Received: 17 Oktober 2024; Revised: 03 February 2025; Accepted: 06 March 2025

EFFICIENCY OF ISLAMIC AND CONVENTIONAL BANKS IN INDONESIA DURING COVID-19: A STOCHASTIC FRONTIER ANALYSIS

Dini Dewindaru[1*]
Ermina Sari[2]
[1,2]STIE Al-Madani Lampung, Indonesia
[*]*Corresponding Email: dini.dewindaru@almadani.ac.id*

ABSTRACT - The COVID-19 pandemic has disrupted global financial systems, with the banking sector facing mounting pressures on operational efficiency and financial stability. In Indonesia, this crisis presented a critical test for both Conventional Banks (CBs) and Islamic Banks (IBs), whose structural and operational models differ significantly. This study aims to evaluate and compare the efficiency levels of CBs and IBs during the COVID-19 pandemic (2020–2022) using a quantitative approach. The Stochastic Frontier Analysis (SFA) with a Cobb-Douglas production function was employed to measure cost efficiency, while an independent samples t-test was used to determine the statistical significance of efficiency differences between bank types. A purposive sample consisting of 39 CBs and 9 IBs was analyzed based on input variables (fixed assets, deposits, and personnel costs) and output (total financing). The results reveal that CBs achieved higher efficiency scores (average = 89.39) compared to IBs (average = 82.27), with the difference being statistically significant ($p < 0.001$). Efficiency among CBs remained relatively stable, while IBs showed more variability and consistent decline over the period. The study identifies key contributing factors to IBs' lower efficiency, including technological constraints, lack of product standardization, and regulatory complexities. These findings underscore the need for structural reforms in the Islamic banking sector, particularly in technology adoption and regulatory harmonization. The study offers valuable insights for regulators, bank managers, and policymakers in enhancing the resilience and competitiveness of Indonesia's dual banking system during periods of financial stress.
Keywords: Banking Efficiency, Stochastic Frontier Analysis, Islamic Banks, Conventional Banks, COVID-19

ABSTRAK - Efisiensi Bank Syariah dan Bank Konvensional di Indonesia Selama Pandemi COVID-19: Analisis Frontier Stokastik. *Pandemi COVID-19 telah mengguncang sistem keuangan global, termasuk sektor perbankan yang menghadapi tekanan besar terhadap efisiensi operasional dan stabilitas keuangan. Di Indonesia, krisis ini menjadi Pelajaran berharga bagi Bank Konvensional (CBs) dan Bank Syariah (IBs) yang memiliki perbedaan struktural dan operasional yang signifikan. Penelitian ini bertujuan untuk mengevaluasi dan membandingkan tingkat efisiensi CBs dan IBs selama pandemi COVID-19 (2020–2022) melalui pendekatan kuantitatif. Metode yang digunakan adalah Stochastic Frontier Analysis (SFA) dengan fungsi produksi Cobb-Douglas untuk mengukur efisiensi biaya, serta uji t independen untuk mengetahui signifikansi perbedaan efisiensi antara kedua jenis bank. Sampel purposif terdiri dari 39 CBs dan 9 IBs, dianalisis berdasarkan variabel input (aset tetap, dana pihak ketiga, dan biaya SDM) serta output (total pembiayaan). Hasil penelitian menunjukkan bahwa CBs memiliki skor efisiensi lebih tinggi (rata-rata = 89,39) dibandingkan IBs (rata-rata = 82,27), dengan perbedaan yang signifikan secara statistik ($p < 0,001$). Efisiensi CBs cenderung stabil, sementara IBs menunjukkan penurunan konsisten dan variasi yang lebih besar. Faktor-faktor yang berkontribusi terhadap rendahnya efisiensi IBs mencakup keterbatasan teknologi, kurangnya standardisasi produk, dan kompleksitas regulasi. Temuan ini menekankan pentingnya reformasi struktural dalam sektor perbankan syariah, khususnya dalam adopsi teknologi dan harmonisasi regulasi. Studi ini memberikan wawasan penting bagi regulator, manajemen bank, dan pembuat kebijakan dalam meningkatkan daya tahan dan daya saing sistem perbankan ganda di Indonesia pada masa krisis keuangan.*
Kata kunci: *Efisiensi Perbankan, Stochastic Frontier Analysis, Bank Syariah, Bank Konvensional, COVID-19*

INTRODUCTION

The global COVID-19 pandemic has significantly disrupted multiple economic sectors, with the banking and financial industries among the most affected. The banking sector inherently faces various types of risks—including unsecured loan risks and stock market volatility—that threaten its profitability and operational stability (Wahyudi, 2020). Reports indicate a national decline in the number of bank employees, exacerbated by reduced credit demand during the pandemic (Bidari et al., 2020; Azhari & Wahyudi, 2020), increased operational expenses (Pratomo & Ramdani, 2021), and weakened revenue generation from core banking activities, particularly net interest margins (NIM) or net operating margins (NOM).

One key indicator of banking performance, particularly during economic disruptions, is cost efficiency. The ratio of Operational Expenses to Operational Revenues (BOPO) serves as a critical metric for assessing operational efficiency. High BOPO values, particularly those exceeding 80%, diminish profitability by increasing the share of revenue consumed by costs (Sukmaningrum & Pohan, 2016). During the pandemic, many banks reported unusually high BOPO ratios—state-owned banks (BUMN), in particular, surpassed 90%—indicating heightened cost inefficiency (Hartono, 2009). Elevated BOPO ratios can further reflect limited resource allocation, reduced competitiveness, and a decline in service quality, all of which compound the economic pressures banks face in crisis periods.

Although widely used, BOPO as a performance metric presents limitations. Lower costs do not necessarily equate to higher efficiency, and cost-cutting measures may compromise service quality and long-term profitability (Hadad et al., 2003). Additionally, BOPO fails to capture broader inefficiencies in banking inputs and outputs, nor does it sufficiently address internal or external factors influencing inefficiency (Wardhani & Mongid, 2019). Its narrow focus on operational revenue versus costs risks overlooking crucial data variability and contextual performance indicators, often resulting in inconsistent assessments of bank efficiency (Bauer et al., 1998; Kyshakevych & Mazharov, 2018).

Beyond ratio analysis, inefficiencies in banking operations also stem from structural issues, such as mismatches between third-party fund mobilization and credit disbursement (Wardhani & Mongid, 2019). These inefficiencies impair revenue generation, erode institutional performance, and ultimately

reduce public trust (Hamdani et al., 2018). Comparative studies have revealed disparities in efficiency across different types of banks in Indonesia. For example, state-owned banks tend to be less efficient than private banks, and domestic banks often lag behind foreign institutions (Hartono, 2009). However, in the 1998 financial crisis, Islamic banks demonstrated relatively better resilience, characterized by lower non-performing loan (NPL) ratios and positive spreads in financing operations (Sukmaningrum & Pohan, 2016). Their higher capitalization and low-risk asset structures contributed to greater liquidity (Pellegrina, 2012), positioning them more favorably than conventional banks. Similar observations were made during the COVID-19 pandemic, with Islamic banks experiencing fewer performance declines due to more conservative lending strategies (Pratomo & Ramdani, 2021).

These findings underscore the importance of analyzing efficiency differences between banking groups to understand their structural strengths and vulnerabilities. In particular, assessing how Islamic and conventional banks respond to economic crises such as the COVID-19 pandemic is critical for informing regulatory and managerial decisions. The current study is motivated by the need to evaluate the efficiency of these two banking models, especially under crisis conditions that demand operational adaptability and financial resilience. Traditional efficiency measurement tools, such as financial ratios, fall short of capturing the full complexity of bank performance under stress (Ibrahim & Rosniar, 2024). Hence, a more nuanced and comprehensive analytical approach is required.

To address this gap, this study employs the Stochastic Frontier Analysis (SFA) methodology—a parametric technique favored for its grounding in economic optimization rather than mere technical benchmarks (Ismail, 2015; Zuhroh et al., 2015). SFA enables the assessment of both efficiency scores and the sources of inefficiency across inputs and outputs, making it a more robust alternative to traditional ratio-based methods. The study begins by identifying the core symptoms of inefficiency during the pandemic, then formulates hypotheses which are statistically tested using SFA on banking data collected during the crisis period.

Previous research on Islamic bank efficiency using SFA can be classified into three thematic clusters: efficiency analyses of Islamic microfinance institutions (BMTs), comparative studies between Islamic and conventional banks, and internal efficiency assessments of Islamic banks. However, most existing studies (Ismail, 2015; Zuhroh et al., 2015; Sa'diyah, 2021; Wardhani &

Mongid, 2019; Hadad et al., 2003) have not directly explored how banking institutions perform during major financial disruptions such as the COVID-19 pandemic; instead, they focus on evaluating static efficiency under stable economic conditions without considering dynamic responses to financial shocks. Ismail (2015) and Zuhroh et al. (2015) discuss the technical and cost efficiency of Islamic banks using Stochastic Frontier Analysis (SFA), but their studies do not address crisis conditions. Similarly, Sa'diyah (2021) analyzes efficiency as a concept linked to performance, yet not within a crisis context. Wardhani & Mongid (2019) and Hadad et al. (2003) critique efficiency measurements, such as the BOPO ratio, and compare different types of banks, but their analyses are not specifically focused on pandemic or crisis scenarios.

This study contributes to a more comprehensive understanding of banking sector resilience, particularly in the face of systemic crises. It addresses a critical gap in the existing literature by linking efficiency measurement to crisis performance. The findings are expected to inform both academic discourse and policymaking by offering valuable insights for regulatory bodies, such as Bank Indonesia, on how to strengthen the banking sector through targeted interventions, including technological innovation incentives and liquidity support. Ultimately, improving the financial system's readiness for future economic disruptions necessitates a deeper understanding of how various banking models respond under conditions of systemic stress.

LITERATURE REVIEW

Efficiency Measurement and the SFA Approach

Efficiency is a fundamental concept in evaluating organizational performance, particularly in the banking sector, where it reflects a bank's ability to optimize inputs—such as labor, capital, and deposits—to generate desired outputs like interest income, financial services, and customer satisfaction (Berger & Humphrey, 1997). In banking studies, efficiency is often assessed through input-output comparisons that reveal how well banks convert resources into productive financial and operational results.

Efficiency measurement methodologies are generally classified into two broad categories: ratio-based approaches and frontier-based approaches. While ratio-based techniques (e.g., the BOPO ratio) offer straightforward insights, they are limited in their ability to account for multiple inputs and outputs or external variability. In contrast, frontier-based approaches—both parametric and non-

parametric—offer a more nuanced and flexible evaluation of efficiency. Among parametric methods, the Stochastic Frontier Analysis (SFA), introduced by Aigner et al. (1977), has gained prominence for its ability to distinguish inefficiency from random error. Non-parametric alternatives, such as Data Envelopment Analysis (DEA), are also commonly used but lack the stochastic properties that SFA incorporates.

SFA allows for the estimation of a production frontier while accounting for random shocks and statistical noise that might affect bank performance. This method is especially relevant in the banking sector, where external factors—such as market volatility or policy changes—can influence observed performance without necessarily indicating inefficiency (Kumbhakar & Lovell, 2000). The ability to isolate inefficiency from external randomness makes SFA a valuable tool for performance assessment, especially under conditions of uncertainty.

Furthermore, SFA enables comparisons of relative efficiency among banking institutions by quantifying deviations from the optimal production frontier. This is particularly useful in highly competitive financial environments where benchmarking against industry leaders can inform strategic decisions (Hadad et al., 2003). Efficiency, in this context, is understood as the ability of a bank to either maximize output with a given set of inputs or minimize inputs for a given level of output—an important distinction in resource-constrained or crisis-hit environments.

Efficiency During the COVID-19 Pandemic

The onset of the COVID-19 pandemic introduced unprecedented disruptions to the global financial sector, including banking operations. These disruptions have affected multiple performance dimensions, including risk exposure, liquidity management, and operational costs. Increased uncertainty led to a surge in customer deposits as individuals and businesses sought financial security, resulting in changes to deposit compositions and liquidity profiles. At the same time, banks faced rising operational costs, particularly related to health protocols, digital infrastructure, and workforce adjustments—factors that strained cost efficiency (Beck et al., 2014).

These conditions have necessitated more robust efficiency assessments that account for the exceptional volatility induced by the pandemic. The relevance of SFA is particularly evident in this context, as it facilitates the examination

of banks' ability to maintain performance despite external shocks. SFA allows researchers to explore how well banks adapt operational strategies and manage resources in response to the pandemic's financial stressors.

Islamic vs. Conventional Banks' Efficiency

In the comparative analysis of Islamic and conventional banks, SFA has emerged as a powerful analytical framework. It enables the decomposition of efficiency into deterministic and stochastic components, allowing researchers to investigate both persistent inefficiencies and those caused by exogenous shocks. This makes SFA especially suitable for analyzing banking performance during periods of economic uncertainty, such as the COVID-19 crisis (Kumbhakar & Lovell, 2000; Zuhroh et al., 2015).

Islamic banks, which operate in accordance with Sharia principles that prohibit interest (riba) and emphasize profit-and-loss sharing, present unique operational models compared to their conventional counterparts. These operational differences can significantly influence how each banking model manages resources, allocates credit, and absorbs risk (Pellegrina, 2012). Accordingly, comparative efficiency studies must account for such institutional distinctions when assessing performance outcomes.

Prior research using SFA has yielded valuable insights into the efficiency levels of both banking models. However, most of these studies have focused on normal economic conditions, with limited attention to performance under systemic crises such as the COVID-19 pandemic (Ismail, 2015; Zuhroh et al., 2015; Sa'diyah, 2021; Wardhani & Mongid, 2019). There is a growing need to understand how Islamic and conventional banks respond to financial disruptions and whether their operational models contribute to greater or lesser resilience under stress.

Contribution of the Present Study

This study builds upon existing literature by extending the use of SFA to assess how bank efficiency has evolved during the COVID-19 crisis. It aims to determine whether Islamic banks exhibit greater resilience compared to conventional banks, and to identify the specific input-output dynamics that influence these outcomes. In doing so, this research contributes to the broader discourse on financial sector stability, offering empirical insights that are

critical for regulators and policymakers seeking to strengthen institutional responses to future economic shocks.

This study not only evaluates relative efficiency but also examines structural factors that shape banking resilience. It therefore offers both theoretical and practical contributions, addressing a gap in the literature while supporting informed decision-making in the regulation and development of a stable, inclusive banking system.

METHODOLOGY

Research Design

This study adopts a quantitative research design, utilizing the Stochastic Frontier Analysis (SFA) method to measure the efficiency levels of banks operating in Indonesia during the COVID-19 pandemic. In addition, an independent sample t-test is employed to assess the statistical significance of efficiency differences between Conventional Banks (CBs) and Islamic Banks (IBs).

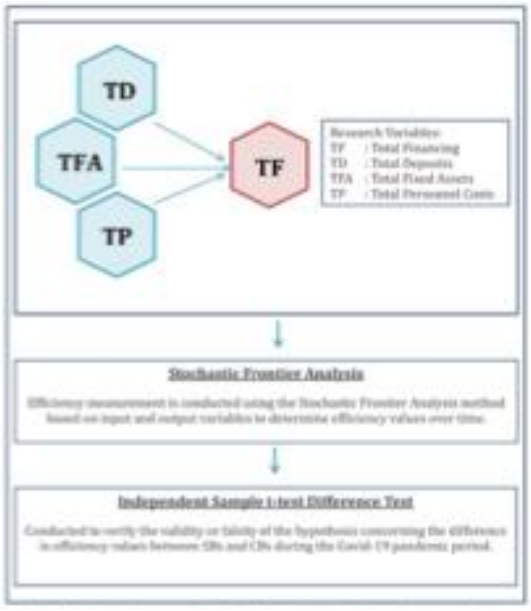

Figure 1. Research Framework

The following hypotheses guide the empirical analysis:

H_0: There is no significant difference in efficiency between CBs and IBs during the COVID-19 pandemic.

H_1: There is a significant difference in efficiency between CBs and IBs during the COVID-19 pandemic.

The overall research framework is illustrated in Figure 1, which outlines the sequence from data collection to statistical testing and interpretation.

Data and Sample

This study relies on secondary, non-experimental data obtained from the annual financial reports of Islamic and conventional banks published through the Indonesia Stock Exchange (IDX) and the Financial Services Authority (OJK). The population consists of all Sharia and conventional commercial banks operating in Indonesia from 2020 to 2022. A purposive sampling method was applied, yielding a total of 48 banks—comprising 9 Islamic Banks (IBs) and 39 Conventional Banks (CBs)—based on the following selection criteria:

1. Banks must have operated continuously from 2020 to 2022.
2. Islamic Banks must be registered with OJK; Conventional Banks must be listed on IDX.
3. Regional Development Banks (BPD) and People's Credit Banks (BPR) were excluded.
4. Banks undergoing legal status changes or mergers during the observation period were excluded.
5. Banks must have complete financial reports for all three years of observation.

Variables and Operational Definitions

This study adopts the production approach, where banks are conceptualized as production units that utilize various resources (inputs) to produce financial services (outputs). The input-output structure is based on the theoretical foundations of banking efficiency literature and includes the following variables:

Table 1. Indicator, Operational Definition, Formula

Indicator	Operational Definition	Formula
Total Financing (Output)	Total disbursement of funds to third parties, including individuals and institutions.	IBs = Murabahah + Istishna + Qardh + Mudharabah + Musharakah financing CBs = Total loans/financing

Total Fixed Assets (Input)	Tangible assets used for long-term banking operations.	IBs & CBs = (Fixed Assets + Inventory) – (Accumulated Depreciation of Fixed Assets + Inventory)
Total Deposits (Input)	Funds collected from the public in forms such as savings and deposits.	IBs = Giro Wadiah + Wadiah Savings + Mudharabah Savings + Mudharabah Deposits CBs = Total Third-Party Funds (DPK)
Total Personnel Costs (Input)	Total expenses related to employee salaries and benefits.	IBs & CBs = Total personnel expenses (salary, allowances, bonuses, etc.)

(Source: Processed Data, 2024)

These input variables were selected due to their critical role in supporting bank operations: deposits represent the primary funding source for credit, fixed assets enable the delivery of banking services, and personnel costs reflect human capital investment.

Analytical Technique

The Stochastic Frontier Analysis (SFA) method is employed to estimate bank efficiency using the Cobb-Douglas production function. This parametric approach is preferred for its capacity to distinguish between inefficiency and random error, making it suitable for assessing performance under crisis conditions. The panel data regression analysis is conducted using Stata, which is used for estimating the production frontier and performing the independent sample t-test. Microsoft Excel is employed for additional data processing, particularly in computing the efficiency scores derived from the SFA model. The Cobb-Douglas functional form used in this analysis is expressed as follows:

$$\ln Y_{it} = \beta_0 + \sum_{k=1}^{n} \beta_k \ln X_{kit} + v_{it} - u_{it} \quad (1)$$

Where:

Y_{it} = Output (total financing) for bank i at time t
X_{kit} = Input k (e.g., fixed assets, deposits, personnel costs)
v_{it} = Random error term
u_{it} = Non-negative inefficiency term

This model enables the calculation of efficiency scores for each bank, where a score of 1 indicates full efficiency, and lower values indicate relative inefficiency.

RESULTS AND DISCUSSION

Efficiency Analysis of Conventional Banks

The efficiency levels of Conventional Banks (CBs) in Indonesia during the COVID-19 pandemic were estimated using the Stochastic Frontier Analysis (SFA) approach. Table 2 presents the Cobb-Douglas stochastic production frontier model results for CBs.

Table 2. Stochastic Frontier Estimation Results for Conventional Banks

Variable	Coefficient	Std. Error	*t*	p-value
Constant (Intercept)	4.027	0.648	6.220	0.000
Total Fixed Assets	0.771	0.013	58.300	0.000
Total Deposits	0.072	0.048	1.490	0.137
Total Personnel Costs	0.058	0.037	1.560	0.118

(Source: Processed Data, 2024)

Based on the model output, total fixed assets had a statistically significant and positive influence on the total financing output ($p < 0.01$), suggesting that investments in physical capital contributed strongly to bank productivity. In contrast, total deposits and personnel costs were not statistically significant at the 5% level, indicating relatively lower marginal effects on output under the model assumptions. The estimated production function for CBs during the study period is as follows:

$$TF = 4.027 + 0.771\ TA + 0.072\ TD + 0.058\ TPC$$

Where:

TF = Total Financing (Output)
TA = Total Fixed Assets
TD = Total Deposits
TPC = Total Personnel Costs

Efficiency scores for individual CBs were calculated over the 2020–2022 period. Table 3 summarizes these values, with the average efficiency scores computed across the three years for each bank. Bank Capital Indonesia Tbk recorded the highest average efficiency score (0.944), particularly achieving its peak efficiency in 2021 (0.960). In contrast, Bank MNC Internasional Tbk posted the lowest average efficiency score (0.842), with its lowest performance observed in 2022 (0.836).

Table 3. Efficiency Scores of Conventional Banks (2020–2022)

No	Bank Name	2020	2021	2022	Average Efficiency
1	Bank Rakyat Indonesia Agroniaga Tbk	0.871	0.886	0.910	0.889
2	Bank IBK Indonesia Tbk	0.894	0.892	0.879	0.888
3	Bank Amar Indonesia Tbk	0.863	0.850	0.846	0.853
4	Bank Jago Tbk	0.940	0.888	0.875	0.901
5	Bank MNC Internasional Tbk	0.851	0.840	0.836	**0.842**
6	Bank Capital Indonesia Tbk	0.922	0.960	0.951	**0.944**
7	Bank Central Asia Tbk	0.891	0.890	0.890	0.890
8	Bank Harda Internasional Tbk	0.888	0.872	0.880	0.880
9	Bank Cbopin Tbk	0.897	0.898	0.902	0.899
10	Bank Mestika Dharma Tbk	0.912	0.910	0.909	0.910
11	Bank Negara Indonesia Tbk	0.895	0.896	0.893	0.895
12	Bank Rakyat Indonesia Tbk	0.890	0.897	0.898	0.895
13	Bank Bisnis Internasional Tbk	0.939	0.939	0.944	0.941
14	Bank Tabungan Negara Tbk	0.879	0.878	0.879	0.879
15	Bank Neo Commerce Tbk	0.892	0.905	0.890	0.896
16	Bank JTrust Indonesia Tbk	0.891	0.882	0.866	0.880
17	Bank Danamon Indonesia Tbk	0.874	0.873	0.870	0.873
18	Bank Ganesha Tbk	0.897	0.890	0.885	0.891
19	Bank Ina Perdana Tbk	0.896	0.866	0.849	0.871
20	Bank QNB Indonesia Tbk	0.891	0.894	0.890	0.892
21	Bank Maspion Indonesia Tbk	0.909	0.904	0.903	0.905
22	Bank Mandiri Tbk	0.898	0.896	0.896	0.896
23	Bank Bumi Arta Tbk	0.938	0.942	0.942	0.941
24	Bank CIMB Niaga Tbk	0.895	0.893	0.892	0.893
25	Bank Maybank Indonesia Tbk	0.891	0.888	0.887	0.889
26	Bank Permata Tbk	0.886	0.885	0.883	0.885
27	Bank Sinarmas Tbk	0.910	0.918	0.922	0.917
28	Bank of India Indonesia Tbk	0.913	0.916	0.906	0.912
29	Bank BTPN Tbk	0.875	0.874	0.871	0.873
30	Bank Victoria International Tbk	0.895	0.891	0.889	0.892
31	Bank Oke Indonesia Tbk	0.892	0.883	0.871	0.882
32	Bank Artha Graha Internasional Tbk	0.933	0.935	0.938	0.935
33	Bank Mayapada Internasional Tbk	0.889	0.877	0.880	0.882
34	Bank China Construction Indonesia Tbk	0.906	0.907	0.899	0.904
35	Bank Mega Tbk	0.922	0.916	0.914	0.917
36	Bank OCBC NISP Tbk	0.886	0.886	0.886	0.886
37	Bank Nationalnobu Tbk	0.871	0.889	0.881	0.880
38	Bank Pan Indonesia Tbk	0.905	0.901	0.903	0.903
39	Bank Woori Saudara Indonesia Tbk	0.870	0.860	0.855	0.862

(Source: Processed Data, 2024)

Figure 2 illustrates the trend of average efficiency scores among CBs from 2020 to 2022.

Figure 2. Trend of Average Efficiency Scores of CBs (2020-2022)
(Source: Processed Data, 2024)

During the observed period, CBs exhibited a slight decline in efficiency. The highest average efficiency occurred in 2020 (0.896), followed by a slight decrease in 2021 (0.894) and 2022 (0.891). This trend suggests a gradual decline in operational efficiency among CBs throughout the COVID-19 pandemic, which may reflect the cumulative impacts of prolonged economic uncertainty, increased risk provisioning, and operational disruptions.

The overall average efficiency score for all CBs across the three years was 0.893, which indicates a relatively high level of efficiency despite pandemic-related pressures. However, the efficiency distribution varied, with 69% of CBs (27 banks) scoring between 0.8 and 0.9, while 31% (12 banks) achieved scores above 0.9, indicating a performance gap among institutions.

These findings contrast with earlier studies such as Pellegrina (2012), which found higher efficiency levels among CBs prior to the pandemic. The results of this study indicate that CBs, while still efficient in general, experienced a noticeable decline in efficiency during the COVID-19 period.

Efficiency Analysis of Islamic Banks

To evaluate the performance of Islamic Banks (IBs) in Indonesia during the COVID-19 pandemic, this study applied the Stochastic Frontier Analysis (SFA) approach using the Cobb-Douglas production function. Table 4 presents the parameter estimates of the SFA model for Islamic banks. The results indicate that total fixed assets had a statistically significant and positive impact on financing output ($p < 0.01$), suggesting that investments in physical infrastructure were a major contributor to efficiency in Islamic banking.

Table 4. Stochastic Frontier Estimation Results for Islamic Banks

Variable	Coefficient	Std. Error	t-value	p-value
Constant	-8.968	3.536	-2.540	0.011
Total Fixed Assets	3.540	1.325	2.670	0.008
Total Deposits	-1.212	1.249	-0.970	0.163
Total Personnel Costs	1.968	0.984	1.390	0.011

(Source: Processed Data, 2024)

Meanwhile, total deposits had a negative and statistically insignificant coefficient, implying that variations in deposit volume did not significantly affect financing efficiency during the pandemic. Personnel costs also had a positive and statistically significant influence, albeit at a lower significance level. The estimated regression equation for SBs is expressed as:

$$TF = -8.968 + 3.540\,TA - 1.212\,TD + 1.968\,TPC$$

Where:

TF = Total Financing (Output)
TA = Total Fixed Assets
TD = Total Deposits
TPC = Total Personnel Costs

Table 5 provides the efficiency scores of the 9 Islamic banks in the study, measured annually from 2020 to 2022, along with their three-year averages.

Table 5. Efficiency Scores of Sharia Banks (2020–2022)

No	Bank Name	2020	2021	2022	Average Efficiency
1	Bank Muamalat Indonesia	0.920	0.916	0.913	**0.917**
2	BTPN Syariah Tbk	0.867	0.871	0.871	0.869
3	BJB Syariah	0.846	0.846	0.849	0.847
4	BCA Syariah	0.812	0.812	0.813	0.812
5	Bank Panin Dubai Syariah Tbk	0.818	0.812	0.814	0.814
6	Bank Mega Syariah	0.848	0.846	0.851	0.848
7	Bank Syariah Cbopin	0.837	0.832	0.824	0.831
8	Bank Victoria Syariah	0.704	0.686	0.649	**0.680**
9	Bank Aladin Syariah	0.766	0.792	0.801	0.786

(Source: Processed Data, 2024)

Bank Muamalat Indonesia recorded the highest average efficiency score (0.917) over the three-year period, while Bank Victoria Syariah had the lowest efficiency score, with an average of 0.680, and its lowest performance recorded

in 2022 (0.649). Figure 3 illustrates the trend of average efficiency scores among SBs over the course of the pandemic.

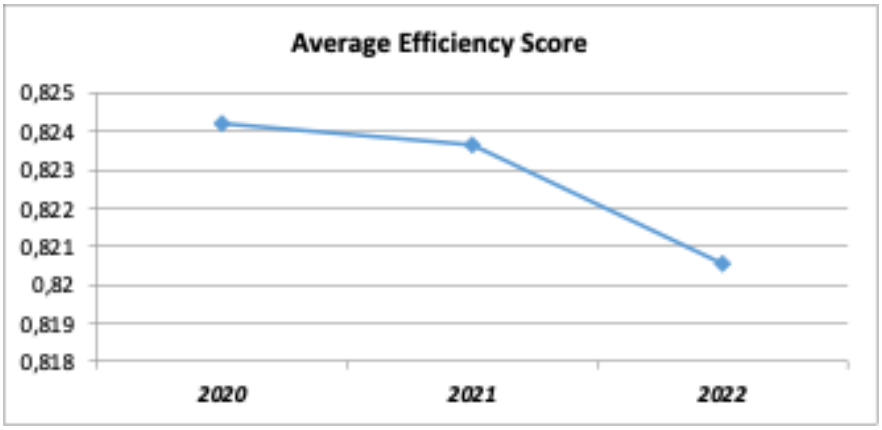

Figure 3. Trend of Average Efficiency Scores of Sharia Banks (2020–2022)
(Source: Processed Data, 2024)

The annual average efficiency values for SBs show a consistent decline: from 0.824 in 2020 to 0.823 in 2021, and further down to 0.820 in 2022. The overall average efficiency for the nine SBs during the COVID-19 period (2020–2022) was 0.822, indicating that, while the sector remained moderately efficient, it faced growing operational challenges throughout the pandemic.

Notably, only one bank (Bank Muamalat Indonesia) achieved an average efficiency above 0.9, while the remaining eight banks (89%) scored between 0.68 and 0.87. This relatively wide range suggests efficiency instability among Islamic banks during the crisis. These findings contrast with those of Nur et al. (2022), who reported higher average efficiency scores (0.71–0.90) for SBs during the 2016–2020 period, suggesting a decline in efficiency during the pandemic.

Several studies have offered explanations for lower efficiency levels in Islamic banks. Among these are the lack of product standardization, which may hinder operational consistency (Johnes et al., 2014), and the limited adoption of advanced banking technologies, which restricts technical efficiency (Abdul-Majid et al., 2017; Parsa, 2020; Safiullah & Shamsuddin, 2020). In addition, the smaller average size of Islamic banks may impact their profitability and economies of scale, contributing to lower efficiency compared to conventional banks (Aulia et al., 2020).

These findings are consistent with earlier studies showing that larger bank size and higher profitability are generally correlated with greater efficiency (Hassan, 2003; Brown & Skully, 2003). Therefore, the observed inefficiencies may reflect broader structural challenges in the Islamic banking sector that were exacerbated during the pandemic.

Comparative Efficiency Analysis

To statistically assess whether a significant difference exists between the efficiency levels of Conventional Banks (CBs) and Islamic Banks (IBs) during the COVID-19 pandemic, an independent samples t-test was conducted. Table 6 summarizes the descriptive statistics and test results.

Table 6. Efficiency Comparison Between CBs and IBs (2020–2022)

Group	Obser-vations	Mean Efficiency	Std. Error	Std. Deviation	95% Conf. Interval
CBs	117	89.393	0.216	2.343	[88.964, 89.822]
IBs	27	82.270	1.223	6.355	[79.755, 84.784]
Combined	144	88.057	0.368	4.425	[87.328, 88.786]
Difference (CB - IB)	—	**7.123**	**1.242**	—	**[4.577, 9.669]**
t-statistic					**5.735**
Degrees of Freedom (Satterthwaite)					**27.65**
p-value (two-tailed)					**< 0.001**

(Source: Processed Data, 2024)

The descriptive results indicate a notable difference in mean efficiency: CBs reported a higher average efficiency score (89.393) compared to IBs (82.270) over the 2020–2022 period. The difference in means (7.123) is both statistically and practically significant, with a p-value < 0.001, well below the 0.05 threshold. This allows for the rejection of the null hypothesis (H_0) that there is no difference in efficiency between CBs and IBs.

The positive t-value of 5.735 supports the conclusion that CBs were significantly more efficient than IBs during the pandemic. These findings validate the alternative hypothesis (H_1) and are consistent with the literature suggesting structural and technological inefficiencies within the Islamic banking model (Abdul-Majid et al., 2017; Safiullah & Shamsuddin, 2022).

Interpretation and Theoretical Alignment

The lower efficiency scores of Islamic banks may be attributed to several interrelated factors. First, technological disparities between CBs and IBs have long been recognized as a constraint on the latter's efficiency. While CBs benefit from widespread adoption of standardized financial technologies and automated systems, IBs tend to operate across more diverse and fragmented platforms, often without full integration (Parsa, 2020). Studies by Abdul-Majid et al. (2017) and Safiullah and Shamsuddin (2022), using both meta-frontier and stochastic frontier approaches, reinforce this observation, concluding that conventional banks outperform Islamic banks due to superior technological integration.

Secondly, IBs face constraints imposed by Sharia compliance, which limits their product offerings and operational flexibility. The absence of standardized Islamic financial instruments across jurisdictions leads to inconsistent application and higher administrative costs (Johnes et al., 2014; Bitar et al., 2019). This complexity often results in lower operational scalability and higher marginal costs, reducing cost-efficiency compared to their conventional counterparts.

Despite generally strong performance in asset quality and risk management (Ali et al., 2021), Islamic banks struggle with capital adequacy and liquidity management, particularly during periods of economic stress (Bitar et al., 2019). These vulnerabilities were further exposed during the pandemic, when funding pressures and market volatility tested the resilience of banking systems worldwide.

In summary, the results of the independent samples t-test confirm that conventional banks in Indonesia demonstrated significantly higher efficiency than Islamic banks during the COVID-19 pandemic. This outcome aligns with existing literature emphasizing the role of bank size, operational scale, technological capability, and regulatory flexibility as key determinants of banking efficiency (Hassan, 2003; Brown & Skully, 2003). The pandemic has highlighted existing structural weaknesses within the Islamic banking model, underscoring the need for technological modernization, product standardization, and policy support to improve the sector's long-term efficiency and resilience.

Discussion

The results of this study provide meaningful insights into the comparative efficiency of Conventional Banks (CBs) and Islamic Banks (IBs) in Indonesia during the COVID-19 pandemic. Using the Stochastic Frontier Analysis (SFA) and independent samples t-test, the study finds that CBs consistently outperformed IBs in terms of cost efficiency from 2020 to 2022. The average efficiency score of CBs (89.39) significantly exceeded that of IBs (82.27), with the difference being statistically significant ($p < 0.001$). These results hold substantial implications when analyzed through the lens of existing theories and empirical studies.

The efficiency gap observed between CBs and IBs is well-documented in financial literature. According to Berger and Mester's (1997) theory of financial firm efficiency, cost efficiency is often associated with a bank's ability to adopt technology, optimize operations, and scale service delivery. Conventional banks, operating under well-established regulatory frameworks and standardized financial products, tend to benefit from economies of scale and scope, allowing for more efficient resource allocation and service automation. By contrast, Islamic banks, while adhering to Sharia principles that prohibit interest (riba) and emphasize risk-sharing, face inherent operational limitations. These include restrictions on permissible financial products, the complexity of Sharia-compliant contracts (e.g., *Murabahah, Mudarabah, Ijara*), and higher transaction and monitoring costs (Johnes et al., 2014). As Bitar et al. (2019) argue, these constraints can result in increased inefficiencies, particularly during periods of economic stress when financial innovation and rapid operational response are critical.

The results are consistent with the findings of Abdul-Majid et al. (2017) and Safiullah and Shamsuddin (2022), who employed meta-frontier and stochastic frontier models, respectively, and found that Islamic banks tend to lag behind their conventional counterparts in technological adoption. Limited use of integrated core banking systems and digital platforms in many IBs leads to lower technical efficiency, which directly impacts their cost structure and service delivery. Moreover, Parsa (2020) highlights that the diversity of banking technologies in Islamic institutions results in fragmented operations, contributing to inefficiencies and reduced responsiveness during crises. This becomes especially problematic during systemic shocks like the COVID-19 pandemic, where agility and digital capacity are central to sustaining service continuity and minimizing operational disruptions.

The observed decline in efficiency for both banking models—albeit more pronounced in IBs—supports theories on the cyclical sensitivity of banking efficiency. The study aligns with the Dynamic Efficiency Hypothesis, which posits that financial institutions may experience reduced efficiency in response to macroeconomic shocks, including liquidity constraints, credit risk surges, and volatility in deposit flows (Kumbhakar & Lovell, 2000). While CBs displayed slight declines in annual efficiency (from 0.896 in 2020 to 0.891 in 2022), the drop in IBs was more persistent and structurally embedded, declining from 0.824 to 0.820 over the same period. This pattern suggests that CBs were relatively more resilient, a finding consistent with Hassan (2003) and Brown and Skully (2003), who reported that larger banks with broader capital bases and diversified revenue streams are better positioned to absorb external shocks.

The lack of product standardization in Islamic banking is another critical issue influencing operational consistency and efficiency. Unlike conventional financial instruments, many Islamic banking products must be custom-structured to comply with Sharia interpretations, which vary by institution and jurisdiction. This legal and administrative complexity increases operational costs and inhibits scalability (Johnes et al., 2014). In addition, IBs face regulatory duality, having to comply with both conventional financial regulations and Islamic jurisprudence. While this provides ethical value and niche market differentiation, it also creates inefficiencies, particularly in capital and liquidity management (Ali et al., 2021).

The results underscore the importance of technological modernization and regulatory support in improving Islamic bank efficiency. Regulators such as Bank Indonesia and the Financial Services Authority (OJK) could play a more proactive role by offering targeted incentives for digital transformation, product innovation, and capacity building in the Islamic banking sector. Furthermore, the evidence suggests that efficiency gaps are not only a result of crisis conditions but also a reflection of long-standing institutional and operational disparities. This implies that interventions must go beyond short-term liquidity support and focus on long-term structural reforms, including harmonizing Sharia standards and enhancing human resource capabilities in Islamic financial institutions.

This study confirms that during the COVID-19 pandemic, Conventional Banks in Indonesia were significantly more efficient than Islamic Banks, a finding that reflects deeper structural, technological, and regulatory challenges faced by

IBs. While Islamic banks provide important financial alternatives grounded in ethical principles, enhancing their competitiveness and resilience will require coordinated efforts to modernize infrastructure, standardize products, and improve regulatory coherence. These findings contribute to the broader discourse on banking sector resilience and underscore the critical role of efficiency in navigating financial crises.

CONCLUSION

This study investigated the efficiency performance of Conventional Banks (CBs) and Islamic Banks (IBs) in Indonesia during the COVID-19 pandemic, using the Stochastic Frontier Analysis (SFA) and an independent samples t-test. The study sought to quantify cost efficiency levels, identify structural differences between bank types, and evaluate how these institutions adapted to pandemic-induced financial pressures. The empirical results demonstrate that: CBs consistently outperformed IBs in terms of cost efficiency during the pandemic. The t-test results confirm that the difference in efficiency between the two banking groups is statistically significant, with CBs exhibiting superior operational performance. While both bank types experienced a slight decline in efficiency over the three-year period, the drop was more pronounced and structurally persistent in IBs. Factors contributing to the lower efficiency of IBs include technological limitations, lack of product standardization, regulatory duality, and smaller institutional size, as supported by prior research.

These findings carry several important implications for theory, policy, and banking practice. From a theoretical standpoint, the results support efficiency models that link institutional scale, technological advancement, and operational flexibility to performance outcomes, particularly during crisis periods. For regulators and policymakers, the results suggest the need for targeted interventions in the Islamic banking sector—such as incentives for digital transformation, product innovation, and Sharia standard harmonization—to enhance resilience and competitiveness. For banking practitioners, the study highlights the value of investing in core technologies, strengthening liquidity and capital management, and aligning internal processes with evolving market demands, especially under conditions of economic uncertainty.

Despite its contributions, this study is subject to several limitations. The analysis is limited to secondary financial data and does not incorporate qualitative insights into managerial practices or internal decision-making

processes. The sample size for IBs (9 banks) is relatively small compared to CBs (39 banks), which may affect the generalizability of the findings. The study is constrained to the Indonesian context, and the results may not be fully applicable to Islamic and conventional banks operating under different regulatory or economic environments. To build on the present study, future research should consider expanding the dataset to include longer time periods or cross-country comparisons, allowing for more comprehensive insights into the structural efficiency of CBs and IBs. Additionally, incorporating qualitative data through interviews or surveys with bank executives could explore how operational strategies, digital adoption, and crisis management practices influence efficiency. Examining efficiency from a customer perspective, such as service accessibility, product innovation, or satisfaction, would provide a multidimensional assessment of banking performance. Furthermore, exploring the role of environmental, social, and governance (ESG) factors in shaping bank efficiency is crucial, particularly as sustainable finance gains prominence in global banking standards.

REFERENCES

Abdul-Majid, M., Falahaty, M., & Jusoh, M. (2017). Performance of Islamic and conventional banks: A meta-frontier approach. *Research in International Business and Finance, 42*, 1327–1335. https://doi.org/10.1016/j.ribaf.2017.07.069

Aigner, D., Lovell, C. A. K., & Schmidt, P. (1977). Formulation and estimation of stochastic frontier production function models. *Journal of Econometrics, 6*(1), 21–37. https://doi.org/10.1016/0304-4076(77)90052-5

Ali, A., Bashir, M. F., & Afridi, M. (2021). Do Islamic banks perform better than conventional banks? *Turkish Journal of Islamic Economics, 8*, 1–17. https://doi.org/10.26414/A082

Ali, Q., Akhtar, M. F., & Sadaqat, S. (2021). Performance analysis of Islamic and conventional banks in Pakistan: A comparative study. *Journal of Islamic Banking and Finance, 9*(2), 15–26.

Aulia, R., Ibrahim, A., & Tarigan, I. R. R. (2020). Operasionalisasi Lembaga Keuangan Baru Dan Dampaknya Terhadap Pertumbuhan Usaha Mikro. *JIHBIZ: Global Journal of Islamic Banking and Finance*, *2*(1), 57-81.

Azhari, A. R., & Wahyudi, R. (2020). Analisis kinerja perbankan syariah di Indonesia: Studi masa pandemi Covid-19 [Analysis of Islamic banking performance in Indonesia during the COVID-19 pandemic]. *Jurnal*

Ekonomi Syariah Indonesia, 10(2), 96–102. https://doi.org/10.21927/jesi.2020.10(2).96-102

Bauer, P. W., Berger, A. N., Ferrier, G. D., & Humphrey, D. B. (1998). Consistency conditions for regulatory analysis of financial institutions: A comparison of frontier efficiency methods. *Journal of Economics and Business, 50*(2), 85–114. https://doi.org/10.1016/S0148-6195(97)00072-6

Beck, T., Degryse, H., De Hass, R., & Van Horen, N. (2014). When arm's length is too far: Relationship banking over the business cycle. *Journal of Financial Economics, 33*(1), 1–25.

Berger, A. N., & Humphrey, D. B. (1997). Efficiency of financial institutions: International survey and directions for future research. *European Journal of Operational Research, 98*(2), 175–212. https://doi.org/10.1016/S0377-2217(96)00342-6

Berger, A. N., & Mester, L. J. (1997). Inside the black box: What explains differences in the efficiencies of financial institutions? *Journal of Banking & Finance, 21*(7), 895–947. https://doi.org/10.1016/S0378-4266(97)00010-1

Bidari, D. R., Hartono, D., & Sari, D. (2020). Bank employees in the era of COVID-19: Job security and operational risks. *Indonesian Journal of Employment Studies, 8*(1), 45–58.

Bitar, M., Hassan, M. K., & Walker, T. (2019). Political systems and the financial soundness of Islamic banks. *Journal of Financial Stability, 44*, 100695. https://doi.org/10.1016/j.jfs.2019.100695

Brown, K., & Skully, M. (2003). Banking efficiency in ASEAN: A frontier approach. In M. Balling, E. Gnan, & F. Lierman (Eds.), *Financial Services in the EU: Banking, Securities and Post-Trading* (pp. 273–294). Routledge.

Hadad, M. D., Hall, M. J. B., Kenjegalieva, K., Santoso, W., & Simper, R. (2003). Efficiency in Indonesian banking: Recent evidence (Loughborough University Economics Research Paper No. 03/17). *Loughborough University*. https://hdl.handle.net/2134/18973

Hamdani, R., Hasibuan, M. S., & Rachmawati, F. (2018). Factors affecting public trust in banking institutions. *Jurnal Ilmu Manajemen dan Bisnis, 9*(2), 101–110.

Hartono, D. (2009). Efficiency analysis of banking sectors in Indonesia: A study of conventional and Islamic banks. *Jurnal Ekonomi dan Keuangan Indonesia, 57*(4), 320–335.

Hassan, M. K. (2003). Cost, profit and X-efficiency of Islamic banks in Malaysia. In M. Iqbal & D. T. Llewellyn (Eds.), *Islamic Banking and*

Finance: New Perspectives on Profit Sharing and Risk (pp. 49–67). Edward Elgar.

Ibrahim, A., & Rosniar, R. (2024). Does intellectual capital efficiency translate into financial performance for Islamic banks in Indonesia? Evidence from the pre-pandemic period. *Qeios, 6*. https://doi.org/10.32388/CHBTCM.2.

Ismail, A. G. (2015). *Money, Islamic banks and the real economy*. Cengage Learning Asia.

Johnes, J., Izzeldin, M., & Pappas, V. (2014). A comparison of performance of Islamic and conventional banks 2004–2009. *Journal of Economic Behavior & Organization, 103*, S93–S107. https://doi.org/10.1016/j.jebo.2013.07.016

Kumbhakar, S. C., & Lovell, C. A. K. (2000). *Stochastic frontier analysis*. Cambridge University Press.

Kyshakevych, O., & Mazharov, O. (2018). Evaluation of efficiency in the banking sector: Methods and challenges. *Banking and Finance Review, 5*(3), 12–23.

Parsa, A. (2020). The impact of technology adoption on the efficiency of Islamic banks. *Journal of Islamic Accounting and Business Research, 11*(5), 1003–1021. https://doi.org/10.1108/JIABR-12-2018-0216

Pellegrina, L. D. (2012). Capital structure and efficiency in banking: A comparison between Islamic and conventional banks. *International Journal of Managerial Finance, 8*(1), 34–47.

Pratomo, D., & Ramdani, L. (2021). COVID-19 and the cost efficiency of Islamic and conventional banks in Indonesia. *Journal of Islamic Monetary Economics and Finance, 7*(1), 145–162.

Sa'diyah, C. (2021). Financial efficiency as a resilience indicator in Islamic banking. *Jurnal Keuangan Syariah, 5*(1), 56–67.

Safiullah, M., & Shamsuddin, A. (2022). Meta-frontier analysis of Islamic and conventional banks: Evidence from the GCC region. *Economic Modelling, 111*, 105817. https://doi.org/10.1016/j.econmod.2022.105817

Sukmaningrum, P. S., & Pohan, H. A. (2016). Comparative efficiency between Islamic and conventional banks during financial crisis in Indonesia. *Jurnal Ekonomi dan Perbankan Syariah, 4*(2), 105–114.

Wahyudi, I. (2020). Risk exposure and bank performance during COVID-19. *Jurnal Manajemen Perbankan, 9*(2), 77–84.

Wardhani, N. K., & Mongid, A. (2019). The inefficiency of Indonesian banks: An input–output approach. *Asian Journal of Economics and Banking, 3*(1), 1–14.

Zuhroh, I., Yudistianto, B., & Ashar, K. (2015). Efficiency of Islamic banking in Indonesia: A stochastic frontier approach. *International Journal of Applied Business and Economic Research, 13*(7), 5565–5584.