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FINANCIAL INCLUSION AND BANK EFFICIENCY: CROSS-COUNTRY EVIDENCE FROM ASEAN-6 BANKING SECTORS

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Abstract:

Financial inclusion has been widely acknowledged for its role in promoting economic growth, enhancing financial stability, and reducing poverty. However, its influence on bank efficiency remains relatively underexplored. Given the pivotal role of banks in mobilizing savings and allocating financial resources, understanding this relationship is crucial. This study investigates how financial inclusion impacts bank efficiency in the ASEAN-6 banking sectors. Utilizing Data Envelopment Analysis (DEA) and Ordinary Least Squares (OLS) regression covering the period from 2013 to 2021, our analysis reveals that the relationship varies across the region. These findings highlight the need for tailored financial inclusion policies that account for the unique characteristics and needs of each country, particularly for unbanked and vulnerable groups. Such policies must be carefully crafted to support efficiency while advancing inclusion.

Keywords:

Bank Efficiency, Financial Inclusion, DEA Method, OLS Regression, ASEAN-6 Banking Sectors.

Introduction

The banking industry plays a foundational role in both emerging and developed financial systems, accounting for over 70% of total financial assets in many countries. A strong and efficient banking system is vital for economic advancement, providing essential functions such as channelling funds from savers to borrowers, facilitating transactions, and supporting monetary policy transmission

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(Sufian et al. 2016). Banks also serve as critical institutions that offer liquidity and credit to various economic agents. Understanding how the banking sector functions is especially important in developing countries, where policymakers must carefully balance regulatory oversight with growth objectives. Effective regulation ensures financial system stability without impeding the ability of banks to support the broader economy (Admati & Hellwig, 2013). An efficient banking sector enables optimal resource allocation and improves the delivery of financial services to underserved populations (Fase & Abma, 2003).

Financial inclusion has recently emerged as a strategic focus for governments and financial regulators. It refers to the access and usage of affordable, timely, and adequate financial services by all segments of society. Enhanced financial inclusion can deepen financial intermediation, reduce transaction costs, and improve economic outcomes (Mehotra & Yetman, 2015). Prior studies have linked financial inclusion to broader benefits such as improved financial stability (Neaime & Gaysset, 2018), higher economic growth (Kim et al. 2018), lower income inequality (Huang & Zhang, 2020), and reduced poverty (Koomson et al. 2020). Within ASEAN, financial inclusion forms a key part of the ASEAN Economic Community (AEC) 2025 agenda, which aims to foster inclusive growth. Despite coordinated efforts, significant disparities in financial inclusion persist among ASEAN member countries (Demirguc-Kunt et al. 2020). The degree to which financial inclusion contributes to bank efficiency in this region remains uncertain (Nguyen & Du, 2020).

This paper addresses this gap by analysing the link between financial inclusion and bank efficiency across ASEAN-6 countries: Singapore, Malaysia, Thailand, Vietnam, Indonesia, and the Philippines. Using data from 200 banks across different income levels and economic structures, we conduct a cross-country analysis incorporating multiple financial inclusion indicators. By applying DEA and OLS models, we assess the direct impact of financial inclusion on banking efficiency. The study further considers both internal factors (e.g. bank size, profitability, credit risk) and external factors (e.g. GDP growth, inflation, market structure).

Literature Review

The discourse on financial inclusion and bank performance has grown substantially in recent years, particularly in emerging markets. Financial exclusion is commonly cited as a structural barrier to development, limiting access to savings and credit, raising costs for marginalized communities, and perpetuating poverty (Sinclair et al. 2009). Conversely, financial inclusion has been shown to promote economic activity, stabilize banking systems, and increase institutional reach (Mehrotra & Yetman, 2015). Studies such as Vo et al. (2021) emphasize that financial inclusion positively influences banking performance in Asia. Ahmad et al. (2020) and Ali et al. (2021) provide additional evidence from global and OIC country samples, demonstrating a significant association between inclusive financial practices and enhanced bank profitability. Kim et al. (2018) find that financial inclusion accelerates economic development in Islamic countries, reinforcing its macroeconomic significance.

In terms of stability, financial inclusion broadens the customer base, encourages saving behaviour, and diversifies lending portfolios (Mehrotra & Yetman, 2015). Accessibility metrics such as the number of ATMs and branches per 1,000 adults are widely used to gauge the extent of financial inclusion and are often linked to better performance outcomes (Arora, 2010; Sharma, 2016). Usage indicators, including the number of bank accounts, credit cards, and outstanding loans, are also key performance drivers (Gupte et al. 2012; Sarma, 2008). However, the empirical evidence is not uniformly positive. For instance, Kondo (2010) reported that ATM expansion in Japan did not significantly enhance bank profitability. Ikram & Lohdi (2015) found that the effects of financial

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inclusion on bank performance in Pakistan were positive but statistically insignificant. In some cases, increased access to banking services has led to higher operational costs and increased non-performing loans (Shihadeh et al. 2018).

Financial inclusion may also heighten risk exposure. Han & Melecky (2013) noted that while greater deposit mobilization reduces withdrawal risk, aggressive lending practices targeting underserved populations can elevate credit risk. Administrative and transaction costs can also be disproportionately high for banks operating in financially excluded regions (Burgess & Pande, 2005). In some cases, this has contributed to lower profitability and financial inefficiencies (Shihadeh & Liu, 2019; Athanasoglou et al. 2008).

Methodology and Data Sources

This study utilizes a balanced panel dataset covering 200 banks from six ASEAN countries consist of Singapore, Malaysia, Thailand, Vietnam, Indonesia, and the Philippines from 2013 to 2021. Bank efficiency is assessed using the non-parametric Data Envelopment Analysis (DEA) method, which calculates technical efficiency scores based on selected input and output variables. Input variables include fixed assets (physical capital), total deposits (funding), and personnel expenses (labour). Outputs consist of total loans, investment in securities, and net interest income. These inputs and outputs are consistent with the intermediation approach to DEA as established by Sealey and Lindley (1977), and further supported by studies such as Sufian & Habibullah (2014) and Kamarudin et al. (2017).

To analyse the relationship between financial inclusion and bank efficiency, this study applies a second-stage regression using Ordinary Least Squares (OLS), following methodologies from Banker & Natarajan (2008) and McDonald (2009). This approach allows for robust estimation of the influence of explanatory variables, including financial inclusion indicators and control variables. Financial inclusion is measured using both accessibility and usage dimensions. Accessibility indicators include the number of bank branches and ATMs per 100,000 adults and per 1,000 km^2, as well as the number of bank accounts per 1,000 adults. Usage indicators cover the number of credit and debit cards, and the number of outstanding loans and deposits. These data are obtained from the Financial Access Survey (FAS) and World Development Indicators (WDI). Control variables include bank-specific factors such as size, profitability, credit risk, capitalization, and diversification, along with macroeconomic indicators like GDP growth, inflation, market concentration (CR3), and unemployment.

Model Specification

To measure bank efficiency, the study employs the Data Envelopment Analysis (DEA) method to assess the technical efficiency (TE) of the ASEAN-6 banking sectors, following the Ruggiero (1996) method. The DEA method is non-parametric, requiring no functional form for technical, cost, or revenue functions, and is individual-firm-based, making it suitable for studying scope economies. It solves the optimisation problem separately for each firm in the sample, optimising over individual firms. The DEA method can be applied effectively to situations with few decision-making units, unlike econometrics, which requires larger samples for statistical reliability.

The CCR model, introduced by Farrell in 1957, is a generalisation of efficiency and uses the constant returns to scale (CRS) assumption to calculate overall technical efficiency (OTE). However, this assumption is incorrect in markets with weak competition. Banker et al. (1984) modified the CCR model by allowing variable returns to scale (VRS), resulting in the BCC model.

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The CRS assumption is valid only if every DMU operates at an optimal scale, preventing scale inefficiency (SIE) from contaminating OTE measures.

Banker et al. (1984) expanded the CCR model by relaxing the CRS assumption and used the BCC model to assess the efficacy of decision-making units (DMUs) described by VRS. VRS assumptions determine the aggregate efficiency (TE) result and divide it into PTE and SE. The TE score quantifies efficiency in ASEAN-6 banking sectors, while the PTE measures managerial efficiency without scale contamination. The study suggests that VRS results may offer more reliable information on DMU efficiency than CRS results. If there is a disparity between the CRS and VRS TE scores for a DMU, it indicates the presence of scale inefficiency (SIE). To determine the type of SIE under VRS, an extra DEA problem with non-increasing return to scale (NIRS) is solved. This helps determine if decision-making units (DMUs) that are not efficient at scale have increasing (IRS) or decreasing returns to scale (DRS).

Results and Discussions

This study utilizes a panel dataset covering 200 banks from six ASEAN countries. This paper investigates the influence of financial inclusion on bank efficiency within the ASEAN-6 banking sectors. In Table 5, we present the results of our panel data regression analysis, which examines the relationship between bank efficiency and financial inclusion indicators.

Table 5: Regression Results for ASEAN-6 Banking Sectors

All Countries					
Explanatory Variables	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Constant	-1.0600***	-11.289***	-11.1573***	-11.4632***	-11.6953***
	(0.2018)	(1.2011)	(1.2142)	(1.1965)	(1.2395)
Bank-Specific Characteristics					
LN (LLP/TL)	-0.0047	-0.0056	-0.0055	-0.0034	-0.0052
	(0.0062)	(0.0063)	(0.0063)	(0.0063)	(0.0063)
LN (ROA)	0.0214*	0.0228*	0.0225*	0.0293**	0.0239*
	(0.013038)	(0.012677)	(0.012696)	(0.012336)	(0.012693)
LN (NII/TA)	0.0567***	0.0544***	0.0539***	0.0540***	0.0547***
	(0.0155)	(0.0151)	(0.0151)	(0.0153)	(0.0152)
LN (NIE/TA)	-0.2613***	-0.2441***	-0.2418***	-0.2275***	-0.2456***
	(0.0381)	(0.0388)	(0.0388)	(0.3871)	(0.3933)
LN (EQASS)	0.1098***	-0.0678**	0.0693**	0.0783**	0.0691**
	(0.0070)	(0.0347)	(0.0347)	(0.3781)	(0.0353)
LN (TA)	-0.0188***	-0.0355***	-0.0346***	-0.0480***	-0.0390***
	(0.0070)	(0.0074)	(0.0075)	(0.0075)	(0.0081)
LN (LOANS/TA)	-0.0289	-0.0250	-0.0252	-0.0165	-0.0231
	(0.0332)	(0.0320)	(0.0321)	(0.0310)	(0.3228)
Macroeconomic Conditions					
LN (INF)	-	0.0453***	0.0475***	0.0497***	0.0434***
		(0.0117)	(0.0115)	(0.1151)	(0.0120)
LN (CR3)	-	1.6354***	1.5673***	1.2986***	1.7194***
		(0.2883)	(0.2937)	(0.2918)	(0.2924)
LN (UNEMP)	-	-0.1221***	-0.1153***	-0.1014***	-0.1356***
		(0.3087)	(0.0322)	(0.2936)	(0.0333)
LN (GDP)	-	0.1521***	0.1513***	0.2437***	0.1670***

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		(0.0249)	(0.0251)	(0.2715)	(0.0286)
Financial Inclusion Indicators					
LN (ATM_ ADULTS)	-	-	0.0339 (0.2824)	-	-
LN (BRANCH_ ADULTS)	-	-	-	-0.2865*** (0.4938)	-
LN (ATM_KM2)	-	-	-	-	-0.0654 (0.5436)

Note: Bank risk can be calculated as LLP/TL = total loan loss provision over total loans. Capitalization can be calculated as EQASS= book value of shareholders equity as a fraction of total assets. Costs can be calculated as NIE/TA = non-interest expenses over total assets. Bank profitability can be calculated as ROA = profit after tax over total assets. Bank size can be calculated as TA = natural logarithm of total assets. Diversification can be calculated as NII/TA = non-interest income over total assets. Liquidity risk can be calculated as TL/TA = total loans over total assets. GDP = natural log of gross domestic products. INF = the rate of inflation. CR3= the three largest banks asset concentration ratio. UNEMP = unemployment rate. ATM_ADULTS = the number of ATM per 1,000 adults. BRANCH_ADULTS = the number of branches per 1,000 adults. ATM_KM2 = the number of ATM per 1,000 km^2 .BRANCH_KM2 = the number of branches per 1,000 km^2. BANK_ACC = the number of bank account. CRE_CARD = the number of credit card. DEB_CARD = the number of debit card. OUT_LOAN = the number of outstanding loans. OUT_DEPO = the number outstanding deposits.

***, ** and * indicate significance at 1, 5 and 10 % level

(cont.) Table 5: Regression Results for ASEAN-6 Banking Sectors

All Countries						
Explanatory Variables	**Model 7**	**Model 8**	**Model 9**	**Model 10**	**Model 11**	**Model 12**
Bank-Specific Characteristics						
Constant	-11.18*** (0.0062)	-11.41*** (1.2435)	-10.92*** (1.2477)	-10.54*** (1.1693)	-11.60*** (1.2030)	-11.19*** (0.0062)
LN (LLP/TL)	-0.0053 (0.0062)	-0.0055 (0.0062)	-0.0045 (0.0061)	-0.0051 (0.0064)	-0.0035 (0.0061)	-0.0048 (0.0062)
LN (ROA)	0.0238* (0.1266)	0.0236* (0.1300)	0.0191* (0.0128)	0.0236* (0.0126)	0.0236* (0.1234)	0.0200* (0.1260)
LN (NII/TA)	0.0542*** (0.0151)	0.0560*** (0.0154)	0.0494*** (0.1532)	0.0515*** (0.1509)	0.0512*** (0.0149)	0.0480*** (0.0151)
LN (NIE/TA)	-0.240*** (0.3898)	-0.249*** (0.0397)	-0.227*** (0.3944)	-0.230*** (0.3966)	-0.205*** (0.0399)	-0.228*** (0.0384)
LN (EQASS)	0.0654* (0.3450)	0.0661* (0.3474)	0.0783** (0.0359)	0.0676* (0.0357)	0.0796** (0.3782)	0.0972*** (0.3785)
LN (TA)	-0.037*** (0.0073)	-0.039*** (0.0105)	-0.0209* (0.0110)	-0.032*** (0.0075)	-0.029*** (0.0070)	
LN (LOANS/TA)	-0.0231 (0.0319)	-0.0255 (0.3196)	-0.0297 (0.3253)	-0.0210 (0.0326)	-0.0276 (0.3224)	-0.0321 (0.3281)
Macroeconomic Conditions						
LN (INF)	0.0437*** (0.11989)	0.0424*** (0.1119)	0.0477*** (0.0114)	0.0535*** (0.1229)	0.0457*** (0.1149)	0.0521*** (0.0110)
LN (CR3)	1.6022*** (0.2874)	1.6835*** (0.3066)	1.4409*** (0.3079)	1.2260*** (0.3075)	1.2000*** (0.3062)	1.5696*** (0.2846)
LN (UNEMP)	-0.116*** (0.0298)	-0.127*** (0.0315)	-0.115*** (0.3175)	-0.117*** (0.3093)	-0.092*** (0.3061)	-0.108*** (0.3173)

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LN (GDP)	0.1616*** (0.2582)	0.1562*** (0.2621)	0.1452*** (0.2611)	0.1521*** (0.0246)	0.1944*** (0.2361)	0.1669*** (0.2587)
Financial Inclusion Indicators						
LN (BRANCH_ KM2)	-0.0746* (0.0423)	-	-	-	-	-
LN (BANK_ACC)	-	-0.0228 (0.3231)	-	-	-	-
LN (CRE_CARD)	-		0.0828** (0.0356)	-	-	-
LN (DEB_CARD)	-	-	-	0.1253** (0.0517)	-	-
LN (OUT_LOAN)	-	-	-	-	0.2329*** (0.4557)	-
LN (OUT_DEPO)	-	-	-	-	-	0.0365*** (0.0065)

Note: Bank risk can be calculated as LLP/TL = total loan loss provision over total loans. Capitalization can be calculated as EQASS= book value of shareholders equity as a fraction of total assets. Costs can be calculated as NIE/TA = non-interest expenses over total assets. Bank profitability can be calculated as ROA = profit after tax over total assets. Bank size can be calculated as TA = natural logarithm of total assets. Diversification can be calculated as NII/TA = non-interest income over total assets. Liquidity risk can be calculated as TL/TA = total loans over total assets. GDP = natural log of gross domestic products. INF = the rate of inflation. CR3= the three largest banks asset concentration ratio. UNEMP = unemployment rate. ATM_ADULTS = the number of ATM per 1,000 adults. BRANCH_ADULTS = the number of branches per 1,000 adults. ATM_KM2 = the number of ATM per 1,000 km^2 .BRANCH_KM2 = the number of branches per 1,000 km^2. BANK_ACC = the number of bank account. CRE_CARD = the number of credit card. DEB_CARD = the number of debit card. OUT_LOAN = the number of outstanding loans. OUT_DEPO = the number outstanding deposits.

***, ** and * indicate significance at 1, 5 and 10 % levels.

The coefficients for BRANCH_ADULTS and BRANCH_KM2 are statistically significant and negatively associated with bank efficiency in ASEAN-6 banking sectors, suggesting that reducing branch networks can enhance efficiency. Harimaya & Kondo (2016) argue that excessive branch expansion leads to inefficiencies due to rising operational costs, increased non-performing loans, and a shift toward digital banking (Kumar et al. 2021). However, studies by Chen et al. (2018) and Shihadeh & Liu (2019) suggest that branch expansion enhances financial intermediation and risk diversification, particularly in underserved areas (Bernini & Brighi, 2018). The coefficients for ATM_ADULTS and ATM_KM2 are statistically insignificant but show opposite trends. While ATM_ADULTS positively correlates with efficiency, supporting findings from Holden & El-Bannany (2004), ATM_KM2 has a negative relationship, aligning with Shihadeh et al. (2018) and Kondo (2010), who argue that excessive ATM deployment leads to inefficiencies. Similarly, the coefficient for BANK_ACC is statistically insignificant and negatively related to efficiency, suggesting that increased bank account penetration alone does not enhance performance due to transaction costs and dormant accounts (Le et al. 2019; Shihadeh & Liu, 2019; Arora, 2010).

Conversely, CRE_CRD, DEB_CRD, and OUT_LOANS are statistically significant and positively associated with bank efficiency, indicating that digital payment adoption and credit expansion drive cost efficiency and financial performance (Alfonso & Florence, 2014; Frame & White, 2012; Vo et al. 2021). Digital banking innovations have played a key role in improving risk management and

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operational efficiency (Akhisar et al. 2015; Muiruri & Ngari, 2014). However, OUT_DEPO is negatively and significantly related to bank efficiency, indicating that high deposit volumes may increase transaction costs and liquidity hoarding, leading to inefficiencies (Jose et al. 2016; Le et al. 2019; Petersen & Rajan, 1995). Inefficient deposit mobilization strategies can result in financial resource misallocation, further reducing profitability (Vincent & Sivakumar, 2019).

Conclusion and Policy Implications

This study utilizes a balanced panel dataset covering 200 banks from six ASEAN countries. This paper investigates the influence of financial inclusion on bank efficiency within the ASEAN-6 banking sectors. By using DEA to assess efficiency and OLS regression to examine influencing factors, the study provides new evidence on the mixed effects of financial inclusion. The findings indicate that while digital financial tools such as debit and credit cards and increased lending activity contribute positively to efficiency, traditional expansion strategies such as branch proliferation and deposit mobilization may reduce it.

The study's outcomes underscore the importance of aligning financial inclusion initiatives with operational efficiency goals. Digital banking innovations should be encouraged, and efforts should focus on promoting active usage of services rather than merely increasing access. Policymakers must also consider regulatory adjustments to facilitate easier access for underserved populations, such as simplified KYC processes. Furthermore, targeted financial literacy and education campaigns can improve financial behaviour, particularly among low-income groups. The development of alternative delivery channels, such as mobile banking and agent networks, can also offer cost-effective ways to enhance inclusion without compromising efficiency (Shukur & Sufian, 2024). Future research should continue to examine how financial technology can bridge gaps in access while maintaining the financial health of institutions.

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