

Banking Performance, Digitalization, and Financial Access on Financial Institution Depth in ASEAN-6

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ABSTRACT

This study investigates the factors influencing the depth of financial institutions in ASEAN-6, namely Indonesia, Malaysia, Thailand, the Philippines, Vietnam, and Singapore. This study uses secondary data from the World Bank and IMF with an observation period of 2008-2022. The analysis method used is panel data regression with the fixed effect model approach to capture heterogeneous effects between countries. The independent variables in this study include bank profitability as measured by return on equity, credit risk represented by the non-performing loans ratio, as well as interest rates and banking digitalization as factors supporting the depth of the financial sector. The results show that bank profitability has a positive and significant effect on the depth of the financial sector, while non-performing loans have a significant negative impact. Banking digitalization has also been found to play a role in increasing the depth of the financial sector by expanding access to financial services. This implies that policies to improve bank operational efficiency, stricter credit risk management, and accelerate the digitalization of financial services are needed to strengthen the financial sector in ASEAN-6. The implications of this study provide recommendations for policymakers to encourage financial stability and depth to support sustainable economic growth in the ASEAN region.

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1. INTRODUCTION

In recent decades, the depth of financial institutions has become one of the main indicators in assessing the development of a country's financial sector. Financial institution depth reflects the extent to which financial services are accessible to the public and the business world, ultimately contributing to economic growth and financial stability (Mbona, 2022). Most empirical studies measure financial development by two main indicators: the ratio of private credit to GDP and stock market capitalization (Guru & Yadav, 2019); (Yang, 2019); (Sehrawat & Giri, 2015). However, as the global financial system develops, the modern financial system is now becoming more complex and multifaceted. This diversity shows that to accurately assess financial development, more than one indicator is needed. To overcome the limitations of using a single indicator as a proxy, (Sahay et al., 2015) Develop several indices that cover various aspects of the progress of financial institutions and markets, such as depth, access, and efficiency.

In ASEAN-6, which consists of Indonesia, Malaysia, Thailand, the Philippines, Singapore, and Vietnam, there are significant differences in the depth of financial institutions, which are influenced by various factors, including bank profitability, access to financial services, technological

developments, and credit risk levels. Inequality in financial access and the rapid development of digital technology are interesting phenomena in ASEAN-6. Based on the data in Figure 1, there is a disparity in the Financial Institution Depth (FID) index among ASEAN-6 countries. Singapore has the highest FID score of 1.00, followed by Malaysia (0.83), Thailand (0.65), Vietnam (0.36), the Philippines (0.22), and Indonesia with the lowest value of 0.16. This data shows that access and depth of the financial sector are still a challenge in developing countries such as Indonesia and the Philippines compared to developed countries such as Singapore.

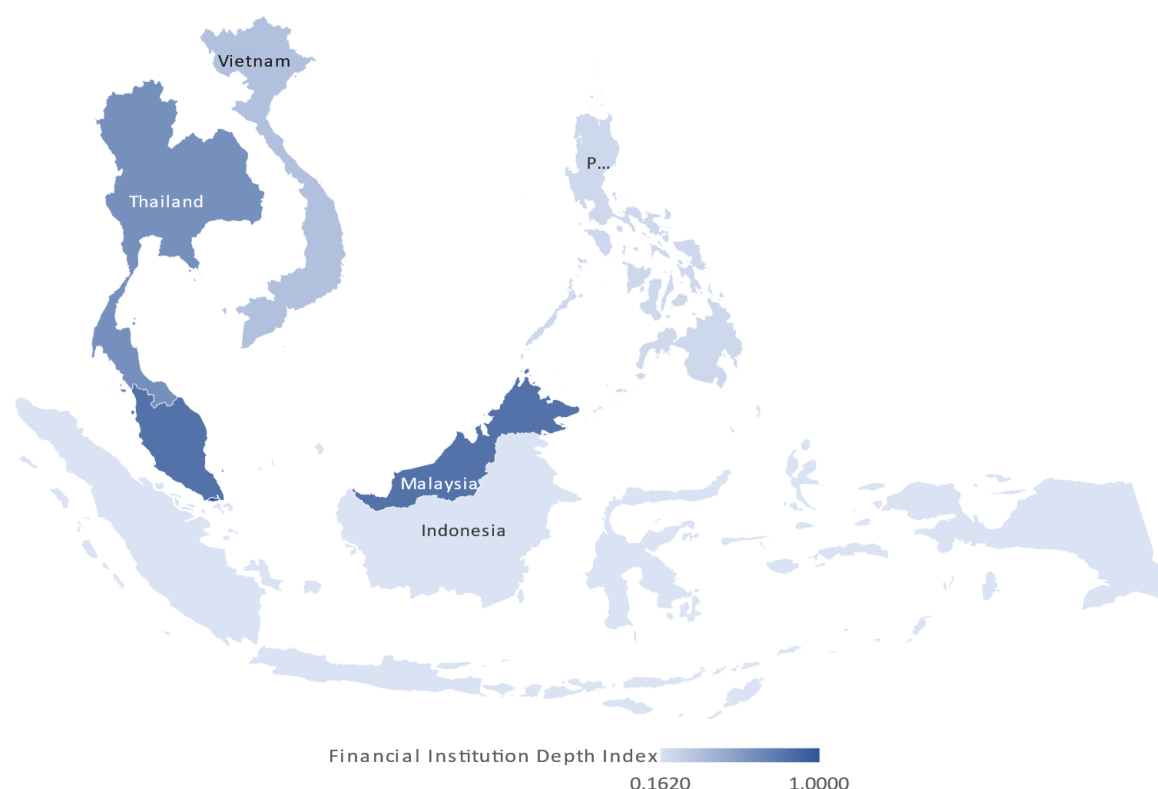


Figure 1. Financial Institution Depth Index ASEAN-6, 2022

Source: IMF (2025)

The development of the financial sector is an important foundation in supporting sustainable economic growth, especially in developing countries. Financial institution depth plays a crucial role in expanding the function of financial intermediation, improving the efficiency of fund distribution, and strengthening resilience to external turmoil (Durusu-Ciftci et al., 2017); (Sena et al., 2021). In the ASEAN-6 Region, strengthening financial depth is a strategic priority to support the region's economic integration. In recent years, digitalization through internet penetration, expanded access to finance, and improved banking profitability performance have played an important role in driving the growth of the financial sector (Evans, 2018); Gabor and Brooks, 2017; Aluko and Ibrahim, 2019). However, on the other hand, credit risk in the form of Non-Performing Loans (NPL) remains a serious challenge that can restrain the pace of deepening of the financial sector (Singh et al., 2021).

Although various studies have examined the determinants of the depth of financial institutions, most studies still focus on macroeconomic aspects, such as economic growth and monetary policy (Wei & Kong, 2016); (Ma & Song, 2018); (Inoue, 2018). Several studies that include aspects of digitalization and access to finance have shown mixed results, depending on the quality of the institution and the characteristics of the domestic economy (Demirgüç-Kunt et al., 2022). In addition, research related to the role of banking profitability and credit risk on the depth of financial institutions in the ASEAN-6 region is still limited. Studies such as Albulescu, (2015) has emphasized the importance of Return on Equity (ROE) as an indicator of banking performance, but empirical testing in relation to the deepening of the financial sector in the ASEAN region has not been widely conducted. Thus, there is a gap in the literature on how the interaction between bank profitability,

traditional financial access, internet penetration, and credit risk affect the depth of financial institutions simultaneously in ASEAN-6.

This study aims to fill this gap by empirically examining the influence of Return on Equity (ROE), financial access, internet penetration, and NPL on the depth of financial institutions in six ASEAN member countries (ASEAN-6). The novelty of this study lies in the integration of these four main factors in one analytical framework, focusing on the ASEAN-6 region as a representation of developing countries with different structural characteristics and digitalization developments. Methodologically, this study uses panel data and a fixed effect model approach, supported by cross-section dependence testing to ensure the suitability of the model with the data characteristics. The findings of this study are expected to make an empirical contribution to the development of financial inclusion policies and strengthening the stability of the banking sector in the ASEAN region.

The structure of this article is arranged as follows: the second part presents theoretical studies and previous research, the third part describes the data and research methods, the fourth part presents the results and discussions, and the last part contains conclusions and policy implications.

2. RESEARCH METHODS

This study analyzes the effects of return on equity (ROE), non-performing loans (NPL), Internet penetration, and financial access on financial institution depth (FID) in ASEAN-6 (Indonesia, Malaysia, Philippines, Vietnam, Singapore, and Thailand). The data used is secondary data obtained from the IMF and the World Bank for the period 2008–2022. The operational definition of each variable can be explained in Table 1.

Table 1. The Variable Operational Definition

Variable	Definition	Measurement	Source
Financial Institution Depth Index	The evaluation of the depth of financial institutions is assessed using several indicators, such as the ratio of private sector loans to GDP, the ratio of financial institutions' assets to GDP, the ratio of M2 to GDP, and the ratio of deposits to GDP.	Index	IMF
Return on Equity	Commercial banks' net profit after taxes on equity on an annual average.	%, after tax	World Bank
Non-performing Loan	The ratio of a bank's non-performing loans to total gross loans is the value of non-performing loans divided by the total value of the loan portfolio (including non-performing loans before deducting allowances for certain loan losses).	Bank nonperforming loans to total gross loans (%)	World Bank
Financial Institution Access Index	Financial Institutions Access index (FIA), which compiles data on bank branches per 100,000 adults and ATMs per 100,000 adults	Index	IMF
Individuals using internet	Individuals who have used the Internet (from any location) in the last 3 months	% of population	World Bank

This study applies panel data regression analysis to test the influence between the variables studied. The regression equation model used in this study is formulated mathematically in Equation (1), which explains the functional relationship between independent and dependent variables.

$$FID_{it} = \beta_0 + \beta_1 ROE_{it} + \beta_2 NPL_{it} + \beta_3 Access_{it} + \beta_4 Internet_{it} + e_{it} \quad (1)$$

where, β is a constant; FID stands for financial institution depth index; ROE is return on equity; NPL is non-performing loan; $Access$ is financial institution access; $Internet$ is an individual who uses the internet; i is cross section; t is the time series; and e is the error term.

In this study, the analysis technique used is panel data regression with the fixed effect model (FEM) approach. FEM has a variety of advantages, including its ability to control constant unobserved effects between entities, which can reduce the potential for bias from variables not

listed in the model and provide more accurate estimates. FEM is also effective in addressing heterogeneity that arises from constant differences between entities. To choose the most suitable method among common, fixed, and random effects, this study uses the Chow test, Hausman test, and LM test. In addition, to ensure the stability of the regression model, an examination of stationary and a classical assumption test is carried out to ensure the validity and reliability of the research results.

3. RESULTS AND DISCUSSION

3.1. The Variable Movement

3.1.1. Development of Financial Institution Depth Index Variables in ASEAN-6

The Financial Institution Depth Index (FID) reflects the depth of the financial sector within a country, which is measured by measures such as banking credit to GDP and market capitalization. In general, based on Figure 2, Singapore recorded the highest FID of all time, with the index stabilizing above 0.85 since 2008 and reaching a maximum of 1.00 in 2020. This shows that the financial system in Singapore is highly developed and has better depth than other ASEAN countries (Ariyasajakorn et al., 2020). Malaysia also showed a high trend, with the FID increasing from 0.63 in 2008 to 0.82 in 2022, although it has experienced slight fluctuations in several years.

On the other hand, Thailand experienced significant growth in FID, increasing from 0.39 in 2008 to 0.65 in 2022. This reflects the deepening role of the financial sector in supporting the Thai economy. BOT's fiscal, structural, and monetary reforms have significantly strengthened the financial system since the Asian crisis in the late 1990s (Taskinsoy, 2019). Meanwhile, the Philippines and Vietnam recorded more moderate growth. The Philippines saw an increase from 0.11 to 0.22 in the same period, while Vietnam grew from 0.21 to 0.36, signaling an increase in the role of financial institutions in their economies.

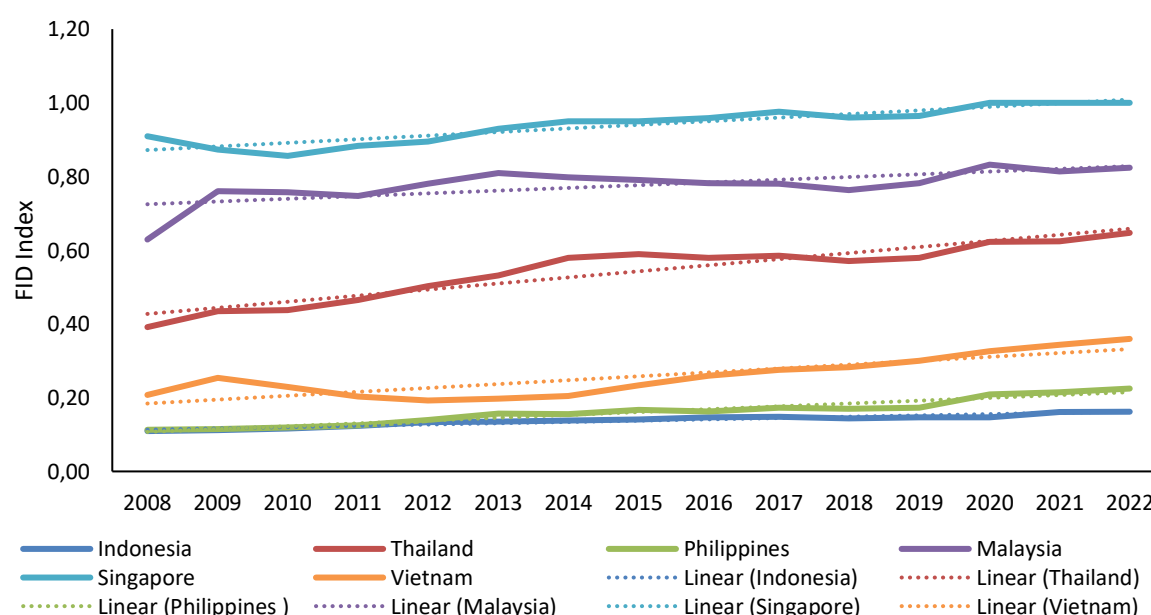


Figure 2. Financial Institution Depth Index in ASEAN-6

Source: IMF (2025)

Indonesia shows relatively slow development compared to other ASEAN countries, with the FID only increasing from 0.11 in 2008 to 0.16 in 2022. This growth is relatively low compared to Thailand and Malaysia, which have increased more rapidly. This can reflect various factors, such as the low level of banking credit penetration, limited public access to formal financial services, and the dominance of the informal sector in the Indonesian economy. In the study (Priyadi et al., 2021) found that in Indonesia, most poor households and MSMEs are unreachable by banking services and

do not take advantage of formal lending practices.

The COVID-19 pandemic that hit the world in 2020–2021 seems to have had a positive impact on the financial depth in several countries. Thailand, Malaysia, and Singapore recorded an increase in the index during this period, likely due to financial stimulus, increased digitalization of the financial sector, and more accommodative monetary policy (Grabowski et al., 2023). However, the impact on Indonesia has been relatively small, with FID only increasing from 0.15 in 2019 to 0.16 in 2022.

3.1.2. Development of Return on Equity Variables in ASEAN-6

Return on Equity (ROE) is a financial performance indicator that measures a company's ability to generate profits from shareholder equity (Ichsani & Suhardi, 2015). A high ROE value reflects capital use efficiency, while a decrease in ROE can indicate a challenge in a company's profitability. Based on data from 2008 to 2022, there are significant fluctuations in ROE in six ASEAN countries. Overall, during the period studied, ROE showed a downward trend in ASEAN-6 (Figure 3).

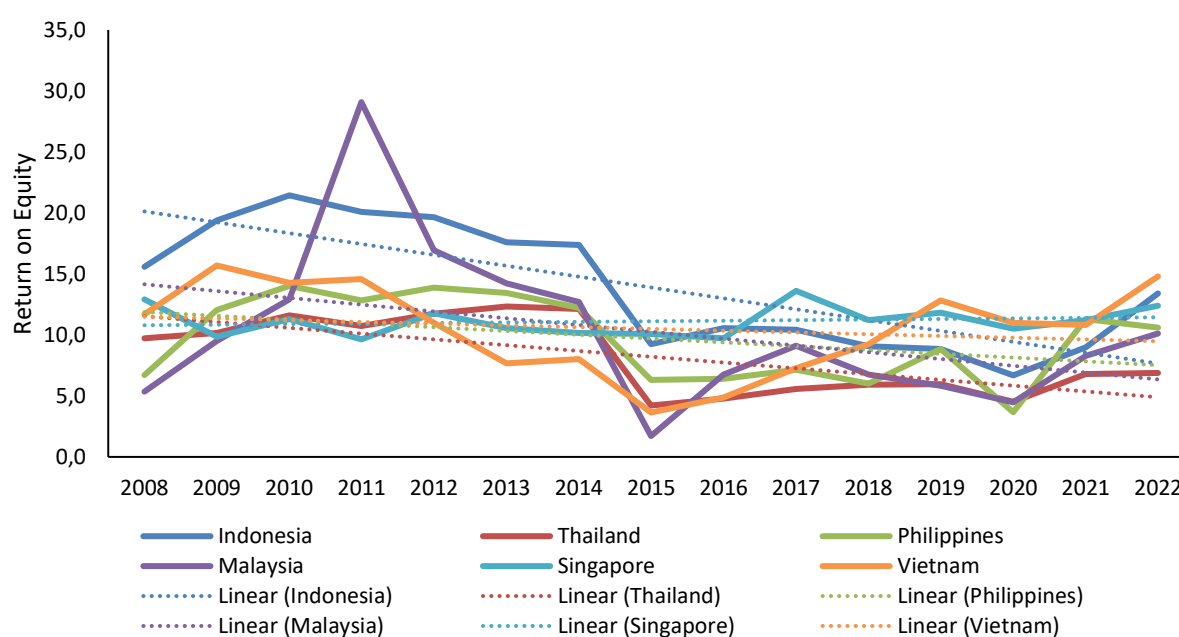


Figure 3. Return on Equity in ASEAN-6

Source: World Bank (2025)

Malaysia recorded the highest ROE in the ASEAN region in 2011 with 29.08% but then dropped drastically to only 1.71% in 2015. In 2011, Malaysia's ROE was high due to several key supporting factors. Domestic demand recorded a strong growth of 8.2% in 2011, mainly private sector spending, as well as increased external demand, especially for commodities and non-electronic products (Bank Negara Malaysia, 2011). The slump in 2015 was caused by the global economic slowdown, falling oil prices, and corporate financial instability in the energy and manufacturing sectors. After a period of crisis, Malaysia managed to recover to 10.10 in 2022, reflecting an improvement in the corporate sector (International Monetary Fund, 2023).

Indonesia showed a positive initial trend, with ROE increasing from 15.6% in 2008 to a peak of 21.4% in 2010. The decline in the prices of major commodities such as palm oil, coal, and minerals in the 2015–2016 period reduced the profits of companies related to this sector (Dutu, 2016). Furthermore, the lowest point was 6.7% in 2020 due to the impact of the COVID-19 pandemic. One of the main causes of this trend is the slowdown in the global economy, the decline in commodity prices, and the increase in credit risk in the banking and business sectors.

Vietnam showed an extreme pattern of fluctuations, with the highest ROE in 2009 (15.69%), but dropped drastically to just 3.64% in 2015. The main causes are the slowdown in foreign investment, pressure on the banking sector, and the economic reforms taking place in the country

(Vuong, 2019). However, since 2017, Vietnam has managed to bounce back with a gradual increase to reach 14.80% in 2022, which is likely driven by the expansion of the manufacturing industry and increased exports. The Philippines and Thailand have a more stable ROE trend, although both experienced a decline in 2015–2020, before finally increasing again in 2021–2022. Singapore, as the financial center of ASEAN, showed a more stable ROE than other countries, with figures ranging from 9% to 13% throughout the period. This shows the sustainability of the company's profitability and the efficiency of capital management.

The COVID-19 pandemic in 2020 led to a drastic decline in ROE in almost all countries, with the sharpest declines seen in the Philippines (3.66%) and Indonesia (6.7%). This is due to a decline in corporate profits, increased credit risk, and economic pressure due to mobility and consumption restriction policies. However, after 2020, there was a significant recovery in almost all countries.

3.1.3. Development of Non-Performing Loan Variables in ASEAN-6

Non-Performing Loans (NPLs) are one of the main indicators in assessing the health of a country's banking sector (Alnabulsi et al., 2022). A high NPL indicates an increase in non-performing loans, which can reflect an economic slowdown, weak bank risk management, or a debtor's inability to meet its obligations (Riahi, 2019). Based on Figure 4, the development of NPLs in Indonesia, Thailand, the Philippines, Malaysia, Singapore, and Vietnam shows a varied pattern, influenced by the global financial crisis, banking sector reforms, and the COVID-19 pandemic.

In 2008, the average NPL in the Southeast Asian region was still quite high, with Thailand recording the highest rate at 5.60%, while Singapore had the lowest NPL rate at 1.40%. The 2008 global financial crisis triggered pressure on the financial sector in several countries, especially those that have a high dependence on global markets and foreign investment (Thakor, 2015). However, in the years following the crisis, most countries managed to lower NPL rates through banking reforms and monetary policies that supported economic stability.

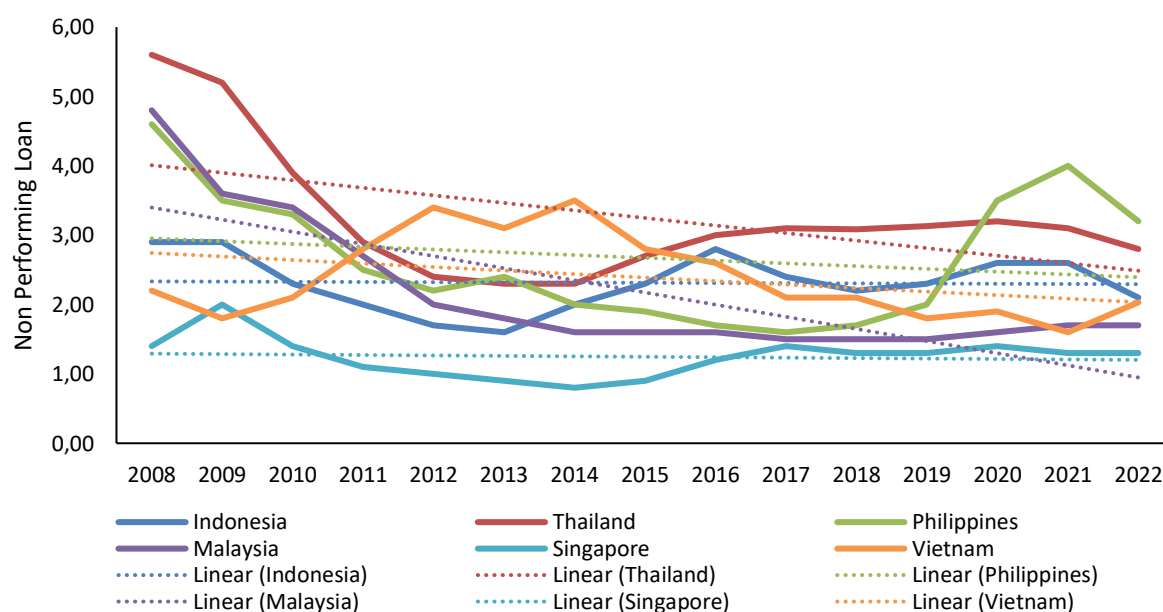


Figure 4. Development of Non-Performing Loan Variables in ASEAN-6

Source: World Bank (2025)

In the 2009–2014 period, the downward trend of NPLs was seen quite significantly, especially in the Philippines and Thailand which fell from 4.60% and 5.60% in 2008 to around 2.00% in 2014, respectively. Malaysia and Indonesia also experienced similar declines, reflecting improvements in credit risk management and strengthening banking regulations. Singapore, which has had low NPLs since its inception, has managed to keep its stability below 1.00% in a few years. Meanwhile, Vietnam is still experiencing fluctuations due to the development of a banking system that is not yet fully mature.

The COVID-19 pandemic in 2020 has become a major challenge for the banking sector around the world, including in Southeast Asia. The increase in NPLs occurred due to the slowdown and physical restrictions, as well as from the business sector, including MSMEs, experiencing a decrease in profits due to reduced people's purchasing power (Shodroková et al., 2023). The Philippines experienced the sharpest increase, with NPLs jumping from 2.00% in 2019 to 4.00% in 2021. Thailand is also facing similar pressure, with NPLs remaining high in the range of 3.00% during the pandemic. Although most countries in Southeast Asia are showing signs of recovery in 2022, which is significant. The property and consumer finance sectors are important sectors that are the main drivers of economic activity in Vietnam. The increase in NPLs in 2022 was largely triggered by financing the property sector, which is experiencing difficulties post-pandemic.

3.1.4. Development of Financial Institution Access Index in ASEAN-6

The Financial Institution Access Index (FIAI), which measures the number of bank branches and ATMs as an indicator of public access to financial institutions, shows interesting trends in the Southeast Asian region between 2008 and 2022. In general, the index showed significant improvements in many countries, although there were some fluctuations influenced by various factors, including the impact of the COVID-19 pandemic.

A consistent upward trend in FIAI was recorded in countries such as Indonesia and Thailand, where the number of bank branches and ATMs continued to increase throughout the observed period. This increase reflects significant efforts to expand access to finance, both in urban areas and previously underserved areas. In Indonesia, the FIAI figure has more than doubled from 2008, with significant additions to bank branches and ATMs, especially outside major cities (Rachmawati et al., 2020). Thailand, despite having a higher figure than Indonesia, also recorded a steady expansion, although a slight decline occurred in 2021, most likely due to the impact of the decline in global economic activity.

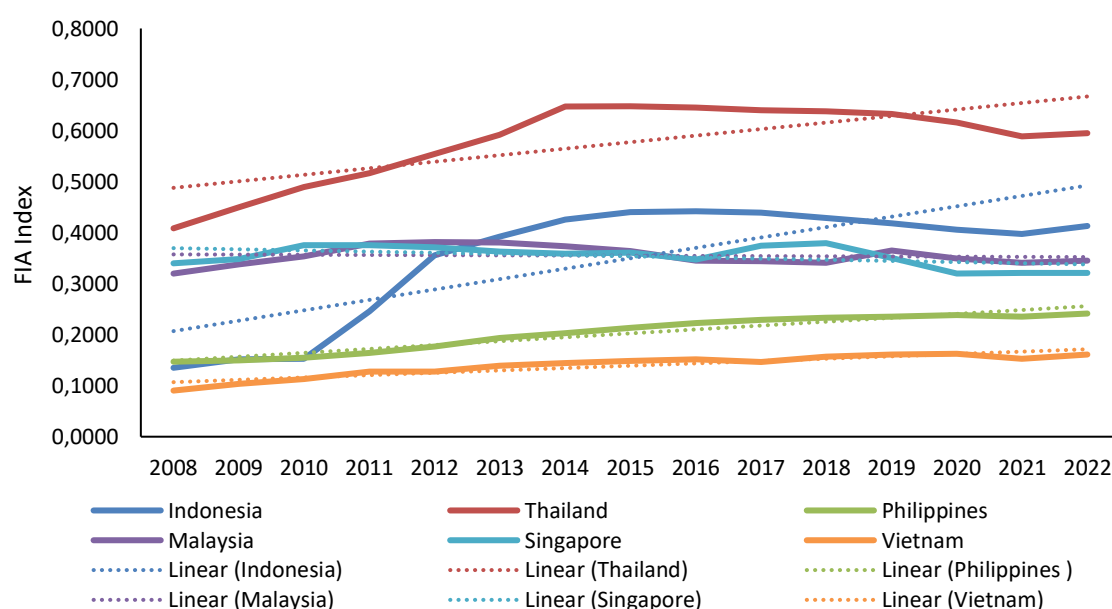


Figure 5. Development of Financial Institution Access Index in ASEAN-6

Source: IMF (2025)

On the other hand, countries such as the Philippines and Vietnam showed slower improvements, although there were still noteworthy improvements. Vietnam, despite starting from a lower figure, managed to significantly increase FIAI in the period, reflecting the efforts of the government and the banking sector to improve financial inclusion, both through the opening of new branches and the wider use of digital technologies (Ozili, 2018). The Philippines, despite improving access to finance, still lags behind its neighbors in terms of the pace of expansion of its banking network (Quimba & Calizo, 2018).

Meanwhile, Malaysia and Singapore, which already have relatively mature financial systems, showed more stable figures throughout the observed period. Although there have been some minor fluctuations, such as a decline in FIAI figures in 2020 in Malaysia, overall, these countries have maintained a relatively high level of access. Malaysia has a mature Islamic finance ecosystem with many Islamic banks, takaful (Islamic insurance), and Islamic capital markets. In fact, the average Malaysia has more than 3 deposit accounts per adult (World Bank Malaysia, 2020). Singapore, with its well-established financial infrastructure, maintained stable FIAI figures, while Malaysia experienced a slight decline in 2016 and 2020, due to a shift in focus on improving digital services and efficiency. Overall, despite some challenges, especially those triggered by the COVID-19 pandemic, the upward trend of FIAI in Southeast Asia reflects significant progress in expanding financial inclusion.

3.1.5. Development of Internet Variables in ASEAN-6

The development of individuals using the internet as a percentage of the population in Southeast Asia shows a significant positive trend throughout the period 2008 to 2022. In general, all countries analyzed experienced a significant increase in internet access, although with varying degrees depending on the individual country.

Singapore, which already has a highly developed digital infrastructure, showed the highest and most stable internet usage figures throughout the period, with almost the entire population (98.8%) accessing the internet in 2022. The country has succeeded in creating an efficient and accessible digital ecosystem, driven by government policies and the development of advanced information technology (Hanna, 2018). Malaysia also showed very high numbers in 2022, with more than 97% of the population using the internet, reflecting rapid technological advancements and government efforts to improve digital accessibility.

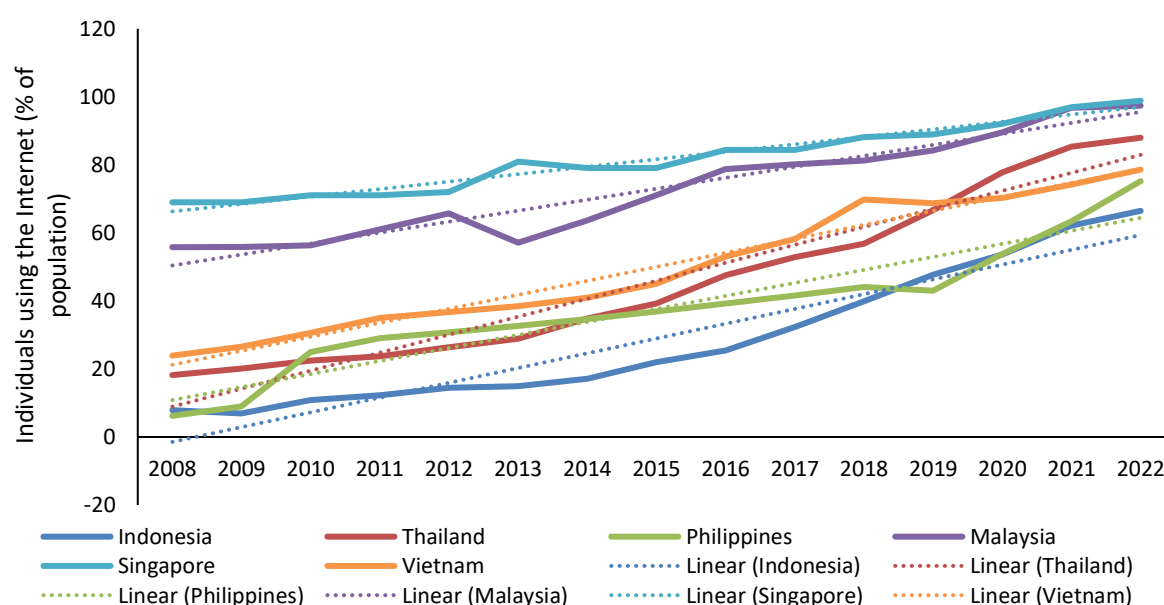


Figure 6. Individuals using the Internet in ASEAN-6

Source: World Bank (2025)

On the other hand, countries such as Indonesia, Thailand, the Philippines, and Vietnam are showing significant increases in internet usage. Indonesia, despite starting with a lower figure compared to its neighbors, has made remarkable progress, with more than 66% of the population accessing the internet in 2022, a rapid increase compared to 7.9% in 2008. This increase reflects the widespread adoption of technology, especially among younger generations, and is driven by the expansion of mobile networks and better internet infrastructure across the country.

Thailand and the Philippines also recorded growing internet usage figures, with figures reaching 88% and 75% in 2022, respectively. This increase is in line with the widespread adoption of technology, although infrastructure challenges remain, especially in rural areas and areas with

limited access to the latest technologies. Vietnam, which started with lower numbers compared to other countries, showed significant progress in internet usage, with more than 78% of the population accessing the internet in 2022, a drastic increase from 23.9% in 2008. According to (World Bank, 2019b), which lags far behind among all populations in Vietnam is the use of digital financial services such as mobile money; Most payments are still made in cash.

One of the main factors behind the increase in internet usage in all these countries is progress in telecommunications infrastructure, increased availability of more affordable mobile devices, as well as advances in government policies that encourage digitalization. The COVID-19 pandemic has also accelerated the adoption of the internet as a key tool for communication, education, and employment, further driving an increase in the number of internet users (De et al., 2020).

3.2. The Result of Descriptive Statistics

The descriptive statistics in Table 2 provide an overview of the characteristics of the variables in this study, including Financial Institution Depth index, Return on Equity, Non-Performing Loans, Access, and Internet Penetration. This analysis includes mean values, median, maximum, minimum, standard deviation, as well as probability distributions represented through skewness, curtosis, and the Jarque-Bera.

Table 2. The Result of Descriptive Statistics

Descriptive	FID	ROE	NPL	Access	Internet
Mean	0.469	10.60	2.340	8.642	44.54
Median	0.375	10.50	2.150	0.375	43.56
Maximum	1.000	29.10	5.600	78.59	98.84
Minimum	0.109	1.700	0.800	0.135	0.090
Std. Dev.	0.314	4.417	0.950	20.02	31.76
Skewness	0.334	1.005	1.019	2.306	0.013
Curtosis	1.517	5.485	4.245	7.014	1.673
Jarque-Bera	9.918	38.35	21.39	140.26	6.598
FID	1.000	-	-	-	-
ROE	-0.126	1.000	-	-	-
NPL	-0.404	-0.130	1.000	-	-
Access	-0.256	-0.023	-0.022	1.000	-
Internet	0.779	-0.236	-0.368	-0.583	1.000

The statistical results show that the FID has an average of 0.4694, with a minimum value of 0.1094 and a maximum of 1.0000, which indicates a considerable variation in the depth of financial inclusion across various observations. ROE shows an average of 10.61, with a widespread between 1.70 to 29.10, indicating a variation in profitability performance between financial institutions. Meanwhile, the NPL variable has an average of 2.34, with a maximum value of 5.60, which indicates the difference in credit risk levels across various financial institutions. The Access variable, which reflects access to financial services, shows an average of 8.64, but has a high standard deviation (20.02), reflecting large disparities in financial access between regions or sectors. Internet Penetration has an average of 44.55, with a minimum score of 0.09 and a maximum of 98.84, which indicates an inequality in digital access between countries or regions in this dataset. Skewness and kurtosis values are used to understand the distribution of data. ROE and NPL have a positive skewness value (> 1), indicating a skewed distribution to the right, where some countries or institutions have values that are much higher than the average. Meanwhile, Access has the highest skewness (2.31), which indicates that most of the observations are at lower values, while only a few have very high financial access.

3.3. The Result of Unit Root test

The results of the unit root test (ADF and PP) in Table 3 show that there is a combination of degrees of integration between variables. The FID and Access variables are not stationary at the level, but become stationary after being differentiated once, so they both belong to $I(1)$. On the

other hand, the ROE and NPL variables are stationary at the level ($I(0)$), both based on ADF and PP. Meanwhile, the Internet variable is significant at the level ($I(0)$) and is steadily stronger after the first difference.

Table 3. The Result of Unit Root test

Variables	Augmented Dickey Fuller		Phillips-Perron	
	level	1st difference	level	1st difference
FID	-1.926	-9.089***	-1.997	-9.089***
ROE	-4.304***	-11.346***	-4.288***	-11.732***
NPL	-3.314**	-10.394***	-3.372**	-10.402***
Access	-1.909	-8.658***	-2.218	-8.695***
Internet	-2.923**	-9.277***	-2.918**	-9.689***

Note: The sign ** and *** represent significance at 5% and 1% levels respectively

3.4. Empirical Results

The results of the cross-section dependence test shown in Table 4 indicate the relationship between the cross-section units in the model. This is shown by the significance of the probability values of the Breusch-Pagan LM ($p = 0.0285$), Pesaran scaled LM ($p = 0.0281$), and bias-corrected scaled LM ($p = 0.0475$) tests all reject the null hypothesis of the Pesaran CD test ($p = 0.1581$) does not. Because the various tests have different sizes and power properties depending on panel dimensions and the form of dependence (De Hoyos & Sarafidis, 2006), many applied researchers treat concordant rejections across multiple diagnostics as stronger evidence of dependence. Hence, with three out of four tests rejecting independence, we conclude that cross-sectional correlation is likely present. The result of the normality test shows a statistic value of 1.4153 with a probability of 0.4925. Since the probability is greater than the 5% significance level, it can be concluded that the residuals are normally distributed. Therefore, the normality assumption is satisfied, and the estimation results of the model can be considered reliable for further statistical analysis.

Based on the results of the panel data regression model selection test, the Chow Test produces a p-value of 0.0000, which means that the Fixed Effect Model (FEM) model is more appropriate to use than the Pooled OLS because H_0 is rejected. Furthermore, the Hausman Test with a p-value of 0.0006 also shows that FEM is more suitable than the Random Effect Model (REM), because a p-value smaller than 0.05 indicates that the individual effects in the data are correlative with independent variables. Thus, the most appropriate model to be used in this analysis is the FEM, the results of which are outlined in Table 4.

The R-squared value of 0.9990 indicates that 99.90% of the variation in the Financial Institution Depth Index can be explained by independent variables in the model. In addition, an Adjusted R-squared value of 0.9989 indicates that after adjusting for the number of variables, the model still has a very high level of explanation, indicating the lack of irrelevant variables in the model. An F-statistic value of 8.8911 with $p = 0.000$ indicates that the model is very significant, which means that the independent variables together have a strong influence on the Financial Institution Depth Index. Based on the correlation results, all variables showed no high correlation relationship, meaning that they were free from the symptoms of multicollinearity.

The regression results show that several factors significantly affect the Financial Institution Depth Index. Return on Equity has a positive coefficient of 0.00152 and is significant at the rate of 1% (p -value = 0.0029), which indicates that the increase in banking profitability contributes to an increase in the depth of financial institutions. In contrast, Non-Performing Loans had a negative coefficient of -0.020172 and were significant at a rate of 1% (p -value = 0.0000), indicating that the increasing non-performing loan ratio worsened the stability and depth of the financial sector. Meanwhile, internet usage has a positive coefficient of 0.001775 and is very significant (p -value = 0.0000), which reflects that increasing internet penetration drives the accessibility of digital financial services and increases the depth of the financial system. Another factor, financial institution access (number of bank branches and ATMs), also had a positive effect with a coefficient of 0.002213 and was significant at the rate of 1% (p -value = 0.0000), indicating that the increasing amount of physical

financial infrastructure increases the depth of the financial system.

Table 4. Empirical Results of Fixed Effect Model

Dependent Variables = FID			
Variables	Coefficient	Std. Error	t-Statistic
Constant	0.40225***	0.01298	30.9718
ROE	0.00152***	0.00049	3.07008
NPL	-0.02017***	0.00187	-10.7677
Internet	0.00177***	0.00015	11.4515
Access	0.00221***	0.00018	12.2577
Cross Section Effect			
Indonesia	-0.29114		
Thailand	0.11076		
Philippines	-0.26925		
Malaysia	0.27217		
Singapore	0.40048		
Vietnam	-0.22302		
Effects Specification			
R-squared	0.9990		
Adjusted R-squared	0.9988		
S.E. of regression	1.0473		
F-statistic	8.8911		
Prob(F-statistic)	0.0000		
Durbin-Watson stat	1.2370		
Selection Models:			
Chow Test	0.0000		
Hausman Test	0.0000		
Diagnostics test:			
	Stat.	Prob.	
Normality test	1.4153	0.4925	
Breusch-Pagan LM	27.029	0.0285	
Pesaran scaled LM	2.1962	0.0281	
Bias-corrected scaled LM	1.9819	0.0475	
Pesaran CD	1.4115	0.1581	

Note: The sign *** represent significance at 1%, levels respectively

The results of the estimation of the cross-section effect show that there are significant differences between countries in the Financial Institution Depth Index. Singapore has the highest cross-section effect (0.40048), suggesting that the depth of its financial institutions is systematically higher than that of other countries, likely due to a more advanced financial system and strong global integration. Malaysia also had a positive effect (0.27217), reflecting a relatively deep financial system with strong banking penetration. In contrast, Indonesia, the Philippines, and Vietnam showed negative effects, with values of -0.29114, -0.26925, and -0.22302, respectively. This indicates that the depth of financial institutions in these countries is relatively lower, likely due to still-growing levels of financial inclusion, limited access to formal banking services, or a more concentrated banking structure on certain segments. Thailand has a positive but smaller cross-section effect (0.11076), which reflects a more developed financial system than countries with negative effects, but not as strong as Malaysia or Singapore.

3.5. Discussion

3.5.1. The Effect of Return on Equity on Financial Institution Depth in ASEAN-6

The results of the study show that Return on Equity has a positive and significant influence on the Financial Institution Depth (FID) Index. These findings indicate that the higher the level of profitability of banks, which is reflected in ROE, the deeper a country's financial sector will be. Higher ROE reflects the ability of financial institutions to generate profits from their equity, which in turn increases their capacity to expand financial services, including increased credit disbursement and

investment in financial infrastructure (Yao et al., 2018). Theoretically, the positive relationship between ROE and FID Index can be explained through the role of banks' profitability in strengthening the stability and competitiveness of the financial sector. Banks with higher rates of return on equity tend to have greater investor and depositor confidence, thus increasing the capital base that can be used to expand access and financial depth (Iyer et al., 2016). In addition, more profitable banks have greater flexibility in implementing financial innovations and expanding service networks, including an increase in the number of branches and ATMs, which ultimately contributes to an increase in the FID Index (Liu, 2021).

Furthermore, this finding is in line with previous studies that confirm that bank profitability is a key factor in supporting the development of a deeper and more inclusive financial system. Higher ROE allows banks to improve operational efficiency as well as provide more credit to the real sector, ultimately strengthening financial intermediation in the economy (Lotto, 2018). This has implications for increasing financial market liquidity and ease of access to financing for economic actors, both in the household and corporate sectors. Several recent studies show mixed findings regarding the influence of Return on Equity (ROE) on Financial Institution Depth (FID). Cobbinah et al., (2024) found that in the banking sector in Ghana, ROE significantly improves financial intermediation through an increase in price-to-book value, which is one of the key indicators of the depth of the financial sector. Similar findings were also presented by McKinsey in the 2023 Global Banking Annual Review, which stated that institutions with higher ROE tend to have stronger price-to-book and price-to-earnings ratios, thus indicating a deeper role in financial markets (McKinsey, 2023). In contrast, a study by Munteanu & Ilie, (2022) on commercial banks in Romania shows that although ROE is high, it does not always have a significant impact on the development of the financial system. These findings suggest that structural and institutional factors can influence the relationship between ROE and financial sector depth. In Singapore and Malaysia, proactive banking policies have supported high ROE and strengthened the depth of the financial sector. Singapore implements strict prudential regulations, such as the Basel III policy that strengthens bank capitalization and increases financial transparency (Hofmann, 2014). With an environment conducive to banking profitability, banks in Singapore can improve financial intermediation and expand access to various financial instruments. Malaysia, through the policy of Bank Negara Malaysia (BNM), encourages banking operational efficiency and financial inclusion, including through strengthening the Islamic banking sector which contributes to financial deepening.

In Thailand and Indonesia, banking policy is more focused on financial stability and inclusion. Thailand has monetary and banking policies that emphasize capital strengthening and credit risk management to improve financial stability. With the increase in ROE, the banking sector in Thailand is increasingly able to expand financial services, especially in supporting small and medium enterprises (SMEs). Indonesia, under the regulation of the Financial Services Authority (OJK) and Bank Indonesia (BI), has pushed for broader financial inclusion policies through banking digitalization and credit expansion (Moorena et al., 2020). However, fluctuating bank profitability is still a challenge in accelerating the optimal deepening of the financial sector. In Vietnam and the Philippines, the main challenges are the efficiency of the banking sector and the growing regulation. Vietnam, despite its rapid banking growth, still faces problems in operational efficiency and credit risk management. The government has implemented banking reforms by strengthening financial sector regulation, but this policy is still in the development stage. The Philippines, on the other hand, has introduced various policies to expand access to finance, including increasing the role of digital banks and fintech. However, the low level of confidence in the banking system and the limitations of financial infrastructure are still obstacles to banking profitability in driving the FID Index.

3.5.2. The Effect of Non-Performing Loans on Financial Institution Depth

The results show that Non-Performing Loans have a negative and significant influence on the Financial Institution Depth (FID) Index in ASEAN-6, in line with the findings of Beck et al. (2013) who stated that high NPLs can hinder financial intermediation and reduce the efficiency of the banking sector. In theory, in classical financial models, the increase in NPLs reflects the high risk of default in the banking system, which in turn reduces the ability of banks to channel new credit (Bacchiocchi et

al., 2022). This is because banks facing a surge in NPLs tend to tighten their credit policies to mitigate risks further, thereby hampering financial expansion and lowering the depth of the financial sector. Other studies by Riahi, (2019) also asserted that high NPLs signal weak banking risk management practices, which can lead to imbalances between banks' assets and liabilities and increase the likelihood of financial instability. In the context of ASEAN-6, these results are in line with research by Abubakar et al. (2020), which found that the increase in NPLs in developing countries tends to decrease the deepening of the financial sector due to rising credit costs and a decrease in investor confidence in the banking system. Singapore and Malaysia have more mature banking systems, with strict banking supervision and the implementation of international regulatory standards such as Basel III. Singapore, as a global financial center, has a very low NPL rate as the Monetary Authority of Singapore (MAS) enforces strict regulations on lending and encourages transparency in bank financial statements (Gardner, 2016). Malaysia, through Bank Negara Malaysia (BNM), is actively adopting macroprudential policies to curb credit risks, such as loan-to-value (LTV) restrictions and high capital reserve requirements. Study by Tanasković & Jandrić, (2015) shows that stronger banking systems in these countries allow them to better manage NPLs, so that the impact on the FID Index is more controlled than other ASEAN countries.

In contrast, Indonesia and Thailand face greater challenges in managing NPLs, especially in the micro, small and medium enterprises (MSMEs) sector, which have a higher risk of default. In Indonesia, the Financial Services Authority (OJK) has implemented various credit restructuring policies to reduce the impact of NPLs, especially after the COVID-19 pandemic. However, according to research by Schwarcz, (2017), credit restructuring that is not accompanied by increased risk management effectiveness can actually lead to moral hazard, where banks are more likely to take higher risks without taking into account the long-term consequences. In Thailand, the Bank of Thailand (BOT) also faces challenges in balancing improving financial access and maintaining banking system stability, especially due to the rise of non-performing loans in the property and manufacturing sectors (World Bank, 2019a).

Vietnam and the Philippines have less developed banking sectors than other ASEAN countries, with relatively higher NPL rates. Study by (Doan et al., 2024) found that the main problem in Vietnam is the high exposure of state-owned banks to risky loans, which slows down the efficiency of the financial sector and increases systemic risks. In the Philippines, the Bangko Sentral ng Pilipinas (BSP) has implemented various policies to strengthen the banking system but still faces challenges in supervising small banks that have high non-performing credit ratings. According to a study by (Alaoui Mdaghri, 2022), in countries with weaker banking regulations, an increase in NPLs can lead to a decrease in banking liquidity, an increase in borrowing costs, as well as a decrease in investor confidence in the financial sector, all of which have a negative impact on the FID Index.

3.5.3. The Effect of Financial Access on Financial Institution Depth

The results show that financial access has a positive and significant impact on the Financial Institution Depth index. These findings are in line with financial economic theory which states that increased access to financial services can strengthen financial intermediation, improve resource allocation efficiency, and encourage broader financial inclusion (Ratnawati, 2020). According to the theory of financial intermediation, when more individuals and businesses have access to banking and financial services, such as bank accounts, credit, and investments, then the financial system will be deeper and more stable, which ultimately increases economic growth.

Study by Aluko & Ajayi, (2018) found that countries with higher levels of financial access have more efficient banking systems, greater credit levels to the real sector, and better economic resilience to external shocks. In the context of ASEAN-6, these results are in line with research by Sarma, (2015), which shows that countries with more progressive financial inclusion policies, such as Malaysia and Thailand, have more developed financial sectors than countries with more limited access to finance, such as the Philippines and Vietnam. However, research by Mlachila et al. (2016) of the International Monetary Fund shows that although some Sub-Saharan African countries have experienced increased access to finance, this has not necessarily been followed by a significant deepening of the financial sector, as credit institutions and infrastructure in some countries are still

weak (Mlachila et al., 2016). While financial development is a prerequisite for financial inclusion and economic growth, regulators also need to be aware of the risks that may arise from increased access to financial services (Hidayat et al., 2023); (Hidayat et al., 2023). Singapore and Malaysia have the most developed financial sectors in ASEAN-6, supported by proactive policies in improving access to finance, both through traditional banking and innovation in the fintech sector (Sari et al., 2023). Singapore, as a global financial centre, has successfully improved access to finance through digital banking, regulations that support financial innovation, and strong financial inclusion policies managed by the Monetary Authority of Singapore (MAS) (World Bank, 2018). Malaysia, through Bank Negara Malaysia (BNM), has implemented various financial inclusion policies, including the Microfinance Scheme and the e-payment adoption program, which increase public participation in the formal financial system (BNM, 2025).

In Thailand and Indonesia, increased access to finance is also supported by national financial inclusion policies. Thailand has developed the National e-Payment Plan, which encourages the adoption of digital transactions to improve access to finance, especially in rural areas. Bank Indonesia (BI) and the Financial Services Authority (OJK) have also introduced the National Non-Cash Movement (GNNT) and various policies to expand financial inclusion, such as the use of e-wallets and the expansion of digital financial services. However, although these policies have increased Financial Access, challenges such as low financial literacy and access gaps between urban and rural areas are still major obstacles.

Meanwhile, Vietnam and the Philippines still face structural obstacles in improving financial access. In Vietnam, the banking sector is still dominated by state-owned banks, which often have limitations in expanding financial services to a wider segment of society. According to (Kovsted et al., 2003), the lack of financial infrastructure and suboptimal regulation in Vietnam's banking sector hampered the growth of financial access, which contributed to a lower FID Index level compared to other ASEAN countries. The Philippines, on the other hand, has a low banking penetration rate, with many people still relying on the informal financial system. Although the Bangko Sentral ng Pilipinas (BSP) has implemented more aggressive financial inclusion policies, such as strengthening microfinance services and expanding mobile banking, the growth of Financial Access in the Philippines still lags behind other ASEAN countries (Valencia, 2019).

3.5.4. The Effect of Internet on Financial Institution Depth

The results of the study show that the internet has a positive and significant influence on the Financial Institution Depth (FID) Index in ASEAN-6. These findings reinforce the theory of digital financial inclusion which states that wider internet penetration increases access to financial services, accelerates financial intermediation, and deepens the financial system as a whole (Bontadini et al., 2024). In the era of digitalization, the internet was the main infrastructure that enables the expansion of financial services, including digital banking, electronic payments, and mobile-based financial technology (fintech).

Study by Gabor & Brooks, (2017) affirming that countries with higher internet access have a deeper and more stable financial system, as digital technologies enable more inclusive and efficient financial services. These results are also in line with research by Evans, (2018), which found that developing countries that successfully increased internet penetration showed significant growth in financial inclusion and the depth of their financial institutions. However, this finding contrasts with the study by Demirguc-Kunt, (2022) which highlighted that in several low-income countries, improvements in internet access alone do not necessarily lead to financial deepening, largely due to gaps in digital literacy, weak regulatory frameworks, and insufficient trust in formal financial institutions. This suggests that while internet access generally promotes financial sector development, its effectiveness can be limited by broader socioeconomic and institutional factors.

Differences in internet penetration and adoption of digital financial services in ASEAN-6 have created a variety of impacts on the Financial Institution Depth Index. Singapore and Malaysia are leaders in digital transformation in the ASEAN region. Singapore, with strong regulation from the Monetary Authority of Singapore (MAS), has developed a fintech ecosystem that allows digital financial services to flourish. The implementation of digital banks, QR code-based electronic

payments, and regulations that support the growth of fintech startups have contributed to the increase in the country's FID Index (Zheng, 2021). In Malaysia, Bank Negara Malaysia (BNM) has encouraged the adoption of digital financial services through initiatives such as e-KYC (electronic Know Your Customer), the National Financial Inclusion Strategy, and an increase in digital transactions that deepen the financial sector (Moenjak et al., 2020). Thailand and Indonesia are also experiencing significant growth in internet integration and digital financial services. Thailand has implemented the National e-Payment Plan, which accelerates the use of internet-based financial services and improves financial access in remote areas. In Indonesia, the Financial Services Authority (OJK) and Bank Indonesia (BI) have encouraged the expansion of digital banking, mobile payments, and peer-to-peer lending services, expanding the reach of financial services and improving the FID Index. In the results of the research by (Thaariq et al., 2021), internet access affects finances in Indonesia differently. In urban areas, the internet increases savings, while in rural areas, access through public means reduces savings as community interaction encourages investment in other assets. In contrast, Vietnam and the Philippines still face challenges in optimizing the impact of the internet on the depth of financial institutions. In Vietnam, despite the growing fintech sector, the adoption of digital financial services is still hampered by regulatory limitations, the dominance of state-owned banks, and low internet penetration in some regions (Phan, 2023). The Philippines faces similar obstacles, where limited internet access in rural areas and low levels of digital literacy hinder the growth of digital-based financial inclusion (San Andres & Hernando, 2019).

4. CONCLUSIONS

The results of the study show that the Financial Institution Depth (FID) Index in ASEAN-6 is influenced by several main factors, namely Return on Equity (ROE), Non-Performing Loans (NPL), and Financial Access. ROE has a positive and significant influence on the FID Index, suggesting that higher bank profitability can increase the depth of the financial sector through increased financial intermediation and innovation. In contrast, NPLs have a significant negative impact on the FID Index, signaling that the increase in non-performing loans hinders financial expansion and lowers the efficiency of the banking sector. Meanwhile, Financial Access contributed positively to the FID Index, supporting the theory that financial inclusion could strengthen the stability and depth of the financial system. At the country level, Singapore and Malaysia have more stable banking sectors with strict regulations that help maintain profitability and reduce NPLs. Thailand and Indonesia face challenges in improving financial inclusion and risk management efficiency, while Vietnam and the Philippines are still struggling with banking efficiency and credit stability. These findings underscore the importance of policies that support bank profitability, manage credit risk, and expand access to finance to strengthen the financial sector in ASEAN-6.

This finding has important policy implications for ASEAN-6 countries. For countries that already have a more mature financial sector, such as Singapore and Malaysia, policy focus can be directed to strengthening fintech regulations, improving the security of digital transactions, and optimizing the technology-based financial ecosystem. This aims to ensure that Financial Access not only covers basic banking services, but also includes more complex financial innovations such as peer-to-peer lending, robo-advisory, and digital-based investments. For countries with lagging levels of financial access, such as the Philippines and Vietnam, more progressive policies are needed to expand banking penetration, increase financial literacy, and strengthen digital and telecommunications infrastructure. The Philippines, for example, can accelerate the adoption of mobile banking to improve financial access in remote areas, while Vietnam needs to increase transparency and reforms in its banking sector to accelerate financial integration. Banking regulators need to tighten regulations related to credit risk management and implement stricter macroprudential policies to reduce NPL levels and improve financial system stability. In addition, banks in ASEAN-6 need to be encouraged to increase credit distribution to productive sectors, such as micro, small and medium enterprises (MSMEs), through regulations that support the availability of credit with competitive interest rates and credit guarantee schemes.

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