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What Drives the Profitability of Islamic Banks?: Insights from Indonesia Using the Vector Error Correction Model (VECM) Approach

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Abstract.
This study examines the influence of various Islamic financing mechanisms – mudarabah, murabaha, musharakah, liquidity, and financing risk – on the profitability of Islamic banking institutions in Indonesia from 2011 to 2020. Utilizing a quantitative approach, the research aims to thoroughly assess both the short-term and long-term effects of these variables on the dependent variable, Islamic banks' profitability. The analysis is based on panel data from the Indonesian Islamic banking sector during the specified period and employs the vector error correction model (VECM) method for data analysis. The outcomes of the estimation tests indicate that each of these variables significantly impacts the return on assets (ROA) of Islamic banks in Indonesia, both in the short and long term, throughout the given period. The findings reveal that changes in mudarabah, murabaha, musharakah, non-performing financing, and financing-to-deposit ratio have led to measurable responses in the ROA of these institutions. This study offers valuable insights into the relationship between Islamic financing components and the profitability of Islamic banks in Indonesia, contributing to a deeper understanding of the financial dynamics in this sector over the past decade.

Keywords: Islamic banks, Islamic financing, profitability, VECM

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1. Introduction

The Islamic banking sector has experienced significant growth, as reflected in the State of the Global Islamic Economy Report (2020) Indonesia ranked 5th among the Top 15 Global Islamic Economy Indicator Score Rankings and 6th in the Islamic Finance Indicator Score Rankings by Sector [1]. The significant growth of Indonesia's Islamic banking sector, driven by strong performance in global rankings and strategic initiatives, positively impacts its expansion by enhancing its competitiveness, increasing market share, and fostering a more integrated Islamic economic ecosystem. This growth strengthens

the sector's role in national economic development, attracting more investments and customers, and paving the way for further innovation and diversification within the Islamic finance industry. A key indicator of banking performance, particularly in terms of profitability, is the Return on Assets (ROA), which measures a bank's ability to generate pre-tax profit relative to its asset ownership. This ratio reflects how effectively a bank uses its total assets to generate net income, as described Tan et al., Muhammad et al. and Sari [2-4]. Figure 1 illustrates the development of ROA in Indonesian Islamic banks from 2011 to 2020. In the early years of Islamic banking in Indonesia, the ROA was relatively high at 1.79% and continued to rise until 2013, reaching 2%. However, a significant decline followed, dropping below Bank Indonesia's minimum ROA ratio of 0.5%. After a period of stagnation around 0.63% in 2016-2017, ROA saw a sharp increase from 1.28% in 2018 to 1.73% in 2019. The crisis faced by Islamic banks in 2014, as noted by OJK [5], was linked to challenges such as a slowdown in growth due to the national economic downturn and restructuring within the national financial industry, emphasizing the need for further research in this area.

Effective liquidity management is essential for Islamic banks to minimize liquidity risk and capitalize on investment opportunities, as emphasized by [6]. However, Islamic banks encounter several unique challenges. One significant issue is the absence of Shariah-compliant deposit insurance, which leaves them more vulnerable in managing liquidity compared to their conventional counterparts. Additionally, the scarcity of high-quality liquid assets like government Sukuk further complicates their ability to maintain sufficient liquidity. Fendi highlights this limitation, noting that the lack of Shariah-compliant facilities from central banks exacerbates the situation, leaving Islamic banks with fewer tools to manage liquidity effectively [7]. Moreover, a substantial portion of Islamic banks' assets are invested in debt-based instruments, such as Murabaha transactions, which are often illiquid due to Shariah restrictions on the sale and trading of debt. Ahmed points out that these restrictions create additional challenges for Islamic banks, as they limit the flexibility needed to respond to liquidity demands [8]. The profit and loss sharing (PLS) mechanism also introduces risks, including withdrawal risk on the liability side and moral hazard on the asset side, as discussed by Nugraheni et al. and Abdo et al. [9,6]. Despite these challenges, PLS investment accounts offer significant advantages to Islamic banks. They are considered deposits with equity-like characteristics, which provide greater flexibility in managing the net stable funding ratio (NSFR). This flexibility allows Islamic banks to better absorb risks and adjust to market conditions, a benefit highlighted by Abedifar et al. [10]. These equity-like characteristics

also help Islamic banks manage liquidity more effectively, offering a buffer against the challenges posed by the illiquid nature of their assets and the limited availability of Shariah-compliant financial instruments.

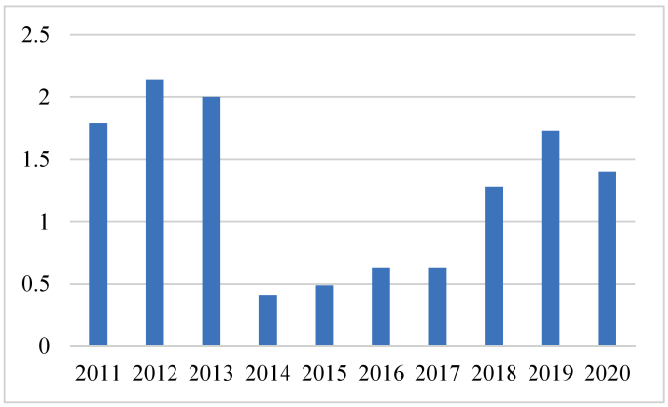

Figure 1: Development of Islamic Banking ROA in Indonesia 2011-2020 (in percent).

Beyond liquidity challenges, Islamic banks distinguish themselves from conventional banks through their approach to financial intermediation, which combines elements of commercial and investment banking. Unlike conventional banks that rely on debt-based mechanisms and risk transfer, Islamic banks focus on asset-based principles and risk-sharing, as noted by Zarrouk et al. and Hasan et al. [11,12]. This approach aligns with Islamic ethical and religious principles, avoiding interest (riba) and speculative activities (gharar). Beck et al. (2013, p. 436) and Abdo et al. highlight that Islamic banks, especially in OIC countries, engage less in traditional banking activities and often have lower net stable funding ratios (NSFR) compared to conventional banks [13,6]. However, they adapt more quickly when liquidity deviates from target levels, with their speed of adjustment (SOA) increasing as the gap widens. The profitability of Islamic banks is closely tied to investment deposits that operate under profit and loss sharing (PLS) principles like Mudarabah and Musharakah. These contracts attract investors seeking returns based on asset performance rather than fixed interest. Although this structure can lead to uncertain profitability, as discussed by Alharbi [14], it benefits Islamic banks by not requiring interest payments on deposits and by not guaranteeing profits, except in cases of negligence, as noted by Arshed & Kalim [15]. This flexible capital structure aligns the interests of the bank with its investors, promoting stability in varying market conditions.

Profitability in Islamic banking is closely linked to financing risk, much like in conventional banking. Financing risk, as defined by Al-Sartawi and Reyad, refers to the risk Islamic banks face when customers fail to meet their financial obligations [16]. Profitable

Islamic banks, being cautious risk-takers, may adopt conservative disclosure practices to avoid regulatory scrutiny. The Non-Performing Financing (NPF) ratio is commonly used to measure the potential returns that Islamic banks can generate from debtors, as explained by Muhammad et al. [3]. This research seeks to build on the work of Ninglasari et al. and Ninglasari et al. by focusing on pre-merger Islamic banks and their sources of Islamic financing [17,18]. Specifically, the study will investigate the impact of Mudarabah, Murabaha, Musharakah, liquidity, and financing risk on the profitability of Indonesian Islamic banks from 2011 to 2020.

2. Literature Review

2.1. Islamic Banks

Islamic banking is distinguished by its unique characteristics, rooted in Islamic principles regarding the creation and management of money. These differences are evident in the function, structure, and objectives of Islamic banks, as discussed by Mohammed & Muhammed and Nomran & Haron [19,20]. Unlike conventional banks, Islamic banks operate under strict prohibitions against interest (riba) and engagement in activities related to alcohol, gambling, and excessive speculation [21,20]. All products and operations of Islamic banks must adhere to Shariah principles [21], requiring the establishment of a Shariah Supervisory Board (SSB) in addition to the regular board of directors to ensure compliance [22]. This additional governance layer, as noted by Shibani & De Fuentes, is essential for monitoring and approving the bank's adherence to Islamic moral principles [23].

Islamic banking is characterized by three main features: it is interest-free, multi-purpose rather than purely commercial, and highly equity-oriented, as highlighted by Ismail [24]. Studies by Iqbal & Mirakhor and Ismail demonstrate that Islamic banking is not only viable but also capable of efficient resource allocation, with Islamic banks facing lower solvency and liquidity risks compared to conventional banks [25,24].

2.2. Hypothesis Development

In Islamic banking, the return on capital is closely linked to the risks involved in trade and investment activities, as discussed by by Zarrouk et al. [11]. This return is governed by profit and loss sharing (PLS) mechanisms in investment activities like Musharakah

and Mudarabah, as described by Bougatef et al. [26]. For trade activities, including Murabaha, Salam, and Istisnaa, profits are derived from the margin between purchase and sale prices. Additionally, Islamic banks generate income from Sukuk (Islamic bonds) and various investment portfolios and funds Kamil et al. [27]. Unlike conventional banks, Islamic bank profitability is not influenced by interest rates [28,29]. Therefore, assessing the profitability of Islamic banks requires an evaluation of returns from non-interest transactions and direct investments, as suggested by Turen [30].

The convergence of profitability determinants such as asset quality, capital, and operational variables between Islamic and conventional banks indicates that conventional banking tools and techniques are often applicable in Islamic banking contexts. This observation is supported by studies from Abdo et al., Ali et al., Fajri et al., Himmawan and Firdausi, Iqbal, Kanapiyanova et al. and Zarrouk et al. [6,31-35,11]. While conventional banks typically use a single financing contract, Islamic banks employ a variety of contracts, including Musharakah, Mudarabah, Ijarah, and Murabaha, as highlighted by Ahsan and Qureshi, Ben Jedidia and Hamza, Chong and Liu, Nugroho et al., Trabelsi and Trad and Zarrouk et al.[36-40,11]. This diversity in contracts underscores both the similarities and distinctiveness in explaining the profitability of Islamic and conventional banks.

H1: Mudarabah financing significantly influenced the profitability of Islamic banks in the long run

H2: Musharakah financing significantly influenced the profitability of Islamic banks in the long run

H3: Murabaha financing significantly influenced the profitability of Islamic banks in the long run

H4: Non-performing finance significantly influenced the profitability of Islamic banks in the long run

H5: Liquidity significantly influenced the profitability of Islamic banks in the long run.

3. Methodology Research

3.1. Data

This empirical study examines the impact of Islamic financing mechanisms, asset quality, and risk management on the profitability of Islamic banks in Indonesia from 2011 to 2020.

Using monthly data from the Bank Indonesia (BI) and Financial Services Authority (OJK), the study analyzes how fund allocation through Mudarabah, Musharakah, and Murabaha influences profitability. It also assesses asset quality via the Financing-to-Deposit Ratio (FDR) and evaluates risk through Non-Performing Finance (NPF). The research highlights the interplay between these factors, showing how Islamic banks' adherence to Sharia principles, effective fund allocation, and risk management practices collectively shape their financial performance.

3.2. Model

The study employs the Vector Error Correction Model (VECM), which necessitates that the variables under investigation are stationary at the same level of differentiation. The model is expressed as follows:

$$ROA_t = \beta_0 + \int_{n=60}^{\infty} Mudharabah_t + \int_{n=60}^{\infty} Murabahah_t + \int_{n=60}^{\infty} Musharakah_t + \int_{n=60}^{\infty} FDR_t + \int_{n=60}^{\infty} NPF_t$$

$\beta 0$ is a constant, $\int_{n=60}^{\infty}$ $are\ sigma$ in the vector autoregression model when forecast in the dependent variable will change the unit of change in the independent variable.

The Vector Error Correction Model (VECM) testing procedure is a detailed process that follows a specific sequence of steps. It begins with a stationarity assessment of the data, commonly known as a unit root test, using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, both applied at a 5% significance level. If the test results indicate stationarity, it confirms that the data is suitable for further analysis. The next step involves determining the optimal number of lags to include in the model, using criteria such as the Akaike Information Criterion (AIC), Likelihood Ratio (LR), and others. These criteria ensure that the selected lag length minimizes prediction errors and enhances model accuracy. After determining the lag structure, the stability of the autoregressive model is assessed by analyzing the inverse roots of the AR polynomial, ensuring the model's reliability over time. This is followed by cointegration analysis using the Johansen Cointegration Test, which identifies and confirms any long-term relationships among the variables. Establishing cointegration is crucial for the VECM, as it ensures that despite short-term fluctuations, the variables maintain a consistent long-term relationship. Finally, the model is estimated, and an Impulse Response Function (IRF) test is conducted. The IRF provides a visual representation of how shocks to one

variable affect others over time, offering valuable insights into the dynamic interactions within the model. This test helps in understanding the underlying economic relationships and the impact of various factors on the variables in question [41].

4. Results and Discussion

4.1. Data Stationarity

The stationarity test assesses the integration order of each variable, which is crucial for ensuring the model's outputs are dependable. A time series exhibiting a unit root is non-stationary at its level, but it becomes stationary when first-order differencing is applied. Non-stationary data can result in misleading regression outcomes and unreliable interpretations, emphasizing the importance of evaluating stationarity. To establish the integration order, the Augmented Dickey-Fuller (ADF) unit root test was conducted on each variable. The findings, detailed in Table 1, underscore the stationarity characteristics of the variables.

TABLE 1: Stationary Test Result.

Variable	Prob ADF Level Statistic	Remarks	Prob ADF First Difference	Remarks
ROA	0.0333	Non-Stationary	0,0000	Stationary
MUDARABAH	0.7829	Non-Stationary	0,0000	Stationary
MUSHARAKAH	0.4055	Non-Stationary	0,0000	Stationary
MURABAHA	0.4540	Non-Stationary	0,0000	Stationary
NPF	0.5323	Non-Stationary	0,0094	Stationary
FDR	0.8309	Non-Stationary	0,0000	Stationary

Table 1 reveals that, at their original levels, most variables fail to demonstrate stationarity, as indicated by p-values exceeding the 0.05 threshold at the 5% significance level. This suggests that the null hypothesis, which posits the presence of a unit root (and hence non-stationarity), cannot be rejected for these variables. As a result, they are considered non-stationary in their original form. However, after applying first-order differencing to the data, a significant transformation occurs. All variables achieve stationarity, as evidenced by p-values that now fall below the 0.05 threshold. This shift indicates that the differenced data no longer contain a unit root, meaning the time series has become stationary after differencing. With the confirmation of stationarity following differencing, the study is well-positioned to advance to the Johansen cointegration

test. This next step is essential for exploring potential long-term relationships among the variables, which is only meaningful once the data is stationary. The Johansen test will help determine whether these stationary variables are cointegrated, meaning they share a stable, long-term equilibrium relationship despite short-term fluctuations.

Table 2: Optimal Lag Selection Result.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1212.726	NA	77.78067	21.38115	21.52516	21.43960
1	-649.1975	1057.851	0.007446	12.12627	**13.13435***	**12.53539***
2	-613.9112	62.52487	0.007578	12.13879	14.01093	12.89859
3	-579.5726	57.23108	0.007903	12.16794	14.90414	13.27841
4	-531.3996	**75.21745***	**0.006542***	**11.95438***	15.55464	13.41552
5	-502.7540	41.71193	0.007753	12.08340	16.54773	13.89522
6	-473.9788	38.87176	0.009363	12.21016	17.53854	14.37265

Table 2 provides a detailed overview of the optimal lag selection for the six models under consideration. The asterisk (*) in the table highlights the smallest value across different criteria, which serves as a critical indicator for identifying the optimal lag length. According to the results, lag 4 emerges as the most suitable choice, as it consistently meets the selection criteria across various models. This indicates that incorporating four lags into the models is likely to enhance their performance, leading to more accurate and reliable estimations.

4.2. Johansen Cointegration

Following the determination of stationarity in the variables, the Johansen cointegration test was conducted to evaluate the existence of long-term relationships among the variables. This test is crucial for understanding whether the variables, despite being individually stationary, share a common stochastic trend over time. The results of the Johansen cointegration test are presented in Tables 3 and 4, employing both the Trace Statistic and Max-Eigen Statistic methods, which are widely recognized for their effectiveness in such analyses.

The results in Table 3 using the Trace Statistic method indicate the presence of at least one cointegration equation. This finding suggests that the variables are not independent in the long run, but instead, they move together, implying a stable, long-term equilibrium relationship. The existence of a cointegration equation supports the notion that despite

Table 3: Johansen's Cointegration Test – Trace Statistic Result.

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.370239	120.6527	95.75366	0.0004
At most 1	0.259497	67.47495	69.81889	0.0758
At most 2	0.119916	32.92605	47.85613	0.5609
At most 3	0.090944	18.23612	29.79707	0.5487
At most 4	0.046342	7.271006	15.49471	0.5463
At most 5	0.015652	1.814201	3.841466	0.1780

short-term fluctuations, the variables tend to return to a certain equilibrium state over time. Similarly, the Max-Eigen Statistic results, detailed in Table 4, confirm the presence of at least one cointegration equation. This reinforces the conclusion drawn from the Trace Statistic method, further validating the existence of long-term relationships among the analyzed variables. The Max-Eigen Statistic is particularly useful for identifying the number of cointegration relationships, and in this case, it aligns with the Trace Statistic, strengthening the evidence for a shared long-term trajectory among the variables.

Table 4: Johansen's Cointegration Test – Max-Eigen Statistic.

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.370239	53.17772	40.07757	0.0010
At most 1 *	0.259497	34.54890	33.87687	0.0415
At most 2	0.119916	14.68993	27.58434	0.7723
At most 3	0.090944	10.96512	21.13162	0.6508
At most 4	0.046342	5.456806	14.26460	0.6834
At most 5	0.015652	1.814201	3.841466	0.1780

4.3. VECM Estimation

Table 5 offers an in-depth look at the Short-Term Vector Error Correction Model (VECM) estimation results, shedding light on the immediate interactions between various financial variables and Return on Assets (ROA). The coefficients associated with Mudarabah, Musharakah, Murabaha, non-performing financing (NPF), and the financing-to-deposit ratio (FDR) reveal significant relationships with ROA. Specifically, Mudarabah, Murabaha, and FDR have positive associations with ROA, as indicated by their positive coefficients.

In contrast, Musharakah and NPF show negative relationships with ROA, as reflected by their negative coefficients. These findings are crucial for understanding the short-term dynamics between Islamic financing modes and ROA, providing valuable insights for financial decision-making. Moreover, these results align with the research by Bougatef et al., which uses the autoregressive distributed lag (ARDL) and bounds testing approaches to demonstrate that Islamic banks' financing significantly contributes to industrial development in Malaysia [26]. The positive short-term effects are particularly evident in Profit and Loss Sharing (PLS) and non-PLS financing, as seen in their impact on the industrial sector.

Table 5: Short-Term VECM Estimation Results.

Variabel	Coefficient	Standard Error	T-Statistic	Remarks
ROA	1.000000			
MUDARABAH	-0.029611	0.01488	-1.98999	Significant***
MUSHARAKAH	-0.107725	0.06544	-1.64623	Significant**
MURABAHA	0.013271	0.00763	1.73894	Significant***
NPF	-0.099594	0.06761	-1.47317	Significant*
FDR	0.009556	0.00917	-1.04176	Significant***

*Denotes: *,**,*** significant at the level of 10%, 5% and 1%*

Table 6, on the other hand, provides insights into the long-term relationships between financial variables and ROA through the Long-Term Vector Error Correction Model (VECM) estimation results. The coefficients reveal significant associations:] Mudarabah, Murabaha, Non-Performing Financing (NPF), and Financing to Deposit Ratio (FDR) exhibit positive long-term associations with ROA. This means that over time, increases in these variables are statistically linked to sustained improvements in ROA. For instance, as Mudarabah and Murabaha forms of Islamic financing increase, they contribute positively to the profitability of the institution, reflected in an enhanced ROA. Interestingly, even the NPF, typically a measure of risk or inefficiency, shows a positive relationship, which may indicate that the effective management of non-performing assets contributes positively to overall profitability in the long run. In addition, a higher FDR, indicating efficient utilization of deposits into financing activities, also correlates with higher long-term profitability. Conversely, Musharakah exhibits a significant negative long-term relationship with ROA. This suggests that an increase in Musharakah, another Islamic financing structure where profit and loss are shared, is associated with a decrease in ROA over the long term. This could be due to the inherent risk-sharing nature of Musharakah, where both profits and losses are distributed

among the partners, potentially leading to reduced profitability in scenarios where the underlying ventures do not perform as expected.

Table 6: Long-Term VECM Estimation Results.

Variabel	Coefficient	Standard Error	T-Statistic	Remarks
ROA	1.000000			
MUDARABAH	0.075817	0.00675	-11.2352	Significant*** (H1 Accepted)
MUSHARAKAH	0.047668	0.05307	-0.89812	Significant* (H2 Accepted)
MURABAHA	-0.082356	0.01042	7.90493	Significant*** (H3 Accepted)
NPF	0.204056	0.06402	-3.18731	Significant* (H4 Accepted)
FDR	-0.011921	0.00583	2.04511	Significant*** (H5 Accepted)
C	5.770856			
R-Square	0.254873			
Adj. R-squared	0.045567			
F-Statistic	2.217708			

*Denotes: *,**,*** significant at the level of 10%, 5% and 1%*

These findings are scientifically significant, as they not only validate the long-term influence of these financial variables on ROA but also provide actionable insights for financial decision-makers. Understanding these relationships enables institutions to develop more informed strategies aimed at optimizing ROA over the long term. For example, increasing focus on Mudarabah and Murabaha while cautiously managing Musharakah could be a strategic approach to enhancing profitability. Moreover, these results align with the broader literature, including the study by Belkhaoui, which highlights the prominent role of Islamic banking in fostering economic growth, particularly in the Middle East and North Africa (MENA) region [42]. The positive long-term relationships identified in this study support the idea that Islamic financial instruments can be powerful tools for sustainable economic development. This is especially relevant in regions where Islamic banking has a significant presence, suggesting that these institutions may have a competitive advantage in promoting economic stability and growth compared to conventional banking systems.

4.4. Impulse-Response Function (IRF)

The result of the Impulse-Response Function (IRF) analysis in Figure 2 visually represents how different financial shocks impact ROA over time. The vertical axis measures

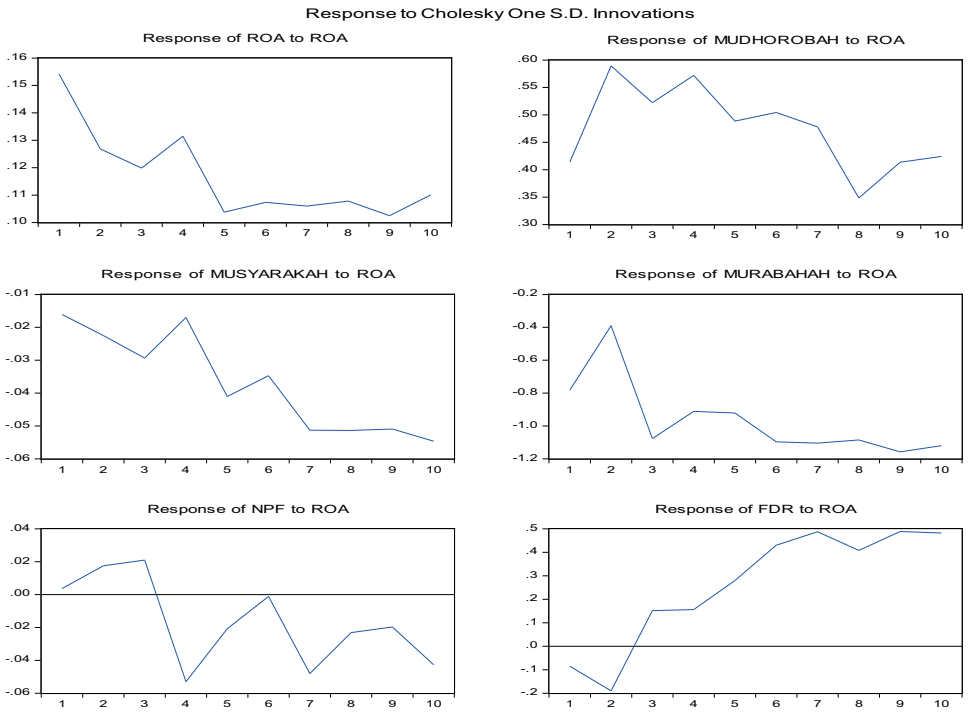

Figure 2: Impulse-Response Function (IRF) Graphics.

the standard deviation, indicating the magnitude of the response, while the horizontal axis represents the duration (in years) of the response to the shock. A response above the horizontal axis indicates a positive effect, while a response below it indicates a negative effect.

Figure 2 illustrates that the ROA response to a Mudarabah shock initially trends positively, peaking in the second period, followed by a negative fluctuation. The response to a Musharakah shock shows a negative trend, with the highest positive response occurring in the third period. For Murabaha, ROA exhibits a positive response in the second period, followed by a negative fluctuation. The response to NPF shocks peaks positively in the second period but later fluctuates negatively. Lastly, the response to FDR shocks shows a negative trend in the second period, followed by a positive fluctuation. These findings highlight the complex and varied nature of ROA responses to financial shocks, emphasizing the need for careful consideration in financial decision-making.

5. Conclusion

This research enhances the understanding of Islamic bank financing by highlighting its critical role in asset quality and profitability, while also emphasizing the inherent risks involved. The study finds that the profitability of Islamic banks is closely tied to economic conditions, with loan defaults posing significant risks during downturns. Additionally, the reliance on short-term loans, though less risky, results in moderate profitability. Effective risk management, particularly in handling non-performing finance, is crucial; poor management can harm short-term profits, while proper practices can boost long-term profitability. However, the study is limited by its focus on the pre-merger context of Islamic banks. To gain a fuller understanding, future research should explore the post-merger dynamics within the Indonesian Islamic banking sector, as mergers can significantly alter financial strategies and outcomes. While Islamic financing is vital for profitability, it requires careful risk management and strategic planning, particularly in the face of economic fluctuations and structural changes within the banking sector.

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