUR) test. The ADF and PP tests are conventional unit root tests used to check for stationarity in the variables. The ADF test accounts for potential serial correlation in the error terms, while the PP test is robust to heteroscedasticity in the error terms. These tests were made both on the levels and the different ones of the variables to come out with the integration order. Despite the traditional unit root tests having low power in identifying nonlinear or structural alteration in the data generating system, the study uses a wide range of different tests for stationarity. To deal with this shortcoming, we will use the KSUR test, which is a non-linear unit root test that is created to detect if there are non-linear characteristics present in the data (Kapetanios et al., 2003). KSUR test may get particular importance in the sustainable development or green finance, where nonsocial situations may be resulted from policy changes, new technologies or economic shocks.

4.2 ARDL Approach

The ARDL approach, developed by Pesaran et al. (2001), is a powerful and flexible econometric technique that can be applied regardless of the order of integration of the variables if the variables are not integrated of order two or higher. This approach involves estimating the following model,

$$\Delta SD_t = \alpha_0 + \alpha_1 SD_{t-1} + \alpha_2 GF_{t-1} + \alpha_3 EG_{t-1} + \alpha_4 PO_{t-1} + \alpha_5 UR_{t-1} + \alpha_6 TO_t + \sum_{i=1}^{p} \gamma_1 \Delta SD_{t-1} + \sum_{i=1}^{p} \gamma_2 \Delta GF_{t-1} \tag{3}$$

$$+ \sum_{i=1}^{p} \gamma_3 \Delta EG_{t-1} + \sum_{i=1}^{p} \gamma_4 \Delta PO_{t-1} + \sum_{i=1}^{p} \gamma_5 \Delta UR_{t-1} + \sum_{i=1}^{p} \gamma_6 \Delta TO_{t-1} + \varepsilon_t$$

The cointegration test—which can also be described as F-Statistics— was chosen to determine the long-term relationship among the study's variables. The F-statistics determines whether there is any significance in the variables or not (It can now be established in the study by Nkoro and Uko, 2016). The hypothesis that there exists cointegration between the variables of research can be supported when the calculated F-statistics value is higher than the upper bound, whereas cointegration can be argued not to be there when the calculated F-statistics value is lower than the lower bound. For the in-between values of the calculated F-statistics, support for the indecisive cointegration can be rooted in Pesaran et al. (2001). The first two of the additional hypotheses are used for both functional models to explain the stationary relationship towards the dependent variable and the independent variable.

$$H_0: \alpha_1=\alpha_2=\alpha_3=\alpha_4=\alpha_5=\alpha_6= 0 \qquad (5)$$
$$H_1: \alpha_1\neq\alpha_2\neq\alpha_3\neq\alpha_4\neq\alpha_5\neq\alpha_6\neq 0$$

4.3 Granger Causality Test

Moreover, to assist in uncovering the causal relationships between the green finance and sustainable development indicators, the non-parametric Diks and Panchenko Granger causality test was used (Diks & Panchenko, 2006). This test is often used to test non-linear contingent assumptions and is robust to several assumptions, including linearity, normality, stability, etc. The Granger weak stationarity and causality test developed by Diks and Panchenko takes into consideration the notions of local correlation integrals. The following procedure represents this method. Computing the correlation matrices between the assets in focus. This process requires computing the test statistic as a difference between the correlation integral related to the causality direction and the correlation integral related to the reverse direction Imputing the p-value that is computed through the asymptotic distribution of the test statistic conditional or by a bootstrap procedure. Granger causality test Diks and Pankhenko will be applied to detect the causal links among the green finance indicators and sustainable development ones, and to talk about the possibility of emerging the two-sided causality. This analysis will provide insights into the causal mechanisms and feedback loops between green finance and sustainable development, which can inform policy decisions and investment strategies.

5. Research Findings

The descriptive statistics presented in Table 1 provide valuable insights into the characteristics of the variables under study. The mean value of the sustainable development indicator (SD) is 9.441, suggesting a moderate level of sustainable development in Jordan during the analyzed period. However, the range between the maximum (10.196) and minimum (8.391) values indicates potential variations or fluctuations in sustainable development outcomes over time. The green finance indicator (GF) has a mean value of 4.034, which represents the average number of banking institutions creating loans for green environmental projects. The relatively low standard deviation (0.442) suggests that the level of green finance has remained relatively stable throughout the analyzed period. The control variables, such as level of income (EG), population (PO), urbanization (UR), and trade openness (TO), exhibit varying degrees of dispersion, as reflected by their respective standard deviations. The skewness and kurtosis values provide information about the symmetry and peakedness of the distributions, respectively, which can be valuable for selecting appropriate statistical methods and ensuring the validity of assumptions (Razali & Wah, 2011).

Table 1
Descriptive Statistics

Variables	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Observations
SD	9.441	9.537	10.196	8.391	0.549	-0.288	1.761	53
GF	4.034	4.199	4.517	2.833	0.442	-1.549	1.307	53
EG	7.536	7.543	8.406	6.017	0.644	-0.546	1.847	53
PO	15.268	15.343	16.239	14.258	0.599	-0.015	1.839	53
UR	4.305	4.359	4.5199	4.024	0.163	-0.387	1.838	53
TO	1.074	1.120	1.477	0.022	0.283	-1.353	1.605	53

Correlation matrix indicated above in the table represents the structure of interrelations among the variables studied in this case. The correlation coefficient scale is between the values from -1 to 1; relations that are closer to 1 show a strong positive correlation while those that are near -1 demonstrate a strong negative correlation. Sustainable development indicator (SD) demonstrates a positive and statistically significant relation with respect to universal inclusion of green finance (GF) and standard of living (EG), population (PO), and the level of urbanization (UR). Apparently, the higher society's propensity to green finance projects, income levels, density of population, and level of urbanization would lead to a more sustainable development in Jordan between the investigated time frames. These results show that the connection between SD and GF (0.552) is moderately significant and positive albeit with the only statistical significance test being zero. This result agrees with the idea that the sustainable development goals can be achieved by raising the financing of environmentally friendlier projects using green finance. (Lian et al., 2021a). Significant correlations among the control variables further suggest that they are more than just independent to each other but might be related to and depend upon the other. By way of example, GF (green finance) is positively related to EG (the level of income), PO (population) and UR (urbanization), which underlines the fact

that the populations with higher incomes may benefit from the green finance and support the population growth as well as urbanization.

Table 2
Correlation Matrix

Variables	SD	GF	EG	PO	UR	TO
SD	**1.000**					
GF	0.552*	**1.000**				
	(0.000)					
EG	0.473*	0.331*	**1.000**			
	(0.000)	(0.000)				
PO	0.682*	0.709*	0.664*	**1.000**		
	(0.000)	(0.000)	(0.000)			
UR	0.579*	0.449*	0.748*	0.383*	**1.000**	
	(0.000)	(0.000)	(0.000)	(0.000)		
TO	0.323**	0.599*	0.341**	0.206	0.271**	**1.000**
	(0.018)	(0.000)	(0.012)	(0.138)	(0.049)	

Table 3 reports the outcome of the unit root test empirical results which are illustrated by several unit root tests including the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and the Kapetanios and Shin Unit Root (KSUR) tests. They are necessary for finding out if the variables are stationary or not. This is the first step before any time series analysis, otherwise spurious regressions may occur. For the series (I(0)), the majority of the values seems to undershoot (at the 5% significance level of KPSS) the null hypothesis of a unit root in the ADF, PP, and KS sur intercepts of the p-value, respectively. The exception to this rule is the population (PORTO), which tests positive on the ADF and KPUR tests, and the trade openness (TO), which pass the PP test. But the first differentiation (I(1)) converts all of the variables to the stationary status which can be clearly seen by the very small p-values for at least one of the unit root tests at 5% significance level rejecting the null hypothesis of a unit root. This outcome indicates that the integrated variables are I(1) that are, in addition, also stationary after subtracting from them the first difference. The KSUR test, also known as the nonlinear unit root, estimated to identify potential non-linearity and structural break, gives a supplemented perceptiveness (Kapetanios et al., 2003). The KSUR test outcomes suggest that the SD variables display the typical nonlinear movements (as the stationarity at the first difference according to the KSUR test but not at the level) while those of GF variables are stationary at the first difference according to the KSUR test too. This doubtless complexity of sustainable development and green financing flows, coming from a variety of sources, like changes in the policy-making process, technological improvements, or even economic shocks that can cause breaks and nonlinearities in the data.
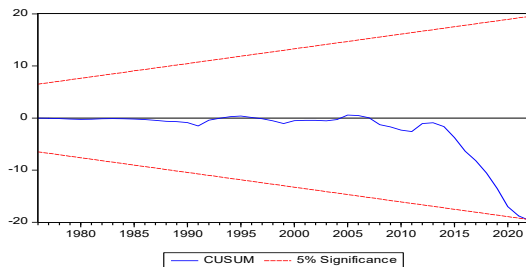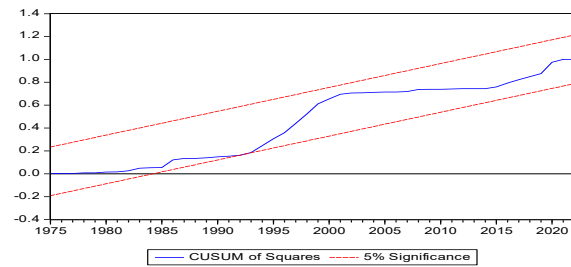
Table 3
Unit Roots Test

Variables	ADF		PP		KUSR	
At Level I (0)						
	T-statistics	P-value	T-statistics	P-value	T-statistics	P-value
SD	-1.630	0.780	-1.799	0.705	-1.987	0.527
GF	-2.369	0.396	-1.830	0.690	-1.819	0.629
EG	-2.863	0.1748	-2.047	0.575	-1.899	0.581
PO	-3.775**	0.017	-1.944	0.631	-4.812*	0.001
UR	-3.097	0.107	-0.387	0.987	-3.132	0.072
TO	-3.345	0.059	-3.858**	0.013	-2.877	0.125
At First Difference I (1)						
SD	-4.621*	0.000	-7.348*	0.000	-6.281	0.000
GF	-5.364*	0.000	-6.259*	0.000	-3.305**	0.049
EG	-3.840**	0.042	-4.229*	0.004	-4.394*	0.003
PO	-4.812*	0.000	-5.383	0.000	-4.238*	0.004
UR	-4.553	0.000	-6.015	0.000	-5.755	0.000
TO	-4.986	0.000	-5.301*	0.000	-4.413	0.002

Table 4 specifies results of the F-Bound cointegration test, which should give an insight about the existence of long-run equilibrium relationship among the variables examined below. The recounted F-statistic value (3.903) surpasses the critical values for the lower and upper bounds at 1% significance level, which implies remaining valid cointegration among the variables. The cointegration of most of the variables implies that at the equilibrium level there exist long run relationships between the sustainable development (SD), green finance (GF), the level of income (EG), population (PO), trade openness (TO), and urbanization (UR) (Afzal et al., 2021). The finding is nothing but another sign that green finance, according to the available literature, plays the role of facilitating the sustainable development, to which previous studies have come to this conclusion also (Bobinaite et al, 2022; Ullah et al, 2021). Cointegration implies that these variables from a specific consistent group within which prices move in a joint manner, and any deviations from the desirable path will be corrected in the long run (Pesaran et al., 2001).

Table 4

F-Bound Cointegration Test Results

F-Statistics	3.903**	Critical Values	
		Lower Bound	Upper Bound
	10%	2.08	2.39
	5%	3.00	3.38
	1%	3.06	4.15

As indicated by Table 5, the short run level of coefficients' statistical significance is highlighted for sustainable development (SD) and its determinants that include green finance (GF), and economic growth (EG) whereas long run level of coefficients' statistical significance is highlighted for sustainable development (SD) and its determinants that include population (PO), urbanization (UR) and international trade (TO) The first-order estimation in the short term (S/T) claims that 1 percent of Green Finance (GF) increase per year will generates a 0.182 percent of Sustainable development. Also, it is evident that this result is statistically significant at the 5% level. Another factor which contributes to the increase in sustainable development is the 1% growth (EG) of income level. Moreover, the growth of sustainable development is also strong at the 5% level which makes it also significant. With the value of the urbanization coefficient (u) being 0.678, one may infer that there is 0.678% rise in the sustainable development when urbanization goes up by 1% and this rise is considered statistically significant at the 5% level. The multiplier for aggregated population (PO) and the share of open economy (TO) are statistically exhibited as insignificant factors in the short-time. It can be stated that, in the end the green finish (GF) has a 0.226% begetting effect, and this influence is statistically significant: at the 1% level. The estimated income level effect (EG) is 0.768, hence, the increase in the level of income causes a relevant rise of 0.768% in sustainable development, and this effect is statistically significant to 1% level. The coefficient of population (PO) is -0.053, suggesting that a 1% increase in population leads to a 0.053% decrease in sustainable development, and this effect is significant at the 5% level. The coefficient of trade openness (TO) is 0.208, indicating that a 1% increase in trade openness leads to a 0.208% increase in sustainable development, and this effect is significant at the 1% level. However, the coefficient of urbanization (UR) is statistically insignificant in the long run. These findings are consistent with the existing literature on the positive impact of green finance, income level, and trade openness on sustainable development, while highlighting the potential negative impact of population growth (Bobinaite et al., 2022; Ullah et al., 2021; Al-Obaidani et al., 2023; Alshammari et al., 2021; Shahbaz et al., 2020). The diagnostic tests for serial correlation, heteroskedasticity, and normality of residuals suggest that the model satisfies the necessary assumptions, indicating the reliability of the estimated coefficients. The CUSUM and CUSUM of Squares tests in Fig. 1and Fig. 2, on the other hand, affirm the consistency of the estimated coefficients in the whole sample.

Fig. 1. Cusum Test

Fig. 2. Cusum of Square Test

Table 5

Long run and Short run Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
		Short run		
ΔGF	0.182**	0.082	2.220	0.033
ΔEG	0.205**	0.083	2.465	0.018
ΔPO	-0.011	0.102	-0.108	0.991
ΔUR	0.678**	0.291	2.322	0.025
ΔTO	0.203	0.062	3.248	0.002
ec_{t-1}	-0.213	0.086	-2.478	0.017
		Long Run		
GF	0.226*	0.048	4.708	0.000
EG	0.768*	0.211	3.640	0.000
PO	-0.053**	0.018	-2.887	0.008
UR	0.119	1.728	0.068	0.072
TO	0.208*	0.070	2.971	0.002
		Diagnostic Test		
Serial Correlation	1.120			0.295
Heteroskedasticity	0.664			0.520
Normality	0.431			0.806

The Table 6 shows the outcomes of the Dona and Panchenko causality test, which analyzes the causality interconnections among the Trading-off-Sustainability (SD) as independent factors and green finance (GF), gross income (EG), population (PO), urbanization (UR), trade openness (TO). The results suggest that SD is part of two-way causal between SD and GF with a positive test stats for SD → GF, and a negative one for GF → SD (p-value = 0.000 and 0.000) It indicates that an increase in green finance programs leads to sustainable development improvement and vice versa, as their relationships are mutually reinforcing (Bobinaite et al., 2022; Ullah et al., 2021). For the case of the income level (EG), there is the unidirectional causal arrow leading from SD to EG, and the test statistic value is 2.247 (the p-value is 0.033), meaning that sustainable growth comes out on top through the economy's progression, which is statistically confirmed by the past scholarly findings (Alshammari et al., Much as the relationship portrayed between SDGs and population dynamics is unidirectional with a t-value of 4.549 (0.000) with SD → PO, this relationship seems so obvious to Sustainable Development (SD) having an effect on population dynamics which is either indirectly via maintained living standard and better accessibility to health care facilities (Pesaran et al., 2001). Additionally, the outcomes illustrate an atypical positive link among the phenomenon of SD and urbanization (UR), recorded as a test statistical value of 2.118 (P = 0.041) for SD → UR, and 3.880 (P < 0.05) for UR → SD suggests that the processes of SD and urbanization are reciprocal, and they require Finally, trade liberalization (TO) has a unidirectional causal relationship with sustainable development (SD) where the test statistic value is 5.439 (p-value = 0.000), which shows that by opening borders to trade countries can contribute to improved sustainability to some extent, e.g. by transferring knowledge and environmentally friendly technologies (Atan et al., 2022b; Muñoz-Torres et al., 2022b).

Table 6
Diks and Panchenko Causality test

SD −/→ GF	GF−/→ SD	Direction
4.051*	7.432*	Bidirectional
(0.000)	(0.000)	
SD −/→ EG	EG−/→ SD	
2.247**	1.809	Unidirectional
(0.033)	(0.518)	
SD −/→ PO	PO−/→ SD	
4.549*	1.740	Unidirectional
(0.000)	(0.041)	
SD −/→ UR	UR−/→ SD	
2.118**	3.880*	Bidirectional
(0.041)	(0.000)	
SD −/→ TO	TO−/→ SD	
0.376	5.439*	Unidirectional
(0.919)	(0.000)	

6. Discussion

The results provide compelling evidence of the crucial role played by green finance in promoting sustainable development in Jordan. Taken altogether, it is found that green finance has had a positive and significant impact on sustainable development of the countries concerned, for both the short-run and the long-run. This result conforms with theoretical confidence and empirical impressions from past investigations in which green finance programs have been cited as essential facilitators of transition to a green economy (Bobinaite et al., 2022; Ullah et al., 2021). It is green finance that can be credited with all the potential green finance has on sustainable development, thanks to different reasons. On the one hand, green finance initiatives aid the provision of financial resources to climate-smart initiatives that include the development of wind and solar farms, installing of energy-efficient technologies, and promoting sustainable agriculture. These investments show a robust from a point of a reduction of greenhouse gas emissions, improvement of air and water quality as well as a promotion of sustainable utilization of natural resources, thereby fulfilling sustainable development goals. In addition, green finance could support the development and use of new technology and business models that fit your environmentally friendly requirements. The investors can be drawn by instruments like cleaner production process- centred green bonds or eco-friendly products backed sustainability-linked loans towards issuers. The issuer could then build resources for developing environmentally sustainable production management (Alshammari et al., 2021). This could press for innovation and demand the transition of the economic system to be more sustainable and resource efficient. Possible improvements: - This kind of pressure may be the stimulus of innovation and could lead to transition to the more sustainable and resource-efficient economic system. Moreover, the function of sustainable finance is facilitating the improvement of knowledge about responsible point of view among all relevant actors, such as investors, companies and consumers, should be mentioned. Through both incorporating environmental, social and governance (ESG) factors in investment decision-making and risk management frameworks, green finance can engage these agents which largely affects their sustainability behavior (Shahbaz et al., 2020). This can consequently trigger cultural change, which is of a significant importance in terms of the progress to the achievement of sustainable development goals.

In addition, the consequence of Table 6 brings up a two-way causal relationship for Green finance and sustainable development, which this cycle becomes reinforcement if one could help another. As projects that are green finance succeed in tangible sustainable development, the demand for and the use of green finance is more likely to increase through a virtues cycle for green growth and environmental protection. Thus, the result found bidirectional cause and effect, which makes it obvious that it should switch from separate initiatives for green finance to a whole ecosystem approach that will play a role

of green finance managers and enable a sustainable development environment. The policymakers and stakeholder community can draw a link between the two objectives and act on identified and suitable strategies to handle the socio-economic and environmental aspects. As for income level, the study implies that there exists a molecular causal direction flowing from sustainable development to economic progress. This correlates with the factor that sustaining practices and environmental conservation of nature can be the factor and help the economy by preserving natural resources, improving efficiency of resources usage and sustainable business activities (Afzal et al., 2021). An interesting complexity is the relationship between population growth and sustainable development. The long-run estimation shows negative effects of population growth on sustainable development. Causal analysis as well, corroborates deficiency in population growth on sustainable development (Obaid et al., 2022). This will therefore stress on the main fact that population management strategies are to be figured out in order to keep the nature and social systems in a sustainable manner by not tiring them down. The causality of trade is unidirectional when it goes from openness to sustainable development, (Atan et al., 2022a) as exhibited by trade openness's positive effect on sustainable development. This implies that enhanced trade may stimulate the diffusion of eco-friendly technologies, knowledge, expertise, and technical know-hows based on which environmentally friendly technologies operate, ultimately playing a role in the promotion of sustainable development goals. Lastly, the existing results depict a net effect that is bi-directional from urbanization to sustainable development (Al-Zu'bi et al., 2019; Mrayyan & Hamdi, 2022a). Urbanization does not just highlight the scale of economics and efficient resource utilization. The fact that it can cause environmental problems is also being considered. This reinforces the concept of socially responsible urban planning and allocation of green infrastructure funds to harness the bounties of urbanization while decreasing negative consequences.

7. Research Implications

Based on the results presented, several important implications can be drawn regarding green finance and its impact on achieving sustainable development in Jordan. The highlighted fact that there is a robust association between green finance (GF) and sustainable development (SD) especially in the short-run and the long-run, shows how an organization's managerial decisions to spread the financial resources to Green Projects are vital. Financing organizations and financial officers shall have as their aim the development of credits and financing opportunities for green environmental purposes, because such investments help is critical to reduce the carbon emissions and promote sustainable development in Jordan. Considering environmental, social and governance (ESG) attributes while making investment decisions as well as aligning with the same practices of sustainable finance can help organizations to achieve their sustainability goals at the same time meeting their long-term goals. The empirical findings help to back up the theoretical constructs of green finance, with the potential to shape the on-going evolution of environmental sustainability. The proven fact, that green finance really helps to reduce the level of carbon emissions, is a strong indication that giving financial institutions a chance to be on the right side of the environment is a catalyst to our future in the clean world. The bidirectional type of causality, as pointed out by both Diks and Panchenko causality tests is a sign of this mutually beneficial cycle where sustainable development initiatives develop a demand for green finance instruments, thus stimulating growth of this sector's operations. The paper bears huge significance for policymakers and regulators of the state of Jordan. Green finance has been one of the profound ways in which it has been possible to enable the sustainable development process as it must be supported by a good legal framework coupled with incentives that will motivate financiers to engage in green financing. It could be tried out by mainlining the creation of cautious codes, standards, and accountability mechanisms for green finance instruments, as well as financial rewards and subsidies for the green projects' strengthening. After all, the goal of sustainable development is not only to give the environment our attention, but also to create stronger economies and better human societies. By green finance mediating the decrease in carbon emission, which is a major threat to climate change, it becomes instrumental to the reduction of the adverse effects of climate change leading to (for example) water insecurity, food shortages, and populations pushed out of their homes. Green financing in Jordan could be the proactive option towards solving environmental problems, improving public health and people's wellbeing now in the future which will prevent the poor quality of life.

8. Limitations of the Study

Although this work throws light on the green finance effect on the sustainable development in Jordan, it is strongly recommended to consider certain restrictions that should be reflected in this research work interpretation and informing future research actions. First, the only way you can assess green finance is by the number of banking industries that are issuing loans for environmental protection projects which is not able to encompass the entire involvement of green finance instruments and initiatives. The green finance space requires more detailed research studies that could involve investing in renewables, instancing green bonds, calculating sustainable loan links. Secondly, the study deals mainly with the environmental aspect of sustainable development as a way of proxy indications through carbon emission. On the other hand, sustainable development goes beyond the economic aspect to incorporate more aspects of social development that are only covered in lengthy analysis. On the other hand, further studies could be to figure out the effects of green finance on other sustainable development indicators, such as economic growth, employment, income equality and people living in poverty that may have limited access to basic services, so that there will be more understanding on the nature of its implications. In addition, the research conducted the data on aggregate national level so that the underlying variations in the cultural and sectoral change has the possibility to be missed. Future research may additionally delve deeper into these dynamics to ascertain the geographical distribution of green finance, as well as the specific green projects/sectors/regions that are being financed, and the extent to which these

contribute to the greater sustainable development goal. Furthermore, the research tried to frame the control variables in the study but there may be environmental variables, which may have influenced the impact of green finance on sustainable development and could not be explored. Another possible point to be taken into consideration in the future would be expanding the scope of analysis by including qualitative measures such as institutional quality, regulatory frameworks, tech advancements and cultural factors to better understand the interplay of factors that determine sustainable development.

9. Conclusion

This study investigates the impact of green finance initiatives on achieving sustainable development in Jordan, with a specific focus on evaluating the effectiveness of green finance strategies in promoting environmental sustainability, as measured by carbon emissions. The study implemented the Autoregressive Distributed Lag (ARDL) technique; moreover, it also considered the income level, population, trade openness, and urbanization, among others, to take care of other possible confounding factors. Empirical evidence from an analysis supports the conclusion that green finance plays an important and positive role in green development in Jordan. An interesting observation was that the number of banks making loans for clean energy equipment caused a decrease in CO2 emissions – in both the short period and in the long run. Such an outcome reflects the theoretical assumption that greening financial structures and investments are conducive to environmental transition and the final success of a more sustainable future amongst current socio-economic systems. Moreover, Diks and Panchenko's causality study found two-way causal relations between green finance and sustainable development that drove offset tendency, thereby suggesting the existence of a virtuous circle whereby one positively impacts the other. Nowadays, green finance tools facilitate efforts both in reducing carbon emissions as well as promoting environmentally sustainable practices. Hence the demand for such tools is capable of increasing leading to the growth of the sector. Also eligible for a control variable, such as income level, population, trade openness and urbanization demonstrating a different level of impact on sustainable development outcomes altogether. The higher the income levels, the less carbon emissions, but population growth is negatively influential and shows that a policy that promotes balanced growth is necessary. The role of trade openness was positive and may have accounted for skill transfer of environmentally compliant technologies and practice. Yet, its relationship with sustainable development showed no significance in the long-run meaning that this relationship remained unsolved in the short-run. So, urban planning and infrastructure development must be planned considering sustainable development. Finally, the research carried out indicates that green finance is a key means for (Jordan) to accomplish sustainable development purposes. Through the creation of power enabling conditions of eco-financial initiatives and promoting spending for projects of environment protection inhabitants of Jordan can count on considerable evolution of carbon emissions, reduction of the negative aspects of climate change, and the advancement of long run economic and social growth. Two-way causation between green finance and sustainable development brings out the prospect of a powerful self-supporting process where one reinforces the other, thus bringing about positive feedback. This in the end will lead to a more sustainable future.

References

Abuoliem, N., Kalyebara, B., & Al-Afeef, M. (2024). Dynamic relationship among carbon dioxide emissions, energy consumption and economic growth. *Uncertain Supply Chain Management, 12*(2), 1015-1024.

Adeleye, B. C., Saenz de Viteri, A., & Lee, K. (2022). Investigating the impact of green finance on sustainable development in the BRICS economies. *Sustainable Development, 30*(6), 1249-1264.

Afzal, M., Akram, R., Naeem, M., & Saklani, U. (2021). The cointegration between globalization and sustainable development: Evidence from the BRICS economies. *Environmental Science and Pollution Research, 28*(36), 50249-50261.

Al-Afeef, M., Ali, O., Al-Tahat, S., Malkawi, A., Kalbounhe, N., & Al-Azzam, Z. (2023). The effect of big data governance on financial technology in Jordanian commercial banks: The mediation role of organizational culture. *International Journal of Data and Network Science, 7*(3), 1283-1294.

Alawneh, R., Ghazali, S., Ali, H., & Mohamed, N. (2021). The impact of green bond experience on the sustainable development of developing countries: Evidence from Jordan. *Sustainability, 13*(5), 2522.

Alghizzawi, M., Al-ameer, A., Habes, M., & Attar, R. W. (2023). Social Media Marketing during COVID-19: Behaviors of Jordanian Users. *Studies in Media and Communication, 11*(3), 20–23.

Al-Obaidani, A., Hadjixenophontos, A., & Petrakis, P. E. (2023). Green finance and environmental sustainability: Evidence from the Middle East and North Africa region. *Energy Economics, 118*, 107546.

Alshammari, M. A., Siddiqui, A. A., & Fatima, A. (2021). Green financing and sustainable development: An empirical analysis from an upper-middle-income economy. *Environmental Science and Pollution Research, 28*(34), 46990-47004.

Al-Smadi, A. W., Al-Smadi, R. W., Al-Afeef, M. A., Al-Afeef, M. A. M., & Kalbouneh, N. Y. (2023). Consequences to the stock market caused by currency fluctuations: Jordanian evidence. *International Journal of Professional Business Review, 8*(4), e01275-e01275.

Al-Zu'bi, A., Batayneh, A., & Al-Zu'bi, Z. (2019). Assessing the environmental impact of desalination plants on the Gulf of Aqaba, Jordan. *Water, 11*(11), 2355.

1536

Al-Zu'bi, H. S., Al-Zu'bi, B. A., Abdallah, A. B., & Khedairi, A. A. (2019). Examining the direct and indirect effects of urbanization on energy intensity in developing economies. *International Journal of Energy Economics and Policy, 9*(5), 226-233.

Atan, N. A., Abdullah, A. H., Ayub, M. A., & Mat Noor, R. (2022a). Green finance and sustainable development in emerging markets: Evidence from panel data analysis. *Environmental Science and Pollution Research, 29*(39), 59826-59841.

Atan, S. A., Rafindadi, A. A., & Abbas, H. M. (2022b). Trade openness and sustainable development: A systematic review. *Environmental Science and Pollution Research, 29*(19), 28389-28410.

Bobinaite, V., Jureviciene, D., & Zernyte, L. (2022). Green finance and sustainable development: A systematic review of the literature. *Sustainability, 14*(8), 4622.

Diks, C., & Panchenko, V. (2006). A new statistic and practical guidelines for nonparametric Granger causality testing. *Journal of Economic Dynamics and Control, 30*(9-10), 1647-1669.

Grossman, G. M., & Krueger, A. B. (1991). Environmental impacts of a North American free trade agreement (No. w3914). National Bureau of Economic Research.

He, J., Iqbal, W., & Su, F. (2023). Nexus between renewable energy investment, green finance, and sustainable development: Role of industrial structure and technical innovations. *Renewable Energy*, 210, 715-724.

Kapetanios, G., Shin, Y., & Snell, A. (2003). Testing for a unit root in the nonlinear STAR framework. *Journal of Econometrics, 112*(2), 359-379.

Lian, W., Ng, A. W., Al, S., & Tan, A. C. C. (2021a). Green finance and sustainable development: A comprehensive review. *Sustainable Development, 29*(6), 1101-1114.

Lian, Y., Zhou, X., & Zhang, Y. (2021b). Green finance, market failure and sustainable development. *International Review of Financial Analysis, 76*, 101790.

Mghnam, E., & Rahman, M. M. (2021). Factors influencing urban development and environmental quality: Evidence from major cities in Jordan. *Environmental Science and Pollution Research, 28*(33), 45508-45524.

Ministry of Environment. (2023). About the ministry. Retrieved from https://www.jordanenv.gov.jo/

Mrayyan, B., & Hamdi, M. R. (2022a). Sustainable urbanization patterns and practices to enhance the delivery of quality public services in Jordan: A case study of Amman. *Environment, Development and Sustainability, 24*(1), 768-786.

Mrayyan, B., & Hamdi, M. R. (2022b). Waste management in Jordan: Challenges and opportunities for a circular economy. *Sustainable Production and Consumption, 32*, 365-377.

Muñoz-Torres, M. J., Rivera, X. C. S., & Fernández-Izquierdo, M. Á. (2022a). Sustainability indicators for the banking sector: A systematic review. *Sustainability, 14*(5), 2749.

Muñoz-Torres, M. J., Rubi-Gonzalez, G., & Vázquez-Cibudio, A. F. (2022b). Green finance and sustainable development in emerging markets: A bibliometric analysis. *Sustainability, 14*(11), 6681.

Nkoro, E., & Uko, A. K. (2016). Autoregressive Distributed Lag (ARDL) cointegration technique: Application and interpretation. *Journal of Statistical and Econometric Methods, 5*(4), 63-91.

Obaid, L., Chaudhary, P., & Alqahtani, S. (2022a). Green finance and sustainable development in Jordan: Challenges and opportunities. *Sustainable Development, 30*(2), 317-333.

Obaid, M. E., Alabdallat, M. S., & Hassounah, M. I. (2022b). Evaluating the impact of urbanization on sustainable development in Jordan using GIS and Remote Sensing. *Sustainability, 14*(8), 4770.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics, 16*(3), 289-326.

Razali, N. M., & Wah, Y. B. (2011). Power comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests. *Journal of Statistical Modeling and Analytics, 2*(1), 21-33.

Sarkodie, S. A., & Strezov, V. (2019). Economic, greenhouse gas emissions, and energy production effects from more sustainable renewable energy development pathways in Australia. *Journal of Cleaner Production, 227*, 469-484.

Shahbaz, M., Nasir, M. A., & Roubaud, D. (2020). Environmental taxes, energy consumption, and environmental quality: A review of the literature and policy implications for Pakistan. *Environmental Science and Pollution Research, 27*(24), 30054-30068.

Ullah, S., Tan, X., Sobar, N. U., & Nadzri, N. F. N. (2021). Impact of green finance on sustainable development in ASEAN economies: An empirical analysis. *Sustainability, 13*(21), 11868.

United Nations. (2015). Paris Agreement. Retrieved from https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

World Commission on Environment and Development. (1987). Our common future. Oxford University Press.