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FINANCIAL STABILITY MODEL THROUGH EFFICIENCY, PROFITABILITY AND FINANCIAL TECHNOLOGY

Asbi Amin[1]*, Buyung Romadhoni[2], Wahyuni[3]
[1]Sekolah Tinggi Ilmu Ekonomi Makassar Bongaya, Indonesia
[2,3]Universitas Muhammadiyah Makassar, Indonesia
*Corresponding Author:
asbi.amin@stiem-bongaya.ac.id

Abstract
The economy sharia development shows the financial stability of Sharia Bank in ASEAN is increasing. The stable financial condition of banks will have an impact of the balance financial system. This research aims to examine the influence of efficiency, profitability, and financial technology on the financial stability of Islamic banking in ASEAN using Vector Auto Regressive (VAR). This VAR model is a system of simultaneous equations where the number of equations formed is the number of variables used. Each equation is related both mathematically and theoretically. This research uses quantitative method. The population used in this research comes from all sharia banks in the Southeast Asia region which have been operating since 2019 – 2023. This research uses a purposive sampling method where the sample is taken randomly by determining several criteria in the sample. Based on the criteria mentioned above by reviewing certain conditions there are 19 sharia banks that can be used as samples in this research. The research result of the cointegration test indicate that between three variables in this research there is a cointegration correlation at the Significance level of 5%. This means that movements in efficiency, profitability, financial technology, and financial stability have a correlation of stability/balance and similar movements in the long term. Furthermore, the result of the Granger causality test shows that the financial stability and efficiency have a one-way relationship. The p-value of financial stability is 0.042 or < 0.005, namely a one-way relationship; the p-value of profitability is 0,029 or <0,05 which means a reject H_0 namely a one-way, and the p-value of profitability is 0,029 or <0,05 which means profitability influence financial stability with a one-way relationship; meanwhile the p-value financial technology is 0,027 or <0,05 which means that financial technology influences financial stability in one-way relationship.

Keywords: Efficiency, Profitability, Financial Technology, Financial Stability, Vector Auto Regressive (VAR)

1. Introduction

In the increasingly widespread era of globalization, the banking sector plays a crucial role in supporting a country's economic stability. At the same time, the developing principles of Islamic finance are becoming important in guiding the role and function of banks in supporting economic sustainability. Sharia banking, as a concrete implementation of Islamic finance principles, brings a new paradigm that not only include financial aspects, but also social and ethical values in the banking context.

Banking sector has a complex relation and interrelated relationship with other economic sectors and contribute to overall economic stability. Therefore, achieving financial stability is an important factor in the banking sector as overall. The occurrence of instability in the banking sector will be reflected to other economic sectors (Kazbekova et al., 2020).

The instability in the banking sector will easily be transmitted to other economic sectors, thereby disrupting the interbank loan market and payment mechanism and reducing the availability of credit to the real sector of the economy (Abdianti et al., 2023). The instability experienced by individual banks can impact the instability of the banking system as a whole and will ultimately disrupt the stability of financial system (Sitorus et al., 2022). The instability of banks can worsen a country's economic conditions due to the bank is being unable to carry out their financial intermediary functions effectively (Rusydiana et al., 2019). Through the financial intermediary function, banks have an important role in realizing economy growth, income distribution, poverty reduction and financial system stability (Amin & Nianty, 2024).

Based on Islamic Finance Development Indicator (IFDR) data, currently four countries in ASEAN region are ranked as the top 15 (Islamic Finance Development Indicator, 2022). This development shows that the financial stability of Sharia bank in ASEAN is increasing. The stable financial condition of banks will have an impact on the balance of the financial system. Further, this condition can be functioning efficiently in managing risks, overcoming uncertainty economy, minimizing bankruptcy and fundamental structural changes. Likewise, if banking finances are unstable will result an imbalance on the financial system, one of the consequences which is a bankruptcy.

The development of Sharia banking has been complementing the banking system in Indonesia. The existence of sharia banking is a form of responsed from economic groups and Islamic banking practitioners to the high demand to provide financial institutions which is related with Islamic sharia values and principles (Muhammad Kurniawan & Sy, 2021). The development of Shariah bank in Indonesia can be seen as follows:

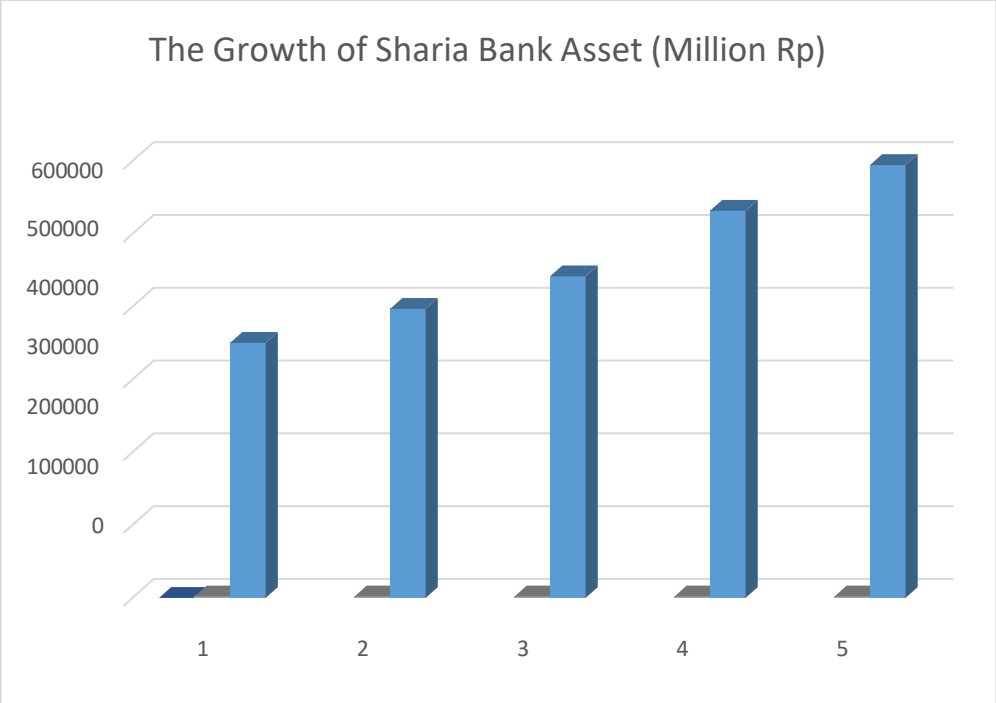

Figure 1. The Growth of Sharia Bank Asset

The development of Shariah bank in Indonesia through total assets is likely to continue to increase every year, because the majority of Indonesian population is Muslim so the existence of Sharia banking will become a necessity. The Sharia banking system is considered safer and more stable because it avoids usury, maysir, and gharar as found in the conventional system (Yudha et al.,2020). Moreover, implementing

profit and loss sharing (PLS) in Sharia banking system can help Sharia banks avoid worsening financial balance caused by economy factors. By implementing profit sharing principle, Sharia banking will be more stable because every risk that arise by financing distribution activities and deposit placement is borne jointly by the bank and also the customer (Syakhrun et al., 2019).

The Shariah banking financial stability is a condition of banking sector financial that is able to carry out its financial intermediary function efficiently and is able to withstand shocks originating from internal and external factor (Fikri et al., 2021). To determine the level of banking stability, they are various accounting- based measurement for bank health according to each use, one of them is callled the Z-score. A common measure of stability at individual institution level is the Z-score. Among researchers, this measurement has become a choice due to the fact that the Z-score has a negative relationship with bankcrupcity of financial institution, that is the possibility of the asset value is being lower than the debt value. When the Z-score is higher it indicates that bankcrupcityof financial institution is lower and it explained that Z-score describes bank's stability (Wu et al., 2022), ROA is Return on Asset of bank during the observation period which describes the bank's ability to generate profits.

Based on the result of previous research, mixed results were found, but previously no one had used the Vector Auto Regressive (VAR) model to study the relationship between financial stability efficiency, profitability, and financial technology on financial stability. Therefore, the researcher will review the influence of efficiency, profitability and financial technology on the financial stability of Sharia banking on ASEAN using the Vector Auto Regressive (VAR) model. Thie model is a system of simultaneous equations where the number of equations formed is the number of variables used. Each equation is related both mathematically and theoretically.

2. Theoretical Background

2.1 Effect of Efficiency on Financial Stability

Operational efficiency in banking is used to find out whether while the banking is running it is working in line with the expectations of shareholders and management. Efficiency can affect income in a banking sector. In this case, in order to see whether the banks have utilized all the production components appropriately will be determined by the operation efficiency (Haralayya & Aithal, 2021). Some previous studies (Hanafia & Karim, 2020), (Azizah & Manda, 2021) and (Siregar & Haryono, 2023) claim that operational efficiency can affect the financial stability of sharia banking negatively and significantly. However, research by (Siregar & Haryono, 2023) reveals that operational efficiency is positive for financial stability. In measuring this efficiency, the BOPO is used. The ratio is used to see the level of capability and efficiency in banking (Astuti, 2022). A high value of BOPO indicates a reduction in financial performance. A low value of BOPO indicates that operational costs used by banks is more efficient (Amalia et al., 2022). If banking operational efficiency runs well, the profit earned by banks will increase, thereby making the banking financial system stable. Indicator influencing financial stability can also be trigged by banking profits.

2.2 Effect of Probability on financial stability

Profitability itself is often known as the ability of banks to obtain profits related to capital, sales, and total assets (Amalia et al., 2022). One factor in determining the stability of a bank is to look at the high level of capital in the bank. The capital is obtained from banking profits. The higher the profits obtained by banks, the positive

impact it will have on banking financial stability (Setyaningsih et al., 2023). Previous studies shows that profitability can have a positive influence on banking financial stability (Bokiu et al., 2023). In measuring banking profitability there are some ratios that can be used, including: Return on Asset, Return on equity, and also Net interest margin (Muhammad Kurniawan & Sy, 2021). In this research, the Return on Assets (ROA) ratio is used to measure profitability because this ratio can show how well a management team in managing assets to generate profits (Amin et al., 2023). ROA can assess the performance of a bank in the context of the bank making a profit. In the previous research (Mehzabin et al., 2023); (Bokiu et al., 2023) profitability measuring uses the ROA ratio.

2.3 Effect of financial technology on financial stability

Effective and efficient service are also needed, such as adopting financial technology. With the continued development of financial technology, all industrial sectors throughout the world are competing to produce innovation in every aspect of their operations. For example, in financial sector, many Financial Technology (Fintech) companies have emerged (Yudha et al., 2020). Fintech developments encourages the economic transaction to run efficiently so that production in the economy increases (Parsaulian, 2021). The growing existences of the Fintech encourages sharia financial players to take part in the process. Sharia financial sector, including Sharia Bank, Sharia BPR, BMT, and other organizations are also developing their services with Fintech to encourage financial stability (Ansori et al., 2024). The ever-growing number of Financial Technology (Fintech) users makes the sharia banking market increasingly widespread (Ma'ruf, 2021). Previous research (Ansori et al., 2024); (Kammoun et al., 2020) stated that Fintech has a positive effect on financial stability.

3. Methods

3.1 Research Design and Data

This study employs a quantitative research design using secondary data to analyze the influence of efficiency, profitability, and financial technology on the financial stability of Islamic banks in the ASEAN region. The analysis utilizes unbalanced panel data from 19 Islamic banks across five ASEAN member countries (Indonesia, Malaysia, Brunei Darussalam, Thailand, and the Philippines) over the period 2019–2023. The use of panel data allows for controlling unobserved heterogeneity across banks and increases the degrees of freedom, enhancing the robustness of the estimation (Baltagi, 2021).

Data were sourced from the annual financial reports (income statements and balance sheets) of each sampled bank, which are publicly available. The 5-year period is considered sufficient to capture post-implementation trends of FinTech and to analyze dynamics that are not visible in purely cross-sectional data.

3.2 Population, Sample, and Sampling Technique

The target population of this study is all fully-fledged Islamic banks operating in the ASEAN region. The sample was selected using a purposive sampling method with the following criteria:

1) The bank operates as a full-fledged Islamic commercial bank (not a conventional bank with an Islamic window).
2) The bank has published complete and consistent annual financial reports for the period 2019–2023.

3) The bank is headquartered and primarily operates within an ASEAN member country.

Based on these criteria, 19 Islamic banks from five countries qualified and were included in the final sample. This sampling technique ensures that the data used are relevant and of high quality for the intended analysis (Sekaran & Bougie, 2016).

3.3 Operational Definitions and Measurement of Variables

All variables are constructed from audited financial data. The definitions and measurements are summarized in Table 1.

Table 1. Operationalization of Variables

Variable	Symbol	Type	Measurement	Theoretical Basis
Financial Stability	ZSCORE	Dependent	(ROA + CAR) / σ(ROA)	Higher Z-score indicates greater distance from insolvency (Stankevičienė & Kabulova, 2022)
Efficiency	OCOI	Independent	Operational Cost / Operational Income × 100%	Higher cost-to-income ratio reflects lower efficiency and weaker stability (Astuti, 2022)
Profitability	ROA	Independent	Net Profit / Total Assets × 100%	Higher profitability strengthens loss-absorbing capacity (Widarjono, 2020)
Financial Technology	LnTI	Independent	Ln(Non-Interest Expense)	FinTech investment may increase short-term costs or enhance long-term efficiency (Uddin et al., 2020)

3.4 Data Analysis Technique: Vector Autoregressive (VAR) Model

To analyze the dynamic interdependencies among the variables where all are treated as endogenous, this study employs a Panel Vector Autoregressive (PVAR) model, as introduced by Holtz-Eakin et al. (1988). The PVAR combines traditional VAR analysis with panel data settings, allowing for unobserved individual heterogeneity. This approach is suitable because the theoretical and empirical relationships between bank efficiency, profitability, FinTech adoption, and financial stability are likely simultaneous and bidirectional.

This research uses quantitative method by analyzing the influence of efficiency, profitability, and financial technology on the financial stability Sharia bank in ASEAN. The population in this research comes from all Sharia banks in the Southeast Asia region in which have been operated since 2019 – 2023 period. This research uses a purposive sampling method where the sample is taken randomly by determining several criteria in the sample. Based on the criteria mentioned above, by reviewing certain conditions, there are 19 Sharia banks that can be used as samples in this research.

The method used is Vector Autoregressive (VAR). This model is a system of simultaneous equations where the number of equations formed is the number of variables used. Each equation is related both mathematically and theoretically. VAR is used for analyzing several variables when we are going to carry out analyzing on several variables, but we cannot differentiate which one is the independent variable and

which one is dependent variables. By using these characteristics of equation, it can be said that VAR is a statistical method that explains the relationship among variables simultaneously. VAR will form a system of equations consisting of many variables used in the system. Each equation is a function of the independent variable along with its lag of the dependent variable. The number of this lags shows the order of the VAR.

4. Results and Discussion

4.1 Descriptive Statistics and Data Characteristics

The study analyzed an unbalanced panel dataset of 95 observations, comprising 19 Islamic banks across ASEAN from 2019 to 2023. **Table 2** presents the descriptive statistics of the key variables.

Table 2. Descriptive Statistics of Research Variables

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
Efficiency (OCOI)	0.785	0.797	2.027	0.311	0.284	95
Profitability (ROA)	0.015	0.012	0.130	-0.067	0.027	95
FinTech (LnTI)	14.66*	15.63*	18.34*	13.86*	2.173*	95
Financial Stability (Z-Score)	430,150.7	32,816.0	958,514.0	5,697,000.0	286,135.5	95

Note: FinTech values reported in original scale (x10^6) for interpretability, though log-transformed values were used in analysis. Standard deviation for FinTech is 21,735,200.
Source: Data Analysis (2024)

The efficiency ratio (OCOI) shows moderate levels with an average of 78.46%, indicating that, on average, Islamic banks spend 78.46% of their operating income on operational costs. Profitability (ROA) demonstrates modest performance with a mean of 1.50%, though the range includes negative values (-6.72% to 13.00%), suggesting varying performance across banks. The financial technology proxy exhibits substantial variation, reflecting differing levels of digital investment across institutions. Most notably, the financial stability measure (Z-Score) shows extremely high values with significant dispersion, indicating substantial heterogeneity in risk profiles across ASEAN Islamic banks.

4.2 Pre-Estimation Diagnostic Tests

4.2.1 Stationarity Test

Before proceeding with VAR analysis, Augmented Dickey-Fuller (ADF) unit root tests were conducted. As shown in Table 3, all variables were non-stationary at level but achieved stationarity after first differencing ($p < 0.05$), confirming the appropriateness of employing a VAR framework that accommodates integrated variables.

Table 3. Unit Root Test Results (ADF Test)

Variable	Level (Intercept)	First Difference (Intercept)	Conclusion
Efficiency (OCOI)	-2.895	-10.855**	I(1)
Profitability (ROA)	-2.897	-9.707**	I(1)
FinTech (LnTI)	-2.899	-6.419**	I(1)
Financial Stability (Z-Score)	-2.894	-14.172**	I(1)

Note: ** indicates significance at 5% level. Critical value at 5% = -2.89 approximately.
Source: Data Analysis, EViews 12 (2024)

4.2.2 Cointegration Test

Johansen cointegration tests were performed to examine long-term equilibrium relationships. Both Trace and Maximum Eigenvalue statistics (Tables 4 and 5) indicated the presence of at least one cointegrating equation at the 5% significance level. This confirms that despite individual non-stationarity, the variables move together in the long run, warranting a Vector Error Correction Model (VECM) specification.

Table 4. Cointegration Test (Trace Statistic)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None*	0.246	54.461	47.856	0.006
At most 1*	0.196	31.630	29.797	0.030
At most 2	0.088	12.430	15.495	0.138
At most 3*	0.048	4.302	3.841	0.038

Note: *denotes rejection of the hypothesis at the 0.05 level.
Source: Data Analysis, EViews 12 (2024)

Table 5. Cointegration Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.246	24.832	27.584	0.108
At most 1	0.196	19.200	21.132	0.091
At most 2	0.088	8.128	14.265	0.366
At most 3*	0.048	4.302	3.841	0.038

Note: *denotes rejection of the hypothesis at the 0.05 level.
Source: Data Analysis, EViews 12 (2024)

4.3 Vector Error Correction Model (VECM) Estimation

Given the presence of cointegration, a VECM was estimated to capture both short-term dynamics and long-term equilibrium relationships. The general form of the VECM is specified as:

$$\Delta Yt = \alpha\beta' Yt-1 + \sum i=1 p-1 \Gamma i \Delta Yt-i + \varepsilon t \Delta Yt = \alpha\beta' Yt-1 + i=1 \sum p-1 \Gamma i \Delta Yt-i + \varepsilon t$$

Where YtYt is the vector of endogenous variables [OCOI, ROA, LnTI, Z-Score], αα represents the speed of adjustment coefficients, ββ contains the cointegrating vectors, ΓiΓi are short-term coefficient matrices, and εtεt is the error term.

The estimated coefficients reveal complex interdependencies. For financial stability (Z-Score), the error correction term was significant with a coefficient of -0.3695, indicating that approximately 36.95% of any deviation from long-term equilibrium is corrected within one period. This suggests a relatively rapid adjustment mechanism toward equilibrium in the Islamic banking sector.

4.4 Granger Causality Analysis

Table 6 presents the Granger causality test results, which examine the directional relationships between variables.

Table 6. Granger Causality Test Results

Null Hypothesis (H_0)	F-Statistic	p-value	Conclusion
Efficiency does not Granger-cause Financial Stability	3.524	0.171	Cannot reject H_0
Financial Stability does not Granger-cause Efficiency	6.320	0.042*	Reject H_0
Profitability does not Granger-cause Financial	4.420	0.029*	Reject H_0

Null Hypothesis (H_0)	F-Statistic	p-value	Conclusion
Stability			
Financial Stability does not Granger-cause Profitability	1.940	0.378	Cannot reject H_0
FinTech does not Granger-cause Financial Stability	3.490	0.027*	Reject H_0
Financial Stability does not Granger-cause FinTech	2.569	0.276	Cannot reject H_0

Note: * indicates significance at 5% level.
Source: Data Analysis (2024)

The results reveal unidirectional causality flowing FROM financial stability TO efficiency (p=0.042), FROM profitability TO financial stability (p=0.029), and FROM FinTech TO financial stability (p=0.027). This suggests that in ASEAN Islamic banks, financial stability influences efficiency measures, while both profitability and technological investments contribute to stability outcomes—not vice versa. These findings align with the resource-based view, where stable institutions can optimize operations, and strategic investments (in both profitability and technology) enhance resilience.

4.5 Impulse Response Analysis

The Impulse Response Functions (IRFs) depicted in Figure 1 trace the dynamic responses of financial stability to shocks in other variables over a 10-period horizon.

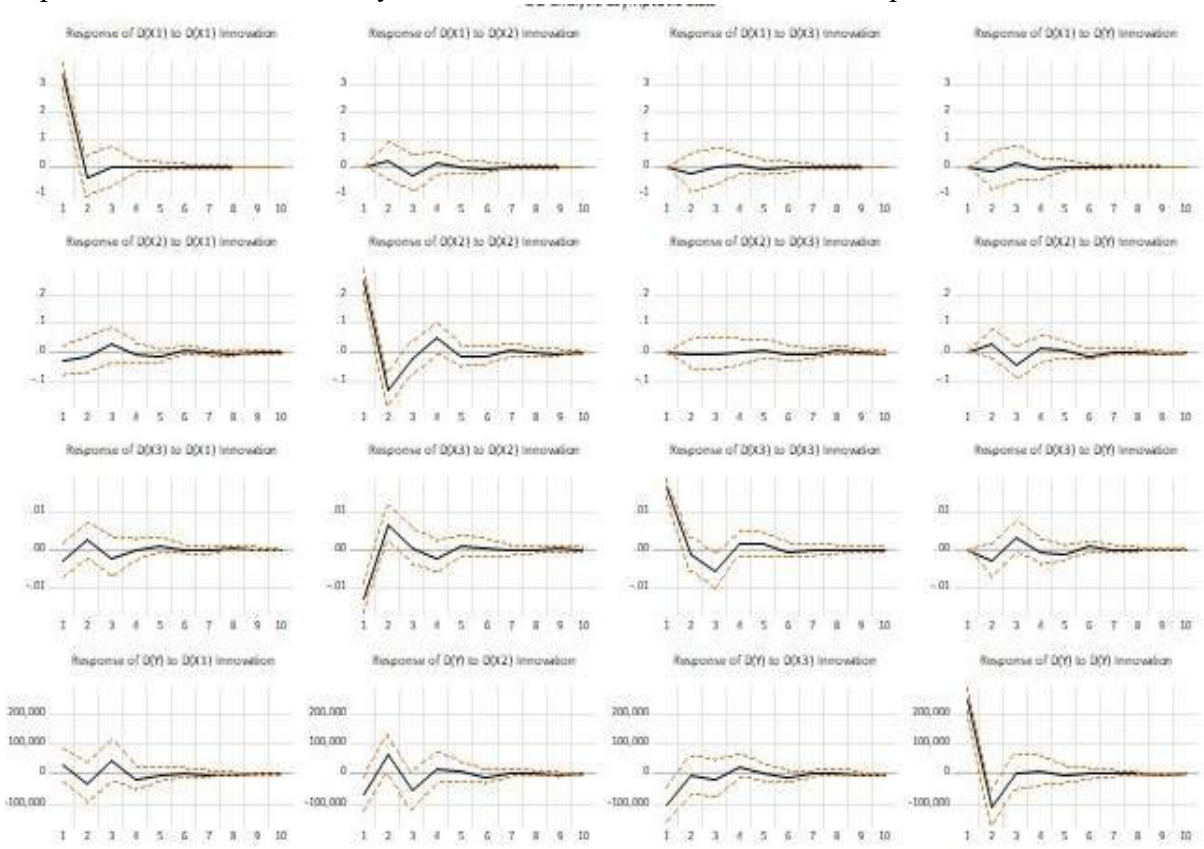

Figure 2. Impulse Response Functions: Response of Financial Stability to One S.D. Innovations

The IRF analysis reveals several key patterns:

1) Efficiency Shock: A one standard deviation shock to efficiency produces a muted, generally positive response in financial stability throughout the horizon, suggesting that operational improvements may contribute modestly to stability.
2) Profitability Shock: Profitability innovations generate an immediate positive spike in stability (period 1), followed by fluctuations that stabilize positively by period 10. This aligns with theoretical expectations that profitability buffers enhance stability.
3) FinTech Shock: Technological investments produce the most pronounced response—a sharp initial increase (periods 1-3) followed by sustained positive effects. This supports arguments that digital transformation strengthens risk management and monitoring capabilities.
4) Own Shock: Financial stability exhibits strong persistence, with shocks decaying gradually but maintaining positive territory throughout the horizon, confirming the Z-Score's effectiveness as a stability measure.

4.6 Discussion and Theoretical Implications

The empirical findings offer nuanced insights into the dynamics of ASEAN Islamic banking stability. The confirmed cointegration validates theoretical models positing long-run equilibrium relationships between operational metrics, performance, technology, and stability in financial institutions (Čihák & Hesse, 2010).

The unidirectional causality from profitability to stability supports the "profit-stability" hypothesis in Islamic banking contexts, contrasting with conventional banking's "stability-profit" nexus (Beck et al., 2013). This suggests that for Islamic banks, profitability serves as a prerequisite for—rather than a consequence of—stability, potentially due to their asset-backed, risk-sharing nature.

The significant FinTech-to-stability relationship extends the digital transformation literature to Islamic finance, indicating that technological investments enhance stability through improved transparency, risk assessment, and operational efficiency (Banna & Alam, 2021). The positive IRF responses corroborate this, suggesting digitalization's stabilizing effects accumulate over time.

Notably, the absence of reverse causality from stability to profitability or FinTech implies that stable Islamic banks may not necessarily reinvest in technology or pursue profit maximization—a finding with implications for regulatory policies encouraging proactive digital adoption.

4.7 Practical Implications for ASEAN Islamic Banks

For practitioners and regulators, three key implications emerge:

1) Strategic Prioritization: Since profitability drives stability, managers should focus on sustainable revenue models (like profit-sharing investments) rather than cost-cutting alone.
2) Technology Roadmaps: The strong FinTech-stability link justifies accelerated digitalization, particularly in regtech and suptech solutions tailored to Sharia compliance.
3) Macroprudential Policies: Regulators could consider tiered capital requirements that incentivize both profitability and technology adoption, as these jointly fortify stability.
4) The VECM's significant error correction term (36.95%) suggests that disequilibria correct relatively quickly—a positive feature for policymakers addressing systemic shocks.

5. Conclusion

This study aimed to analyze the dynamic relationships between efficiency, profitability, financial technology, and financial stability in Islamic banks across ASEAN countries. Employing a Vector Error Correction Model (VECM) on panel data from 19 banks (2019–2023), the research provides robust empirical evidence of both short-term dynamics and long-term equilibrium among these critical variables.

The key findings that address the research objectives are threefold. First, the Johansen cointegration test confirms a significant long-term equilibrium relationship among all variables. This implies that efficiency, profitability, FinTech adoption, and financial stability in ASEAN Islamic banks move in concert over time, converging toward a shared steady state despite short-term fluctuations. Second, the Granger causality tests reveal specific directional influences: profitability and FinTech adoption each Granger-cause financial stability, but not vice versa. Additionally, financial stability Granger-causes efficiency. This pattern of unidirectional causality suggests that profitable and technologically advanced banks achieve greater stability, and that stable banks, in turn, can operate more efficiently. Third, the Impulse Response Functions illustrate the positive and sustained impact of shocks to profitability and FinTech on financial stability over a 10-period horizon, underscoring their role as drivers of resilience.

This study extends the application of financial stability frameworks to the unique context of Islamic banking in emerging economies. It validates the "profit-stability" hypothesis within a Sharia-compliant framework and introduces FinTech as a significant exogenous driver of stability, thereby enriching the literature on technology in finance.

The findings offer clear guidance for bank managers and regulators. For bank management, prioritizing investments in digital transformation (FinTech) and sustainable profit-generating activities is not merely a competitive strategy but a fundamental pillar for ensuring long-term institutional soundness. For policymakers and regulators in ASEAN, the evidence supports the development of integrated regulatory frameworks that incentivize digital adoption and profitable, Sharia-compliant business models as a macroprudential strategy to strengthen the overall resilience of the Islamic banking sector.

This study is subject to certain limitations that also point to valuable directions for future inquiry. The reliance on a proxy for FinTech (non-interest expense) and a specific stability measure (Z-Score) suggests that future research could employ more direct metrics, such as investment in specific regtech or digital banking assets. The geographical focus on ASEAN, while insightful, invites comparative studies with Islamic banks in the Middle East or North Africa. Furthermore, the quantitative approach could be fruitfully complemented by qualitative case studies to unravel the mechanisms—such as specific FinTech applications or governance structures—through which profitability and technology translate into stability. Finally, expanding the timeframe to capture pre- and post-pandemic effects could provide deeper insights into the resilience of these relationships during systemic crises.

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