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The impact of non-performing financing and operational efficiency on the stability of Islamic banks in Persian Gulf countries

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ABSTRACT

Introduction
Islamic banking has become an integral part of the global financial system, particularly in the Persian Gulf region. Due to its reliance on profit-sharing and non-interest-based operations, Islamic banking faces unique challenges in maintaining stability, particularly when financing problems arise.

Objectives
This study analyzes the effect of Non-Performing Financing (NPF), operational efficiency, and input-output optimization on the stability of Islamic banks in the Persian Gulf countries.

Method
This study employs a quantitative approach using panel data regression models, specifically the random effects model (REM), to analyze data from 27 Islamic banks in eight Persian Gulf countries. The study includes classical assumption tests, such as normality, multicollinearity, and heteroscedasticity, followed by hypothesis testing using t-tests and F-tests.

Results
The results indicate that both NPF and efficiency have significant negative impacts on the stability of Islamic banks. The t-test reveals that NPF has a probability value of 0.0447 and a negative coefficient, suggesting that higher NPF levels reduce bank stability. Similarly, operational efficiency, as measured by the input and output variables, also shows a negative influence on stability, with a probability value of 0.0435. The *F*-test confirms that NPF, input, and output significantly affect Islamic bank stability, with an *F*-statistic probability value of 0.038223.

Implications
These findings have important implications for the management of Islamic banks in the Persian Gulf countries. Effective management of NPF is critical for maintaining stability, and operational improvements in efficiency can also enhance financial performance. Islamic banks should focus on improving their financing practices, including better monitoring problematic loans and diversifying revenue streams to reduce reliance on financing income.

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ABSTRACT

Originality/Novelty
This study contributes to the understanding of Islamic bank stability by exploring the combined effects of Non-Performing Financing (NPF) and operational efficiency on bank financial health. By focusing on Islamic banks in the Persian Gulf countries, this study highlights region-specific challenges and offers strategies for mitigating financial risks and enhancing bank resilience through better management of NPF and operational efficiency.

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INTRODUCTION

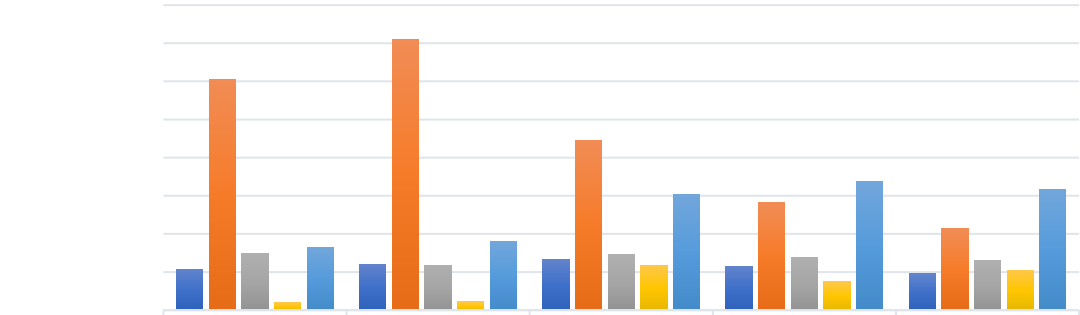
The Islamic economy worldwide has become increasingly visible with the rise of numerous Islamic banks in various countries. Initially, the first Islamic bank was established in Egypt, followed by the emergence of several Sharia-compliant banks in the 1970s, particularly in the Middle East such as the Dubai Islamic Bank and Bahrain Islamic Bank (Hassan & Aliyu, 2018; Mokodenseho et al., 2024; Musyafah, 2019). Rapid economic development in the Middle East has attracted international banking institutions to participate in the growth of the banking industry in the region (Rambe, 2021). This is also due to the fact that the Middle East serves as a bridge between three continents—Asia, Africa, and Europe—offering significant geopolitical and geostrategic potential. Another key factor is the region's abundant oil resources, which are crucial to the economy. In 2018, six key Islamic financial markets—Saudi Arabia, Qatar, the United Arab Emirates (including the Persian Gulf), Indonesia, Turkey, and Malaysia—held Islamic banking assets valued at US$ 1.8 trillion (Raharjo, 2018). Eight countries in the Middle East fall within the Persian Gulf region, including Saudi Arabia, Bahrain, Iraq, Iran, Kuwait, Oman, Qatar, and the United Arab Emirates (Tétreault et al., 2011).

However, this rapid economic growth is not without global challenges, which can affect the region's economic stability. One significant challenge is the fragmentation of the global geo-economic. Global geo-economic fragmentation poses considerable risks to Gulf Cooperation Council (GCC) countries. Geopolitical tensions, such as the conflict in Ukraine, could restrict the movement of capital, goods, technology, and labor, as well as increased volatility in commodity prices such as oil. These consequences could threaten economic growth, inflation, and short-term economic stability in the GCC while also reducing long-term growth potential. This situation is highly relevant to the stability of Islamic banks in the GCC, which are closely tied to the real economy and the commodity sector. Commodity price volatility and capital movement restrictions could disrupt liquidity and profitability for Islamic banks, while economic uncertainty could heighten financing risks and impact investor confidence in the Islamic banking sector (Retnasih, 2023; Siyamto, 2023).

The current study was conducted in the context Persian Gulf region since its Islamic financial data indicated some spike in non-performing financing. For Indonesian context, Bank of Indonesia Regulation No. 23/2/PBI/2021 set the maximum net NPL/NPF value at 5% (Fitri & Sriyana, 2023; Ikhsan, 2023). The smaller the NPF value, the lower is the financing risk borne by the bank, and vice versa. NPF reflects financing risk, as higher NPF ratios indicate a decline in bank financing quality. For international context, Islamic Financial Services Board also indicated the importance of maintaining non-performing financing (NPF) to total financing ratios within acceptable benchmarks (Islamic Financial Services Board, 2024b, p. 24).

Figure 1

Average Non-Performing Financing (NPF) Values of 5 Persian Gulf Countries from 2018 to 2022



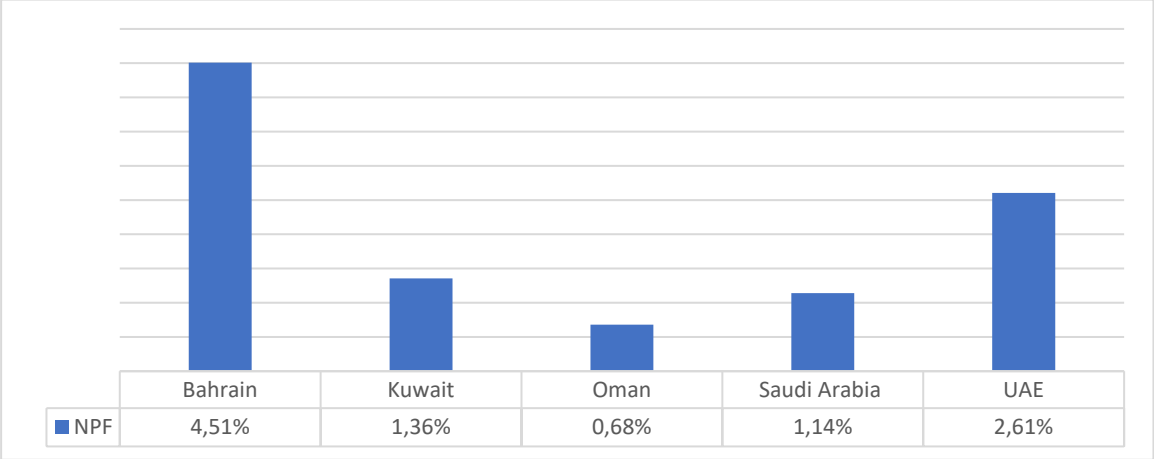
	2018	2019	2020	2021	2022
Saudi Arabia	1,08%	1,20%	1,33%	1,15%	0,95%
Bahrain	6,04%	7,09%	4,46%	2,82%	2,14%
Kuwait	1,48%	1,18%	1,45%	1,38%	1,30%
Oman	0,20%	0,23%	1,18%	0,75%	1,05%
UAE	1,65%	1,80%	3,03%	3,38%	3,18%

Source: Islamic Financial Services Board (2024a).

Figure 1 shows that the NPF values from the five Persian Gulf countries are not stable. In Saudi Arabia, the highest fluctuation during the 2018-2022 period occurred in 2020, reaching 0.13%. In Bahrain, fluctuations occurred in 2019, with an NPF value of 1.05%. Kuwait experienced the highest fluctuation in 2020, at 0.27%. In Oman, the highest fluctuation was observed in 2020 (0.95 %). Finally, in the UAE, the highest NPF fluctuation occurred in 2020, at 1.23%.

Figure 2

Total Average NPF Values of 5 GCC Countries



Source: Islamic Financial Services Board (2024a).

Based on Figure 2, the total average data for the five countries in the Persian Gulf are presented. Complete data for Iraq, Iran, and Qatar were not available from the IFSB (Islamic Financial Services Board, 2024a). It is evident that the average net NPF values of all countries remained below 5% during the 2018-2022 period. Bahrain had the highest average NPF value at 4.51%, still within the NPF standard, although close to the 5% threshold (Muarif et al., 2021).

Previous studies indicated that NPF has a partial influence on profitability, as proxied by ROA (Kusumastuti & Alam, 2019; Minarni et al., 2023; Qurotulaeni & Wirman, 2021). Furthermore, credit risk, as proxied by NPF, has a significant negative impact on bank stability when using the Z-Score method (Yulianti et al., 2023; Yurida et al., 2023). However, other studies suggested that asset quality as proxied by NPF did not affect stability (Budi L. P. et al., 2020; Nugroho & Anisa, 2018). Lestari & Suprayogi (2020) found that efficiency, proxied by BOPO, has a significant and negative influence on Islamic banks' stability, as indicated by the Z-Score. However, Nugroho & Anisa (2018) suggested that efficiency proxied by BOPO has no effect on stability. Based on the explanation above, the current study aims to analyze the impact of non-performing financing and efficiency on Islamic banks' stability in the context of Persian Gulf countries.

LITERATURE REVIEW

Non-Performing Financing

Non-Performing Financing (NPF) refers to default financing (loans) caused by a debtor's inability to fulfill agreed-upon payment obligations within the established timeframe (Tamimah, 2020). NPF represents the default financing experienced by Islamic banks, which clearly impacts their performance as financial institutions and affects their profits (Ardichy & Rahayu, 2022; El Islami & Jaya, 2022). Consequently, a debtor's activities may create financing risks that ultimately affect the banking system

(Tamimah, 2020). The capital conditions of Islamic banks must be continuously monitored because they are closely tied to the bank's stability, which is influenced by NPF, a ratio used to determine default financing (Fathonah & Hermawan, 2020; Najib & Iskandar, 2022; Yurida et al., 2023). Default financing affects the stability of banks, meaning that lower NPF values can improve a bank's stability. However, it is important to note that the growth of non-performing loans financing can lead to bank instability.

Input and Output

This study utilizes three input variables: operational costs, labor costs, and total assets as suggested by previous studies (Hasanatina et al., 2021; Marsondang et al., 2020; Rusydiana et al., 2019). Total credit is the output variable (Marsondang et al., 2020; Sholihah, 2021). The three input variables are explained as follows: First, operational costs are the expenses incurred to acquire goods, produce goods, conduct marketing, sales, and other operational activities (Anggraini & Kusufiyah, 2020). Second, labor costs include all the wages and salaries of identifiable workers (Harahap & Prima, 2019). Third, total assets serve as an indicator of the contribution of Islamic banking to the national economy and provide a quantitative measure of the bank's size (Riauwanto & Sulastiningsih, 2019). The output variable, total credit, refers to the total amount of credit disbursed (Sholihah, 2021).

Stability

Financial stability refers to the ability of a financial system to allocate resources to support economic activities, manage risk, and withstand disruptions (Fatoni & Sidiq, 2019). Improvements in public welfare through better living standards and economic growth are often driven by economic stability (Windarsari & Zainuddin S, 2020). Financial stability is difficult to describe and even harder to measure. Generally, the financial sector can be considered stable in the absence of excessive volatility. However, there is no fixed range for determining whether volatility is excessive (Kuntadi & Kristin, 2022). A bank's stability can be measured using the Z-score, a traditional method for assessing bank risk (Yurida et al., 2023). Additionally, measuring stability with the Z-Score is not only traditional but also popular among researchers due to the fact that the Z-Score negatively correlates with financial institution bankruptcy, meaning the likelihood that a bank's assets will be worth less than its liabilities is reduced (Fatoni, 2022). Stability was measured using the Altman Z-score model with ROA and CAR as the variables being assessed.

Based on previous explanation, research framework for this study can be viewed in Figure 3. The hypotheses of this study are as follows:

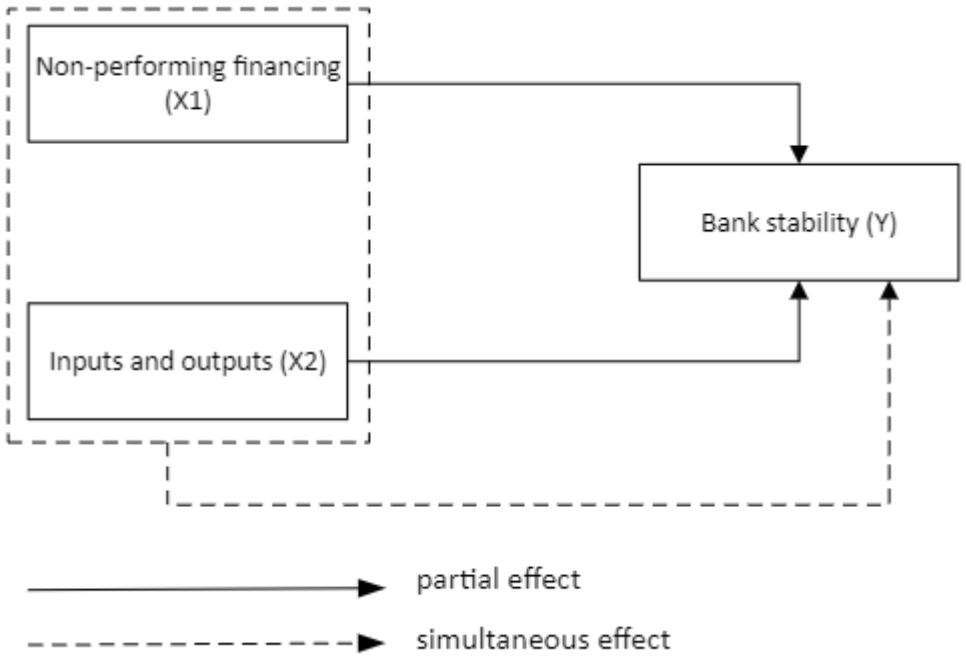
H1: NPF affects Islamic banks' stability.

H2: Inputs and Outputs affect Islamic banks' stability.

H3: NPF, Inputs, and Outputs together influence Islamic banks' stability.

Figure 3

Research Framework



Source: Primary data.

METHOD

A quantitative approach is adopted in this study. The data used consist of secondary data obtained from financial/annual reports for the 2018-2022 period, available on the official websites of Islamic banks in Persian Gulf countries. All Islamic banks in the Persian Gulf region were identified by the researchers from the respective countries' central bank websites for the 2018-2022 period from the population of this study. The decision to select this period is based on several considerations: first, the limited availability of data, as many financial/annual reports from banks in the Persian Gulf region are not yet fully accessible on their official websites for the year 2023; second, the risk of incomplete data if the study was extended to 2023; and third, the uncertainty of values if data from 2023 were included. Therefore, using the 2018-2022 period reduces these risks and maintains consistency in data analysis.

The sample comprises Islamic banks in the Persian Gulf region that meet the following criteria.

a. Islamic banks in eight countries in the Persian Gulf region
b. Islamic banks provided annual or financial reports on their official websites during the study period.
c. Financial data from required financial reports for the 2018-2022 period.

The sample selection method used in this study was purposive sampling, and based on predetermined criteria, 27 Islamic banks from eight countries in the Persian Gulf region were selected as the research sample. This study uses the NPF ratio and

efficiency as independent variables. The NPF ratio is measured by dividing non-performing financing by total financing and multiplying the result by 100%. Efficiency was measured using inputs and outputs in Data Envelope Analysis (DEA). Stability was measured using the Altman Z-score. The panel data equation model is as follows.

$$Y_{it} = \alpha + \beta_1 X_{1it} + \beta_2 X_{2it} + e_{it}$$

Where:

Y_{it} = Dependent variable (bank stability)

X_{it} = Independent variables (non-performing financing and efficiency)

i = Entity *i*

t = Period *t*

After establishing the panel data equation model, Chow, Hausman, and Lagrange multiplier tests were conducted.

RESULTS

Descriptive Analysis

Based on 27 Islamic banks examined over the 2018-2022 period, 135 observations were used. Table 1 presents the descriptive analysis results. The descriptive statistics in Table 1 present the key metrics for the three variables: stability (Y), Non-Performing Financing (NPF) (X1), and efficiency (X2) for 135 observations. The average stability value (Y) of the banks is 16.45, with a median of 13.03, indicating that the majority of banks have stability levels of around 13. The maximum and minimum values for stability are 48.78 and 1.05, respectively, showing significant variation in the stability levels across banks. A standard deviation of 11.31 suggests that there is considerable spread in the stability data, which is further supported by the skewness value of 0.97, indicating a rightward skew in the distribution. Additionally, the Jarque-Bera statistic (21.44848) and its probability value of 0.000022 suggest that the stability variable does not follow a normal distribution.

Table 1

Descriptive Statistics of Variables

Items	Stability (Y)	NPF (X1)	Efficiency (X2)
Mean	16.45048	0.034434	0.517774
Median	13.02876	0.019000	0.623029
Maximum	48.78098	0.191645	1.000000
Minimum	1.050408	0.000800	0.000110
Std. Dev.	11.30890	0.034104	0.381219
Skewness	0.970482	1.889988	-0.117866
Kurtosis	3.213834	6.839444	1.396754
Jarque-Bera	21.44848	163.2912	14.77107

Items	Stability (Y)	NPF (X1)	Efficiency (X2)
Probability	0.000022	0.000000	0.000620
Sum	2220.815	4.648600	69.89954
Sum Sq. Dev.	17137.41	0.155850	19.47392
Observations	135	135	135

Source: Authors' estimation.

For the NPF (X1) variable, the mean is 0.034434 and the median is 0.019, indicating that most banks have relatively low levels of problematic financing. The maximum NPF value is 0.1916, while the minimum is 0.0008, indicating a large range in NPF values across banks. A standard deviation of 0.0341 reflects moderate variability, and a skewness of 1.89 indicates a positive skew, meaning that a few banks have relatively high NPF levels compared to the rest. Efficiency (X2) has a mean of 0.517774 and median of 0.623029, suggesting that the average bank operates with an efficiency of approximately 52 %. The maximum efficiency value is 1.0, indicating that some banks are fully efficient, whereas the minimum value is very low (0.00011), indicating that some banks are extremely inefficient. The standard deviation of 0.381219 also highlights substantial variation in efficiency levels across banks, and the skewness of -0.117866 suggests that the data are slightly left-skewed, though closer to symmetric compared to the other variables.

Panel Regression

The regression model was determined using panel data regression, with tests including the Chow test, Hausman test, and Lagrange multiplier (LM) test to determine the most suitable model for the research data.

Table 2

Panel Regression Model Selection

No.	Test	Results	Criterion	Model
1.	Chow	0.0000	Prob < 0.05	Fixed Effect Model
2.	Hausman	0.1034	Prob > 0.05	Random Effect Model
3.	LM	-	-	-

Source: Authors' estimation.

From Table 2, it can be observed that the Chow test shows a Chi-square probability value of 0.0000, which is much smaller than the significance threshold of 0.05. Therefore, when choosing between the CEM and FEM, the Chow test selects the FEM model, meaning that H0 is rejected and H1 is accepted. The analysis continues with other model tests to explore the characteristics of the panel data further. The Hausman test results show a cross-sectional random value of 0.1034, which is greater than 0.05, thus accepting H0 and rejecting H1. Therefore, the final decision for the panel data regression model is to use the random effects model (REM).

Classical Assumptions Tests

Table 3 presents the results of the classical assumption tests. The normality test result had a probability value of 0.220237, which was greater than 0.05, indicating that the residuals were normally distributed. This suggests that the data meets the assumption of normality, which is crucial for the validity of many statistical tests and ensures that the model's predictions are reliable.

Table 3

Classical Assumption Test Results

No.	Test	Result	Criteria	Conclusion
1.	Normality	0.220237	Prob > 0.05	Normally Distributed
2.	Multicollinearity	0.222879	Prob < 0.05	No Multicollinearity
3.	Heteroscedasticity	X1 = 0.5006 X2 = 0.9265	Prob > 0.05	No Heteroscedasticity

Source: Authors' estimation.

The multicollinearity test showed a probability value of 0.222879, which is less than 0.05, confirming the absence of multicollinearity in the model. This implies that the independent variables (NPF and efficiency) are not highly correlated, allowing the regression coefficients to be estimated without distortion. Additionally, the heteroscedasticity test results for NPF (X1) and efficiency (X2) had probability values of 0.5006 and 0.9265, respectively, both of which were greater than 0.05. This indicates that the assumption of homoscedasticity is satisfied, meaning that the variance of the errors is constant across all levels of independent variables, which supports the reliability of the regression model. From the classical assumption tests above, it can be concluded that all variables passed the classical assumption tests, including normality, multicollinearity, and heteroscedasticity tests.

Hypothesis Testing

Hypothesis testing was conducted to determine the statistical significance of the regression coefficients. A non-zero regression coefficient indicates sufficient evidence to conclude that independent variables affect the dependent variable. Table 4 presents t-test results for this study (See Appendix A for complete panel data regression results).

Table 4

t-Test Results

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	15.91388	2.234153	7.123002	0.0000
X1	-0.419112	0.206791	2.026746	0.0447
X2	-2.025682	0.993935	-2.038043	0.0435

Source: Authors' estimation.

Based on the results in Table 4, the equation for this study can be written as

$$Y = 15.9138805276 - 0.419112119904\ X1 - 2.02568241306\ X2$$

Based on the partial *t*-test in Table 5, the probability of NPF (X1) is 0.0447 < 0.05, and the coefficient for X1 is negative, indicating that NPF has a significantly negative impact on stability. Meanwhile, Input and Output (X2) have probability values of 0.0435 < 0.05, with a negative coefficient, indicating that input and output, proxied by efficiency, have a significant negative effect on stability. In this study, X1 has a negative impact on the stability of Islamic banks, and X2 has a negative effect on the stability of Islamic banks.

Table 5

F-Test Results

F-statistic	3.346388
Prob(F-statistic)	0.038223

Source: Authors' estimation.

Based on the simultaneous *F*-test in Table 5, the *F*-statistic value was 3.346388 and the *F*-statistic probability value was 0.038223. Because the probability value is less than 0.05, NPF and optimization, proxied by efficiency, collectively affect the stability.

Table 6

Coefficient of Determination Test Results

R-squared	0.048256
Adjusted R-squared	0.033836

Source: Authors' estimation.

Based on Table 6, regarding the coefficient of determination, the Adjusted R-squared value is 0.033836, or 3.3836%, indicating that NPF (X1) and optimization (X2) can explain 3.3836% of the stability (Y), while the rest can be explained by other variables or factors outside the scope of this study.

DISCUSSION

The Impact of NPF on Islamic Bank Stability

Based on the tests and analyses conducted, it was found that NPF (X1) had a significant negative effect on the stability of Islamic banks. This is evidenced by a probability value of 0.0447 < 0.05 and a negative NPF coefficient. Therefore, it can be concluded that NPF significantly negatively affects the stability of Islamic banks. This finding aligns with the previous research by Qurotulaeni & Wirman (2021) and Yurida et al. (2023), which found that NPF affects profitability proxied by ROA, and that credit risk (NPF) has a significant negative impact on bank stability when measured by the Z-Score. However, this contrasts with the findings of Ketaren & Haryanto (2020) and Nugroho & Anisa (2018), who stated that NPL has a positive effect on banking stability and that asset quality, proxied by NPF, does not affect stability. The higher the NPF value, the lower the profitability proxied by ROA. Furthermore, NPF can also be influenced by exchange rates, economic growth, and Islamic bank interest rates, both

partially and simultaneously, so these factors should also be considered when managing NPF in Islamic banking (Karima et al., 2024). Additionally, non-financing income can provide diversification in revenue sources when NPF is well managed, strengthening banks' stability and reducing operational risks (Daradkah & Al-Sayyah, 2020). Profit-sharing-based financing at Bank Syariah Indonesia has a significant negative impact on NPF, indicating that higher profit-sharing contracts reduce financing risk, thus strengthening banking stability (Saputri & Ahmadi, 2022).

The Impact of Input and Output on Islamic Bank Stability

The tests and analysis reveal that the efficiency variable (X2), proxied by inputs and outputs, has a significant negative effect on Islamic bank stability. This is demonstrated by the probability value of 0.0435 < 0.05, and a negative coefficient. Therefore, it can be concluded that input and output, measured using DEA, significantly negatively impact Islamic banks' stability. This finding aligns with the research of Lestari & Suprayogi (2020), which found that efficiency, proxied by BOPO, significantly negatively affects the stability of Islamic banks, as proxied by the Z-Score. However, Nugroho & Anisa (2018) find that the BOPO does not affect Islamic bank stability. In other words, higher input and output levels lead to a decline in the stability of Islamic banks.

The Combined Effect of NPF, Input, and Output on Islamic Bank Stability

The tests and analysis found that NPF (X1) and the Input and Output variables (X2), measured using DEA, collectively affect the stability of Islamic banks, with a probability value of 0.038223 < 0.05. This means that NPF, input, and output influence the stability of Islamic banks. Therefore, this study is consistent with the findings of Qurotulaeni & Wirman (2021) and Yurida et al. (2023) regarding the impact of NPF on stability as well as the research by Lestari & Suprayogi (2020) on the effect of efficiency on stability.

CONCLUSION

This study found that NPF, input, and output affect the stability of Islamic banks in Persian Gulf countries, both partially and collectively. Consequently, Islamic banks should reassess their problematic financing, as this can lead to financial instability. If not addressed promptly, this could lead to financial distress among Islamic banks. Furthermore, Islamic banks should optimize their inputs and outputs to achieve maximum results with minimal inputs.

Additionally, Islamic banks must improve their monitoring and restructuring systems to manage problematic financing and diversify their financing portfolios. Input and output optimization should be achieved through operational improvements, innovative product development, and enhanced human resource competencies. These measures strengthen the financial stability and reduce the risk of future financial distress. To improve financial stability, policies on risk management regulations in Islamic banks, particularly in managing Non-Performing Financing (NPF), are essential. Financial authorities must also tighten the supervision of Islamic

banks' performance to detect and address financial issues early. Moreover, this study highlights the importance of diversifying financing portfolios to reduce risk and increase resilience to economic shocks. Islamic banks are also expected to enhance transparency in their financial reports and continuously improve education and training on risk and financing management for their employees. These steps will help Islamic banks stabilize and reduce potential risks in the future.

Limitations of the Study

The dependence on secondary data from financial and annual reports of Islamic banks in the nations of the Persian Gulf for the period–2018-2022 is one of the most significant constraints of this study. Because of the limited availability of data for the year 2023 and the fact that the data were incomplete, the scope of the research was restricted, and the analysis may not have been as extensive as it could have been under different circumstances. Despite attempts to ensure that the data were consistent over the observed time, the absence of more recent data may limit the relevance of the findings to the present market conditions. This is because the global economic landscape may change by 2022.

Furthermore, the utilization of panel regression models, which depend on particular assumptions for the purpose of data analysis, such as tests for normality, multicollinearity, and heteroscedasticity, constitutes an additional limitation. Despite the fact that the study was successful in passing these checks, panel data regression models may still oversimplify the intricate dynamics of Islamic bank stability because they assume that the variables have homogeneous connections with one another across time. However, other models that have not been explored or variations in the analysis could potentially yield different results or insights into the relationship between Non-Performing Financing (NPF), input, output, and bank stability. The random effects model (REM) was utilized in the study, and its determination was based on the Chow and Hausman tests.

Finally, the research examined only a small number of input and output factors, notably operating costs, labor costs, total assets, and total credit. Other external elements, such as macroeconomic conditions, regulatory changes, and geopolitical threats, were not included in the analysis despite the fact that these variables are essential for measuring the performance of Islamic banks. It is possible that these unexplained factors will have a considerable impact on the stability of Islamic banks, particularly in locations such as the Persian Gulf, which is characterized by frequent economic volatility and political instability. In subsequent research, it may be possible to add a wider variety of variables to provide a more comprehensive perspective on the factors that influence Islamic bank stability.

Implications for Further Research

The findings of this study, particularly those demonstrating the strong negative impact of ((NPF) and efficiency on the stability of Islamic banks, provide a framework for future research that will investigate additional variables that may influence stability. Future research could expand on the current analysis by investigating

macroeconomic issues such as inflation rates, exchange rates, and economic growth. These elements were not included in this study, but they could provide a more thorough understanding of the dynamics that affect the stability of Islamic banks. The incorporation of these components makes it possible for academics to investigate the ways in which external economic conditions interact with internal banking performance measures.

Additional research should concentrate on comparative studies of Islamic banks located in various regions. Although this study focused on Islamic banks in the Persian Gulf, expanding the scope to include Islamic banks in Southeast Asia, Europe, and other emerging markets could provide valuable insights into the ways in which regional differences, such as regulatory environments or economic structures, affect the stability of Islamic banks. Comparative assessments of this kind would improve the generalizability of the findings and could help discover issues or tactics that are specific to a region to maximize bank stability through optimization.

One possible direction for future research is to investigate the influence of innovative financial products and digital transformation on the stability of Islamic banking. Due to the growing popularity of fintech and digital banking services, it is absolutely necessary to explore the ways in which these technological breakthroughs influence the efficiency, management of risks, and overall stability of banks. To gain new insights into how Islamic banks might adapt to the changing financial landscape while preserving stability and minimizing risks connected with financing, it is possible that performing an analysis of the role that digital innovation plays in either decreasing or increasing NPF risks could provide such insights.

Author Contributions

Conceptualization	L.Z.S. & T.J.J.	Resources	L.Z.S. & T.J.J.
Data curation	L.Z.S. & T.J.J.	Software	L.Z.S. & T.J.J.
Formal analysis	L.Z.S. & T.J.J.	Supervision	L.Z.S. & T.J.J.
Funding acquisition	L.Z.S. & T.J.J.	Validation	L.Z.S. & T.J.J.
Investigation	L.Z.S. & T.J.J.	Visualization	L.Z.S. & T.J.J.
Methodology	L.Z.S. & T.J.J.	Writing – original draft	L.Z.S. & T.J.J.
Project administration	L.Z.S. & T.J.J.	Writing – review & editing	L.Z.S. & T.J.J.

All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement

Informed consent was not required for this study.

Data Availability Statement

The data presented in this study are available as an online attachment to this file.

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Conflicts of Interest

The authors declare no conflicts of interest.

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Appendix A Panel Data Regression Results

Dependent Variable: Y
Method: Panel EGLS (Cross-section random effects)
Date: 06/07/24 Time: 23:08
Sample: 2018 2022
Periods included: 5
Cross-sections included: 27
Total panel (balanced) observations: 135
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15.91388	2.234153	7.123002	0.0000
X1	-0.419112	0.206791	-2.026746	0.0447
X2	-2.025682	0.993935	-2.038043	0.0435

	Effects Specification	
	S.D.	Rho
Cross-section random	10.74986	0.9868
Idiosyncratic random	1.243412	0.0132

	Weighted Statistics		
Root MSE	1.236963	R-squared	0.048256
Mean dependent var	0.849817	Adjusted R-squared	0.033836
S.D. dependent var	1.272657	S.E. of regression	1.250941
Sum squared resid	206.5605	F-statistic	3.346388
Durbin-Watson stat	1.578939	Prob(F-statistic)	0.038223

	Unweighted Statistics		
R-squared	0.061317	Mean dependent var	16.45048
Sum squared resid	16086.60	Durbin-Watson stat	0.020274