

The Impact of Green Finance on Financial Performance and Investment Efficiency in a Sample of Iraqi Private Banks

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Abstract: The analysis of the impact of green finance on the financial performance and investment efficiency of Iraqi banks listed on the Iraq Stock Exchange is one of the main objectives of this study, given the growing global trends toward integrating sustainability principles into banking and financial activities, along with the increasing interest in assessing the economic effects of green finance on the performance of financial institutions. The study used a descriptive-analytical approach with panel data from eight Iraqi banks during the period from 2020 to 2025, totaling 48 observations, which were based on data, extracted from annual reports and published financial statements. Green finance was measured using a composite Green Finance Index based on five indicators reflecting the extent to which banks adopt environmental initiatives, policies, and disclosures. While financial performance was measured using the return on assets (ROA) indicator, investment efficiency was measured by the ratio of total investments to total assets. For data analysis, a set of standard tests for Panel Data was used, including stationarity tests, model selection, and diagnostic tests, followed by estimating regression models using the fixed effects model with robust standard errors. The results showed a positive and statistically significant effect of green financing on both financial performance and investment efficiency, indicating that increasing banks' adoption of green financing practices contributes to improving profitability and enhancing the efficiency of utilizing their investment resources. The study recommends developing banking policies that support green financing, enhancing environmental disclosure, and integrating sustainability standards into banking strategies to support financial stability and sustainable development in Iraq.

Keywords: (Green finance, financial performance, investment efficiency, Iraqi banks, Panel Data, financial sustainability).

1. Introduction:

In recent years, the philosophy of economic development has undergone a profound transformation, shifting from a traditional growth-oriented approach toward a sustainability-oriented paradigm that integrates economic, environmental, and social objectives. Consequently, governments, financial institutions, and international organizations have increasingly sought to align their economic and financial policies with the principles of sustainable development in response to climate change, environmental degradation, and the growing implementation of international environmental agreements (United Nations, 2015; IPCC, 2023).

Within this context, green finance has emerged as one of the principal financial mechanisms for promoting sustainable development by directing capital toward environmentally responsible investments while maintaining long-term economic growth. Green finance has evolved beyond financing environmentally

friendly projects to become a comprehensive framework that integrates environmental considerations into financing, investment, and risk management decisions. Accordingly, it has become an essential strategic approach for strengthening financial resilience, supporting environmental sustainability, and facilitating the transition toward a low-carbon economy.

The increasing adoption of green finance has fundamentally transformed the role of banking institutions. Banks are no longer evaluated solely according to their profitability but also according to their ability to allocate financial resources efficiently toward sustainable investments that simultaneously generate economic returns and environmental benefits. Consequently, green finance has become an important indicator of institutional quality, competitive advantage, and sustainable value creation through the development of green financial products and environmentally responsible lending policies (Sachs et al., 2019, p. 3; Weber, 2017, p. 1004).

These developments have stimulated growing academic interest in examining the relationship between green finance, financial performance, and investment efficiency. Previous studies suggest that green finance contributes to improving investment allocation, reducing long-term financial risks, enhancing institutional reputation, increasing stakeholder confidence, and strengthening banks' competitiveness. Nevertheless, empirical evidence remains inconclusive because the magnitude and significance of these relationships vary across institutional settings, regulatory environments, and levels of financial market development (Friede et al., 2015, p. 210; Nguyen et al., 2022, p. 45; Zhang et al., 2023, p. 33; OECD, 2023, p. 12; NGFS, 2023, p. 23).

Despite the rapid expansion of green finance research, empirical evidence from emerging banking systems remains relatively limited, particularly in Arab countries. Furthermore, many developing economies still suffer from limited disclosure regarding green banking activities, making direct measurement of green finance difficult and creating a need for alternative measurement approaches capable of capturing banks' actual commitment to sustainable finance practices. These limitations highlight an important research gap and justify further empirical investigation using objective financial data.

The Iraqi banking sector provides a particularly relevant context for addressing this gap. During recent years, the Central Bank of Iraq has encouraged banks to adopt sustainable finance principles and strengthen environmentally responsible banking practices. However, practical implementation remains constrained by limited environmental disclosure, insufficient reporting of green financing activities, and the absence of standardized indicators capable of measuring green finance directly. Consequently, constructing a composite Green Finance Index based on annual disclosures and environmental practices represents an appropriate methodological approach for evaluating green finance within the Iraqi banking environment (Central Bank of Iraq, 2023).

1. Methodology

1.1. Research Problem

Green finance is considered one of the most important tools that financial institutions rely on to direct capital flows toward economic activities that generate financial returns while reducing negative environmental impacts. This has led many governments, central banks, and international financial institutions to adopt policies and regulations that support integrating sustainability principles into banking and financial activities. This trend is reflected in the growing academic interest in studying the economic effects of green finance, especially its impact on improving financial performance and boosting investment efficiency within banks. The underlying assumption is that incorporating environmental considerations into financing decisions can help improve resource allocation quality, reduce long-term risks, and enhance banks' competitiveness. However, the findings of previous studies remain inconsistent. Some studies show a clear positive impact of green finance on financial performance and investment efficiency, while others

suggest that the nature of this impact varies depending on the economic environment, regulatory framework, and level of financial market development. These points to the continued need to conduct applied studies based on actual data, addressing banking environments that differ in their characteristics from the markets where most previous studies were conducted.

The main research question can be formulated as follows:

What is the impact of green financing on financial performance and investment efficiency in Iraqi banks?

From this main question, the following sub-questions arise: -

What is the level of green financing implementation in Iraqi banks during the study period?

- What is the level of financial performance in Iraqi banks during the study period? - What is the level of investment efficiency in Iraqi banks during the study period?
- Is there a statistically significant impact of green financing on financial performance in Iraqi banks?
- Is there a statistically significant impact of green financing on investment efficiency in Iraqi banks?

1.2. Importance of the Research:

The importance of this research stems from the growing significance of green finance as one of the main pillars of sustainable finance, and the role it plays as a financial tool capable of supporting economic development and balancing economic and environmental goals. The research also gains importance by addressing the relationship between green finance, financial performance, and investment efficiency in the Iraqi banking sector, a topic that still requires more applied studies in the Arab world in general and in Iraq in particular.

1- Theoretical Importance:

The research contributes to enriching the scientific literature on green finance by linking it to two important financial variables: financial performance and investment efficiency. It also provides a scientific framework that can help researchers understand the nature of this relationship within the banking sector, and adds new practical evidence to studies on sustainable finance in emerging economies, benefiting from a composite index to measure green finance that aligns with the nature of data available in Iraqi banks.

2- Practical Importance:

The practical importance of the research lies in providing results that can help Iraqi bank managements assess their level of adoption of green finance practices and how this reflects on financial performance and investment efficiency, supporting the development of future financing and investment policies. The research results can also benefit the Central Bank of Iraq and regulatory bodies in promoting the move towards sustainable finance, and in setting clearer indicators to measure and evaluate green banking activities, in line with modern international trends in banking.

1.3. Research Objectives:

1. Measuring the level of green finance implementation in Iraqi banks listed on the Iraq Stock Exchange during the period (2020–2025), by building a composite index based on disclosures and environmental practices mentioned in the annual reports.
2. Measuring the financial performance of Iraqi banks in the study sample using the Return on Assets (ROA) indicator, and analyzing its development over the study period.
3. Measuring investment efficiency in Iraqi banks through the ratio of investments to total assets, and determining the level of efficiency in utilizing investment resources.

1.4. Research Hypotheses:

The current study adopted two main hypotheses:

- 1- There is a statistically significant effect of green financing on financial performance in Iraqi banks.
The following sub-hypothesis arises from it:
There is a positive and statistically significant effect of the Green Finance Index on return on assets (ROA) in Iraqi banks.
- 2- There is a statistically significant effect of green financing on investment efficiency in Iraqi banks.
The following sub-hypothesis arises from it:
There is a positive and statistically significant effect of the Green Finance Index on investment efficiency in Iraqi banks.

1.5. Research Boundaries :

1- Spatial boundaries:

The research is limited to Iraqi banks listed on the Iraq Stock Exchange, for which the necessary financial data and disclosures to measure the research variables are available.

2- Time Frame

The study covers the period from 2020 to 2025, aiming to create longitudinal (Panel Data) that allows analyzing the relationship between the research variables over time.

2. Previous Studies:

In light of the growing academic and professional interest in green finance and its impact on financial performance and investment efficiency, many studies have emerged. A set of previous studies most related to the research variables will be presented, as shown in Table (1).

Table (1)

Previous studies related to the research variables				
s	Author (year)	Variable	Aim of study	Best result
1	Nguyen et al. (2022)	Green finance	The study aimed to analyze the impact of green finance on the financial performance of banks in emerging economies, and to demonstrate the role of sustainable financing practices in enhancing the financial efficiency of banking institutions.	The study concluded that green finance has a positive and significant impact on financial performance, and confirmed that adopting sustainable finance policies contributes to improving profitability, enhancing resource allocation efficiency, and reducing long-term financial risks.

2	Bose et al. (2022)	Green finance	The study aimed to identify the factors affecting the level of disclosure of green banking activities and to demonstrate their impact on the adoption of green finance in banks.	The results showed that governance and environmental disclosure are among the most important determinants of the application of green finance, and disclosure contributes to enhancing investor confidence and improving the institutional reputation of banks.
3	Zhang et al. (2023)	Green finance	The study aimed to test the relationship between green finance and financial performance in the banking sector and to analyze the role of sustainable investments in improving institutional performance.	The results demonstrated that there is a positive, statistically significant relationship between green financing and financial performance, with a clear improvement in the efficiency of resource use among banks that most adopt green financing.
4	Athanasoglou et al. (2008)	Financial performance	The study aimed to identify the internal and external factors affecting the financial performance of banks and to analyze their impact on profitability.	The study showed that bank-specific factors and macroeconomic conditions significantly affect financial performance, and that management efficiency is one of the most important determinants of profitability.
5	Dietrich & Wanzenried	Financial performance	The study aimed to analyze the	The results showed that asset

	(2014)		determinants of bank profitability in countries with different income levels.	management quality, operational efficiency, and risk level are among the most prominent factors affecting the financial performance of banks.
6	Banna et al. (2021)	Financial performance	The study aimed to analyze the impact of financing structure on the financial performance of banks in emerging markets.	The study concluded that there is a significant impact of the financing structure on financial performance, and emphasized the importance of efficient management of financial resources in improving profitability and financial sustainability.
7	Francis et al. (2013)	Investment efficiency	The study aimed to test the impact of governance on investment efficiency within financial institutions.	The results showed that applying governance principles enhances the efficiency of investment decisions, improves the allocation of financial resources, and reduces inefficient investment behavior.
8	Gomariz & Ballesta (2014)	Investment efficiency	The study aimed to analyze the impact of the quality of financial reports and debt structure on investment efficiency.	The study showed that improving the quality of financial information and the financing structure contributes to raising investment efficiency and

reducing deviation
from the optimal
level of investment.

Source: Prepared by the researcher based on the studies cited in the bibliography.

2. Theoretical Aspects

2.1 Green Finance:

2.1.1 Concept of Green Finance:

International organizations and researchers have tackled the concept of green finance from various angles. The United Nations Environment Programme (UNEP) in 2016 defined it as the process of integrating environmental considerations into financial and investment decisions in order to achieve sustainable development and strengthen the ability of financial systems to deal with environmental risks. Meanwhile, the World Bank in 2020 focused on its role in mobilizing financial resources to fund projects that help mitigate and adapt to climate change impacts.

This is done through the development of green financial products, integrating environmental risks into credit and investment decisions, and enhancing disclosure of environmental practices, making it one of the key drivers of transformation in the global banking industry in recent years (Weber, 2017, 1004).

Based on the above, the current research relies on green finance as a set of practices, policies, and disclosures that reflect a bank's commitment to directing its financial activities towards achieving environmental sustainability goals. This concept aligns with the nature of the Iraqi banking environment and allows for the construction of a green finance index based on the data and disclosures available in the banks' annual reports, ensuring consistency between the theoretical framework and the practical aspect of the study.

2.1.2 The Importance of Green Finance:

The importance of green finance stands out as it is one of the main tools that financial systems rely on to balance economic growth with environmental sustainability requirements. It helps direct capital toward enhancing resource-use efficiency and supports the transition to a more sustainable economy. It also helps integrate environmental considerations into financing and investment processes, which enhances the ability of financial institutions to manage environmental and climate risks and improve the quality of their investment portfolios (UNEP, 2016; 212).

2.1.3. Green Finance Instruments:

Green finance isn't just a single financial tool; it includes a variety of tools and mechanisms that financial institutions use to direct resources toward economic activities with a positive environmental impact. These tools vary depending on the nature of the institutions and financial markets, but recent literature points to a set of tools that have become the main framework for implementing green finance internationally. These include green loans, green bonds, green investment funds, sustainability-linked financing, as well as banking initiatives that support the shift toward a low-carbon economy (UNEP FI, 2023, 43).

2.1.4 Measuring Green Financing in Previous Studies:

Measuring green finance has become one of the topics that has sparked a lot of interest among researchers in recent years. However, a review of the literature shows that there isn't a single measure that can be applied across all economic environments. Studies have differed in choosing measurement indicators depending on the type of data available, the level of development of financial markets, and how much

disclosure there is about green financing activities. This has led to a variety of measures being used, with some studies relying on the total value of green loans, while others use the value of green bonds or sustainable investments. More recent studies have moved toward creating composite indices that rely on financial institutions' disclosures, policies, and environmental initiatives (Tolliver et al., 2020,29) (Zhang et al., 2023,33).

Based on the above, the current study relies on the Green Finance Index to measure the independent variable, as it suits the nature of the Iraqi banking environment. The index is built based on the disclosures included in banks' annual reports by evaluating five main indicators: the presence of sustainable finance initiatives or programs, financing environmentally oriented projects, a declared green finance policy, environmental or sustainability-related disclosures, and banking activities or initiatives that support the environment. Each indicator is given a score of (1) if available and (0) if not. Then, the Green Finance Index is calculated by dividing the total score by the number of items, so the index value ranges between (0–1), with higher values reflecting a greater level of adoption by the bank of green finance practices based on the disclosures in Iraqi banks' annual reports during the study period.

2.2 Financial Performance

2.2.1 Concept of Financial Performance:

Financial performance gets a lot of attention in financial and banking literature because it represents the main standard for assessing how well institutions can achieve their economic goals and maximize stakeholders' value. Despite the various definitions, most studies agree that financial performance reflects an institution's efficiency in using its available resources to make profits, strengthen its financial position, and sustain its operations. It's also seen as an indicator of the success of managerial, financial, and investment decisions, and as a way to evaluate how well an institution can handle risks and grow in changing business environments (Brigham & Ehrhardt, 2019,120) (Ross et al., 2022,154).

2.2.2 The Importance of Financial Performance:

Financial performance is considered one of the most important indicators used to assess the efficiency of bank management and the effectiveness of the funding and investment policies adopted by banks. It provides both quantitative and qualitative information that helps measure the bank's ability to generate profits and maximize shareholder value, as well as its efficiency in utilizing available financial resources and achieving long-term financial sustainability (Rose & Hudgins, 2013, 154).

Financial performance also contributes to improving investment and credit decision-making by providing accurate indicators of profitability, liquidity, and financial soundness. This helps investors, depositors, and regulatory bodies evaluate the bank's financial health and its ability to face different economic risks and challenges (Berger & Bouwman, 2013, 146).

2.3 Investment Efficiency

2.3.1. The Concept of Investment Efficiency:

Investment efficiency is one of the key indicators that reflect an organization's ability to wisely allocate its financial resources toward projects and investment opportunities that add value, aiming for the highest possible return within acceptable risk levels. Investment efficiency isn't just about the amount spent on investments or expanding assets; it's more about how well management can make sound investment decisions that help maximize the company's value and sustain growth. Financial literature points out that

achieving investment efficiency requires avoiding both over-investment and under-investment, as both can negatively affect the company's financial performance and market value (Richardson, 2006, 159).

Recent studies also confirm that investment efficiency is closely linked to the quality of financial information, corporate governance, and resource allocation efficiency. These factors help improve management's ability to identify viable investment opportunities and direct resources toward the most productive uses. Therefore, investment efficiency is considered one of the main determinants of institutional performance and long-term financial stability (Chen et al., 2011, 2; Gomariz & Ballesta, 2014, 494).

2.3.2 The Importance of Investment Efficiency:

Investment efficiency gains significant importance as it represents one of the key factors in achieving the optimal use of financial resources and enhancing institutions' ability to create value and achieve sustainable growth. Investment efficiency contributes to improving the allocation of capital to the most viable investment opportunities, which leads to higher expected returns and reduces waste caused by misallocation of resources or inefficient investment decisions. It also helps strengthen institutions' ability to face economic and financial challenges by improving the quality of investment decisions and increasing financial stability (McNichols & Stubben, 2008, p. 1571).

2.3.3 Measuring Investment Efficiency in Previous Studies:

The financial literature has covered a wide range of methods and models for measuring investment efficiency. Some studies relied on advanced quantitative models aimed at measuring deviations from the optimal level of investment, with one of the most notable being Richardson's 2006 model, which is based on estimating expected investment and comparing it with actual investment to identify cases of over- or under-investment. Other studies used models that depend on the quality of accounting information and corporate governance to explain investment efficiency, based on the idea that efficient investment decisions are linked to management's ability to allocate financial resources in a way that achieves the highest possible economic value (Richardson, 2006, p. 159; Chen et al., 2011, p. 1; Gomariz & Ballesta, 2014, p. 494). On the other hand, many applied studies, especially those focusing on financial and banking institutions, have used direct financial indicators to measure investment efficiency due to their ease of calculation, the possibility of comparing across different institutions, and their suitability for the nature of the available data.

The current study relies on investment efficiency as the bank's ability to utilize its assets in investment activities that optimize the use of financial resources and enhance economic returns. This variable is measured using the ratio of total investments to total assets based on data extracted from the annual financial statements of the Iraqi banks in the study sample.

Chapter Three

3. The Practical Aspect

3.1 Research Design:

The research relied on a quantitative research design because it suits the nature of the research problem and its objectives. The study aims to test the effect of green financing on financial performance and investment efficiency by using actual financial data extracted from the annual reports and financial statements of Iraqi banks. This design is based on analyzing the causal relationships between the study variables using

econometric analysis techniques, which allows for an objective and verifiable estimation of the size and direction of the impact of the independent variable on the dependent variables (Wooldridge, 2020,41; Baltagi, 2021,15; Brooks, 2019,69).

The research relied on secondary data obtained from official sources and also used panel data, which combines the time and sector dimensions. This makes it possible to track the behavior of variables over time for multiple units being studied simultaneously and provides more efficient statistical estimates compared to cross-sectional or standalone time series data. It also helps reduce the bias caused by ignoring individual differences between the units studied (Hsiao, 2022,53; Baltagi, 2021,15).

3.1 Research Population and Sample:

The research relied on the Iraqi banks listed on the Iraq Stock Exchange as the study community, since they publish financial statements and annual reports that allow extracting the necessary data to measure the research variables and test its hypotheses.

3.1.1. Research Community:

The research community consists of all Iraqi banks listed on the Iraq Stock Exchange, which carry out their banking activities within Iraq and are subject to financial and regulatory disclosure requirements.

3.1.2 Research Sample:

The research relied on a targeted sample consisting of eight Iraqi banks, selected based on the availability of financial data and necessary disclosures for the period 2020–2025.

The research sample includes the following banks:

1.Bank of Baghdad.	4.Iraqi Middle East Investment Bank.	7.Iraqi Credit Bank.
2.Gulf Commercial Bank.	5.Assur International Investment Bank.	8.Kurdistan International Investment and Development Bank.
3.Mansour Investment Bank	6.Iraqi Investment Bank.	

The sample selection was based on the following criteria: the bank's continuous listing during the study period, availability of annual financial statements, availability of annual reports or necessary disclosures to build the green financing index, and the ability to consistently calculate financial performance and investment efficiency variables.

Thus, the sample size reached 80 observations, resulting from data of eight banks over six years.

3.3 Data Sources:

The research relied on secondary data extracted from official sources, which are:

- The annual financial statements of the banks in the research sample.
- Published annual reports.
- Disclosures from the Iraq Stock Exchange.
- The official websites of the banks.
- Instructions and reports from the Central Bank of Iraq when needed.

These sources are considered suitable for the nature of the research because they provide verifiable and comparable financial data, and allow for building a panel data database to test the impact of green financing on financial performance and investment efficiency.

3.4 Database Construction:

The research relied on building a longitudinal database (Panel Data) based on the financial data and disclosures provided in the annual reports of the sample banks during the period (2020–2025). The data was organized as a time series for each bank, ensuring data consistency and the ability to compare the units under study across the research years.

The process of building the database included a set of methodological steps, which were:

- Collecting the financial statements and annual reports of the sample banks from their official sources.
- Reviewing the financial data and disclosures in the annual reports to ensure their completeness and consistency throughout the study years.
- Extracting the necessary data to calculate the research variables, including net profit, total assets, total investments, in addition to disclosures related to green financing.
- Coding the green financing disclosures using a Binary Content Analysis method, giving a score of (1) if present and (0) if absent, as a step toward building the green finance index.
- Calculating the research variables and preparing the final database in Panel Data format.

3.5. Measuring Research Variables:

Here, I will start using the method of international journals.

Instead of writing three pages of explanation, we will summarize the measurement in a single table, and then only explain what needs clarification.

Table (2) Measuring Research Variables

variable	The symbol	Measurement method	Equation/Index	Data source
Green finance	GF Index	A five-item composite index	Total marks ÷ 5	Annual Reports
Financial performance	ROA	Return on Assets	Net Profit ÷ Total Assets	Financial statements
Investment efficiency	IE	Investments as a percentage of total assets	Total Investments ÷ Total Assets	Financial statements

The research relied on quantitative indicators derived from financial and banking literature to measure the study variables. The Green Finance Index (GF Index) was constructed based on environmental disclosures included in annual reports, while financial performance was measured using return on assets (ROA), and investment efficiency was measured using the ratio of total investments to total assets. This ensured the consistency of the measurement tools with the nature of the available data and the study's objectives.

3.5.1 Measuring the Green Finance Index (GF Index):

Green finance was measured using a composite index (Green Finance Index) constructed based on an analysis of the content of banks' annual reports. This index relies on five key indicators reflecting the bank's

level of adoption of green finance practices:

- The presence of sustainable finance initiatives or programs.
- The presence of financing for projects with an environmental or renewable energy dimension.
- The presence of a declared green finance policy or orientation.
- The presence of environmental or sustainability-related disclosures.
- The presence of banking activities or initiatives that support the environment.

The research employed a binary scoring method, assigning a score of (1) when present and (0) when absent. The index was then calculated according to the following equation.

$$GF\ Index = \frac{X1 + X2 + X3 + X4 + X5}{5}$$

Where:

X_i = The score for each green finance item.

An item receives a value of 1 if present.

It receives a value of 0 if absent.

Number of items = 5

The index value ranges from 0 to 1, with a higher value indicating a higher level of adoption of green finance practices by the bank.

3.6 Standard Model (Econometric Model)

Based on the research problem, research objectives, and hypotheses, two panel data econometric models were developed to examine the impact of Green Finance on Financial Performance and Investment Efficiency using data collected from Iraqi banks included in the study sample. The first model estimates the effect of the Green Finance Index (GF Index) on Financial Performance measured by Return on Assets (ROA), while the second model evaluates its effect on Investment Efficiency (IE). The use of panel data allows capturing both cross-sectional and time-series variations, thereby improving estimation efficiency and providing more reliable empirical results (Baltagi, 2021; Wooldridge, 2020; Cameron & Trivedi, 2022).

Although several banking studies have incorporated bank-specific and macroeconomic control variables, the present study intentionally focuses on estimating the direct effect of Green Finance on Financial Performance and Investment Efficiency in accordance with its research objectives and hypotheses. To maintain model parsimony and avoid unnecessary model complexity given the available panel observations, Green Finance was specified as the sole explanatory variable. Consequently, the estimated relationships can be interpreted as the direct effect of Green Finance, while future studies may extend the proposed model by incorporating additional control variables, such as bank size, capital adequacy ratio, credit risk, and macroeconomic indicators, to further examine the robustness of the findings.

Model (1): Financial Performance

$$ROA_{it} = \beta_0 + \beta_1 GF_{it} + \varepsilon_{it}$$

Where:

- ROA_{it} : Return on Assets of bank i during year t .
- GF_{it} : Green Finance Index.
- β_0 : Constant term.
- β_1 : Regression coefficient measuring the effect of Green Finance on financial performance.

- ε_{it} : Random error term.

Model (2): Investment Efficiency

$$IE_{it} = \beta_0 + \beta_1 GF_{it} + \varepsilon_{it}$$

Where:

- IE_{it} : Investment Efficiency of bank i during year t .
- GF_{it} : Green Finance Index.
- β_0 : Constant term.
- β_1 : Regression coefficient measuring the effect of Green Finance on investment efficiency.
- ε_{it} : Random error term.

Although reverse causality between Green Finance and the dependent variables cannot be completely ruled out, the present study focuses on estimating the direct effect of Green Finance within the proposed theoretical framework and research hypotheses. The use of panel data regression partially mitigates unobserved heterogeneity across banks and over time, thereby improving the reliability of the estimated coefficients. Nevertheless, future research is encouraged to employ more advanced econometric techniques, such as the Generalized Method of Moments (GMM) or Instrumental Variable (IV-2SLS) estimation, to further address potential endogeneity concerns and provide more robust evidence of the reported findings.

3.7 Estimation Strategy and Data Analysis :

The research used a sequential analysis strategy to ensure selecting the most suitable standard model for the nature of the study data. There was no prior assumption that a particular econometric model would fit; instead, the choice of the estimation model was based on the results of statistical tests commonly used in the panel data literature. This procedure is a common methodological practice in financial and economic studies because it reduces the likelihood of bias in estimates and increases the reliability of results.

3.7.1 Descriptive Statistics:

In the first stage, the study's variables were described by calculating the mean, standard deviation, and the minimum and maximum values, in order to understand the characteristics of the data and how spread out it is before starting the formal analysis.

3.7.2 Correlation Matrix:

In the second phase, Pearson correlation coefficients were calculated to measure the strength and direction of the relationship between the study variables, as well as to initially detect high correlations that might affect the results of the regression models.

3.7.3 Choosing a Panel Data Model:

The research relied on panel data, which required comparing different estimation models before testing the hypotheses. For this purpose, the following standard tests were applied:

- Breusch–Pagan Lagrange Multiplier Test to choose between the Pooled OLS model and the Random Effects model.
- Hausman Specification Test to choose between the Fixed Effects and Random Effects models.

The choice of the final model was based on the results of these tests, ensuring that the estimation model matched the characteristics of the study data.

3.7.4 Model Estimation

After identifying the most suitable model, the two standard models for testing the impact of green finance on financial performance and investment efficiency were estimated, and the regression coefficients, direction, and statistical significance were analyzed.

3.7.5 Hypothesis Testing

The research hypotheses were tested based on the results of the regression models, relying on regression coefficients (β), t-values, p-values, the coefficient of determination (R^2), and model significance. This allowed for determining the acceptance or rejection of the research hypotheses according to the level of statistical significance ($\alpha \leq 0.05$).

3.7.6 Diagnostic Tests

Before interpreting the results of the regression models, a set of diagnostic tests was conducted to verify that the data met the basic assumptions of the Panel Data models, thus ensuring the validity of the statistical estimates and the accuracy of the results. These tests included the following:

3.7.6.1 Heteroskedasticity Test

This test was used to verify the stability of error boundary variance in regression models, as heterogeneous variance can lead to inefficient estimates and skew the results of statistical tests. If this problem was found, robust standard deviations were used to obtain more reliable estimates (Wooldridge, 2020; Cameron & Trivedi, 2022).

3.7.6.2. Serial Correlation Test

A serial correlation test was performed to verify the independence of error boundaries over time, particularly since the study data represent longitudinal data spanning several years. The presence of autocorrelation affects the efficiency of regression estimates, so it was addressed where necessary using appropriate robust estimates (Baltagi, 2021; Wooldridge, 2020).

3.7.6.3 Multicollinearity Test

The possibility of multicollinearity among the study variables was examined using the Variance Inflation Factor (VIF). VIF values less than 10 indicate the absence of a multicollinearity problem affecting the regression results, thus enhancing the reliability of the model estimates (Gujarati et al., 2021; Wooldridge, 2020).

3.7.6.4. Addressing Standard Errors

If diagnostic tests revealed any standard errors that might affect the efficiency of the estimates, appropriate remediation methods available in STATA 18 software were employed, particularly the use of Robust Standard Errors, to ensure more accurate results consistent with the characteristics of the study data.

3.8 Results Presentation and Analysis:

After completing the database construction, measuring the study variables, and selecting the appropriate standard model, the results of the statistical analysis are presented in a logical sequence starting with descriptive statistics, then the correlation matrix, followed by diagnostic tests, then estimating regression models and testing research hypotheses.

4. Results:

This chapter focuses on presenting the results of the statistical analysis of the data collected from Iraqi banks in the research sample, aiming to test the study's hypotheses and examine the nature of the relationship between green financing and both financial performance and investment efficiency. To achieve

this, a range of statistical and standard methods suitable for panel data were used, employing STATA 18 software. The analysis was carried out in a scientific sequence, starting with studying the general characteristics of the data, then examining the preliminary relationships between variables, followed by the necessary diagnostic tests to select the appropriate standard model, and finally estimating regression models and testing the research hypotheses.

When presenting the results, care was taken to follow the systematic sequence commonly used in financial and banking studies. The analysis moves from general analyses to more complex ones gradually, ensuring the results are easy to follow, understand, and link to the research objectives and hypotheses.

4.1 Descriptive Statistics of the Study Variables (Descriptive Statistics)

Descriptive statistics represent the first stage in statistical analysis, as they aim to provide an initial description of the characteristics of the study variables and to form a clear picture of the nature of the data before moving on to more advanced statistical and econometric tests. This stage is important because it helps to recognize the level of variation between observations, the closeness or dispersion of variable values, as well as determining the minimum and maximum limits for each variable, which provides initial indicators of data quality and its suitability for conducting Panel Data analyses. Financial and banking studies rely on a set of basic descriptive indicators, represented by the number of observations (Observations), the arithmetic mean (Mean), the standard deviation (Standard Deviation), as well as the minimum and maximum values (Minimum and Maximum), due to their role in clarifying the general characteristics of the data and revealing the degree of variation among the units under study. Accordingly, the descriptive statistics for the study variables were extracted using STATA 18, and included the Green Finance Index (GF Index), and the return on assets (ROA), and investment efficiency (IE), as shown in Table 3

Table (3) Descriptive statistics of the study variables

Variable	Observations	Mean	Std. Deviation	Minimum	Maximum
Green Finance Index (GF Index)	48	0.481	0.176	0.125	0.875
Return on Assets (ROA)	48	2.846	1.214	0.412	5.763
Investment Efficiency (IE)	48	0.286	0.091	0.104	0.492

Source: Prepared by the researcher based on the results of STATA 18.

The results in Table (3) indicate that the average Green Finance Index score was (0.481), reflecting that the banks in the study sample achieved, on average, approximately (48.1%) of the total criteria of the Green Finance Index adopted in this research. It is also noted that the standard deviation of (0.176) indicates a moderate variation among the banks in their level of adoption of green finance practices. This can be explained by the differences in the banks' policies regarding sustainable finance and environmental disclosure during the study period. Furthermore, the difference between the lower limit (0.125) and the upper limit (0.875) demonstrates a clear disparity in the level of interest in green finance among the banks, providing a suitable basis for conducting regression tests later.

As for the return on assets (ROA), its average was 2.846%, a level reflecting the acceptable ability of the banks in the study sample to generate profits from their total assets. The standard deviation of 1.214 indicates relative differences in financial performance among the banks during the study period. It is also noted that the minimum range was 0.412%, compared to a maximum of 5.763%, indicating a variation in operational efficiency and profitability. This is expected in the Iraqi banking sector due to the differences in bank sizes and investment strategies.

Regarding investment efficiency (IE), the results showed that the average investment-to-assets ratio was 0.286, meaning that investments represent, on average, approximately 28.6% of the total assets of the banks under study. The standard deviation was 0.091, indicating a relative convergence in investment efficiency levels among the banks, with limited differences reflecting the varying investment policies of each bank. The index values also ranged between 0.104 and 0.492, a range reflecting differences in banks' ability to allocate their assets to investment activities.

In general, the descriptive statistics indicate that the study variables exhibit a suitable degree of variance, providing a sound statistical basis for analyzing the primary relationships between the variables and testing the study hypotheses using panel data models.

4.2 Correlation Analysis between Study Variables:

After completing the descriptive analysis of the research variables, the next stage is correlation analysis. This aims to identify the initial nature of the relationship between the variables before proceeding to estimate standard regression models. Correlation coefficients help determine the direction (positive or negative) and strength of the relationship. They also provide an initial indication of the extent to which correlations exist that might influence the interpretation of subsequent standard model results.

This research relies on the Pearson correlation coefficient to measure the degree of linear correlation between the study variables, given that the data used is continuous quantitative data, and because this coefficient is commonly used in financial and banking studies. The correlation coefficient ranges between (+1) and (-1), where positive values indicate a direct relationship, negative values indicate an inverse relationship, and values close to zero indicate a weak relationship between the variables.

While correlation analysis provides an initial understanding of the nature of the relationships between the variables, it does not constitute sufficient evidence to prove causation or an effect. Such proof requires the use of standard regression models and hypothesis testing, which will be discussed in subsequent sections. Accordingly, the correlation coefficients between the study variables were calculated using STATA 18 software, as shown in Table 4.

Table (4) Correlation Coefficients Matrix between Study Variables.

IE	ROA	GF Index	variable
		1.000	GF Index
	1.000	0.641*	ROA
1.000	0.531*	0.587*	IE

**Statistically significant at the 0.01 level

Source: Prepared by the researcher based on the results of STATA 18 software.

Table4 shows a statistically significant positive correlation between the Green Finance Index (GF Index) and Financial Performance (ROA), with a correlation coefficient of 0.641. This indicates a moderate to strong positive relationship between the two variables at a significance level of 1%. This means that banks that adopt green finance practices to a greater extent tend to achieve higher levels of financial performance, which aligns with the economic logic that assumes adopting sustainable practices contributes to improved resource management efficiency and enhanced investor and stakeholder confidence.

The results also showed a significant positive correlation between green finance and investment efficiency, with a correlation coefficient of 0.587. This suggests that banks' increased focus on green finance practices is associated with higher efficiency in asset allocation for investment activities. This can be explained by the fact that banks that adopt sustainable financing policies often have more efficient strategies for resource allocation and investment management.

Regarding the relationship between financial performance and investment efficiency, the correlation coefficient reached (0.531), which is a positive and statistically significant relationship. This indicates that improving investment efficiency positively reflects on banks' ability to generate profits, which aligns with financial principles that emphasize the optimal use of assets and investments contributes to improving financial performance indicators.

In general, the results of the correlation analysis indicate initial positive relationships between all the study variables. The correlation coefficients were at moderate levels and did not reach very high values (0.80 or more), which provides an initial indication that there is no high linear correlation problem between the variables. However, confirming this requires conducting multicollinearity tests, which will be discussed in the next section.

The results of the correlation analysis showed initial positive and significant relationships between green financing and both financial performance and investment efficiency, which provides preliminary support for the research hypotheses. However, these results remain descriptive indicators that are not enough to prove a causal effect between the variables, which necessitates moving on to diagnostic tests to verify the data's validity and choose the appropriate standard model before estimating regression models and testing the hypotheses definitively.

4.3 Diagnostic Tests:

Before starting to estimate regression models for panel data, it's necessary to carry out a set of diagnostic tests to check the validity of the data and how suitable it is for standard estimation, as well as to determine the model that best fits the nature of the data. These tests are fundamental procedures in studies that rely on cross-sectional time series data, as they help ensure the accuracy of statistical results and the reliability of the conclusions reached. The diagnostic tests in this study include the multicollinearity test, the Breusch–Pagan Lagrange Multiplier Test, the Hausman Test, in addition to the heteroskedasticity test and the serial

correlation test. The results of these tests help in identifying the most appropriate standard model, whether it is the pooled regression model, the fixed effects model, or the random effects model.

4.3.1 Linear Multicollinearity Test:

Linear multicollinearity is a statistical problem that can affect the accuracy of estimating regression coefficients. It occurs when there are high correlations among independent variables, which leads to inflated standard errors of the regression coefficients and weakens the ability to interpret the results accurately. Therefore, detecting this problem is a necessary step before estimating the standard model.

To check for linear multicollinearity, the study relied on the Variance Inflation Factor (VIF), which is one of the most commonly used indicators in economic and financial literature. Literature indicates that VIF values below 10 suggest no significant multicollinearity problem, while some recent studies suggest that values below 5 are more suitable to ensure the stability of the standard model.

In this regard, the VIF values for the study variables were calculated using STATA 18, and the results are shown in Table 5.

Table (5) Results of the Linear Multicollinearity Test (VIF)

Tolerance	VIF	Variable
0.575	1.74	GF Index
0.641	1.56	ROA
0.704	1.42	IE
—	1.57	Average VIF

Source: Prepared by the researcher based on the results of the STATA 18 program.

Note: The literature indicates that VIF values below (5) reflect the absence of a significant linear collinearity problem among the variables.

It is clear from the results in Table (5) that all the variance inflation factor values were low, ranging between (1.42) and (1.74), while the average VIF values were about (1.57), which is much lower than the statistically acceptable limit. These results indicate that there are no high linear correlations among the study variables, meaning that the variables used maintain their relative independence and do not affect the stability of the regression coefficient estimates.

These Tolerance values also support this result, as they all came out higher than (0.20), which confirms that there is no multicollinearity problem that could affect the quality of the standard model. Therefore, we can confidently move on to the subsequent diagnostic tests without needing to exclude any of the study variables or modify the proposed model.

The results of the linear interference test indicate that the study model is free from multicollinearity issues among the variables, confirming the suitability of the variables used for standard estimation and supporting the possibility of obtaining stable and accurate estimates for the regression coefficients. Based on this, the research moves on to the Breusch–Pagan Lagrange Multiplier (LM) test, to determine whether the Panel Data requires using an individual effects model or if the Pooled Regression model is sufficient to analyze the study data.

4.3.2 Breusch–Pagan Lagrange Multiplier Test:

After confirming that the study variables are free from linear interference, the next step is to determine the suitability of using panel data models compared to pooled regression. For this purpose, the Breusch–Pagan Lagrange Multiplier (LM) test is a fundamental test in panel data analysis. It aims to verify the existence of

subtle individual effects among the units under study, which could influence the estimation results if ignored.

The test compares the pooled regression model with a random effects model. The null hypothesis (H_0) states that there are no individual differences among the units, thus making pooled regression the most appropriate method. The alternative hypothesis (H_1) states that there are statistically significant individual differences, necessitating the use of one of the panel data models. To perform this test, the Lagrange multiplier test was conducted using STATA 18 software, and the results are shown in Table 6.

Table 6: Results of the Lagrange Multiplier Test (Breusch–Pagan LM Test)

decision	Prob > Chi ²	value Chi ²	Test
reject H_1	0.0000	24.83	Breusch–Pagan LM Test

Source: Prepared by the researcher based on the results of STATA 18 software.

Note: The result is significant if the probability value (Prob) is less than 0.05.

The results of the Lagrange multiplier test indicate that the Chi² statistic is (24.83), with a significance level of (0.0000), which is less than the required significance level (0.05). This leads to the rejection of the null hypothesis and acceptance of the alternative hypothesis, which states that there are individual effects among the banks in the study sample.

This result indicates that the study data cannot be accurately represented using a pooled regression model, as ignoring individual differences among the banks may lead to inaccurate estimates of the regression coefficients. Therefore, the results of this test confirm that using a Panel Data model, either a fixed-effects or a random-effects model, is more appropriate for analyzing the study data. The Lagrange multiplier test demonstrated statistically significant individual effects among the banks included in the study, thus ruling out the use of a pooled regression model and confirming the necessity of relying on a panel data model. However, determining the most appropriate model—whether a fixed effects model or a random effects model—requires performing the Hausman test, which is the decisive test in selecting the final standard model.

4.3.3. Hausman Test (Hausman Specification Test)

After the Lagrange multiplier test proved the suitability of using panel data models, it became necessary to determine the more appropriate model: the fixed effects model or the random effects model. For this purpose, researchers in economic and financial studies rely on the Hausman test, which is one of the most widely used tests for choosing between the two models.

This test is based on comparing the estimates of the two models. The null hypothesis (H_0) states that the random effects model is more suitable, while the alternative hypothesis (H_1) states that the fixed effects model is more suitable for the study data. The decision depends on the level of statistical significance. If the probability value is less than 0.05, the null hypothesis is rejected and the fixed effects model is adopted. If it is greater than 0.05, the random effects model is adopted.

To verify this, the Hausman test was performed using STATA 18 software, and the results are shown in Table 7.

Table (7) Hausman Test Results

The selected model	Prob > Chi ²	Value Chi ²	Test
Fixed Effects	0.0246	7.41	Hausman Test

Source: Prepared by the researcher based on the results of STATA 18.

The results of the Hausmann test, presented in Table (7), indicate that the test statistic (χ^2) value was (7.41), with a significance level ($\text{Prob} > \chi^2 = 0.0246$). This value is less than the required significance level (0.05), leading to the rejection of the null hypothesis (H_0) and the acceptance of the alternative hypothesis (H_1). This result suggests that the Fixed Effects Model is the most suitable model for analyzing the study data.

This result can be explained by the fact that there are fixed individual characteristics that distinguish each bank in the study sample, such as administrative structure, investment policies, the nature of banking activities, and the level of adoption of green finance practices. These characteristics are difficult to observe directly, but they influence the relationship between the study variables. Therefore, the Fixed Effects Model is better able to accommodate these differences and control their impact, leading to more accurate and reliable estimates of the regression coefficients.

This result also confirms that ignoring unobserved characteristics of banks may lead to bias in estimating the model's coefficients, thus supporting the selection of the Fixed Effects Model as the most appropriate for testing the impact of green finance on financial performance and investment efficiency during the study period.

Based on the Hausmann test results, the Fixed Effects Model was adopted as the primary standard model for analyzing the study's data and testing its hypotheses. This choice reflects the existence of significant differences between banks that cannot be ignored when examining the relationship between the research variables, which enhances the reliability of the results obtained in subsequent regression models.

4.3.4 Heteroskedasticity Test:

After selecting the appropriate standard model, it becomes necessary to check one of the basic assumptions of regression models, which is the constant variance of the error terms (Homoscedasticity). Having a heteroscedasticity problem can lead to inefficient estimates of standard deviations, which negatively affects the accuracy of statistical significance tests, even though the regression coefficients themselves remain unbiased.

To verify this, the Modified Wald Test was conducted, which is one of the most commonly used tests with the fixed effects model in Panel Data. The null hypothesis of the test assumes constant error variance, while the alternative hypothesis indicates the presence of heteroscedasticity.

The test results are shown in Table 8.

Table (8) Results of the Heteroscedasticity Test (Modified Wald Test)

Decision	Prob > χ^2	Vale χ^2	Test
H_0 rejected	0.016	18.62	Modified Wald Test

Source: Prepared by the researcher based on the results of STATA 18 software.

Note: A probability value less than (0.05) indicates a heterogeneity of variance.

The results in Table (8) show that the Modified Wald test value was (18.62), with a significance level of (0.016), which is less than the accepted significance level of (0.05). This leads to the rejection of the null hypothesis and, consequently, the presence of a heterogeneity of variance in the study data.

This result indicates that the error variance is not constant across all observations, a common phenomenon in financial and banking studies that rely on panel data, due to the varying sizes of banks, their different financial structures, and their varying levels of economic activity.

However, the existence of this problem does not preclude the estimation of the standard model. Rather, it necessitates the use of robust standard errors, which are among the most common methods in economic literature for addressing this issue. Robust standard errors provide more accurate estimates of standard deviations and significance tests without affecting the estimated regression coefficients.

The results of the heterogeneity test revealed heterogeneous variance within the error limits. This necessitated the use of robust standard errors when estimating regression models to ensure more accurate and reliable results. The model is then ready for the final diagnostic test, the serial correlation test, before proceeding to test the research hypotheses.

4.3.5 Serial Correlation Test:

After verifying the problem of linear overlap and heterogeneity of variance, it remains essential to ensure that the standard model is free from the autocorrelation problem, which is a common issue in panel data models. Autocorrelation refers to the existence of a relationship between error boundary values across time intervals, which leads to a decrease in the efficiency of regression estimators and affects the accuracy of statistical significance tests.

To verify the presence of this problem, the research employed the Wooldridge test for autocorrelation, which is one of the most widely used tests in economic and financial studies that rely on panel data. The null hypothesis (H_0) states that there is no autocorrelation between the error boundaries, while the alternative hypothesis (H_1) indicates the presence of autocorrelation that must be addressed before accepting the regression results.

Accordingly, the Wooldridge test was performed using STATA 18 software, and the results are shown in Table 9.

Table (9) Results of the Wooldridge Test for Autocorrelation

Decision	Prob > F	Value F	Test
Acceptance of H	0.191	1.83	Wooldridge Test

Source: Prepared by the researcher based on the results of STATA 18 software.

Note: A p-value greater than 0.05 indicates the absence of autocorrelation.

Table 9 shows that the F-statistic was 1.83, while the significance level (Prob > F) was approximately 0.191, which is greater than the accepted significance level of 0.05. This leads to the acceptance of the null hypothesis, which states that there is no autocorrelation between the error limits.

This result indicates the independence of random errors across the study years, which enhances the efficiency of the econometric model estimates and increases the reliability of the results derived from the regression models. It also indicates that the variables used in the study do not suffer from a problem affecting the independence of the time observations, which supports the validity of the data for econometric analysis.

From an applied perspective, the absence of autocorrelation reflects the stability of the relationships between the study variables during the time period covered by the analysis and confirms that the changes experienced by Iraqi banks during the study years did not lead to the emergence of a time pattern that would affect the error limits. Based on the Wooldridge test results, the study data exhibits no autocorrelation, which strengthens the validity of the econometric model and confirms the reliability of the regression results in testing the study's hypotheses. Thus, the data have passed the main diagnostic tests and

are now suitable for estimating regression models and analyzing the impact of green finance on both financial performance and investment efficiency.

4.3.6 Summary of Diagnostic Test Results:

Before proceeding to test the study's hypotheses, it is appropriate to present a summary of the most important results of the diagnostic tests conducted to clarify the validity of the data and the econometric model used in the analysis. Table (10) summarizes the results of these tests and the decisions made in light of them.

Table (10) Summary of Diagnostic Test Results

decision	Result	Test
No linear interference issue	Mean VIF = 1.57	Linear Interference Test (VIF)
Panel Data model adoption	Statistically significant	LM Test
Fixed Effects model adoption	Statistically significant	Hausman Test
Robust Standard Errors used	Problem exists	Acoustic Heterogeneity Test
Model accepted	No problem exists	Autocorrelation Test

Source: Prepared by the researcher based on the results of the STATA 18 program.

It is clear from the results of the diagnostic tests that the study data met the basic requirements necessary for estimating Panel Data models. The results showed that there was no problem of multicollinearity among the independent variables, and also confirmed the necessity of using Panel Data models instead of the pooled regression model. The Hausman test also indicated that the fixed effects model is the most appropriate for analyzing the study data, while the results showed a problem of heteroscedasticity, which was addressed using Robust Standard Errors. Finally, the Wooldridge test results confirmed that there was no autocorrelation in the error terms.

Based on these results, the standard model meets the basic conditions for analysis, which allows moving on to the main phase of the study, namely testing the research hypotheses and estimating the effect of green financing on financial performance and investment efficiency.

4.4 Testing the Research Hypotheses

Testing the research hypotheses represents the main stage in the practical aspect, as it aims to verify the nature of the relationship between the study variables and measure the impact of green financing on both financial performance and investment efficiency in the Iraqi banks included in the sample. This test is based on the results reached in the previous chapters, particularly the descriptive statistics, correlation analysis, and diagnostic tests, which confirmed that the data are suitable for econometric estimation and support the use of the Fixed Effects Model with Robust Standard Errors, ensuring more accurate and reliable estimates. Based on this, the study's regression models were estimated using STATA 18 to test the research hypotheses and verify the significance of green financing's impact on the dependent variables, relying on regression coefficient significance indicators, model quality tests, and ultimately deciding whether to accept or reject the hypotheses based on the obtained statistical results.

This chapter includes testing two main hypotheses. The first hypothesis examines the impact of green financing on financial performance, while the second hypothesis examines its impact on investment efficiency. The results of each hypothesis are presented, analyzed, and discussed separately.

The hypotheses were tested by estimating the econometric models specified in Section 3.6. Model (1) was used to examine the impact of the Green Finance Index (GF Index) on financial performance measured by Return on Assets (ROA), whereas Model (2) was employed to estimate the impact of the Green Finance Index on Investment Efficiency (IE). The estimated coefficients, their statistical significance, and the overall model diagnostics constitute the basis for accepting or rejecting the research hypotheses.

4.5 Interpretation of the Results:

The findings of the study indicate a statistically significant positive impact of green financing on both financial performance and investment efficiency in Iraqi banks. This reflects the growing role that sustainable financing practices can play in enhancing the efficiency of the banking sector and improving its financial and investment outcomes. These results suggest that banks adopting green financing policies are no longer just meeting environmental requirements or adhering to international sustainability trends, but it has become a factor that can contribute to achieving tangible economic and financial benefits. The results of the first hypothesis show that green financing is linked to improved financial performance of Iraqi banks. This can be explained by the fact that banks adopting sustainable financing policies are better able to manage their financial resources efficiently, as well as diversifying their credit and investment portfolios and reducing the risks associated with traditional projects. Moreover, focusing on sustainability boosts investor and customer confidence and enhances the bank's institutional image, which positively reflects on profitability and financial performance indicators.

As for the second hypothesis, the results showed that green financing also contributes to improving investment efficiency. This suggests that integrating environmental considerations into financing and investment decisions helps banks direct their resources toward projects with higher economic feasibility, while limiting investments in high-risk or low-efficiency activities. It also shows that green financing can improve the quality of investment decisions by relying on more comprehensive criteria in evaluating investment opportunities, achieving a balance between economic return and environmental sustainability.

The results of the research generally align with recent trends in financial and banking literature, which emphasize that green financing is one of the main pillars for promoting financial sustainability and improving the efficiency of banking institutions. Many studies have pointed out that integrating sustainability principles into financing and investment policies helps improve financial performance, reduce risks, and enhance investment efficiency, which is consistent with the findings of this research.

Moreover, these results hold special significance in the Iraqi banking environment, which in recent years has shown increasing interest in developing the banking sector and keeping up with global trends in sustainable finance. The research findings indicate that promoting the adoption of green finance practices can help improve the efficiency of Iraqi banks, increase their ability to face economic and environmental challenges, and strengthen their role in supporting sustainable development goals.

Based on the above, it can be said that the results of the research provide practical evidence of the importance of green financing as a strategic tool that can help improve financial performance and enhance investment efficiency in Iraqi banks. This, in turn, supports the move toward strengthening banking policies and programs related to sustainability and provides a scientific basis that can be relied upon when planning future strategies to develop the Iraqi banking sector.

The findings of the present study are generally consistent with previous empirical studies that reported a positive association between green finance, financial performance, and investment efficiency in the banking sector (Nguyen et al., 2022; Zhang et al., 2023; Tolliver et al., 2020). However, the current study extends this evidence by providing empirical results from the Iraqi banking sector, which is characterized by an emerging financial system and a gradual transition toward sustainable banking practices. These findings suggest that expanding green finance initiatives may contribute not only to improving banks' financial outcomes but also to strengthening the resilience and long-term sustainability of the Iraqi banking industry under evolving environmental and economic conditions.

5. Conclusions and Recommendations

5.1 Conclusions:

In light of the theoretical framework and the applied aspects, and based on the statistical analysis of data from the Iraqi banks in the study sample, the research reached a set of conclusions, which can be presented as follows:

1. The study results showed a disparity in the level of adoption of green finance practices among the Iraqi banks in the study sample. This reflects the varying degrees of interest in applying the principles of sustainable finance and disclosing environmental and sustainability activities.
2. The descriptive statistics showed that the study variables exhibited a suitable degree of variability, providing a suitable statistical basis for using panel data models to test the research hypotheses.
3. The results of the correlation analysis revealed positive and significant correlations between green finance and both financial performance and investment efficiency. This provided an initial indication of a positive relationship between the study variables.
4. The diagnostic tests confirmed the suitability of the Fixed Effects Model, using robust standard errors, for estimating the study models, thus ensuring more accurate and reliable estimates.
5. The results of testing the first main hypothesis showed a statistically significant positive impact of green finance on the financial performance of Iraqi banks, indicating that increased adoption of green finance practices contributes to improved profitability and financial performance indicators.
6. The results of testing the second main hypothesis demonstrated a statistically significant positive impact of green finance on investment efficiency, confirming that adopting sustainable finance policies contributes to improving resource allocation efficiency and enhancing the quality of investment decisions.

5.2 Recommendations:

Based on the research findings, a set of recommendations can be made to enhance the role of green finance and improve the performance of Iraqi banks, as follows:

1. Iraqi banks must adopt clear and transparent green finance policies that include objectives and implementation procedures to integrate sustainability principles into their financing and investment activities.
2. Expanding financing for environmentally friendly and renewable energy projects by designing specialized banking and financing products that encourage investment in sustainable activities, thereby supporting the national economy and achieving sustainable development goals.

3. Enhancing the level of environmental and sustainability disclosure in banks' annual reports, in line with international practices, to improve transparency and increase investor and stakeholder confidence.
4. Developing legislation and regulations issued by the Central Bank of Iraq to encourage banks to adopt green finance practices, while also establishing regulatory incentives for banks that make progress in this area.
5. Integrate environmental sustainability criteria into credit and investment project evaluation policies to improve the quality of financing decisions and reduce risks associated with projects that have negative environmental impacts.
6. Invest in human capacity building by implementing specialized training programs for banking sector employees to raise awareness of green finance concepts, their application mechanisms, and their impact on improving financial performance and investment efficiency.

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