

Cost Efficiency of Malaysian Banks During Financial Liberalisation: A Stochastic Frontier Analysis of the Financial Sector Master Plan (2001–2010)

Muhammad Nizam Jalil^{1*}, Azni Tamjis², Siti Zuraidah Zainal³

^{1,2,3} Institute of Graduate Studies, Universiti Poly-Tech Malaysia, 56100, Kuala Lumpur, Malaysia.

Corresponding author: Muhammad Nizam Jalil Email: rujedah@uptm.edu.my DOI: https://doi.org/10.61688/ajpbs.v6i1.477	Article History			
	Received	Revised	Accepted	Published
	30 April 2025	20 May 2025	31 May 2025	30 June 2025

ABSTRACT

This study examines the cost efficiency of Malaysian banks around the Financial Sector Master Plan (FSMP), using bank-level data from 2000 to 2011 to bracket the 2001–2010 reform period. Using stochastic frontier analysis (SFA) with a translog cost function, the study evaluates 354 bank-year observations from Malaysian commercial and Islamic banks. The analysis incorporates input prices, output quantities, and environmental factors such as ownership, bank size, liquidity, reform phases, and the global financial crisis to capture structural and macroeconomic changes. The results show that average cost efficiency declined from 87.6% in 2000 to 71.8% in 2011, with an overall mean of 76.5%, indicating substantial adjustment costs during the reform period. Foreign ownership, Islamic specialisation, larger bank size, and the 2008–2010 global financial crisis were associated with higher estimated cost inefficiency, while the negative time trend is consistent with cost-reducing technological change over the study period. The findings suggest that liberalisation and restructuring involved short-term cost pressures and provide evidence relevant to the sequencing of future financial-sector reforms.

Keywords: *cost efficiency, stochastic frontier analysis, Malaysian banks, financial liberalisation, Financial Sector Master Plan*

How to Cite

Jalil, M. N., Tamjis, A., & Zainal, S. Z. (2025). Cost efficiency of Malaysian banks during financial liberalisation: A stochastic frontier analysis of the Financial Sector Master Plan (2001–2010). *The Asian Journal of Professional & Business Studies*, 6(1), 110–126. <https://doi.org/10.61688/ajpbs.v6i1.477>

Copyright © 2025 The Author(s)

Published by Universiti Poly-Tech Malaysia. This is an open access article under the Creative Commons Attribution (CC BY 4.0) licence:
<https://creativecommons.org/licenses/by/4.0/legalcode>

1. INTRODUCTION

The assessment of banking efficiency has long constituted a central theme in financial economics, particularly within the context of regulatory reform and market liberalisation. Cost efficiency represents a fundamental indicator of a bank's ability to minimise production costs while maintaining a given level of output. In a liberalising financial environment, cost efficiency also reflects the managerial capacity to respond effectively to new competitive pressures, technological requirements, and evolving regulatory frameworks (Berger & Mester, 1997). In Malaysia, banking efficiency gained more attention after the 1997–1998 Asian Financial Crisis, which revealed vulnerabilities in capital adequacy, risk management, and cost control within the domestic financial system (Sivalingam, 2008). In response, Bank Negara Malaysia (BNM) introduced the Financial Sector Master Plan (FSMP) in 2001, a ten-year reform blueprint designed to strengthen the financial system's institutional framework, enhance competition, and improve efficiency through a sequenced process of consolidation and liberalisation. The FSMP was implemented across three distinct phases: 2001 to 2003, 2004 to 2007, and 2008 to 2010. Each phase introduced progressively higher levels of openness, market discipline, and foreign participation.

The introduction of the FSMP marked a pivotal shift from a protected, domestically focused banking landscape toward a more competitive and market-oriented system. Over the course of the plan, the Malaysian banking industry underwent extensive consolidation, while the Islamic banking segment and technological infrastructure expanded (Sufian & Habibullah, 2013). These structural changes were expected to improve efficiency and productivity in the long term, but they also imposed substantial short-term adjustment costs as banks integrated systems, merged operations, and complied with evolving prudential standards. While numerous studies have examined the impact of financial liberalisation on overall banking performance, there remains limited evidence on how liberalisation specifically affected cost efficiency during the FSMP implementation period (Casu et al., 2017; Deng et al., 2014). Earlier studies, such as Zulkhibri and Sufian (2007) and Abdul-Majid et al. (2011), reported mixed outcomes, with short-term declines in efficiency attributed to restructuring costs and subsequent adjustment as reforms matured. However, the mechanisms and magnitude of these changes remain underexplored within the Malaysian context, particularly when distinguishing between consolidation, regulatory phases, and global financial conditions.

To address this research gap in the Malaysian context, this study employs the Stochastic Frontier Analysis (SFA) framework to estimate and analyse the cost efficiency of Malaysian banks using a 2000–2011 panel that brackets the 2001–2010 FSMP implementation period. Emphasising cost efficiency, rather than profit-based measures, isolates operational factors that directly reflect managerial performance, technological adaptation, and policy-induced structural change (Assaf et al., 2019; Zhang & Liu, 2024). This study adds empirical evidence on how a sequenced liberalisation strategy under the FSMP was associated with banks' cost efficiency in a developing economy. It also offers insights for policymakers seeking to balance financial liberalisation and prudential stability, showing that efficiency gains from reform are neither automatic nor immediate. Despite the FSMP concluding in 2010, revisiting the implementation period remains analytically important because it bridges post-crisis reconstruction and the foundations of Malaysia's modern banking system.

2. LITERATURE REVIEW

2.1. Financial Liberalisation and Banking Sector Reform

Financial liberalisation refers to the process of reducing government intervention and regulatory restrictions within the financial system to promote market-oriented allocation of financial resources. McKinnon (1973) and Shaw (1973) argued that financial repression, characterised by interest rate ceilings, directed credit programmes, and state intervention, constrains savings mobilisation and the efficient allocation of investment. Liberalisation, therefore, aims to improve financial intermediation, enhance competition, stimulate innovation, and support economic growth.

In developing economies, financial liberalisation is often introduced to strengthen the banking system and increase efficiency. Liberalisation policies include deregulating interest rates, removing entry barriers, opening capital accounts, and expanding foreign bank participation. According to McKinnon (1973), market-determined interest rates encourage savings and improve capital allocation efficiency. Similarly, Shaw (1973) argued that financial deepening contributes positively to economic development by enhancing investment opportunities and productivity.

Despite its potential benefits, liberalisation also introduces significant risks. Demirgüç-Kunt and Detragiache (1998) found that poorly sequenced financial liberalisation may increase banking fragility and financial crises, especially in countries with weak regulatory institutions. Increased competition may encourage excessive risk-taking, speculative lending, and deterioration in asset quality. Consequently, strong prudential supervision and institutional reforms are necessary to ensure stability during liberalisation.

Malaysia implemented substantial banking reforms following the Asian Financial Crisis of 1997–1998. The crisis exposed weaknesses in the domestic banking sector, including high non-performing loans, weak risk management, and excessive credit growth. In response, Bank Negara Malaysia (BNM) introduced extensive restructuring programmes involving recapitalisation, consolidation, and stronger prudential regulation. One major initiative was the consolidation programme that reduced domestic banking institutions to ten anchor banking groups.

The Financial Sector Master Plan (FSMP) 2001–2010 was Malaysia's most comprehensive financial reform framework. The FSMP aimed to strengthen resilience, improve competitiveness, promote Islamic banking, encourage technological innovation, and gradually liberalise the financial sector. BNM played a critical role in implementing risk-based supervision, strengthening corporate governance, improving capital adequacy standards, and facilitating banking consolidation. The FSMP also encouraged foreign participation and modernisation of banking operations through digital technologies and enhanced financial infrastructure.

Fries and Taci (2005) argued that banking reforms and liberalisation can improve cost efficiency through stronger competition and better managerial practices. However, transitional restructuring costs and organisational adjustments may initially reduce performance before long-term efficiency gains emerge. Therefore, evaluating banking efficiency during the FSMP period provides important insights into the effectiveness of financial liberalisation policies in Malaysia.

2.2. Concept of Cost Efficiency in Banking

Researchers have frequently used efficiency measures to evaluate the performance and reform outcomes of the banking sector. Among these measures, cost efficiency is particularly important as it reflects how effectively banks minimise input costs while maintaining output levels. Across developing countries, cost efficiency serves as a benchmark for both managerial performance and policy effectiveness, especially during periods of structural transformation and financial liberalisation (Berger & Mester, 1997; Casu & Girardone, 2009). For Malaysia, cost efficiency became a key concern after the Asian Financial Crisis of 1997–1998, which exposed weaknesses in bank capitalisation, risk management, and operational cost control (Sufian, 2010). As part of its post-crisis reform agenda, BNM launched the ten-year FSMP in 2001 as a comprehensive framework to strengthen and modernise Malaysia's financial system. Assessing cost efficiency over this decade of regulatory reform is therefore essential to understand how financial liberalisation and institutional restructuring influenced the operational performance of Malaysian banks.

Cost efficiency in banking measures how closely a bank's observed costs align with the optimal (minimum) cost of producing its outputs, given its input prices and production technology (Aigner et al., 1977). It indicates managerial effectiveness in controlling operating costs while maintaining service quality. Studies typically estimate cost efficiency using Stochastic Frontier Analysis (SFA) or Data Envelopment Analysis (DEA). The stochastic frontier method, introduced by Aigner et al. (1977) and Meeusen and van Den Broeck (1977), has been widely applied in banking research because it distinguishes inefficiency from random error, thereby allowing for robust statistical inference (Battese & Coelli, 1995). In the context of financial reform, SFA provides a suitable framework for assessing how banks respond to deregulation, technological change, and macroeconomic shocks. As the literature shows, financial liberalisation can improve efficiency over time but may initially increase costs due to restructuring, learning costs, and competitive pressures (Fries & Taci, 2005; Kumbhakar & Sarkar, 2003; Leightner & Lovell, 1998). For example, studies in India, Thailand, and other transition economies found that efficiency tends to fall in the early stages of financial liberalisation as banks invest heavily in technology and governance systems, and it could only recover once reforms stabilised (Fries & Taci, 2005; Wonglimpiyarat, 2008). Similarly, Malaysia's experience under the FSMP reflected a phased approach that combined consolidation with gradual deregulation to prevent abrupt destabilisation in the existing financial system. Empirical evidence on Malaysian banking efficiency reflects these transitional effects. Sufian (2010) and Zulkhibri and Sufian (2007) found that cost efficiency declined during the early liberalisation period, largely because of merger-related integration costs and investments in information systems. Abdul-Majid et al. (2011) reported similar patterns, explaining that Islamic

banks, in particular, faced temporary inefficiencies as they expanded and diversified early on. Mohd Tahir et al. (2010) found that domestic banks were generally more cost-efficient than foreign banks, partly because of regulatory limitations on foreign banks. Meanwhile, Hasan et al. (2012) observed that although average efficiency remained relatively high, differences across ownership types and bank sizes persisted throughout the FSMP decade.

These findings align with international banking evidence that structural and regulatory change can generate short-term inefficiency even as long-term competitiveness improves. During the FSMP implementation period, Malaysian banks faced multiple simultaneous adjustments, including post-merger integration, adoption of the New Interest Rate Framework (NIRF), growing competition from foreign entrants, and compliance with new risk-based capital standards. Each development changed existing cost structures and required significant resource reallocation. Hence, the resulting short-term inefficiencies were a natural by-product of transformation rather than an indication of declining performance (Dadzie & Ferrari, 2019). Therefore, examining cost efficiency during the FSMP period could offer additional insight into how Malaysian banking institutions respond to these adjustments. The FSMP was not merely a deregulation exercise. Rather, it represented a prudently sequenced reform designed to balance financial liberalisation with stability. As such, assessing cost-efficiency outcomes helps determine whether the policy achieved its intended objectives of strengthening competitiveness while maintaining systemic soundness. It also provides important lessons for other emerging countries, where the success of financial liberalisation hinges on the careful timing and sequencing of regulatory reforms. (Nasim et al., 2025). In addition, the FSMP period coincided with the emergence of digital banking, automation, and electronic payment systems, all of which required substantial capital investment and affected banks' overall cost efficiency (Naveed et al., 2025). The significant technological progress observed in later years, as shown by the negative time trend in stochastic frontier estimates, suggests these investments gradually yielded efficiency gains after 2010. Thus, understanding the dynamics of cost efficiency over this period helps explain how the sector evolved from a protected, domestically focused industry into a modern, competitive, and innovation-driven financial system (Tarawneh et al., 2024).

In summary, the literature offers a coherent understanding of Malaysia's experience with financial liberalisation, highlighting the balance between reform costs and long-term gains. In this context, cost efficiency is a critical indicator of both operational soundness and effective policy implementation. Although the FSMP initially increased transitional inefficiencies associated with structural reforms and regulatory realignment, these were subsequently offset by improvements in technological capacity, managerial practices and institutional resilience. Therefore, investigating cost efficiency during the FSMP implementation period offers not only empirical insight into the performance of Malaysian banks but also broader policy lessons on how emerging economies can balance financial liberalisation and stability in the pursuit of sustainable financial development (Duygun et al., 2015).

2.3. Stochastic Frontier Analysis (SFA) Theory and Methodology

Stochastic Frontier Analysis (SFA) is one of the most widely used approaches for measuring efficiency in banking and financial institutions. The methodology was independently developed by Aigner, Lovell, and Schmidt (1977), and Meeusen and van den Broeck (1977). SFA estimates an efficient frontier while separating random statistical noise from inefficiency effects.

The central concept of SFA is the frontier production or cost function. Banks operating on the frontier are considered fully efficient, while those below the frontier are regarded as inefficient. Unlike deterministic frontier methods, SFA recognises that deviations from the frontier may result not only from managerial inefficiency but also from random shocks, measurement errors, and external economic conditions.

The stochastic frontier model decomposes the error term into two components: a symmetric random error term and a non-negative inefficiency term. The random error captures external influences beyond managerial control, while the inefficiency component reflects operational shortcomings. This distinction is a major advantage of SFA over non-parametric approaches such as Data Envelopment Analysis (DEA).

DEA constructs an efficiency frontier using linear programming techniques without specifying a functional form. Although DEA is flexible and does not require distributional assumptions, it assumes that all deviations from the frontier reflect inefficiency. As a result, DEA is highly sensitive to measurement errors and outliers. In contrast, SFA incorporates

statistical noise and allows formal hypothesis testing, making it better suited to banking studies where macroeconomic fluctuations and regulatory changes influence performance.

Battese and Coelli (1995) extended the stochastic frontier framework by introducing models that allow inefficiency effects to vary over time and depend on explanatory variables. Their one-stage panel data approach has become widely used in banking efficiency research because it estimates frontier parameters and determinants of inefficiency simultaneously. Time-varying inefficiency models are particularly useful for analysing banking reforms because they capture dynamic changes in efficiency during periods of liberalisation and restructuring.

SFA has therefore become an important methodological tool in banking studies examining the effects of deregulation, mergers, foreign bank participation, technological change, and financial sector reforms. Its ability to distinguish random disturbances from inefficiency makes it well-suited to evaluating Malaysian banking performance during the FSMP period.

2.4. Empirical Studies on Banking Efficiency

A substantial body of empirical literature has examined banking efficiency across developed and developing economies. In developed countries such as the United States and European economies, deregulation and technological innovation have generally improved banking productivity and operational performance. Berger and Mester (1997) found that efficiency differences among US banks were strongly associated with managerial practices, technological capabilities, and risk management quality.

Studies in European banking sectors similarly reported that liberalisation and integration increased competitive pressures and encouraged efficiency improvements. However, consolidation and mergers produced mixed outcomes: some banks gained economies of scale, while others faced integration challenges and increased operational complexity.

In Japan, banking reforms following financial instability during the 1990s also emphasised restructuring and recapitalisation. Empirical evidence suggests that technological modernisation and stronger regulatory frameworks contributed to improved banking performance, although efficiency gains varied across institutions.

In developing and transition economies, banking liberalisation has produced diverse outcomes depending on institutional quality and regulatory capacity. Fries and Taci (2005) examined banking efficiency in transition economies and found that competitive banking environments and foreign ownership positively influenced cost efficiency. Foreign banks often introduced superior managerial practices, advanced technologies, and stronger governance systems.

Studies on Asian banking sectors following the Asian Financial Crisis highlighted the importance of restructuring and consolidation. In Thailand and Indonesia, post-crisis reforms focused on recapitalisation, prudential regulation, and foreign participation. Although efficiency improved in the long run, short-term restructuring costs and non-performing loans reduced performance during the transition period.

Research in China and India has also demonstrated that banking reforms and market-oriented policies contributed to greater operational efficiency. Technology adoption, digital banking expansion, and competition reforms improved service delivery and cost management. Nevertheless, state ownership and regulatory constraints continued to influence efficiency performance in many developing banking systems.

Overall, empirical evidence suggests that financial liberalisation and banking reforms can improve efficiency, but outcomes depend heavily on regulatory quality, institutional development, and the sequencing of reform policies.

2.5. Empirical Studies on Malaysian Banking Efficiency

Numerous studies have examined banking efficiency in Malaysia, particularly in relation to financial liberalisation, mergers, Islamic banking, and foreign bank participation. Malaysian banking reforms after the Asian Financial Crisis created an important context for evaluating changes in efficiency.

Sufian (2010) analysed Malaysian banks' efficiency performance and found that consolidation and restructuring programmes contributed positively to operational efficiency. Larger banking institutions generally benefited from economies of scale, improved technology adoption, and stronger managerial capabilities. However, some banks experienced adjustment difficulties following mergers and restructuring exercises.

Zulkhibri and Sufian (2007) compared domestic and foreign Islamic banks in Malaysia and reported significant differences in efficiency levels. Foreign banks tended to demonstrate higher managerial efficiency due to advanced technologies, international expertise, and superior governance systems. Domestic banks, however, benefited from stronger local market knowledge and government support.

Abdul-Majid et al. (2010) examined efficiency differences between Islamic and conventional banks across multiple countries and reported differences in input use and efficiency across banking models. Hasan and Dridi (2010) examined Islamic and conventional banks during the global financial crisis and found differences in resilience and performance across the two banking models. Together, these studies indicate that banking specialisation may be associated with distinct operating structures and efficiency patterns.

Several Malaysian studies also examined the FSMP's impact on banking performance. Interest-rate liberalisation, increased competition, foreign bank entry, and technological modernisation improved operational efficiency across many banking institutions. Banks invested heavily in information technology, internet banking platforms, ATM networks, and electronic payment systems to cut operating costs and improve customer service.

Research further indicates that mergers and consolidations enhanced scale efficiency in Malaysian banking. Consolidating numerous small banking institutions into larger anchor banks strengthened capital adequacy and improved operational resilience. However, integration costs and organisational restructuring initially reduced efficiency for some institutions during the adjustment phase.

Overall, the Malaysian banking literature suggests that post-crisis reforms and FSMP initiatives contributed significantly to improvements in banking efficiency, competitiveness, and financial stability.

2.6. Financial Sector Master Plan (FSMP) and Banking Transformation

The Financial Sector Master Plan (FSMP) 2001–2010 represented a major transformation strategy for Malaysia's financial sector. Introduced by Bank Negara Malaysia, the FSMP aimed to create a resilient, efficient, competitive, and dynamic financial system to support long-term economic growth.

One of the FSMP's primary objectives was banking consolidation. The consolidation programme reduced the number of domestic banking institutions and created stronger banking groups with improved capital strength and operational capabilities. Larger banking institutions were expected to achieve economies of scale, improve cost efficiency, and strengthen risk management systems.

The FSMP also promoted gradual liberalisation and foreign participation in the Malaysian banking sector. Foreign banks introduced new technologies, innovative products, and advanced management techniques, thereby increasing competitive pressure within the industry. This encouraged domestic banks to modernise operations and improve service quality.

Prudential regulation and risk-based supervision constituted another major component of the FSMP. Bank Negara Malaysia strengthened supervisory frameworks, corporate governance standards, and capital adequacy requirements to improve financial stability. Risk management practices became increasingly important following lessons from the Asian Financial Crisis.

The FSMP also introduced the New Interest Rate Framework (NIRF), which enhanced market-based pricing mechanisms and improved monetary policy transmission. The framework encouraged greater flexibility in interest rate determination while promoting efficient allocation of financial resources.

Technological development also became a critical focus of the FSMP. Banks expanded electronic banking services, digital payment systems, and internet banking platforms to improve operational efficiency and customer accessibility. Technological innovation reduced transaction costs and enhanced competitiveness within the banking sector.

The FSMP therefore represented a comprehensive reform agenda integrating liberalisation, prudential regulation, technological modernisation, and institutional restructuring. Evaluating banking efficiency during this period provides important evidence regarding the effectiveness of Malaysia's financial sector transformation policies.

2.7. Research Gap

Although extensive literature exists on banking efficiency and financial liberalisation, several important gaps remain in the Malaysian context. First, many previous studies focus only on specific aspects of banking efficiency, such as Islamic banking, mergers, or foreign bank participation, rather than examining the broader impact of financial sector reforms.

Second, relatively few studies analyse the entire FSMP period from 2001 to 2010. Most research examines shorter sub-periods or focuses on immediate post-crisis restructuring effects. Consequently, evidence on long-term efficiency dynamics across the full implementation of the FSMP remains limited.

Third, while various methodologies have been applied in banking efficiency research, fewer Malaysian studies employ stochastic frontier analysis to measure cost efficiency during the liberalisation period. Since SFA distinguishes random shocks from inefficiency effects, it provides a more appropriate framework for evaluating banking performance during periods of economic and regulatory transition.

Fourth, empirical research on changes in dynamic efficiency during the sequential implementation of reforms remains limited. Banking reforms often produce short-term adjustment costs followed by long-term efficiency gains. Existing studies rarely examine these transitional dynamics comprehensively.

Therefore, this study contributes to the literature by examining the evolution of cost efficiency in Malaysian banks during the FSMP period using stochastic frontier analysis. The study integrates financial liberalisation theory, banking sector reforms, and efficiency measurement within a unified analytical framework to deepen understanding of banking transformation in Malaysia.

3. METHODOLOGY

This study employs the Stochastic Frontier Analysis (SFA) approach to estimate the cost efficiency of Malaysian banks during the Financial Sector Master Plan (FSMP) period. SFA is widely used in banking efficiency studies because it distinguishes inefficiency from random statistical noise, allowing a more accurate assessment of bank performance under varying economic and regulatory conditions. Following Berger and Mester (1997), cost efficiency measures the extent to which a bank minimises total costs relative to a best-practice bank that produces the same level of output under similar operating conditions.

The stochastic cost frontier model is specified as follows:

$$\ln TC_{it} = f(w_{it}, y_{it}, c_{it}, z_{it}, \beta) + v_{it} + u_{it}$$

where $\ln TC_{it}$ represents the natural logarithm of total cost for bank i at time t . The function $f(\cdot)$ denotes the translog cost frontier, while w_{it} represents the vector of input prices, y_{it} denotes the vector of outputs, c_{it} represents control variables, and z_{it} denotes environmental variables. The parameter vector β captures the coefficients to be estimated.

The composite error term consists of two components. The first component, v_{it} , represents random statistical noise arising from measurement errors, external shocks, and other uncontrollable factors. It is assumed to follow a normal distribution with mean zero and variance σ^2_v . The second component, u_{it} , represents cost inefficiency and is assumed to be non-negative and one-sided. This term captures deviations from the efficient frontier attributable to managerial inefficiency and operational shortcomings.

Cost efficiency is estimated as the ratio of the minimum possible cost to the actual observed cost. The efficiency score

ranges from 0 to 1, with values closer to 1 indicating higher efficiency. A bank with a score of one is considered fully efficient relative to the best-practice frontier.

To estimate the cost frontier, this study adopts the translog functional form due to its flexibility and widespread application in banking efficiency literature. The translog specification allows for interaction effects among outputs, input prices, and control variables without imposing restrictive assumptions regarding production technology. The estimated translog cost function is expressed as:

$$\begin{aligned} \ln(TC_{it} / W3_{it}) = & \alpha_0 + \sum \beta_n \ln(W_{nit} / W3_{it}) + \sum \delta_k \ln Y_{kit} \\ & + 1/2 \sum \sum \beta_{nj} \ln(W_{nit} / W3_{it}) \ln(W_{jit} / W3_{it}) \\ & + 1/2 \sum \sum \delta_{km} \ln Y_{kit} \ln Y_{mit} \\ & + \sum \eta_{nk} \ln(W_{nit} / W3_{it}) \ln Y_{kit} \\ & + \sum \chi_r \ln C_{rit} \\ & + \text{interaction and time trend terms} \\ & + v_{it} + u_{it} \end{aligned}$$

The model incorporates time trend variables to capture technological progress and structural changes over the sample period. In addition, interaction terms between inputs, outputs, and control variables are included to account for non-linear relationships within banking operations.

This study applies the one-stage estimation procedure developed by Battese and Coelli (1995). Under this framework, inefficiency effects are estimated simultaneously with the stochastic frontier model, allowing environmental factors to directly influence inefficiency levels. This approach is preferred because it avoids inconsistency problems associated with two-stage estimation methods.

Control variables are incorporated into the deterministic component of the frontier to capture heterogeneity across banks. These variables directly influence banking operations and production technology. Environmental variables are included within the inefficiency component to explain variations in cost efficiency across institutions.

3.1. Data and Variables

The study utilises an unbalanced panel dataset comprising Malaysian commercial and Islamic banks from 2000 to 2011. The sample includes 2000 as a pre-FSMP baseline, the full 2001–2010 FSMP implementation period, and 2011 as an immediate post-FSMP observation. It also spans the Global Financial Crisis, providing a broader context for examining banking efficiency during financial liberalisation and economic restructuring.

Financial data were obtained from proprietary banking databases and annual reports. Investment banks were excluded because their operational characteristics differ significantly from commercial and Islamic banking institutions. Observations with incomplete financial information, zero non-performing loans, or missing fixed asset data were also excluded. The final sample consists of 354 bank-year observations across the 2000–2011 study period.

The study adopts the intermediation approach introduced by Sealey and Lindley (1977), which views banks as financial intermediaries transforming deposits, labour, and capital into loans and earning assets. This approach is widely used in banking efficiency studies because it incorporates interest expenses as a major component of banking costs.

Total cost (TC) is used as the dependent variable and includes interest expenses, personnel expenses, depreciation, provisions, and other operating costs. Three input price variables are included in the model: the price of funds (W1), measured as interest expenses divided by total deposits and borrowings; the price of labour (W2), measured as personnel expenses divided by total assets; and the price of physical capital (W3), measured as operating and administrative expenses divided by fixed assets.

The output variables consist of loans (Y1), investments (Y2), and other earning assets (Y3). To account for differences in

banking operations and financial conditions, the model also incorporates control variables, including asset quality, capital adequacy, liquidity, and time trends.

In addition, several environmental variables are included to explain variations in inefficiency across banks. These variables include ownership structure, banking specialisation, stages of financial liberalisation under the FSMP, the Global Financial Crisis, bank size, market concentration, and market share.

The inclusion of these variables enables the model to capture the effects of financial liberalisation, banking consolidation, technological development, and regulatory reforms on the cost efficiency of Malaysian banks. Consequently, the methodology provides a comprehensive framework for evaluating the dynamic efficiency performance of Malaysian banking institutions throughout the FSMP reform period.

Table 1
Descriptive Statistics for Inputs, Outputs, Control, and Environmental Variables, 2000–2011

Variables		Description	Mean	Std Dev.	Min.	Max.
Dependent variables						
TC	Total Cost (MYR million)	Variable operating costs of deposits, personnel and investments	1,438.86	97.97	17.05	12,413.74
Independent variables/outputs						
Y1	Loans (MYR million)	Total loans, net of interest in suspense and NPL	15,273.20	19,496.82	19.85	99,506.07
Y2	Investments (MYR million)	Dealing securities, investment securities, government and private debt securities	3,393.27	4,349.12	0.05	27,420.31
Y3	Other earning assets (MYR million)	Interbank deposits in other banks	4,473.50	5,374.63	25.04	30,884.64
Independent variables/input prices						
W1	Price of funds (%)	Interest expenses on deposits / total deposits and borrowings	2.41	0.81	0.25	10.06
W2	Price of labour (%)	Personnel expenses/total assets	0.64	0.25	0.03	1.85
W3	Price of physical capital (%)	Operating and administrative expenses / fixed assets	11.50	13.89	0.00	121.02
Control Variables						
C1	Capital adequacy (%)	Capital/total assets	10.43	6.38	1.19	36.85
C2	Asset quality (%)	Non-performing loans/loans	8.00	7.72	0.07	54.23
C3	Liquidity (%)	Loans/deposits	66.79	22.55	0.63	120.34
T	Time trend	T1 = 2000, T2 = 2001,..., T12 = 2011	6.95	3.51	1.00	12.00
Environmental Variable						
Z1	Ownership	Foreign = 1, domestic = 0 (dummy)	0.47	0.50	0.00	1.00
Z2	Specialisation	Islamic banks = 1, conventional banks = 0 (dummy)	0.25	0.43	0.00	1.00
Z3	Deregulation FSMP phase 2	Dummy for 2004 – 2007 = 1, otherwise = 0	0.31	0.46	0.00	1.00
Z4	FSMP Phase 3 / 2011 extension	Dummy for 2008–2011 = 1 (Phase 3 plus 2011 post-FSMP observation), otherwise = 0	0.40	0.49	0.00	1.00
Z5	Effect of global financial crisis on Malaysia	Dummy for 2008 – 2010 = 1, otherwise = 0	0.31	0.46	0.00	1.00
Z6	Bank size (MYR million)	Total assets	32,320.00	41,679.13	721.17	229,504.17

Z7	Market concentration (%)	Herfindahl–Hirschman index (concentration of banks' assets)	7.79	0.81	6.58	8.73
Z8	Market share (%)	Bank deposits/total banking deposits	3.39	3.98	0.08	19.69

4. FINDINGS AND DISCUSSION

Based on the estimated cost model, the reported first-order coefficients for the prices of funds (β_1), labour (β_2), and physical capital (β_3) are 0.6720, 0.3711, and -0.0431, respectively. The positive coefficients for W1 and W2 indicate that higher funding and labour prices are associated with higher total cost, whereas the small negative W3 coefficient should be interpreted cautiously within the normalised translog specification. For the output variables, the reported coefficients indicate positive cost effects for loans (Y1) and investments (Y2), while other earning assets (Y3) show a small negative coefficient. The sum of the three output coefficients is 1.0382, suggesting that a proportional expansion of outputs is associated with a slightly more than proportional increase in total cost, which is consistent with diseconomies of scale at the point of evaluation. The time trend coefficient is negative (-0.04) and statistically significant at the 5% level, a pattern consistent with cost-reducing technological change over the study period.

The ownership variable, i.e., domestic versus foreign banks ($\psi_1 = 1.0956$, $p < 0.01$), was positive and statistically significant in the inefficiency model, indicating higher estimated cost inefficiency for foreign banks than for domestic banks during the study period. This differs from evidence in some emerging markets where foreign participation has been associated with greater efficiency (Claessens et al., 2001), and should therefore be interpreted as specific to the Malaysian institutional and regulatory context. The specialisation variable, i.e., Islamic versus conventional banks ($\psi_2 = 0.3837$, $p < 0.10$), was also positive in the inefficiency model, indicating higher estimated cost inefficiency for Islamic banks. A plausible interpretation is that the expansion and institutional development of Islamic banking during the mid-2000s involved transitional administrative, infrastructure, and compliance costs (Abdul-Majid & Hassan, 2011).

The global financial crisis variable ($\psi_5 = 0.6225$, $p < 0.05$) was positive and statistically significant in the inefficiency model, indicating higher estimated cost inefficiency during 2008–2010. The global liquidity shock and deteriorating asset quality likely increased operating costs through loan-loss provisioning, portfolio restructuring, and strengthened risk-management practices. The bank size variable ($\psi_6 = 2.4994$, $p < 0.01$) was also positive and statistically significant, indicating higher estimated cost inefficiency among larger banks. This is consistent with the possibility that post-merger complexity, integration costs, and managerial redundancies reduced cost discipline during the adjustment period (Kwan, 2006; Sufian, 2004). The result is also consistent with the “quiet life” hypothesis, under which market power can weaken incentives for strict cost control (Berger & Hannan, 1998). The market concentration variable ($\psi_7 = 3.6821$) was positive but statistically insignificant, so no statistically reliable relationship with inefficiency can be inferred. In contrast, the market share variable ($\psi_8 = -2.9020$, $p < 0.01$) was negative and statistically significant, indicating lower estimated inefficiency among banks with larger market shares, consistent with the Relative Market Power perspective (Berger, 1995). Among the control variables in the deterministic cost function, asset quality ($\chi_2 = 0.1396$) was positive but statistically insignificant, while liquidity, measured as the loans-to-deposits ratio ($\chi_3 = -0.8275$, $p < 0.01$), was negatively associated with total cost, holding other factors constant. Because these variables enter the deterministic cost component, they should not be interpreted directly as inefficiency effects (Girardone et al., 2004).

4.1. Cost Efficiency Scores

As indicated in Table 2, the overall mean cost-efficiency score for Malaysian banks during 2000–2011 is 0.7655 (76.5%). Under the stated cost-efficiency definition, this implies that banks could potentially reduce observed costs by about 23.5% on average to reach the estimated best-practice frontier, holding outputs and input prices constant. This magnitude is broadly comparable with earlier SFA-based banking studies (Berger & DeYoung, 2001; Bonin et al., 2005; DeYoung, 1998). The initial analytical window (2000–2003) combines the 2000 pre-FSMP baseline with Phase 1 of the FSMP (2001–2003). Following the 1997–1998 Asian Financial Crisis, Malaysia pursued bank consolidation and restructuring rather than widespread bank closures, creating transitional costs related to mergers, branch rationalisation, staffing, and technology integration (Abd Kadir et al., 2010; Abdul-Majid & Hassan, 2011; Sufian, 2004).

Table 2
Average SFA Cost Efficiency Scores, 2000–2011

Year	Count	Mean	Standard Deviation	Minimum	Maximum
2000	24	0.8760	0.1519	0.2600	0.9721
2001	26	0.8614	0.1537	0.2698	0.9787
2002	24	0.8523	0.1524	0.3253	0.9725
2003	24	0.8103	0.1528	0.3731	0.9582
2004	25	0.7596	0.1734	0.2404	0.9270
2005	26	0.7913	0.1554	0.2088	0.9418
2006	29	0.7450	0.2095	0.2033	0.9317
2007	31	0.7648	0.1440	0.2704	0.9402
2008	36	0.7098	0.1783	0.0509	0.9324
2009	37	0.7025	0.1877	0.0296	0.9271
2010	37	0.7065	0.1884	0.0738	0.9478
2011	35	0.7177	0.2157	0.0848	0.9702
2000-2003	98	0.8502	0.1523	0.2600	0.9787
2004-2007	111	0.7647	0.1707	0.2033	0.9418
2008-2011	145	0.7090	0.1909	0.0296	0.9702
2000-2011	354	0.7655	0.1834	0.0296	0.9787

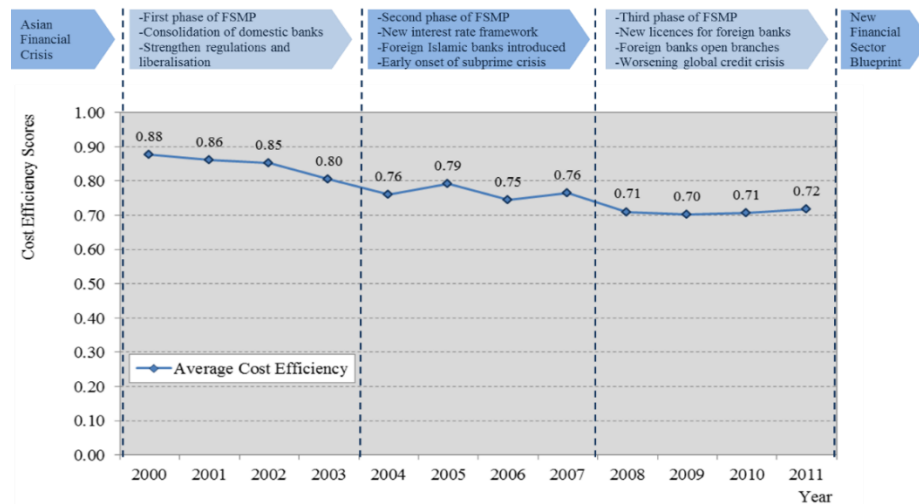
In the second phase of the FSMP (2004–2007), BNM introduced NIRF to promote more efficient pricing of financial products. Following the removal of BNM’s intervention rate, Malaysian banks were able to price their funding costs and revenues according to their own cost structures and to compete for customers using independent interest rate pricing. This interest-rate deregulation aimed to enhance efficiency, productivity, innovation, and profitability within the banking system (Berger & Mester, 2003; Leightner & Lovell, 1998; Sensarma, 2006). As a result of interest-rate deregulation, banks needed to adjust their inputs and outputs to remain competitive. During this period, cost efficiency scores increased slightly in 2005, following the liberalisation of the Base Lending Rate (BLR), indicating greater price competition among Malaysian banks. Towards the end of the second phase of the FSMP, cost efficiency scores fell marginally partly due to significant losses incurred by one Islamic bank and the entry of several new foreign Islamic banks. The overall average cost-efficiency scores declined because newly established foreign Islamic banks incurred inherently higher operational costs in their early stages (Sufian, 2010).

In the final analytical window (2008–2011), which comprises FSMP Phase 3 (2008–2010) and the 2011 immediate post-FSMP observation, Malaysian banks were initially relatively insulated from the early stages of the U.S. subprime crisis. However, by mid-2008, weakening global demand adversely affected Malaysia’s real sector (Elekdag et al., 2012). Malaysia’s GDP subsequently contracted in 2009, while banks faced greater pressure from loan restructuring and risk management. The downward trend in cost efficiency during this window is consistent with higher operating costs associated with managing deteriorating credit conditions (Ibrahim, 2011). BNM also reduced the overnight policy rate during the crisis period, requiring banks to adjust funding prices, portfolios, and operations under rapidly changing market conditions. In addition, Basel II implementation between 2008 and 2010 required further investment in technology, physical assets, external expertise, and specialised labour.

Overall, the analysis of cost efficiency from 2000 to 2011 reveals a complex transition characterised by alternating periods of efficiency gains and declines that broadly mirror the sequencing of reform and macroeconomic shocks. The persistence

of moderate efficiency levels indicates that the banking system continued operating through substantial structural adjustment, while the improvement from 0.7025 in 2009 to 0.7177 in 2011 suggests some stabilisation toward the end of the sample. Because the dataset extends only one year beyond the FSMP, however, the results should not be interpreted as establishing long-run post-FSMP efficiency gains.

Figure 1
Average SFA Cost Efficiency Scores of Malaysian Banks, 2000–2011



5. CONCLUSION

This study's SFA analysis reveals a downward trend in Malaysian banks' cost efficiency over the 2000–2011 study period, which brackets the 2001–2010 FSMP. Average cost efficiency was 76.5%, declining from 87.6% in 2000 to 71.8% in 2011. The pattern is consistent with substantial transitional and structural costs associated with consolidation, liberalisation, and regulatory adjustment. The initial reform period involved post-crisis consolidation and rationalisation, while the second phase introduced greater interest-rate flexibility and competitive pressure. The 2008–2010 global financial crisis added further pressure through weaker external demand, credit-quality concerns, and more intensive risk management (Elekdag et al., 2012; Ibrahim, 2011).

The negative and statistically significant time coefficient is consistent with cost-reducing technological change during the study period. The modest improvement in average efficiency after 2009 suggests some stabilisation as banks adjusted to operational and regulatory changes. However, because the sample ends in 2011, the analysis does not establish the long-run post-FSMP effect of liberalisation. Rather, the evidence supports a more cautious conclusion: financial-sector reform was associated with substantial short-term cost pressures, while technological and institutional adjustment was still underway. For policymakers, the results underscore the importance of careful reform sequencing, supervisory capacity, and sufficient adjustment time when pursuing competitiveness alongside financial stability (Sufian & Habibullah, 2013).

6. ACKNOWLEDGEMENT

The authors gratefully acknowledge the institutional support of Prince Sultan University and its ESGAL Lab, as well as Universiti Poly-Tech Malaysia, whose collaboration and resources made this study possible.

7. CONFLICT OF INTEREST

The authors declare no known competing financial interests or personal relationships that could have influenced the work reported in the paper.

8. AUTHOR CONTRIBUTION STATEMENT

Muhammad Nizam Jalil contributed to the conceptualization, research design, and writing of the original draft. Azni Tamjis was responsible for data collection, analysis, and result validation. Siti Zuraidah Zainal provided supervision, critical review, and editing of the final manuscript. All authors have read and approved the final version of the manuscript.

9. ETHICS STATEMENT

This study used secondary financial data obtained from bank annual reports and proprietary banking databases. It did not involve direct interaction with human participants, personal data collection, clinical procedures, or experiments involving humans or animals. Accordingly, institutional ethics approval and informed consent were not required. The data were used solely for academic research and were analysed and reported in accordance with accepted standards of research integrity.

REFERENCES

- Abd Kadir, H., Selamat, Z., & Idros, M. (2010). Productivity of Malaysian Banks after Mergers and Acquisitions. *European Journal of Economics, Finance and Administrative Sciences*, 111–122.
- Abdul-Majid, M., & Hassan, M. K. (2011). The Impact of Foreign-Owned Islamic Banks and Islamic Bank Subsidiaries on the Efficiency and Productivity Change of Malaysian Banks. *Journal of King Abdulaziz University-Islamic Economics*, 24, 177–206. <https://doi.org/10.4197/Islec.24-2.5>
- Abdul-Majid, M., Saal, D. S., & Battisti, G. (2010). Efficiency in Islamic and conventional banking: An international comparison. *Journal of Productivity Analysis*, 34(1), 25–43. <https://doi.org/10.1007/s11123-009-0165-3>
- Abdul-Majid, M., Saal, D. S., & Battisti, G. (2011). The impact of Islamic banking on the cost efficiency and productivity change of Malaysian commercial banks. *Applied Economics*, 43(16), 2033–2054. <https://doi.org/10.1080/00036840902984381>
- 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](https://doi.org/10.1016/0304-4076(77)90052-5)
- Assaf, A. G., Berger, A. N., Roman, R. A., & Tsionas, M. G. (2019). Does efficiency help banks survive and thrive during financial crises? *Journal of Banking & Finance*, 106, 445–470. <https://doi.org/10.1016/j.jbankfin.2019.07.013>
- Battese, G. E., & Coelli, T. J. (1995). A model for technical inefficiency effects in a stochastic frontier production function for panel data. *Empirical Economics*, 20(2), 325–332. <https://doi.org/10.1007/BF01205442>
- Berger, A. N. (1995). The Profit-Structure Relationship in Banking--Tests of Market-Power and Efficient-Structure Hypotheses. *Journal of Money, Credit and Banking*, 27(2), 404–431. <https://doi.org/10.2307/2077876>
- Berger, A. N., & DeYoung, R. (2001). The Effects of Geographic Expansion on Bank Efficiency. *Journal of Financial Services Research*, 19(2), 163–184. <https://doi.org/10.1023/A:1011159405433>
- Berger, A. N., & Hannan, T. H. (1998). The Efficiency Cost of Market Power in the Banking Industry: A Test of the “Quiet Life” and Related Hypotheses. *The Review of Economics and Statistics*, 80(3), 454–465. <http://www.jstor.org/stable/2646754>
- 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](https://doi.org/10.1016/S0378-4266(97)00010-1)

- Berger, A. N., & Mester, L. J. (2003). Explaining the dramatic changes in performance of US banks: technological change, deregulation, and dynamic changes in competition. *Journal of Financial Intermediation*, 12(1), 57–95. [https://doi.org/10.1016/S1042-9573\(02\)00006-2](https://doi.org/10.1016/S1042-9573(02)00006-2)
- Bonin, J. P., Hasan, I., & Wachtel, P. (2005). Bank performance, efficiency and ownership in transition countries. *Journal of Banking & Finance*, 29(1), 31–53. <https://doi.org/10.1016/j.jbankfin.2004.06.015>
- Casu, B., & Girardone, C. (2009). Testing the relationship between competition and efficiency in banking: A panel data analysis. *Economics Letters*, 105(1), 134–137. <https://doi.org/10.1016/j.econlet.2009.06.018>
- Casu, B., Deng, B., & Ferrari, A. (2017). Post-crisis regulatory reforms and bank performance: lessons from Asia. *The European Journal of Finance*, 23(15), 1544–1571. <https://doi.org/10.1080/1351847X.2016.1177566>
- Claessens, S., Demirgüç-Kunt, A., & Huizinga, H. (2001). How does foreign entry affect domestic banking markets? *Journal of Banking & Finance*, 25(5), 891–911. [https://doi.org/10.1016/S0378-4266\(00\)00102-3](https://doi.org/10.1016/S0378-4266(00)00102-3)
- Dadzie, J. K., & Ferrari, A. (2019). Deregulation, efficiency and competition in developing banking markets: Do reforms really work? A case study for Ghana. *Journal of Banking Regulation*, 20(4), 328–340. <https://doi.org/10.1057/s41261-019-00097-x>
- Demirgüç-Kunt, A., & Detragiache, E. (1998). Financial liberalization and financial fragility (IMF Working Paper No. 98/83). International Monetary Fund. <https://doi.org/10.5089/9781451850512.001>
- Deng, B., Casu, B., & Ferrari, A. (2014). The Impact of Deregulation and Re-regulation on Bank Efficiency: Evidence from Asia. In T. Lindblom, S. Sjögren, & M. Willeson (Eds.), *Governance, Regulation and Bank Stability* (pp. 100–128). Palgrave Macmillan UK. https://doi.org/10.1057/9781137413543_6
- DeYoung, R. (1998). Management Quality and X-Inefficiency in National Banks. *Journal of Financial Services Research*, 13(1), 5–22. <https://doi.org/10.1023/A:1007965210067>
- Duygun, M., Shaban, M., Sickles, R. C., & Weyman-Jones, T. (2015). How a regulatory capital requirement affects banks' productivity: an application to emerging economies. *Journal of Productivity Analysis*, 44(3), 237–248. <https://doi.org/10.1007/s11123-015-0451-1>
- Elekdag, S. A., Lall, S., & Alp, H. (2012). *An Assessment of Malaysian Monetary Policy During the Global Financial Crisis of 2008-09* (Vol. 2012, Issue 035). International Monetary Fund. <https://doi.org/10.5089/9781463933203.001>
- Fries, S., & Taci, A. (2005). Cost efficiency of banks in transition: Evidence from 289 banks in 15 post-communist countries. *Journal of Banking & Finance*, 29(1), 55–81. <https://doi.org/10.1016/j.jbankfin.2004.06.016>
- Girardone, C., Molyneux, P., & Gardener, E. (2004). Analysing the determinants of bank efficiency: The case of Italian banks. *Applied Economics*, 36, 215–227. <https://doi.org/10.1080/0003684042000175334>
- Hasan, M., & Dridi, J. (2010). The effects of the global crisis on Islamic and conventional banks: A comparative study (IMF Working Paper No. 10/201). International Monetary Fund. <https://doi.org/10.5089/9781455205318.001>
- Hasan, M. Z., Kamil, A. A., Mustafa, A., & Baten, M. A. (2012). A Cobb-Douglas stochastic frontier model on measuring domestic bank efficiency in Malaysia. *PLOS ONE*, 7(8), e42215. <https://doi.org/10.1371/journal.pone.0042215>
- Ibrahim, M. bin. (2011). Impact of the global crisis on Malaysia's financial system. In B. for I. Settlements (Ed.), *The global crisis and financial intermediation in emerging market economies* (Vol. 54, pp. 267–278). Bank for International Settlements. <https://EconPapers.repec.org/RePEc:bis:bisbpc:54-16>
- Kumbhakar, S., & Sarkar, S. (2003). Deregulation, Ownership and Efficiency in Indian Banking. *Arthaniti-Journal of Economic Theory and Practice*, 2, 1–26. <https://doi.org/10.1177/0976747920030101>
-

- Kwan, S. H. (2006). The X-efficiency of commercial banks in Hong Kong. *Journal of Banking & Finance*, 30(4), 1127–1147. <https://doi.org/https://doi.org/10.1016/j.jbankfin.2005.05.016>
- Leightner, J., & Lovell, C. (1998). The Impact of Financial Liberalisation on the Performance of Thai Banks. *Journal of Economics and Business*, 50, 115–131. [https://doi.org/10.1016/S0148-6195\(97\)00073-8](https://doi.org/10.1016/S0148-6195(97)00073-8)
- McKinnon, R. I. (1973). *Money and capital in economic development*. Brookings Institution Press.
- Meeusen, W., & van Den Broeck, J. (1977). Efficiency Estimation from Cobb-Douglas Production Functions with Composed Error. *International Economic Review*, 18(2), 435–444. <https://doi.org/10.2307/2525757>
- Mohd Tahir, I., Abu Bakar, N. M., & Haron, S. (2010). Cost and Profit Efficiency of the Malaysian Commercial Banks: A Comparison between Domestic and Foreign Banks. *International Journal of Economics and Finance*, 2, 186. <https://doi.org/10.5539/ijef.v2n1p186>
- Nasim, A., Nasir, M. A., & Downing, G. (2025). Determinants of bank efficiency in developed (G7) and developing (E7) countries: role of regulatory and economic environment. *Review of Quantitative Finance and Accounting*, 65(1), 257–294. <https://doi.org/10.1007/s11156-024-01272-6>
- Naveed, M. M., Liu, T., Mustafa, S., & Chen, X. (2025). Unraveling the Nexus Between Competition and Banking Efficiency in an Emerging Economy: A Two-Stage Stochastic Frontier Analysis Framework. *Systems*, 13(5). <https://doi.org/10.3390/systems13050354>
- Sealey, C. W., Jr., & Lindley, J. T. (1977). Inputs, outputs, and a theory of production and cost at depository financial institutions. *The Journal of Finance*, 32(4), 1251–1266. <https://doi.org/10.1111/j.1540-6261.1977.tb03324.x>
- Sensarma, R. (2006). Are foreign banks always the best? Comparison of state-owned, private and foreign banks in India. *Economic Modelling*, 23(4), 717–735. <https://doi.org/https://doi.org/10.1016/j.econmod.2006.04.002>
- Shaw, E. S. (1973). *Financial deepening in economic development*. Oxford University Press.
- Sivalingam, G. (2008). Financial Reforms in an Emerging Economy: The Case of Malaysia. *Economic Papers: A Journal of Applied Economics and Policy*, 27(4), 393–402. <https://doi.org/https://doi.org/10.1111/j.1759-3441.2008.tb01052.x>
- Sufian, F. (2004). The efficiency effects of bank mergers and acquisitions in a developing economy: Evidence from Malaysia. *International Journal of Applied Econometrics and Quantitative Studies*, 1, 53–74.
- Sufian, F. (2010). The impact of the Asian financial crisis on bank efficiency: The 1997 experience of Malaysia and Thailand. *Journal of International Development*, 22(7), 866–889. <https://doi.org/10.1002/jid.1589>
- Sufian, F., & Habibullah, M. S. (2013). Financial Sector Consolidation and Competition in Malaysia. *Journal of Economic Studies*, 40(3), 390–410. <https://doi.org/10.1108/01443581311283970>
- Tarawneh, A., Abdul-Rahman, A., Ghazali, M. F., Amin, S. I. M., & Al-Hajieh, H. (2024). Does Fintech Affect Bank Profitability? Empirical Insights from Malaysia. *Revista de Gestão - RGSA*, 18(5), e8240. <https://doi.org/10.24857/rgsa.v18n5-199>
- Wonglimpiyarat, J. (2008). Thai Banking: A Note on Technological Change and Technological Capabilities. *International Journal of Banking and Finance*, 5(1), 165–184.
- Zhang, T., & Liu, Z. (2024). Navigating Integration Through Rising Complexity: Convergence Dynamics in the ASEAN Banking Markets. *Open Economies Review*, 35(4), 801–826. <https://doi.org/10.1007/s11079-024-09771-8>
- Zulkhibri, M., & Sufian, F. (2007). Consolidation and Competition in Emerging Market: An Empirical Test for Malaysian Banking Industry. *Economic Change and Restructuring*, 39(1–2), 105–124. <https://doi.org/10.1007/s10644-007-9022-4>