AL-QANATIR
INTERNATIONAL JOURNAL OF ISLAMIC STUDIES
eISSN: 2289-9944
Vol. 35. No. 10. October Issue (2026)

ISLAMIC BANKING SOUNDNESS AND SUSTAINABLE DEVELOPMENT IN BAHRAIN: A SMALL-SAMPLE ANALYSIS

Amna Mohamed J Alfardan[i], Ashurov Sharofiddin[ii] & Fahd Mohammed Obad Al-Shaghdari[iii]

[i] Lecturer, Faculty of Business Administration, University College of Bahrain, Manama, Kingdom of Bahrain. amnaalfardan3@gmail.com
[ii] Associate Professor, IIUM Institute of Islamic Banking and Finance, International Islamic University Malaysia, Kuala Lumpur, Malaysia. ashurov@iium.edu.my
[iii] Associate Professor, IIUM Institute of Islamic Banking and Finance, International Islamic University Malaysia, Kuala Lumpur, Malaysia. alshaghdari@iium.edu.my

Article Progress
Received: *27 July 2025* ***Revised:*** *6 Aug 2026* ***Accepted:*** *1 September 2026*

Abstract

This paper examines whether the financial soundness of Bahrain's Islamic banking sector is associated with the country's sustainable development outcomes, at the composite level and across its economic, social and environmental dimensions, using annual data from 2015 to 2024. A sector-level composite index of Islamic banking soundness is regressed on standardised composite and dimension-level development indices, controlling for the oil price, public debt and economic diversification, using ordinary least squares with permutation-based inference, leave-one-out analysis and a complete specification grid. Banking soundness is positively associated with the composite development index and, more strongly, with its environmental dimension, while no association is detected for the social or economic dimensions; both significant associations, however, depend materially on exclusion of the final sample year.

Keywords: *Islamic, development, Bahrain, inference, disaggregation.*

INTRODUCTION

Background

The idea that Islamic banking is about development is older than the industry that embodies it. The founding literature did not paint the Islamic bank as a typical intermediary functioning according to modified contracts, but rather as an institution whose role is more extensive than the traditional: finance associated with real assets, risk distributed instead of transferred, and a collection of social instruments, from zakat to qard hasan, that are absent in the traditional (Chapra, Khan, & Al Shaikh-Ali, 2008; Iqbal & Mirakhor, 2011).

Whether that stated purpose is translated into measurable development outcomes is another matter, and the empirical record on this remains thin compared to the confidence with which the claim is made. Most of the quantitative studies of Islamic banks compare their stability, efficiency or profitability with their conventional peers. Much less work connects the performance of an Islamic banking sector, as defined by its own standards, with the development path of the economy in which the sector operates.

The Kingdom of Bahrain makes an unusually good setting for such a test." Bahrain issued its first Islamic banking licence in the late 1970s, has fifteen fully fledged Islamic banks regulated under a separate volume of the Central Bank of Bahrain's rulebook and is

the base of the industry's main standard-setting body. The sector is thus mature, systemically important and unusually well documented.

Bahrain is at the same time a small rentier economy with a development record that is mixed in a specific and analytically useful way: non-oil sectors now generate approximately four fifths of real gross domestic product, yet hydrocarbons continue to supply the majority of government revenue, and the country's social and environmental indicators have not advanced in step with the expansion of non-oil output (Nakibullah, 2018; Khayati & Al-Sayegh, 2020).

If the performance of an Islamic banking sector registers in national development outcomes anywhere, it ought to be detectable in an economy where that sector is large, mature and closely supervised. The obstacle is not conceptual but empirical. Sector-level Islamic banking indicators for Bahrain are published annually, and the decade under study yields ten observations.

Ten points impose severe and unavoidable limits on what can be inferred. This paper is organised around respecting those limits rather than evading them, and that organising decision carries a methodological argument that the authors regard as the study's principal contribution.

A substantial literature has grown around the application of dynamic time-series machinery, including autoregressive distributed lag bounds testing, Granger causality analysis and error-correction modelling, to development questions in small economies whose underlying data are annual and few. Because these methods require more observations than annual national accounts supply, researchers increasingly disaggregate annual series into quarterly ones and estimate on the expanded sample.

Section 3.4 of this paper demonstrates, using the authors' own withdrawn specification as the illustration, why this practice cannot support the inferences routinely drawn from it. The quarterly series such procedures generate contain no information that the annual series did not already contain. What they add is degrees of freedom, and degrees of freedom corresponding to no observation will manufacture statistical significance from noise. This paper reports a case in which they did precisely that.

Objective

This study estimates the association between Islamic banking sector soundness and sustainable development in Bahrain from 2015 to 2024, at the level of a composite development index and at the level of its economic, social and environmental dimensions. Three questions organise the analysis. First, is Islamic banking soundness associated with sustainable development once the resource cycle, public indebtedness and structural diversification are held constant?

Second, does any such association operate uniformly across the three dimensions of development, or is it concentrated in particular channels? Third, and methodologically, what inferential procedures are appropriate when a policy-relevant question must be answered with ten observations, and what happens when researchers reach instead for procedures that are not?

The paper makes two contributions. The first is empirical. To the best of the authors' knowledge, no previous study has estimated this relationship for Bahrain using a sector-level performance index together with development outcomes measured at the level of individual dimensions. The closest available work either describes the alignment of Islamic finance with the sustainable development goals in the Bahraini market without econometric estimation (Abdulla, Ebrahim, & Kumaraswamy, 2021), or analyses several Arab economies jointly without isolating the Bahraini case (Otman, 2022).

The second contribution is methodological, and the authors would emphasise it. The results reported below show that the association between banking soundness and the composite development index is positive and detectable, that the association with the

environmental dimension is substantially stronger, and that no association with the social dimension can be detected at all.

An earlier version of this study, estimated on temporally disaggregated quarterly data, reported a significant social-dimension coefficient. That coefficient does not exist in the observed data. Reporting this failure, and explaining its mechanism precisely, is offered as a caution to a literature in which the combination of short national samples, policy-relevant questions and readily available disaggregation software is common, and in which the software issues no warning.

The paper also speaks to a policy moment. The Central Bank of Bahrain issued sustainable finance principles in 2022 and 2023, and the question of whether the sector's performance actually reaches development indicators bears directly on whether those principles should remain guidance or become binding requirements.

Literature Review

Background Theory

The paper draws on two theoretical traditions. The first is the literature on finance and development, which starts from the observation that financial intermediaries do more than lubricate exchange. They decide which projects will receive patient capital, they oversee borrowers, and they diversify risk, and in doing so they affect not just the rate of economic growth but its composition (Levine, 2005).

Hence the developmental contribution of any banking sector is determined by the destination of its financing. A sector dedicated to short-term consumer credit can be profitable and stable, but contribute little to structural outcomes. A sector which finances production, inclusion and environmental investment translates its performance into development indicators. This has implications for empirical work in that we should expect co-movement of banking performance and development outcomes only where the intermediation function is targeted at developmental ends.

The second tradition is unique to Islamic finance. This maqasid al-Shariah framework is one that uses the goals of Islamic law, not just shareholder value, as the basis for institutional success. Chapra et al. (2008) categorise these objectives as the protection of vital human interests.

Dusuki and Bouheraoua (2011) translate these objectives into operational objectives that are applicable to financial institutions, building on the earlier operationalisation of Mohammed, Razak, and Taib (2008), whose Maqasid Index remains among the most widely applied instruments for translating these objectives into a measurable performance score.

Three of these objectives are closely related to the traditional dimensions of sustainable development. The obligation to preserve wealth is an economic obligation, which requires that finance be directed from speculation towards real productive activity. In the social dimension, the preservation of life and society is an obligation, achieved through zakat, qard hasan, waqf and microfinance. The protection of the environment is an obligation of the environmental dimension, expressed in the principle of stewardship, according to which ecological harm must be taken into account in the financing decisions.

The mapping of the maqasid channels onto the dimensions of development provides a testable framework and importantly, predicts an ordered, rather than uniform effect. Wherever social instruments are respected by Islamic banks, their performance should be recorded in the social dimension of development. Where environmental screening is driven into financing decisions by regulation or conviction, the environmental dimension should register it likewise.

The economic dimension is the most difficult for two reasons found in the literature. In rentier economies the macro cycle is driven by the fiscal channel of resource revenue and bank-level performance can be overwhelmed by oil price movements (Gylfason, Herbertsson, & Zoega, 1999; Espinoza & Senhadji, 2011), a constraint

compounded in dual-banking systems by the still-modest scale of the Islamic segment relative to its conventional counterpart (Abedifar, Hasan, & Tarazi, 2016).

Moreover, when Islamic banks have significant holdings of government paper, or when their funding is concentrated in murabahah-type consumer products, their intermediation has only an indirect effect on the macroeconomy (Otman, 2022). But the framework does not ensure that these channels are operating with equal force, and critical scholarship has documented a divide between maqasid rhetoric and practice in parts of the industry.

Julia and Kassim (2019) compare the performance of green banking between Islamic and conventional banks in Bangladesh in an explicitly maqasid-based framework, finding that the alignment between stated Shariah objectives and observed financing behaviour is weaker than the theoretical literature suggests. Hence the relative strength of each channel is an empirical question and testing the channels separately is as important as testing any aggregate relationship. It is this very reflection that justifies the choice of the design of the dimension level made here.

Theory also has implications for measurement and it is here that the difficulties of the paper begin, not end. If the developmental claim of Islamic banking is based on maqasid obligations, then profitability ratios alone cannot reflect the performance of an Islamic bank.

Therefore, several researchers have proposed composite measures by combining conventional financial indicators with sustainability and Shariah-purpose components (Al-Malkawi & Pillai, 2018; Muhamad, Zain, Samad, Rahman, & Yasoa, 2022; Mergaliyev, Asutay, Avdukic, & Karbhari, 2021). We endorse this measuring philosophy, but as we are frank to explain in Section 3.2, we could not implement it because the sector-level data needed to construct such an index are not published for Bahrain at an annual frequency.

Previous Studies

The empirical literature relevant to this paper can be divided into three strands.

The first strand considers how Islamic banking is linked to development outcomes in countries. Otman (2022) examined a set of Arab economies from 2013-2020 using an autoregressive distributed lag framework and found positive contributions to the sustainable development goals in markets where banks adopted a developmental financing orientation and weak contributions where portfolios were focused on short-term products.

The closest antecedent to the argument presented here is this conditional finding that the developmental contribution of Islamic banking depends on the financing composition rather than on the mere existence of Islamic institutions. Asaad and Al-Saad (2025) studied the poverty-reduction and equity effects of zakat, waqf, qard hasan and musharakah instruments.

They documented mechanisms through which the social channel would be expected to operate. The role of Islamic banks in green housing finance and emission reduction and the mechanism of the environmental channel are documented by Shoaib, Zaman, and Arslan (2024). Alghafes, Al-Malkawi and Pillai (2024) studied environmental, social and governance factors in Gulf Islamic banks and found that such practices improve financial performance, implying that developmental and commercial objectives need not be at odds.

Collectively, this strand establishes that plausible transmission mechanisms exist for each of the three dimensions, but it does not establish that any of them operates at national scale in any given market. The leap from documented instrument-level effects to observable national-level associations is exactly the leap that this paper tries to make, and is exactly the leap where sample size becomes binding.

The second strand is specific to Bahrain. Abduh, Brahim, and Omar (2012) provide the earliest econometric evidence for this economy, reporting a long-run positive relationship between Islamic financial deepening and conventional economic growth

using cointegration and error-correction methods on quarterly data; the present paper differs in its outcome variable, sustainable development rather than growth, and in confining inference to the annual frequency at which the underlying sector-level soundness data are genuinely observed.

Abdulla et al. (2021) studied the alignment of Islamic finance with sustainable development goals in the Bahraini market, reporting the early institutional adoption of sustainability initiatives but also the lack of binding indicators and unified reporting standards. The study is institutional and descriptive (rather than econometric) and identifies the measurement gap that the present paper finds, from the other direction.

The structural characteristics of the Bahraini economy that define any finance and development nexus are pointed out by Nakibullah (2018) and Khayati & Al-Sayegh (2020) as limited hydrocarbon reserves, early peak in production, non-oil growth focused on construction and services and persistent fiscal reliance on oil revenue despite the diversification of output. None of this work has been econometrically estimated the banking and development relationship for Bahrain and the present paper is the first attempt to do so, to the authors' knowledge.

The third strand is methodological and the paper's ultimate contribution is greatest to the third strand. A chronic problem for finance and development studies in small resource economies is the combination of short samples, persistent series, and the confounding effect of the resource cycle. The bounds testing approach of Pesaran, Shin and Smith (2001) allows regressors of mixed integration order less than second, and has become the default response to this problem in the applied Islamic finance literature.

When structural identification is not possible, Granger causality tests are often employed to provide evidence of the temporal precedence. Inference in persistent series is obtained using heteroskedasticity- and autocorrelation-consistent standard errors (Newey and West, 1987).

Both of these tools are good. The problem is that they are deployed on the sample sizes. The annual national accounts of one small economy over ten years yield ten observations, and none of these procedures work with ten observations. The increasingly popular approach is temporal disaggregation, converting annual series into quarterly series using the techniques of Chow and Lin (1971) or Denton, as implemented in software such as the tempdisagg package (Sax & Steiner, 2013).

The expanded sample is then supported by the dynamic machinery and results are reported on the expanded sample. The distinguishing feature of these methods, which is typically ignored by practitioners, is that they extract a high frequency path from low frequency totals by regressing the low frequency series on one or more high frequency series of indicators that are available and believed to move with the variable of interest.

The indicator gives the information content of the resulting quarterly series. It is only limiting the yearly totals. In the absence of an indicator series, the procedure has nothing to work with but the annual values themselves and produces a smooth deterministic interpolation.

Hypotheses

The hypotheses follow from the theory and from the evidence reviewed above. The composite hypothesis is stated first, and the dimension-level hypotheses separately, because the maqasid channels predict effects that may differ in magnitude and detectability across the three dimensions.

H1. Islamic banking sector soundness is positively associated with the composite sustainable development index in Bahrain.

H1a. Islamic banking sector soundness is positively associated with the economic dimension of sustainable development.

H1b. Islamic banking sector soundness is positively associated with the social dimension of sustainable development.

H1c. Islamic banking sector soundness is positively associated with the environmental dimension of sustainable development.

The hypotheses are stated as associations rather than as effects. This is not a rhetorical hedge. With ten observations, no control strategy and no instrument, the design identifies conditional association and nothing stronger, and the language of the hypotheses is chosen to reflect what the design can deliver.

METHODOLOGY

Data

The unit of analysis is the Bahraini economy, observed annually from 2015 to 2024, yielding ten observations. The decade spans the oil price collapse of 2015 and 2016, the COVID-19 shock of 2020, the subsequent recovery, and the issuance of the Central Bank of Bahrain's sustainable finance principles in 2022 and 2023.

Data were collected from official sources: the Ministry of Finance and National Economy, the Central Bank of Bahrain's Financial Stability Reports, the Information and eGovernment Authority, the United Nations Development Programme, the World Bank's World Development Indicators, and the International Monetary Fund's World Economic Outlook database. Islamic banking indicators were compiled at sector level from the Central Bank of Bahrain's Financial Stability Reports.

One data limitation must be recorded before any estimation is described. The Islamic banking series for the years 2015 to 2017 are, by the acknowledgement of the compilation from which they are drawn, partly reconstructed from the trend of later observations rather than read directly from contemporaneous Financial Stability Reports.

Approximately one third of the early history of the independent variable is therefore estimated rather than observed. The authors flag this rather than resolve it, since resolution requires retrieving the 2015 to 2017 reports from primary sources, and note that it compounds the small-sample problem described throughout.

Variable Construction

Islamic banking soundness (IBP) is constructed as a sector-level composite of five standardised indicators: return on assets, return on equity, the capital adequacy ratio, the non-performing financing ratio entered with reversed sign, and total sector assets. Each component is standardised to zero mean and unit variance before aggregation, and components are equally weighted.

It is necessary to state plainly what this index measures and what it does not. It measures financial soundness and scale. It does not measure developmental orientation. The authors state this explicitly because the distinction is material to interpretation, and because the Islamic banking literature has argued persuasively, and in the authors' view correctly, that performance in this sector should be measured against maqasid objectives rather than profitability alone (Al-Malkawi & Pillai, 2018; Muhamad et al., 2022).

The variables that such an index would require, namely the share of financing directed to industrial sectors and to small and medium enterprises, the volume of financing extended to environmental and social projects, and measures of Islamic financial inclusion, are not published for Bahrain at annual sector level. Constructing them would require hand-collection from the annual reports of fifteen institutions, which is the natural extension of this work and is discussed in Section 5.3.

The consequence for what follows is one genuine limitation and one genuine advantage. The limitation is that any developmental interpretation of the banking coefficient is necessarily indirect. The analysis can establish that a sounder and larger Islamic banking sector coincides with improved environmental outcomes; it cannot establish that Islamic banks financed those outcomes.

The advantage is that the independent variable shares no components with any dependent variable, so that a positive coefficient cannot be an artefact of definitional overlap. This concern is not hypothetical: composite performance indices in this literature

that fold environmental financing into the performance measure, while the corresponding development measure incorporates environmental expenditure, are structurally vulnerable to precisely this artefact. The index used here is immune to it by construction, if only because the data that would have created the vulnerability do not exist.

Sustainable development (SD) is constructed as the equally weighted mean of three standardised sub-indices. The economic dimension (SD_ECO) combines non-oil gross domestic product growth, gross domestic product per capita, consumer price inflation entered with reversed sign, and the current account balance. The social dimension (SD_SOC) combines the Human Development Index, education expenditure as a share of gross domestic product, health expenditure as a share of gross domestic product, and life expectancy.

The environmental dimension (SD_ENV) combines carbon dioxide emissions per capita, entered with reversed sign, and the renewable energy share of total energy. The environmental sub-index rests on two indicators, which is thin, and the renewable energy share moves over a very small base, rising from 0.1 per cent to 1.2 per cent across the decade. Both facts temper any strong reading of the environmental result reported below, and both are stated here rather than buried in a limitations section.

Three control variables enter every specification. The Brent crude oil price (OIL) captures the rentier cycle that drives Bahraini public finance. The ratio of government debt to gross domestic product (DEBT) reflects the debt-financed character of the recent non-oil expansion. An index of economic diversification (ED), constructed from the non-oil share of real gross domestic product, the non-oil share of government revenue, and the manufacturing share of output, absorbs structural change in the production base, so that the banking coefficient is not credited with effects properly belonging to diversification itself.

Model Development

The estimating equation is deliberately austere:

$$SD_i,t = \beta_0 + \beta_1 IBP_t + \beta_2 ED_t + \beta_3 OIL_t + \beta_4 DEBT_t + \varepsilon_t \quad (1)$$

where SD_i denotes in turn the composite development index and each of its three dimensions, and β_1 is the coefficient of interest, testing H1 and, in the dimension-level specifications, H1a, H1b and H1c respectively. Equation (1) is estimated by ordinary least squares.

Because Islamic banking soundness is not assigned to the Bahraini economy independently of its wider macroeconomic and regulatory environment, and because the design admits no credible instrument, equation (1) identifies conditional association rather than a causal effect; this is a property of the model's identification, not merely an interpretive caveat to be raised later, and every coefficient reported below should be read accordingly.

With ten observations and four regressors, equation (1) leaves five residual degrees of freedom. That is the ceiling imposed by the data. The specification therefore excludes a lagged dependent variable, excludes interaction terms, and excludes additional controls, not because such terms are theoretically uninteresting but because each would consume degrees of freedom that do not exist.

A lagged dependent variable in particular, which the development literature would ordinarily recommend given the persistence of development indicators, would reduce the effective sample to nine and the residual degrees of freedom to three, at which point the estimates cease to be informative in any meaningful sense.

Inference, and the Specification That Was Abandoned

Asymptotic p-values are unreliable at a sample size of ten. The paper therefore reports ordinary least squares p-values alongside permutation p-values, obtained by reshuffling the IBP series ten thousand times and recording the proportion of permuted coefficients that equal or exceed the observed coefficient in absolute value. Permutation inference

makes no distributional assumption and provides the appropriate reference distribution at this sample size. Where the two disagree, the permutation p-value is relied upon.

The paper additionally reports a leave-one-year-out analysis, since with ten observations a single year can carry a result, and a complete specification grid across all combinations of the three controls, since with a small candidate set the entire specification space can be displayed rather than selected from. Displaying the full grid is a deliberate guard against specification search, which is a serious hazard in small samples and an invisible one in published work.

An earlier version of this study followed the practice now common in this literature. The ten annual observations were disaggregated into forty quarterly observations using the tempdisagg package (Sax & Steiner, 2013), and the expanded series were used to estimate an autoregressive distributed lag bounds test, Granger causality tests at one, two and four lags, and dynamic regressions with a lagged dependent variable and Newey-West standard errors.

Those results were considerably stronger than the results reported in Section IV. They have been withdrawn, and the reasons are set out here in detail because the practice is widespread and the failure mode is not self-evident. The disaggregation was specified with a constant and no indicator series. In the notation of the software, the model was of the form td(y_annual ~ 1).

With no indicator series, the Chow-Lin and Denton-Cholette procedures have no external information to draw upon, and return a smooth deterministic interpolation through the annual values. The authors verified this directly: an ordinary cubic spline, fitted independently through the ten annual capital adequacy observations, reproduces the "disaggregated" quarterly capital adequacy series with a correlation of 0.996. The quarterly series is the interpolation.

Three consequences follow, and each invalidates a distinct class of result.

First, the effective sample size is ten, not forty. Thirty of the forty quarterly observations are generated rather than observed. Standard errors, t-statistics, F-statistics and bounds-test critical values computed on thirty-nine degrees of freedom are being computed on a sample that contains the information of ten. They will be too small, and coefficients will appear significant that are not.

Second, all within-year dynamics are artefacts of the smoothing algorithm. A Granger causality test at a lag of two quarters asks whether one interpolating curve bends before another does. It is a property of the spline, not of the Bahraini economy. Any lag structure shorter than one year is uninterpretable on data constructed in this way, and the temporal precedence such a test appears to establish is a property of the software.

Third, unit-root inference is biased towards the conclusion of integration of order one. Smoothing induces persistence by construction. The finding that every series in the expanded dataset is I(1) is close to guaranteed by the interpolation, and cannot be treated as an independent property of the data or as a justification for the dynamic methods that the finding is then used to justify.

The cost of the practice, in the authors' own case, is concrete and measurable. Estimated on the interpolated quarterly series, the association between Islamic banking soundness and the social dimension of development was significant at conventional levels, with a coefficient of 0.113 and a p-value of 0.018. Estimated on the ten observed annual points, the same association is not significant, with a coefficient of 0.287 and a p-value of 0.392, and it is significant in zero of ten leave-one-out folds.

The interpolation did not reveal a relationship that annual data were too coarse to detect. It manufactured one. Had the authors not returned to the raw annual series, that coefficient would have been published, and it would have been interpreted, plausibly and at length, in terms of zakat, qard hasan and Islamic microfinance. Accordingly, this paper reports no cointegration test, no Granger causality test, no error-correction model and no

parameter-stability test. Ten annual observations cannot support them, and temporal disaggregation does not change what the data contain.

RESULTS

Descriptive Statistics

Table 1 reports descriptive statistics for the underlying variables.

Table 1. Descriptive Statistics, 2015 to 2024 (N = 10)

Variable	Mean	SD	Min	Max
Return on assets (%)	0.47	0.33	0.10	1.10
Return on equity (%)	3.94	2.65	0.90	9.00
Capital adequacy ratio (%)	20.01	3.70	16.80	27.70
Non-performing financing (%)	8.89	2.18	4.90	11.00
Islamic banking assets (USD bn)	31.90	5.01	25.80	41.00
Non-oil GDP (% of real GDP)	82.46	2.11	79.50	86.00
Human Development Index	0.881	0.014	0.859	0.899
CO2 emissions per capita (tonnes)	21.99	0.62	20.80	23.10
Renewable energy (% of total)	0.40	0.36	0.10	1.20
Brent oil price (USD per barrel)	66.07	18.45	41.80	99.80
Government debt (% of GDP)	106.40	23.08	66.70	134.00

Note: Composite indices (IBP, SD, SD_ECO, SD_SOC, SD_ENV, ED) are standardised to zero mean and unit variance by construction and are therefore omitted from this table.
Sources: MOFNE, CBB Financial Stability Reports, IGA, UNDP, World Bank WDI, IMF WEO.

The banking data contain one pattern that will matter for interpretation. The sector's capital adequacy ratio averages 20.01 per cent over the decade, far above regulatory minima, while its return on assets averages 0.47 per cent. High capital strength combined with low asset returns describes balance-sheet capacity held in low-yield

positions rather than deployed into higher-return productive finance. Section 4.5 returns to this observation.

Correlation Analysis

Table 2 reports the correlation matrix.

Table 2. Correlation Matrix (N = 10)

	IBP	SD	SD_ECO	SD_SOC	SD_ENV	ED	OIL	DEBT
IBP	1.000							
SD	0.838	1.000						
SD_ECO	0.818	0.668	1.000					
SD_SOC	0.499	0.853	0.239	1.000				
SD_ENV	0.722	0.913	0.386	0.836	1.000			
ED	0.586	0.741	0.544	0.650	0.610	1.000		
OIL	0.709	0.482	0.892	0.095	0.186	0.483	1.000	
DEBT	0.654	0.884	0.595	0.827	0.730	0.874	0.467	1.000

Islamic banking soundness correlates with the composite development index at 0.838 (p = 0.002), with the economic dimension at 0.818 (p = 0.004), and with the environmental dimension at 0.722 (p = 0.018). The correlation with the social dimension, at 0.499 (p = 0.142), is not statistically distinguishable from zero.

Two further diagnostics follow from this correlation structure. Variance inflation factors, computed from the regressor correlation matrix, are 4.37 for ED, 1.32 for OIL and 4.28 for DEBT, with a condition number of 17.8 for the three regressors jointly; these values indicate moderate collinearity, concentrated in the ED-DEBT pair, that inflates the standard errors on both coefficients without approaching the threshold, conventionally a condition number above 30 or a VIF above 10, at which coefficient estimates become numerically unreliable.

Serial correlation in the annual series themselves, as distinct from the artefactual persistence that Section 3.4 documents in the temporally disaggregated quarterly series, is not formally tested here: with five residual degrees of freedom per specification (Table 3), a Durbin-Watson statistic would carry a sampling distribution too wide at this sample size to be informative, and the authors report this limitation directly rather than a statistic that would imply a precision the design cannot support.

Regression Results

Table 3 reports estimates of equation (1) for the composite index and for each dimension.

Table 3. Regression Results (N = 10, OLS, standard errors in parentheses)

Variable	SD	SD_ECO	SD_SOC	SD_ENV
Constant	0.000 (0.114)	0.000 (0.151)	-0.000 (0.175)	-0.000 (0.163)
IBP	0.608** (0.201)	0.298 (0.264)	0.287 (0.306)	0.894** (0.286)
ED	-0.104	-0.122	-0.167	0.037

	(0.253)	(0.333)	(0.386)	(0.360)
OIL	-0.215 (0.174)	0.644** (0.229)	-0.505 (0.266)	-0.664** (0.248)
DEBT	0.678* (0.269)	0.205 (0.354)	1.021* (0.411)	0.422 (0.383)
R^2	0.927	0.874	0.831	0.853
Adjusted R^2	0.869	0.773	0.695	0.735
Residual df	5	5	5	5

Note: *** p < 0.01, ** p < 0.05, * p < 0.10.

Table 4 reports permutation-based inference on the coefficient of interest.

Table 4. Permutation Tests (10,000 reshuffles of IBP)

Model	**β (IBP)**	**OLS p**	**Permutation p**	**Decision**
SD	0.608	0.029	0.010	H1 supported
SD_ECO	0.298	0.310	0.149	H1a not supported
SD_SOC	0.287	0.392	0.244	H1b not supported
SD_ENV	0.894	0.026	0.013	H1c supported

Islamic banking soundness is positively associated with the composite development index and, more strongly, with its environmental dimension. Permutation inference agrees with ordinary least squares in both cases and is, if anything, marginally more favourable, which indicates that the results are not artefacts of the normality assumption. Neither the economic nor the social dimension exhibits a detectable association once the controls are included.

The oil price coefficients complete the picture and repay attention. Oil enters the economic dimension positively and significantly, with a coefficient of 0.644, and the environmental dimension negatively and significantly, with a coefficient of -0.664. Bahraini economic development continues to ride the hydrocarbon cycle, while environmental performance deteriorates when oil revenue is abundant.

The positive banking coefficient in the environmental equation is therefore operating against the resource cycle rather than alongside it, which is what makes it substantively interesting and also what makes it worth doubting.

Robustness

Table 5 reports the robustness of the banking coefficient across four checks.

Table 5. Robustness of the IBP Coefficient

Check	**SD**	**SD_ECO**	**SD_SOC**	**SD_ENV**
Leave-one-out: β minimum	0.229	0.140	-0.028	0.381
Leave-one-out: β maximum	0.785	0.539	0.403	1.082
Leave-one-out: folds	5 of 10	0 of 10	0 of 10	6 of 10

with p < 0.05				
Excluding 2020 (COVID): p	0.054	0.591	0.297	0.027
Excluding 2024: p	0.743	0.831	0.980	0.703
Bivariate (no controls): p	0.002	0.004	0.142	0.018

Table 6 reports the complete specification grid.

Table 6. Specification Grid, IBP Coefficient (p-value in parentheses)

Controls included	**SD**	**SD_ECO**	**SD_SOC**	**SD_ENV**
None	0.838 (0.00)	0.818 (0.00)	0.499 (0.14)	0.722 (0.02)
OIL	0.997 (0.01)	0.372 (0.10)	0.868 (0.08)	1.187 (0.00)
DEBT	0.453 (0.02)	0.749 (0.03)	-0.073 (0.80)	0.427 (0.20)
ED	0.614 (0.02)	0.760 (0.02)	0.180 (0.62)	0.555 (0.11)
OIL + DEBT	0.615 (0.02)	0.306 (0.26)	0.298 (0.33)	0.892 (0.01)
ED + OIL + DEBT	0.608 (0.03)	0.298 (0.31)	0.287 (0.39)	0.894 (0.03)

Three conclusions emerge, and the third is reported as prominently as the first two.

The environmental association is the most robust finding in the data. It is significant in the bivariate case, in four of six control specifications, in six of ten leave-one-out folds, under permutation inference, and after excluding 2020. That last exclusion is the one that would most plausibly have overturned the result, since the COVID year is the most obvious candidate for an outlier driving the association, and it does not.

The social association is absent. It is significant in no leave-one-out fold, in one of six specifications, and only when the oil price is the sole control. Its permutation p-value is 0.244. As Section 3.4 records, this same coefficient was significant at p = 0.018 on the temporally disaggregated quarterly series. It is the clearest illustration available in these data of what disaggregation does to inference, and the authors report it as such rather than omitting the earlier estimate.

Every result depends on 2024. Excluding the final year raises the p-value on the composite index from 0.029 to 0.743, and on the environmental dimension from 0.026 to 0.703. The last year of the sample is the year in which the sector's return on assets reached its decade maximum of 1.1 per cent, capital adequacy peaked at 27.7 per cent, non-performing financing bottomed at 4.9 per cent, and the renewable energy share reached 1.2 per cent, having stood at 0.1 per cent for most of the period. The association reported here is, to a substantial degree, the observation that these developments occurred in the same year.

That is not nothing, and it is not much. A relationship that requires its final observation in order to exist is a relationship that may not survive the arrival of 2025 and 2026. The authors state this rather than allow a referee or a reader to discover it.

DISCUSION

The data support a single channel, not an ordered gradient. The Islamic banking sector in Bahrain became larger, better capitalised and more profitable during the decade and at the same time the environmental dimension of development improved, conditional on the oil price, public debt and diversification. That association holds up to every test the sample size allows.

A plausible mechanism exists. The latter years of the period provide the Central Bank of Bahrain's sustainable finance principles of 2022 and 2023, which codified environmental screening into financing practice for the first time, together with the regional expansion of ijarah-based renewable energy finance (Shoaib et al., 2024). A sector with a strong capital headroom and improving asset quality is a sector well placed to absorb the long-tenor, capital-intensive exposures renewable energy projects require.

The mechanism cannot, however, be tested here, and the reason must be stated precisely. The banking index is a measure of soundness, not the composition of financing. The analysis observes that sound banks and improving environmental indicators coincide it does not observe that Islamic banks financed the improvement.

These data cannot exclude a competing narrative: the same national policy shift that produced the sustainable finance principles may also have produced the renewable energy investment, with the banking sector a beneficiary or a bystander rather than a channel. Distinguishing these accounts requires financing-composition data. This is discussed in Section 5.3 as a future work.

The least surprising finding in the present report is the absence of a link to the economic dimension. In a rentier economy, the macro-economic cycle is driven by the fiscal channel of resource revenue (Gylfason et al., 1999; Espinoza & Senhadji, 2011) and the oil price does indeed dominate the economic-dimension equation, entering with a coefficient of 0.644 at the five per cent level.

Bank-level soundness has limited room to register against a force of that magnitude. The sector's own balance sheet points the same way: capital well above regulatory minima earning 0.47 per cent on assets describes capacity that is held rather than deployed, the very configuration under which the maqasid obligation to preserve wealth through productive finance would be least well discharged.

The lack of association with the social dimension calls for more prudence than the economic one, for two reasons. First, theory identifies the social channel at which the unique instruments of Islamic banking should be most apparent, and the poverty and equity effects of those instruments are documented elsewhere (Asaad & Al-Saad, 2025). Second, the opposite was reported in an earlier specification of this very study.

The authors interpret the null result not as evidence that these instruments accomplish nothing, but rather as evidence that they do not move national social indicators at the scale and frequency observed here. Bahrain's social indicators are high and slow-moving, the Human Development Index only spanning 0.859 to 0.899 over the decade. A national composite index may just be the wrong instrument to detect effects that operate at household level.

The more general analytical point revisits the paper's methodological contribution. The data is the binding constraint. Dynamic methods are called for by the research question but cannot be provided by the data. Temporal disaggregation seems to be a solution, as it generates a dataset on which the methods can work and produce results. But a method that executes is not a method that identifies.

The quarterly series in the abandoned specification had exactly the same amount of information as the annual series from which they were generated (a fact verified directly by the authors), while carrying four times the nominal degrees of freedom. The product was a statistically significant social-dimension coefficient that does not exist in the observed data. The authors do not consider their case to be unique, and researchers using these procedures should at least report the indicator series used. For the specification td(y ~ 1) no indicator was used and the resulting series should not be treated as observations.

CONCLUSION

This paper asked whether the financial soundness of Bahrain's Islamic banking sector is associated with the country's sustainable development outcomes over the decade from 2015 to 2024, and what ten annual observations can legitimately establish.

Across those ten observations, Islamic banking soundness is positively associated with the environmental dimension of sustainable development, with a coefficient of 0.894 and a permutation p-value of 0.013, and with the composite development index, with a coefficient of 0.608 and a permutation p-value of 0.010, conditional on the oil price, government debt and economic diversification.

Hypotheses H1 and H1c are supported. The association survives permutation inference, the majority of control specifications, and exclusion of the COVID-19 year. It does not survive exclusion of 2024. No association is detectable for the social dimension (H1b) or, once the oil price is controlled for, for the economic dimension (H1a).

The dimension pattern does not conform to the ordered maqasid gradient that the theoretical framework predicts. There is one channel, environmental, rather than a hierarchy of three. The authors regard this as a finding about the Bahraini sector rather than a refutation of the maqasid framework, but they decline to construct a post hoc theoretical account that would accommodate whichever ordering the data happened to produce, since a framework that accommodates any ordering predicts none.

The study began with a quarterly dataset, a bounds test, Granger causality results and a theoretically satisfying gradient across development dimensions. None of it was in the data. What is in the data is a single association, fragile at the margin, that a properly designed panel could confirm or dismiss. Reporting the smaller finding is the more useful thing to do.

Policy Recommendations

Three recommendations follow for regulators and for the industry.

The Central Bank of Bahrain's sustainable finance principles of 2022 and 2023 align with the only channel for which evidence is found here. Translating those principles from guidance into measurable requirements, accompanied by common sectoral reporting indicators for environmental and social financing, would serve two purposes.

It would allow whatever effect exists to compound, and it would create the data that would permit the effect to be evaluated properly at bank level rather than inferred from sector aggregates. The absence of such indicators is, as Abdulla et al. (2021) noted from an institutional standpoint and as this paper has encountered from an econometric one, the binding constraint on evidence-based supervision in this domain.

The absent economic channel exposes the sector's unfinished business. The sector holds capital far above regulatory minima and earns 0.47 per cent on assets. If banking soundness is to register in aggregate economic outcomes, financing weight must shift away from short-term consumer products and holdings of government paper and towards musharakah- and mudarabah-based productive finance. The capacity to make that shift evidently exists on the sector's balance sheet; the incentive apparently does not.

Researchers and supervisors evaluating the developmental role of Islamic banking should track dimension-level outcomes rather than composite indices alone, since aggregation can conceal the channels through which the sector is supposed to be distinctive, and can equally conceal the channels through which it is not.

Limitations and Future Research

The limitations of this study are its substance rather than an appendix to it.

Ten observations with four regressors leave five residual degrees of freedom, and every result depends materially on the final year of the sample. The banking index measures financial soundness rather than developmental orientation, so its developmental interpretation is indirect. The banking series for 2015 to 2017 are partly reconstructed from trend rather than read from source.

The environmental sub-index rests on two indicators, one of which moves over a very small base. No causal claim is made, and none is available: this is a conditional association observed in ten annual observations of a single country.

Two extensions would settle what this paper can only raise.

The first is financing-composition data at bank level. The variables that would render a maqasid-based performance index operational, namely sectoral financing shares, exposure to small and medium enterprises, volumes of green and social financing, and measures of financial inclusion, exist in the annual reports of Bahrain's fifteen Islamic banks and can be hand-collected. With them, the research question becomes whether banks that finance environmental projects are associated with environmental outcomes, which is the question that matters, rather than whether sound banks are.

The second is a Gulf Cooperation Council panel. Four to six Gulf economies observed over the same decade would yield forty to sixty observations that are genuinely observed rather than interpolated. This is the design that delivers what temporal disaggregation only appears to deliver: sufficient degrees of freedom for dynamic estimation, cross-sectional variation capable of identifying effects that a single time series cannot, and the ability to exploit differences across countries in oil dependence and in the depth of Islamic banking. It is a larger undertaking, and it is the correct one.

ACKNOWLEDGEMENT AND DISCLOSURE

Prior specification. An earlier version of this analysis, derived from the first author's doctoral thesis, estimated the relationships reported here on quarterly series obtained through temporal disaggregation of the annual data (N = 40), and reported an autoregressive distributed lag bounds test, Granger causality results, and a statistically significant coefficient on the social dimension of development.

Section 3.4 explains why those results were withdrawn. A companion manuscript drawn from the same thesis dataset, addressing whether Islamic banking performance moderates the relationship between economic diversification and sustainable development, is under review at another journal and reports results based on the quarterly series. The authors have notified that journal of the issue described in Section 3.4.

Data and code. The annual dataset and the full estimation code, including the permutation and leave-one-out routines, are available from the authors on request. Use of artificial intelligence. The authors disclose the use of artificial intelligence tools to translate source material from Arabic, to assist in drafting and editing the English text, and to replicate and audit the estimation reported here. All data, analytical decisions and conclusions are the authors' own, and the authors have reviewed and verified the entire manuscript and take full responsibility for its contents.

REFERENCES

Abduh, M., Brahim, S., & Omar, M. A. (2012). A study on finance-growth nexus in dual financial system countries: Evidence from Bahrain. World Applied Sciences Journal, 20(8), 1166-1174.

Abdulla, Y., Ebrahim, R., & Kumaraswamy, S. (2021). Islamic finance and sustainable development goals in Bahrain. In 2021 International Conference on Sustainable Islamic Business and Finance (pp. 8-13). IEEE. https://doi.org/10.1109/IEEECONF53626.2021.9686323.

Abedifar, P., Hasan, I., & Tarazi, A. (2016). Finance-growth nexus and dual-banking systems: Relative importance of Islamic banks. Journal of Economic Behavior and Organization, 132, 198-215. https://doi.org/10.1016/j.jebo.2016.03.005.

Alghafes, M., Al-Malkawi, H. N., & Pillai, R. (2024). Influence of key ESG factors on Islamic banks' financial performance: Evidence from GCC countries. Research in

International Business and Finance, 71, 102445. https://doi.org/10.1016/j.ribaf.2024.102445.

Al-Malkawi, H. N., & Pillai, R. (2018). Analyzing financial performance by integrating conventional governance mechanisms into the GCC Islamic banking framework. Managerial Finance, 44(5), 604-623. https://doi.org/10.1108/MF-05-2017-0200.

Asaad, A., & Al-Saad, A. (2025). The role of Islamic finance in achieving sustainable development: Islamic banks as a model. International Islamic University Malaysia Journal, 9(2).

Chapra, M. U., Khan, S., & Al Shaikh-Ali, A. A. (2008). The Islamic vision of development in the light of Maqasid al-Shari'ah. Herndon, VA: The International Institute of Islamic Thought.

Chow, G. C., & Lin, A. (1971). Best linear unbiased interpolation, distribution, and extrapolation of time series by related series. The Review of Economics and Statistics, 53(4), 372-375. https://doi.org/10.2307/1928739.

Dusuki, A. W., & Bouheraoua, S. (2011). The framework of Maqasid al-Shari'ah and its implication for Islamic finance. ISRA International Journal of Islamic Finance, 2, 316-336.

Espinoza, R., & Senhadji, A. (2011). How strong are fiscal multipliers in the GCC? An empirical investigation (IMF Working Paper No. 11/61). Washington, DC: International Monetary Fund.

Gylfason, T., Herbertsson, T., & Zoega, G. (1999). A mixed blessing: Natural resources and economic growth. Macroeconomic Dynamics, 3(2), 204-225. https://doi.org/10.1017/S1365100599011049.

Iqbal, Z., & Mirakhor, A. (2011). An introduction to Islamic finance: Theory and practice (2nd ed.). Singapore: John Wiley & Sons.

Julia, T., & Kassim, S. (2019). Exploring green banking performance of Islamic banks versus conventional banks in Bangladesh based on Maqasid Shariah framework. Journal of Islamic Marketing, 11(3), 729-744. https://doi.org/10.1108/JIMA-10-2017-0105.

Khayati, A., & Al-Sayegh, J. (2020). The journey of Bahrain to economic diversification. In Economic development in the Gulf Cooperation Council countries (pp. 141-156). Singapore: Springer.

Levine, R. (2005). Finance and growth: Theory and evidence. In P. Aghion & S. N. Durlauf (Eds.), Handbook of economic growth (Vol. 1A, pp. 865-934). Amsterdam: Elsevier.

Mergaliyev, A., Asutay, M., Avdukic, A., & Karbhari, Y. (2021). Higher ethical objective (Maqasid al-Shari'ah) augmented framework for Islamic banks: Assessing ethical performance and exploring its determinants. Journal of Business Ethics, 170(4), 797-834. https://doi.org/10.1007/s10551-019-04331-4.

Mohammed, M. O., Razak, D. A., & Taib, F. M. (2008). The performance measures of Islamic banking based on the Maqasid framework. Paper presented at the IIUM International Accounting Conference (INTAC IV), Putrajaya, Malaysia.

Muhamad, S. F., Zain, F. A. M., Samad, N. S. A., Rahman, A. H. A., & Yasoa, M. R. (2022). Measuring sustainable performance of Islamic banks: Integrating ESG and Maqasid Shari'ah. IOP Conference Series: Earth and Environmental Science, 1102, 012080. https://doi.org/10.1088/1755-1315/1102/1/012080.

Nakibullah, A. (2018). Economic diversification in Bahrain. Applied Economics and Finance, 5(5), 67-74. https://doi.org/10.11114/aef.v5i5.3576.

Newey, W. K., & West, K. D. (1987). A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. Econometrica, 55(3), 703-708. https://doi.org/10.2307/1913610.

Otman, A. (2022). Islamic banks and sustainable development goals in the Arab world: A case study of selected countries. Abu Dhabi: Arab Monetary Fund.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics, 16(3), 289-326. https://doi.org/10.1002/jae.616.

Sax, C., & Steiner, P. (2013). Temporal disaggregation of time series. The R Journal, 5(2), 80-87. https://doi.org/10.32614/RJ-2013-028.

Shoaib, H. M., Zaman, M., & Arslan, M. (2024). Islamic banks and environmental sustainability: Evidence from green finance and ESG practices. Journal of Islamic Accounting and Business Research, 15(2), 198-217.

Disclaimer

Opinions expressed in this article are the opinions of the author(s). Al-Qanatīr: International Journal of Islamic Studies shall not be responsible or answerable for any loss, damage or liability etc. caused in relation to/arising out of the use of the content.