How's the Environmental Disclosure Index, Economic Growth, and Inflation Enhance the Banking Performance? In the Context of Listed Islamic Banks of Saudi Arabia.

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Abstract

This research explains applied methods, current techniques, challenges, and future development agendas related to Islamic commercial banking and their performance factors. This article examines the connection between the performance of publicly traded Islamic commercial banks in Saudi Arabia and the performance factors such as return on assets, return on equity, and net profit. The methodology consists of a time series annual analysis. The content analysis is used to collect information from annual reports of ten listed Islamic commercial banks of Saudi Arabia on the Tadawul stock exchange from 2013 to 2022. The influencing factors are regressed with banking performance to check the banking performance using the autoregressive distributed lag model (ARDL) for short- and long-run estimators with the ARDL bound testing technique. The results interpret that bank size and GDP increase profitability metrics, while higher credit, inflation, and environmental disclosure negatively affect bank performance indicators in the long run. However, GDP, credit, and environmental disclosure have slight negative effects, suggesting volatility in the short term. Furthermore, governments and policymakers concentrated on environmental contribution and disclosure by the banking sector for a sustainable environment and banking performance.

Keywords: Islamic commercial banks; ARDL; content analysis and bound test

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Introduction

The banking sector of Saudi Arabia is important for the country's economic development owing to the principles of Islamic finance. Islamic commercial banking works on Sharia's principles of ethical financial practice, risk sharing, and no-interest-based deals (Farooque et al. 2023). Over the years, Saudi Arabia has developed a well-established Islamic commercial banking setup that merges religious precepts with modern financial mechanisms to meet socioeconomic challenges holistically (Alshater et al. 2023). This framework enables the quantification of some valuable key performance metrics such as return on assets (ROA), return on equity (ROE), and net profit, which are the signs of financial health and profitability of Islamic commercial banks (Kanna et al. 2023). The banking sector of the Kingdom of Saudi Arabia, especially in Islamic banks, is greatly linked to economic growth (Maulida 2023). These banks follow ethics in terms of investment; they avoid activities that are harmful to society or the environment. ROA, ROE, and net profit measure Islamic banks' financial performance (efficiency and profitability) (Ripai et al. 2023). ROA gauges whether a bank is generating money from its assets; ROE looks at how good a bank is in using shareholders' equity; and net profit is the one that is left within a bank after all costs have been accounted for, symbolising how the business is doing financially (Yaseen et al. 2023). The importance of these metrics lies in understanding Islamic banks' competitiveness in the globally integrated environment (Nasution et al. 2023). Partly because banking services demand typically increases as GDP rises, and as a result, profits can be higher (Nizam 2024). Saudi Arabia's economy has been diversified under the economic diversification Vision 2030 project, which is responsible for the growth of the country's GDP by promoting sectors like technology, finance, and tourism (Mai et al. 2023). The bank's size affects economies of scale, risk diversification, and operational efficiency. The advantage of size as a leading factor in achieving superior financial performance is illustrated by Islamic commercial banks in Saudi Arabia, such as Al Rajhi Bank, the world's largest Islamic bank by market capitalisation (Rahman et al. 2023). An important issue for Islamic commercial banks is maintaining the balance between efficiency and growth (Alshammari 2023; Kismawadi 2024). In the case of Islamic commercial banks, however, inflation creates special problems because their operation is closely related to asset-based financing and profit sharing (Aziz et al. 2023).

With growing global awareness about environmental issues, banks are expected more and more to share their environmental impact and initiatives to become more sustainable (Ines and Mohammed 2024). Environmental disclosure is consistent with Sharia principles of social responsibility and ethical conduct as practiced by Islamic banks in Saudi Arabia (Oladapo 2024). Consequently, the findings demonstrate how Islamic banks can use their ethical underpinnings to accomplish both financial aims (Sayari 2024). The challenge these variables provide is uniquely addressed by Saudi Arabia's

Islamic commercial banking industry. The alignment of financial performance metrics with sustainability goals is how Islamic banks can help achieve the Kingdom's vision of economic diversification and environmental stewardship (Sayed and Nefzi 2024). Alignment of this nature, therefore, needs to be done in a way that harmonises profit-making with social and environmental responsibility. Moreover, technologies like digital banking or blockchain can increase the efficiency of operations and transparency, which is useful for adopting environmental disclosure practices in banking (Djelassi and Boukhatem 2024). Finally, in Saudi Arabian Islamic banks, financial performance in terms of ROA, ROE, and net profit is affected by independent variables such as GDP, bank size, inflation, and environmental disclosure. The interplay of these variables indicates the complicated nexus between economic, financial, and environmental determinants of Islamic commercial banks' performance. When addressed, these variables will allow Islamic commercial banks to enhance their competitive advantage, satisfy stakeholders' expectations, and comply with the Kingdom's development vision for sustainable development. Identifying and analysing the key factors that are determinants of the performance of Islamic commercial banks, this research contributes to understanding the factors driving performance. It provides a framework for developing strategies that create the link between financial performance and environmental as well as social performance. Given that Saudi Arabia has pressing economic diversification and sustainability objectives, the Islamic banks will still play a key role in the success of these objectives, which signifies the need for further research and innovation in this field (see figure 1).

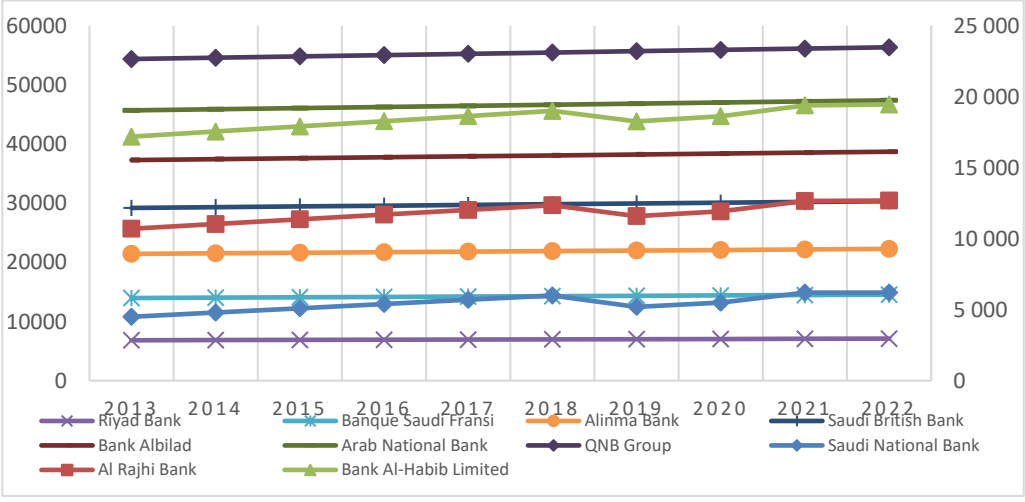


Figure 1: Net profit assessment of the Islamic commercial banks

Literature Review

The financial market and banking systems of Saudi Arabia are divided into two segments based on the roles of government entities. The Central Bank of Saudi Arabia was created in 1950 and is the nation's monetary authority. The central bank's tasks include issuing national currency, managing and preserving foreign currency exchange reserves, ensuring exchange rate stability, guaranteeing a robust and secure financial system, and operating a cross-bank electronic financial system (Mohsin, Xuhua, et al. 2024). The Capital Market and Exchange Authority of Saudi Arabia (CMA), formed in 2015, is the second financial market that oversees the capital marketplace and stock exchange in the country. The credibility and legality of CMA as a government organisation are indisputable. The norms and regulations, administrative autonomy, legal jurisdiction, and financial reliability are intimately associated with the Kingdom of Saudi Arabia (Azam et al. 2023). The bank was recognised as a monetary law regulator in 1966, and the stock exchange was founded in 1983. Domestic investors typically regarded automobiles as long-term investments, which endured for decades (Patten 2002). The Saudi Investment Bank (SAIB) has commenced prioritising the nation's future and sustainable environment by integrating these theoretical innovations across consumer banking, commercial banking, treasury and investment management, and brokerage services for its clientele (Buallay and Alhalwachi 2022). The foundational principle of SAIB's business expansion is crucial for the beneficial development of both the economy and society within an environmentally friendly and healthy environment. The banking sector can indirectly control the activities related to natural resources, production, wastage, and emissions as a financial institution via close investigation of investment and its environmental impact. Environmental protection measures can mitigate corporate costs and hazards while augmenting potential and long-term shareholder returns (Alam et al. 2020).

A significant transformation occurred post-1990–1991, during the Persian Gulf War, which incurred a financial expenditure of US$60 billion, draining the nation's resources. The Saudi Arabian Monetary Agency increased from SAR 97 million to SAR 2.44 billion between 1991 and 2006, attracting short-term investment and remaining below 10% of market value according to international criteria (Gunawan et al. 2022). The decentralisation of shares from institutions to people contributed to the Saudi Arabian exchange market reaching an all-time high of 20,634.86 in February 2006. The Saudi Arabia Index (TSAI) attained a market capitalisation of around USD2.2 trillion (Alharbi et al. 2023; Mohsin, Shamsudin, et al. 2024). Economic growth and ecological development are intrinsically interconnected, like body and spirit. Currently, stakeholders are primarily concerned with companies' environmental assessment reports before making investments, as these reports indicate banks' contributions to global ecological sustainability (Salamat et al. 2021). The definitive

summary of the KPMG survey indicated that the organisation's environmental assessment reports demonstrated its positive and eco-friendly conduct, prioritising public health and genuine national growth over profit maximisation (Rehman et al. 2021). The Bangladeshi government has compelled the banking sector to provide environmental assessment reports publicly, thereby raising public awareness and improving environmental quality (Masud et al. 2016). This strategy was initially implemented by the world's largest banks (i.e., Citibank, J. P. Morgan Chase, Bank of America, Toronto Dominion, Goldman Sachs) in 2000, indicating that financial support was not extended to companies that did not adhere to environmentally sustainable policies comprehensively. Hussain et al. (2024) examine the influence of environmental, social, and governance (ESG) disclosures on corporate performance, concentrating on firms listed on the Saudi stock exchange (Tadawul). Their research identified a favourable correlation between ESG disclosures and financial performance indicators, including ROE and ROA. Qian et al. (2021) examine the incentives for environmental disclosures in Saudi Arabia from a stakeholder perspective. Their findings indicated corporations prioritise stakeholders such as the Saudi government and integrate their practices with Islamic beliefs, illustrating how local contexts influence disclosure tactics.

Dao and Nguyen (2020), Liu et al. (2022), and Sarfraz et al. (2022) assert that industrial concentration and economic situation are assessed by GDP growth and stock market performance. Development has substantial factors influencing the profitability of Japanese banks. Phan et al. (2020) researched the impact of controlled and uncontrolled influences on Islamic banks' profitability. The study's results indicated that gross domestic product and conventional interest rates positively correlated with profitability. Owusu Kwateng et al. (2020) and Sarfraz et al. (2022a) discovered that the money supply, inflation, and interest rates exert influence. Regarding the significant impact on the profitability of Islamic banks, Naseem et al. (2024) and Yusuf and Ichsan (2021) explored drivers of bank efficiency during the unstable macroeconomic landscape in Malaysia. Their research findings indicated that GDP exhibits a negative correlation with banks. This may be attributed to unstable post-crisis economics. The state of affairs may induce diminished activity within the financial sector. Gupta and Mahakud (2020) show that inflation negatively correlates with the profitability of financial institutions in Bangladesh.

The literature review indicates no research on the Saudi Arabian banking system concerning ecologically sustainable practices and environmental evaluation reporting systems. This research will facilitate decision-making for environmentalists and economists dedicated to the ecological improvement of Saudi Arabia and Middle Eastern nations. Future environmental dangers can be mitigated and diminished by

adhering to research and enhancing the banking system's productivity and prospects while alleviating the ecological strain on national economies.

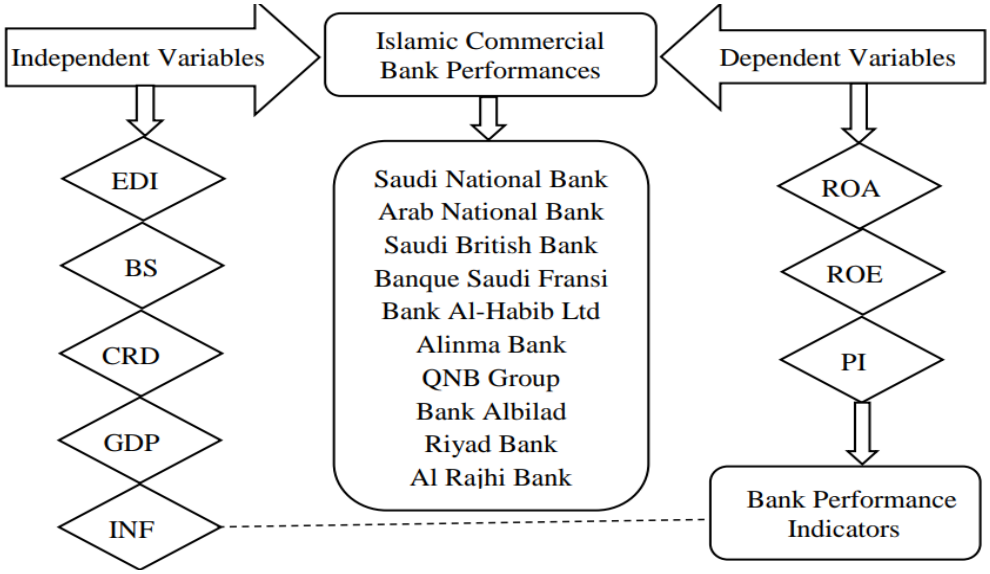


Figure 2: Variables conceptual framework

Methodology

Research Samples

The total population of listed commercial banks of Saudi Arabia with the Tadawul stock exchange is ten banks (Al Rajhi Bank, Bank Albilad, Saudi British Bank, QNB Group, Riyad Bank, Alinma Bank, Bank Al-Habib, Saudi National Bank, Banque Saudi Fransi, Arab National Bank) for analysis, except for Standard Chartered Bank Limited due to unavailability of data. The GDP, inflation, and credit loan data were collected from the World Development Indicator (WDI). The study covers data from 2013 to 2022 because of environmental evolution and green financing in the banking sector (Sharif and Rashid 2014). In Saudi Arabia, many reforms in the environment, green banking, and code of corporate governance were introduced in selected data periods (table 1).

Table 1: Definition of variables

Variable	Abbreviation	Description	Sources
Return on assets	ROA	Percentage of operating profit to total assets	Annual report
Return on equity	ROE	The ratio of net income to shareholder's equity	Annual report
Net profit	PI	Net income/Total assets	Annual report
Environmental disclosure index	EDI	Measured as the ratio of disclosure points over the maximum score (21) a bank can score	Annual report
Bank size	BS	Natural log of the bank's total assets	Annual report
Gross domestic product	GDP	The natural log of GDP relates to changes in national income	WDI
Domestic credit	CRD	Banks credit to private organisations as a % of GDP	WDI
Inflation	INF	Natural log of annual inflation rate as a % of GDP	WDI

Research Design

All of the variable detailed descriptions and measurements unite; the data collection sources are shown in the above data collection sources. In this study, we used ROA, ROE, and PI as dependent variables, while EDI, BS, GDP, CRD, and INF were the independent variables. In addition, the model of the study is presented below:

$$(ROA) = f(EDI_t, (BS_t), (GDP_t), (CRD_t), (INF_t) \ldots . (I)$$

$$(ROE) = f(EDI_t, (BS_t), (GDP_t), (CRD_t), (INF_t) \ldots . (I)$$

$$(PI) = f(EDI_t, (BS_t), (GDP_t), (CRD_t), (INF_t) \ldots . (I)$$

All of these variables are logit transformed. By transforming the log variables into natural logarithms, the regression form in equation 2 is used to avoid complications in the estimated results.

$$(LNROA_{2t}) = a_0 + \beta_1 LNEDI_t + \beta_2 LNBS_t + \beta_3 LNCRD_t + \beta_2 LNGDP_t + \beta_3 LNINF_t + \varepsilon_t \ (II)$$

$$(LNROE_{2t}) = a_0 + \beta_1 LNEDI_t + \beta_2 LNBS_t + \beta_3 LNCRD_t + \beta_2 LNGDP_t + \beta_3 LNINF_t + \varepsilon_t \ (II)$$

$$(LNPI_{2t}) = a_0 + \beta_1 LNEDI_t + \beta_2 LNBS_t + \beta_3 LNCRD_t + \beta_2 LNGDP_t + \beta_3 LNINF_t + \varepsilon_t (II)$$

Before the estimate of the Bounds test approach to cointegration, this study used the augmented Dickey–Fuller and Phillips–Perron unit root tests (Dickey and Fuller 1979; Phillips and Perron 1988). This study used the autoregressive distributed lag model (ARDL), developed by Pesaran et al. (2001), for the long- and short-run estimation of variables. The ARDL model offers several advantages over the conventional cointegration method, as it can be applied to series that are stationary at level or at first difference. This study uses a combination of series that are stationary at different levels—some at level and others at first difference. Therefore, the ARDL model utilised in the study can be stated as follows:

$$(\Delta LNROA_{2t}) = \beta_0 + \beta_1 LNEDI_{t-i} + \beta_2 LNBS_{t-i} + \beta_3 LNGDP_{t-1} + \beta_4 LNCRD_{t-1} + \beta_5 LNINF_{t-1} + \sum_{i=1}^{p} \gamma_1 \Delta LNROA_{t-i} + \sum_{i=1}^{q} \gamma_2 \Delta LNEDI_{t-i} + \sum_{i=1}^{p} \gamma_3 \Delta LNBS_{t-i} + \sum_{i=1}^{p} \gamma_4 \Delta LNGDP_{t-1} + \sum_{i=1}^{p} \gamma_5 \Delta LNINF_{t-i} \sum_{i=1}^{p} \gamma_6 \Delta LNBS_{t-i} + \mu_t \ldots . (III)$$

$$(\Delta LNROE_{2t}) = \beta_0 + \beta_1 LNEDI_{t-i} + \beta_2 LNBS_{t-i} + \beta_3 LNGDP_{t-1} + \beta_4 LNCRD_{t-1} + \beta_5 LNINF_{t-1} + \sum_{i=1}^{p} \gamma_1 \Delta LNROE_{t-i} + \sum_{i=1}^{q} \gamma_2 \Delta LNEDI_{t-i} + \sum_{i=1}^{p} \gamma_3 \Delta LNBS_{t-i} + \sum_{i=1}^{p} \gamma_4 \Delta LNGDP_{t-1} + \sum_{i=1}^{p} \gamma_5 \Delta LNINF_{t-i} \sum_{i=1}^{p} \gamma_6 \Delta LNBS_{t-i} + \mu_t \ldots . (III)$$

$$(\Delta LNPI_{2t}) = \beta_0 + \beta_1 LNEDI_{t-i} + \beta_2 LNBS_{t-i} + \beta_3 LNGDP_{t-1} + \beta_4 LNCRD_{t-1} + \beta_5 LNINF_{t-1}66 + \sum_{i=1}^{p} \gamma_1 \Delta LNPI_{t-i} + \sum_{i=1}^{q} \gamma_2 \Delta LNEDI_{t-i} + \sum_{i=1}^{p} \gamma_3 \Delta LNBS_{t-i} + \sum_{i=1}^{p} \gamma_4 \Delta LNGDP_{t-1} + \sum_{i=1}^{p} \gamma_5 \Delta LNINF_{t-i} \sum_{i=1}^{p} \gamma_6 \Delta LNBS_{t-i} + \mu_t \ldots . (III)$$

In this, the equation Δ sign is the variance operator; LN denotes natural logarithms, where β_0 is constant; $\beta_1 \ldots \beta_6$ are compatible with a long-term relationship; maximum lag order is denoted by q and p; $\gamma_1 \ldots \gamma_6$ signifies the short-term coefficient; the last μt indicate the error term. For diagnostics, we applied the Breusch–Pagan–Godfrey test of heteroskedasticity and the Breusch–Godfrey serial correlation LM test. Likewise, the cumulative sum of recursive residuals (CUSUM) and cumulative sum of the recursive residual of squares (CUSUMQ) tests were conducted to determine the model's durability. Recursive residual regression is based on these integrations and tests the short- and long-run dynamics using residuals. If the results of these tests show that the bound critical value falls below the 5% significance level, the assessed model is considered stationary.

Measurement of Banking Performance

The internal factors of the banking sector predominantly account for fluctuations in financial performance, as measured by ROA, ROE, and net profit (PI). The current literature identifies ROA, ROE, and net profit as essential performance measures for the

banking sector (Badwan 2023; Rehman et al. 2021; Ruf et al. 2001). The ROA demonstrates managerial proficiency, efficiency, and capability to enhance profitability by optimally utilising banks' limited assets and resources. The accounting metric ROE is an auxiliary indication to assess the firm's robust performance, as it is closely correlated with ROA. The balance sheet is the ratio of total assets the bank manages to the loans the bank acquires and disburses. This research uses ROA to assess the financial performance of publicly listed Islamic commercial banks, with conclusions corroborated by the implications of ROE and net profit.

Environment Disclosure Measurement

Data is extracted from the annual reports of publicly traded commercial banks in Saudi Arabia using principle component analysis (PCA) index analysis methodology. The content analysis process is more precise and cost-effective than existing methods (Delai and Takahashi 2013). The unweighted scoring approach documents data for the environmental assessment reporting index (EARI) (Doan and Sassen 2020; Sarfraz et al. 2022). The dichotomous method assigns the values 1 and 0 to items reported and not disclosed in the annual report (Zahid et al. 2020). The study utilised ten environmental disclosures (refer to figure 3), categorised as 1 and 0 according to their disclosure status. The final ratings contribute to the overall disclosures of environmental assessment reports for each sample bank. To evaluate the practice of environmental disclosure, the environmental disclosure index (EDI) was calculated as follows:

$$EDI_{jt} = \frac{\sum_{i=1}^{n} X_{ijt}}{N}$$

In the EDI, N represents the number of constructs or items reported by the bank, where $N \leq 10$, and X_{ijt} equals 1 if a build or item is declared, and 0 if it is not disclosed. The item is undisclosed, hence $0 \leq I_j \leq 1$.

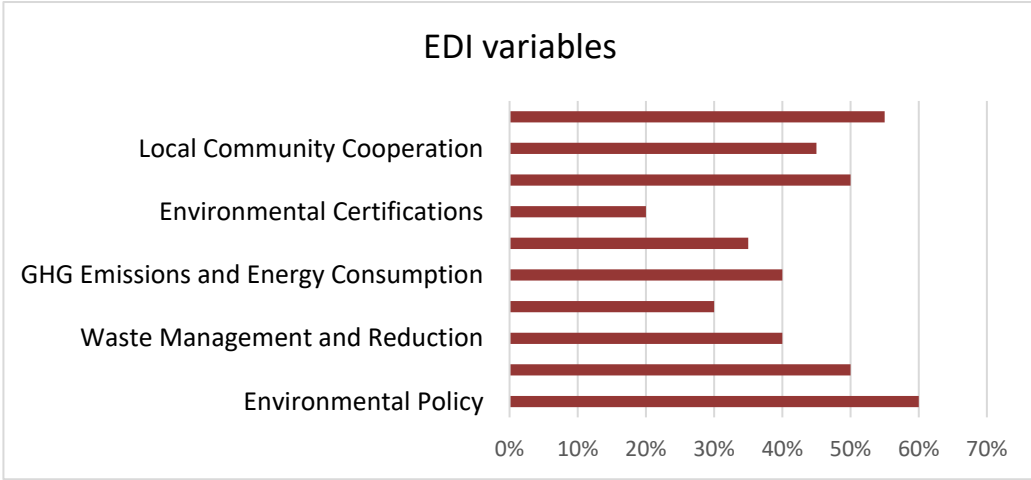


Figure 3: Highest disclosed environmental disclosure index (EDI) variables (sources: author calculation)

Note: The data indicates an increase in environmental disclosure practices, reflecting a favourable trend in the Islamic commercial banking industry of Saudi Arabia.

Simultaneously, the reporting practice is inconsistent, indicating that data were not supplied for all observed years. The reports lack standardisation. Concerning the disclosure of the EDI components, the most disclosed environmental policy is referenced by 60%, collaboration with the local community in executing environmental protection programmes by 45%, and efficiency in the utilisation of water, energy, and paper by 50%, as illustrated in figure 3. The bank rankings reveal that disclosure practices are fully implemented in only one systemically important Islamic commercial bank in Saudi Arabia, as shown in table 2.

Table 2: Banks' ranking according to the average EDI value

Bank name	EDI score (hypothetical)	EDI score ranking
Bank Albilad	0.21 (21%)	10
Bank Al-Habib	0.27 (27%)	9
Alinma Bank	0.34 (34%)	8
Arab National Bank	0.40 (40%)	7
QNB Group	0.46 (46%)	6
Saudi British Bank	0.57 (57%)	5
Riyad Bank	0.66 (66%)	4
Banque Saudi Fransi	0.75 (75%)	3
Saudi National Bank	0.77 (77%)	2
Al Rajhi Bank	0.84 (84%)	1

The analysed banks exhibit varying approaches to environmental disclosure in their reports. Certain banks emphasise it by incorporating it into the CEO's message. Conversely, others include it in a dedicated portion of the report focused on environmental issues or within the segment about corporate social responsibility practices. The EDI values are illustrated in figure 4.

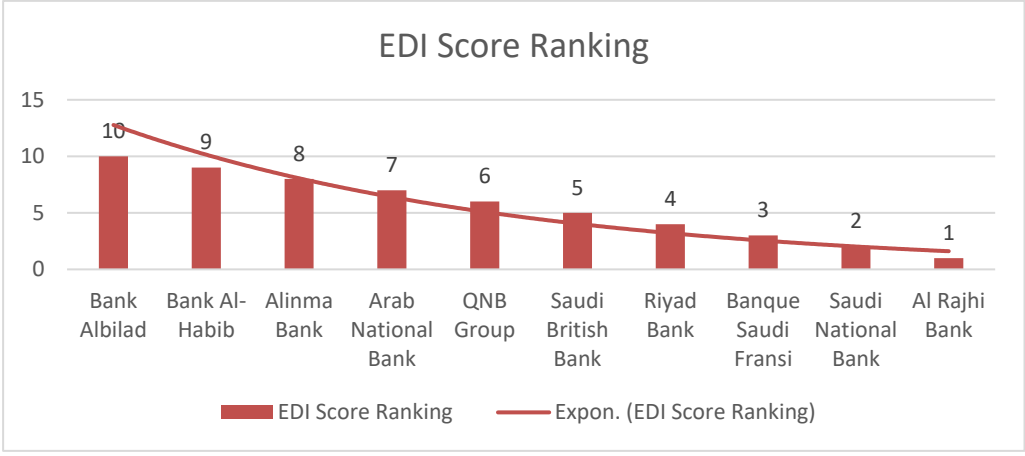


Figure 4: Banks' environmental disclosure ranking

Results and Discussion

Descriptive Statistics

Table 3 delineates the variables employed in the study along with their interrelations, as evidenced by descriptive statistics and correlation coefficients. Descriptive statistics provide insights into the distribution of each variable. For example, EDI has a mean of 1.977 with moderate variability (SD = 0.208), whereas bank size (BS), exhibits greater variability. Skewness reveals that INF has significant negative skewness, indicating asymmetry in the data, whereas kurtosis values assess the flatness or peakedness of distributions relative to a normal distribution. The correlation matrix illustrates the pairwise correlations among variables. The Jarque–Bera test results demonstrate that most variables diverge from a normal distribution, especially GDP and INF, which may impact econometric modelling. The EDI and BS are essential for financial performance, showing a negligible positive link with EDI and a significant negative association with CRD. Nonetheless, it implies that credit levels and equity returns may represent a trade-off. Ln PI shows a substantial positive correlation with ln BS, underscoring the significance of bank size in profitability. GDP and INF exhibit minor correlations with ROA and EDI, but INF demonstrates a slight positive correlation with ROE. These results are supported by Hassan et al. (2022). These elements exert a complicated and multidimensional influence on financial performance. The results show significant insights into the data's structure and linkages, facilitating comprehension of essential dynamics and guiding subsequent statistical research.

Table 3: Descriptive statistics and correlation matrix

	LNROA	**LNROE**	**LNPI**	**LNEDI**	**LNCRD**	**LNBS**	**LNGDP**	**LNINF**
Mean	0.391	2.371	3.882	1.977	1.690	4.545	4.414	1.037
Med	0.336	2.347	3.881	2.079	1.696	4.413	4.417	1.061
Max	3.121	3.173	4.262	2.303	1.760	5.439	4.484	1.262
Min	0.039	1.947	3.653	1.386	1.600	3.380	4.300	0.187
Std. D	0.337	0.280	0.087	0.208	0.049	0.553	0.037	0.180
Skew	0.222	0.860	1.317	−0.546	−0.271	−0.171	−1.084	−1.968
Kurt	1.751	3.378	2.517	2.390	1.780	1.953	1.733	1.200
Jarq–B	71.140	13.692	16.511	6.908	7.874	5.356	34.020	29.740
LNROA	1							
LNROE	−0.114	1						
LNPI	0.229	−0.594	1					
LNEDI	0.004	0.406	−0.340	1				
LNCRD	0.094	−0.703	0.457	−0.069	1			
LNBS	0.221	−0.274	0.853	−0.124	0.299	1		
LNGDP	−0.056	0.192	−0.242	−0.014	-0.195	−0.112	1	
LNINF	0.005	0.549	−0.545	0.324	-0.432	−0.320	0.463	1

Unit Root Test

The result of the unit root test (ADF and PP) for testing the stationarity of variables at the level and the first difference in their levels are shown in table 4. Most variables such as LNROA, LNROE, LNPI, LNEDI, LNCRD, LNBS, LNGDP, and LNINF are found to be non-stationary at the level as the high *p*-values (insignificant results) for series imply. The variables tend to become stationary after making one difference to them, and hence we find significant ADF and PP results (low *p*-values). The analysis results indicate that, as is typical in economic and financial time series data more than other

variables, most of the observed variables are integrated of order one, denoted hereafter as I (1). Some slight variations in the PP results for LNCRD at first difference raise the possibility that there may be nuances or differences in the sensitivity of the tests.

Table 4: Unit root results

	AT level				**At 1st difference**			
Variables	**ADF**		**PP**		**ADF**		**PP**	
LNROA	−2.768	−0.070	−2.761	−0.077	−7.422	0.000	−7.410	0.000
LNROE	2.253	−0.999	−3.624	−0.012	−6.977	0.000	−8.593	0.008
LNPI	−1.565	−0.487	−2.858	−0.064	−7.107	0.000	−7.078	0.000
LNEDI	−1.181	−0.671	4.527	−1.000	−4.553	0.009	−3.040	0.001
LNCRD	3.771	−1.000	−1.565	−0.487	−6.273	0.000	−6.312	0.058
LNBS	−2.731	−0.279	−1.181	−0.671	−5.407	0.001	−5.408	0.000
LNGDP	2.733	3.891	3.213	−1.000	−2.783	0.076	−2.755	0.000
LNINF	1.494	−1.453	−2.022	−0.276	−5.044	0.003	−5.346	0.000

Lag Order Selection by VAR

Before finishing the F-bound evaluation, the ARDL check must be completed, as this check has limitations. The proper slack configuration of the factors must be used for the survey if the elements are co-integrated. The outcomes per the assessment in this calculation shown in table 5. However, a problem with the lag length order selection criterion is that it gives a biased estimation of *F*-statistics. Distributed lag length computation and supportive lag selection algorithms based on statistics show that a lag length selection of lag criteria is optimal and feasible.

Table 5: Var Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	−821.616	NA	1.17E+15	51.72597	52.00079	51.81706
1	−652.252	264.6306	2.94E+11	43.39074	45.31452	44.02842
2	−601.881	59.81502	1.55E+11	42.49258	46.06531	43.67684
3	−527.626	60.33229*	3.08e+10*	40.10164*	45.32332*	41.83248*

* Indicates lag order selected by the criterion, FPE: Final prediction error. AIC: Akaike Information Criterion

ARDL Bound Test for Cointegration

The bound test for the ARDL cointegration verifies if a long-run relationship exists among the variables under study. Table 6 below presents the outcome of the bound test technique for cointegration analysis between the dependent variable and all the independent variables, in the comparison of *F*-statistics with the critical value ARDL tests. The null of no cointegration was tested using the critical values of *F*-statistics tabulated as an alternative (Ben Amar 2022). Therefore, the upper bound critical value significance of 1% at the level of *F*-statistics (15.1523) is more than 1% at the significance level. Thus, there exist long-run cointegration relationships between the dependent variables and the independent variables.

Table 6: ARDL bound test results

Test statistic	**Value**	**k**
F-statistic	15.15269	5
Critical value bounds		
Significance	Bound I (0)	Bound I (1)
10%	2.08	3
5%	2.39	3.38
2.50%	2.7	3.73
1%	3.06	4.15

Note: "I (0), I (1)" shows the lower bound and upper bound, respectively.

Johansen's Cointegration Test

The Johansen cointegration test is used to determine the appropriate lag length before conducting the cointegration analysis. Based on the least AIC and SC values, we can estimate the lag interval duration for the five initial transition problems of the unrestricted VAR model. Tables 7 and 8 show the outcome of the Johansen cointegration valuation, which was selected because all components are interrelated in a comparable order.

Table 7: Johansen cointegration assessment results

Hypothesised	**Trace**		**0.05**	
No. of CE(s)	Eigenvalue	Statistic	Critical value	Prob.**
None *	0.793	136.158	95.754	0.000
At most 1 *	0.728	84.194	69.819	0.002
At most 2	0.526	41.206	47.856	0.182
At most 3	0.302	16.595	29.797	0.670
At most 4	0.108	4.753	15.495	0.834
At most 5	0.029	0.974	3.841	0.324

Table 8: Johansen cointegration assessment results

Hypothesised	**Max-Eigen 0.05**			
No. of CE(s)	Eigenvalue	Statistic	Critical value	Prob.**
None *	0.793	51.964	40.078	0.002
At most 1 *	0.728	42.989	33.877	0.003
At most 2	0.526	24.611	27.584	0.115
At most 3	0.302	11.841	21.132	0.563
At most 4	0.108	3.780	14.265	0.882
At most 5	0.029	0.974	3.841	0.324

Long- and Short-Run Estimation

Results from an ARDL model estimating short-term and long-term relationships between key independent variables and the dependent variables, ROA, ROE, and net profit are shown in table 9. For long-term estimation, some of the significant variables influencing independent variables are LNBS, LNCRD, LNEDI, LNINF, and LNGDP. The coefficient of LNBS (the natural logarithm of the total bank assets) is positive, which means that an increase in bank size leads to a rise in profitability metrics. However, problematically, both LNCRD and LNEDI have negative coefficients, indicating that higher environmental and credit disclosure is associated with lower profitability. First, LNGDP has a strong positive effect, merely indicating that economic growth is a factor contributing to profitability. In the long run, LNINF is not statistically significant. Both the change in LNCRD and the change in LNGDP are significant in the short-term estimation and, therefore, indicate immediate profitability effects. The

negative impact of LNCRD and a slight negative impact of GDP presumably suggest volatility in the short-term economic conditions. Significant with a negative sign is the speed of adjustment term CointEq (−1), which confirms the existence of a stable long-term relationship and also states that 19.3% of disequilibrium from the previous period is corrected in the current period. These results are supported by Sidaoui et al. (2022). However, the results overall indicate that although some aspects such as GDP and bank size have a strong positive long-run influence, other factors such as credit and environmental disclosure need to be properly managed to yield profit in the Saudi banking sector.

Table 9: Long-term estimation

Variable	**Coefficient**	**Std. error**	***t*-statistic**	**Prob.**
LNBS	0.132	0.026	5.155	0.035
LNCRD	−0.903	0.048	−11.026	0.000
LNEDI	−0.094	0.023	−25.987	0.050
LNGDP	1.369	0.076	19.765	0.039
LNINF	−0.155	0.351	−18.501	0.404
Short-run estimation				
Variable	**Coefficient**	**Std. error**	***t*-statistic**	**Prob.**
d(LNBS)	1.018	0.593	1.269	0.214
d(LNCRD)	−0.477	0.175	−0.484	0.063
d(EDI)	−0.042	0.060	−3.514	0.002
d(GDP)	−0.935	0.052	−0.179	0.004
d (INF)	0.121	0.808	0.705	0.488
Coint Eq (−1) *	−0.193	0.069	−5.798	0.010

Analytical Test

Diagnostic test results for the validity and robustness of the regression model used are presented in table 10. Analytical results include the Ramsey RESET test for residual element normality, heteroskedasticity, and the LM test for measurement. With the data available, the short-run approach can do the analytical computation. Regarding methods of formulation of residual expressions, as normally distributed, the operational formula for heteroskedasticity and serial correlation has never been stated. The Breusch–Godfrey LM test tests whether errors are serially correlated. With a *p*-value for *F*-

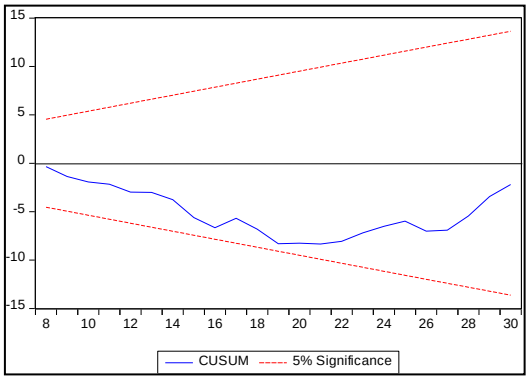
statistic (0.7773) and a *p*-value for Obs R-squared (0.6919) comparatively high, there is no evidence that the residuals in our model are serially correlated. The ARCH test is testing for heteroskedasticity, meaning that the residuals' variance is not constant over time. The *p*-values are 0.2475 (1.3877) and 0.2345 (1.4132) for *F*-statistic and Obs R-squared, respectively. We find no evidence of heteroskedasticity in the model implied by these results. Model specification is evaluated using the Ramsey RESET test for omitted variable bias or incorrect functional form. A *t*-statistic (0.6192) and an *F*-statistic (0.3099) generate significant *p*-values (0.5714 and 0.6314), showing the lack of significance in the misspecification of the model these similarities found with (Reyad et al. 2022). In general, these diagnostic tests suggest that the model is well-specified, uncorrelated across time moments, and also does not have heteroskedasticity. It supports the reliability of the estimated results.

Table 10: Analytical results

LM Test Breusch–Godfrey			
F-statistic	0.254692	Prob. F (2,23)	0.7773
Obs*R-squared	0.736687	Prob. Chi-Square	0.6919
Heteroskedasticity test: ARCH			
F-statistic	1.387743	Prob. F (1,32)	0.2475
Obs*R-squared	1.413192	Prob. Chi-Square (1)	0.2345
Ramsey RESET test			
	Value	**df**	**Probability**
t-statistic	0.619201	20	0.5714
F-statistic	0.309862	(1, 20)	0.6314

Model Stability Test

In this study, moreover, the CUSUM and CUSUMQ technique is used as a stability diagnosis. Because CUSUM and CUSUMQ plots, after these blue (two red) lines are within the limits at the 5% significance level then the study parameters are stable and vice versa (Tanizaki 1995). Figure 5 reports CUSUM and CUSUMQ outcomes for the study model, showing that the study model passed mutually stable tests since the blue line in both tests is at 5% significance with the red line limits (Naseem et al. 2021; Turner 2010).



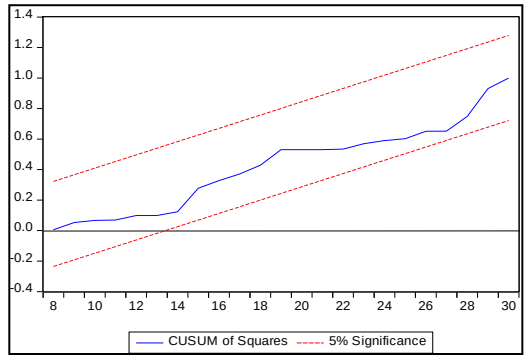


Figure 5: CUSUM and CUSUMQ test results

Conclusion

This article studied the relationship between environmental disclosure, GDP, bank size, credit to private organisations, inflation, and the financial performance indicators of listed Islamic commercial banks in Saudi Arabia. It looks through the factors influencing the financial performance regarding ROA, ROE, and net profit in a particular banking or economic framework. Results from the analysis reveal that variables like bank size, credit risk, GDP, and inflation have important impacts on these performance metrics. We find these variables to be positively and negatively associated with performance in the long run, exhibiting levels of variation and suggesting strategic focus in operations. While some variables produce fewer gradual effects in the short run, they are both more and less important in determining outcomes over time. The findings underline the need for credit risk management and strategic solutions for bank size to enable profitability. All this demonstrates the importance of economic policies that help maintain banking stability and explains why operational efficiency and profitability depend to such a large extent on external economic conditions, e.g., GDP growth and inflation. Diagnostic tests confirm the robustness of the analytical model used, hence the reliability of the results and recommendations.

Recommendations

The study recommends strengthening credit risk frameworks to align the bank's size with its operational goals and integrating economic policies to support stability. While addressing short-term challenges is important, long-term strategies focused on sustainability and growth should also remain a priority. Banks are encouraged to further enhance credit risk management frameworks to reduce the incidence of loan defaults, diversify the credit portfolio, and enhance asset quality to improve financial outcomes. For sustainable growth of the bank, operational efficiency and economies of scale

should be balanced, and expansion strategies should be planned carefully. Internal process streamlining and cost-effective measures are improved operational efficiency and profitability indicators. The macroeconomic conditions need to be adapted dynamically in the banks, such as GDP fluctuations and inflation, and also the strategies in the banks, such as interest rates and revenue diversification. Sustainable growth principles should be incorporated as long-term planning within the framework of global trends in ESG frameworks. There is a significant opportunity for investment in technological innovation (digitisation and advanced analytics) to positively influence customer experience, decision-making, and revenue. Policymakers and financial institutions must collaborate to strengthen regulatory frameworks that are flexible enough to recover from future events, and stable enough to prevent instability. For staff, there should be training and capacity building on adapting to technological innovations and for managing credit risks effectively. The role of governments is to promote macroeconomics conducive to banking while banks, on the other hand, have the responsibility of providing diversification against single-stream revenues and increasing resilience. This is all we can do for the banks to achieve sustainable growth and improve their financial performance aiming to be still influential in a dynamic and complicated environment.

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