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Fintech Innovation and Bank Efficiency in Indonesia

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Abstract

This study intends to determine the impact of fintech adoption on the efficiency of conventional banks in Indonesia between 2013 and 2019. The population of this study consisted of all conventional banks listed on the Indonesia Stock Exchange (IDX) between 2013 and 2019, whilst the sample consisted of 38 conventional banks selected using the purposive sampling technique. This study employs two analyses: Data Envelopment Analysis (DEA) to measure bank efficiency and panel data regression analysis to test the hypothesis of the effect of fintech adoption on commercial banks in Indonesia in 2013-2019 using the Stata program. According to the findings of this research, fintech appears to have a positive and discernibly noticeable impact on the operational efficiency of banks. The greater the number of fintech facilities offered by banks, the greater their efficiency; therefore, banks must strengthen innovation and bank infrastructure in order to implement fintech.

Keywords: Fintech Adoption, Efficiency, Conventional Bank

Abstrak

Penelitian ini bertujuan untuk mengetahui dampak adopsi tekfin terhadap efisiensi bank konvensional di Indonesia antara tahun 2013 dan 2019. Populasi penelitian ini adalah seluruh bank konvensional yang terdaftar di Bursa Efek Indonesia (BEI) antara tahun 2013 dan 2019, sedangkan sampelnya terdiri dari 38 bank konvensional yang dipilih dengan teknik purposive sampling. Penelitian ini menggunakan dua analisis: Data Envelopment Analysis (DEA) untuk mengukur efisiensi bank dan analisis regresi data panel untuk menguji hipotesis pengaruh adopsi tekfin pada bank umum di Indonesia tahun 2013 -2019 dengan menggunakan program Stata. Menurut temuan penelitian ini, fintech tampaknya memiliki dampak positif dan nyata terhadap efisiensi operasional bank. Semakin banyak fasilitas tekfin yang ditawarkan bank, semakin besar efisiensinya; Oleh karena itu, bank harus memperkuat inovasi dan infrastruktur bank dalam rangka implementasi fintech.

Kata kunci: Adopsi Fintech, Efisiensi, Bank Konvensional

INTRODUCTION

Access to the internet appears to be a primary need for nearly everyone in the modern era. Indonesia is one of the countries with a relatively high internet connectivity, therefore it has the potential to improve financial inclusion in Indonesia, where the increasing number of smartphone users contributes to the growing number of fintech service users in Indonesian banking. According to Woetzel et al. (2016), consumer use of financial technology has expanded substantially. AT Kearney's analysis of the Banking Transformation Roadmap survey (AT Kearney, 2014) indicates that by 2020, smartphone users will control 80% of the market share.

Financial Technology is an innovation in the use of technology, the product of which is a system that facilitates the mechanism of financial transactions (Prasetyo, 2022). Bitler et al. (2018) explains that mobile banking, Internet banking, SMS Banking, and phone banking are some of the financial technologies utilized by banks. Lipton & Pentland (2018) forecast the future role of banks when they incorporate fintech

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technology from the perspective of their clients, investors, and the bank itself. According to the report, in the future, the banking system will not only serve as financial intermediary institutions and providers of financial services, but also as financial advisors for consumers, and banks will be able to connect directly with customers in real-time due to fintech services. The introduction of fintech increases the competitiveness among banks (Berger et al., 2013; Huang et al., 2014). The rise of fintech adoption has boosted the competitiveness of commercial banks since financial technology has played a significant role in enhancing the effectiveness of the services offered by banks to MSMEs and private companies (Berg et al., 2020). Lipton et al. (2016) state that technological advancements result in greater productivity and promote company efficiency. The greater a company's efficiency and productivity, the greater its capacity to compete and control the market. The majority of banks in Indonesia have implemented digital banking technology as their primary strategy, according to empirical data (Price Waterhouse & Coopers, 2018), with the goal of minimizing operational costs and risks to improve efficiency and customer satisfaction to reach consumers, broader scope, resulting in a rise in demand for fintech applications. According to Rajapathirana & Hui (2018), there is a positive correlation between company efficiency and innovation. Innovation plays a vital role in the banking business in improving bank efficiency (K. Wang et al., 2014). In addition, Klus et al. (2019) and Holotiuk et al. (2018) propose that bank innovation in fintech can boost bank efficiency. In quantitative research, Phan et al. (2020) discover that FinTech has a detrimental impact on the performance of Indian banks, whereas (Y. Wang et al., 2021a) explore the effects of FinTech on the efficiency of Chinese commercial banks.

This study covers fintech advancements in the form of mobile banking, adding SMS banking, phone banking, and internet banking to the list of fintech services in Indonesia. In previous studies, fintech adoption was more focused on fintech service users, such as research conducted by Bureshaid (2021) and Tun-Pin et al. (2019) that examined why customers want to use fintech services, whereas, in this study, the adoption of fintech is bank-focused, examining whether the bank's efficiency will be affected if it adopts fintech services. In addition, previous research has focused more on the impact of fintech adoption on bank performance, however according to Paulet & Mavoori (2019), Lee et al. (2021), and Cucari et al. (2022), innovation in fintech has a significant impact on improving bank efficiency.

RESEARCH METHOD

This study utilizes the adoption of fintech as the independent variable, bank efficiency as the dependent variable, and nine control factors, including bank size, ROA, Capital, Credit Risk, Expense Management, liquidity, Inflation, Economic Growth, and bank type. The population of this study consisted of all conventional banks listed on the Indonesia Stock Exchange (IDX) between 2013 and 2019, while the sample consisted of 38 banks selected using the purposive sampling method. This study utilizes secondary data extracted from the 2013-2019 Annual Reports of conventional commercial banks. In addition, 266 observational data acquired from bank financial statements published on the official website of the Indonesia Stock Exchange (IDX), www.idx.co.id, have been used in this study.

Variable Operational Definition

Table 1. Definition of Operational Variables

Variable	Description	Measurement	Scale
Independent	Internet Banking	Dummy	Ratio
	Mobile Banking	Dummy	Ratio
	SMS Banking	Dummy	Ratio
	Phone Banking	Dummy	Ratio
Dependent	Efficiency Bank	Input: Saving, fixed assets, and labor costs Output: total credit and operational income	
		Output/Input	Ratio
Control	Size	Size = In total assets	Ratio
	Type of Bank	Dummy	Ratio
	ROA	$\frac{Net\ Income}{Total\ Asset}$	Ratio
	Capital	$\frac{equity\ capital}{total\ assets}$	Ratio
	Credit risk	$\frac{NPL}{total\ loans}$	Ratio
	Expense Management	$\frac{Operating\ Cost}{Total\ Assets}$	Ratio
	Liquidity	$\frac{Total\ Loans}{Total\ Deposits}$	Ratio
	Inflation	% Change in CPI	Ratio
	Economic Growth	GDP Growth	Ratio

Variable Measurement

This study employs two analyses: Data Envelopment Analysis (DEA) to measure bank efficiency and panel data regression analysis to test the hypothesis of the effect of fintech adoption on commercial commercial banks in Indonesia in 2013-2019 using the Stata Application.

Data Envelopment Analysis (DEA)

According to Ngo & Le (2019), data envelopment analysis (DEA) can determine the efficiency score in banking by employing financial ratios at the bank. In this study, DEA was chosen because it can calculate efficiency values accurately with small sample size and is more susceptible to specification errors than SFA, making it more flexible (Akhtaruzzaman et al., 2021). The DEA's Decision Making Unit (DMU) is able to transform inputs into outputs. The evaluation of the DEA model's efficiency is input-oriented since the banking system's inputs are easier to manage than its outputs in a more competitive market (Ngo and Le 2019).

$$\textbf{Bank Efficiency} = \frac{\sum \boldsymbol{mi-1\ uixij}}{\sum_{i-1}^{s} \boldsymbol{vjyrj}}$$

Maximizing Bank Efficiency

$$= \frac{\sum_{i-1}^{m} uixij}{\sum_{i-1} vjyrj} \leq 1 \ ; \ r = {}_{1,\ldots,N}$$

Where ui and vj ≥ 0

This study utilizes a method of intermediation in which bank deposits are considered inputs. This is because the bank deposits will be converted into other sorts of income-generating assets, mainly loans.

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In this study, the input variables are savings, fixed assets, and labor costs, and the output variables are total credit and operational income. In addition, this study employs the DEA VRS model, which demonstrates that the ratio between the total of inputs and outputs is not the same. The results of this model add convexity conditions to the weight values by including the following Constraints in the model:

$$\sum_{j-1}^{n} \lambda j = 1$$

Moreover, the VRS model can be represented by the following equation:

Max π (Efficiency DMU Model VRS)

Subject to:

$$\sum_{j=1}^{n} Xij\ \lambda ij \geq \pi i0\ \ i = 1,2, \ldots . m \sum_{j=1}^{n}$$

$$yrj\ \lambda j \geq yi0\ i = 1,2, \ldots . s$$

$$\sum_{j=1}^{n}\ j\ \geq\ 1 \text{ (VRS)}$$

$$\sum_{j=1}^{n}\ j\ \geq\ 0\ i = 1,2, \ldots_{.}\ n$$

Where π = DMU Model VRS, n = Tot DMU, m = Number of inputs (savings, fixed assets, and labor costs), s = Total output (total credit and operational), xij = Number of inputs to the-i DMU j, yrj = Sum of outputs of the r-th DMU j, and j = Weight of the DMU j for the computed DMU.

Panel Data Regression

This study employs panel regression analysis with a random-effects strategy. The random effect was chosen because, according to the Chow-test, Lagrange Multiple Test, and Hausman Test, the Random Effect model is the best appropriate for calculating regression in this study. The random effect model is an estimation technique that adds disturbance variables (error terms) that may emerge in the interaction between persons and time. In contrast to the common effect paradigm, which disregards individual and time dimensions. In the random-effects model, it is therefore assumed that there are individual differences in intercepts. Consequently, there are two residual components, namely, the residual as a whole and individually. The overall residual is a combination of time-series and cross-section, whereas the individual residuals represent the residuals of each cross-sectional unit. This analysis is conducted to determine the influence of the independent variable, i.e. fintech adoption, on the dependent variable, i.e. bank efficiency. The efficiency of a bank is based on input and output factors as determined by DEA analysis. Based on earlier research, this study employs control variables comprised of micro and macro bank levels. The micro-level includes bank size, ROA, Capital, Credit Risk, Expense Management, liquidity, and bank type; the macro level includes Inflation and Economic Growth (Behr et al., 2017; Lee et al., 2021b; Li et al., 2021; Lozano-Vivas et al., 2002; Lozano-Vivas & Pasiouras, 2010; G.-J. Wang et al., 2018; Y. Wang et al., 2021b)

$$Y = \alpha + \beta 1 Fintechit + \beta 2 Sizeit + \beta 3 TipeBankit + \beta 4 ROAit + B5 Capitalit + B6 CreditRiskit$$

$$+ \beta 7 ExpenseManagementit + \beta 8 Liquidityit + \beta 9 Inflasiit + \beta 10 GDBit + \varepsilon it$$

Where Y is Bank efficiency, α is constant, β1, β2, β3… β10 is the parameter, and i,t is bank x to year x.

RESULT AND DISCUSSION

Descriptive statistics data are shown in Table 2, which includes the minimum, maximum, average (mean), and standard deviation values for each variable.

Table 2. Descriptive Statistics of Overall Data

Variable	Observation	Mean	Std Deviation	Minimum	Maximum
Bank Efficiency	266	0.680677	0.192466	0.28	1
Fintech	266	2.567.669	1.656.641	0	4
Size	266	1.705.727	1.863.828	1.323.427	2.107.164
dBUMN	266	0.105263	0.307471	0	1
dBSN	266	0.447368	0.49816	0	1
dBA	266	0.368421	0.483286	0	1
ROA	266	159.109	1.689.777	0.02	22.4
Capital	266	0.127594	0.055439	0.06	0.81
Credit Risk	266	0.026572	0.073719	0.001	1.011
Expense Management	266	0,006601	0.035315	0.000044	0,214803
Liquidity	266	0.827279	0.849825	0.087	1.485
Inflation	266	4.652.857	23.691	2.72	8.38
Economic Growth	266	5.11	0.203572	4.9	5.56

Source: Output Stata

According to table 2, the independent variable, namely fintech adoption, indicates that the average bank adopting fintech is 2.567669 with a standard deviation of 1.656641, the minimum value is 0 and the maximum value is 4, so it can be concluded that 65% of all conventional commercial banks in Indonesia used as the research sample have adopted fintech. The dependent variable, bank efficiency, indicates that conventional commercial banks in Indonesia have an average efficiency of 0.680677. 68% of banks in Indonesia have achieved bank efficiency with a standard deviation of 0.192466, minimum value of 0.28, and maximum value of 1.

The following are the results of descriptive statistical tests of control variables based on table 2: (1) control variable size shows that the average size or size of commercial banks based on assets owned by banks during the study period is 17,05727 with a standard deviation of 1.863828 with a minimum value of 13,23427 and the maximum value is 21.07164 (2) The credit risk control variable shows that the average bank credit risk is 0.026572 based on the NPL ratio, with a standard deviation of 0.073719, a minimum value of 0.001 and a maximum value of 1.011. (3) The ROA control variable indicates that the average ROA of the sampled commercial banks during the study period is 1.59109, indicating that the average bank's financial performance at the ROA ratio is still above the BI standard of 1.5 percent, with a standard deviation of 1.689775. The minimum ROA value is 0.02 and the maximum ROA value is 22.4. (4) The capital control variable shows that the average bank capital is 0.127594 with a standard deviation of 0.055439, a minimum value of 0.06, and a maximum value of 0.81. (5) The expense management control variable shows that the average bank expense management is 0.006601 with a standard deviation of 0.035315, a minimum value of 0.000044, and a maximum value of 0.214803.03. (6) The liquidity variable shows that the average liquidity is 0.827279 with a standard deviation of 0.849825. The minimum value is 0.087 and the maximum value is 1.485. (7) According to the inflation control variable, the average rate of inflation in Indonesia from 2013 to 2019 is 4.652857 with a standard deviation of 2.3691. (8) The control variance of economic growth shows that the average economic growth in Indonesia during the 2013-2019 period is 5.11 with a standard deviation of 0.203572. (9) bank types based on ownership are divided into three, namely state-owned banks (dBUMN), national private banks (dBSN), and foreign banks (dBA) where state-owned banks have an average of 0.105263 with a standard deviation of 0.307471, while national private banks have an average of 0.447368 with a standard deviation of 0.49816 and

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foreign banks have an average of 0.368421 with a standard deviation of 0.483286. The minimum value for the three bank types is 0 and the maximum value is 1 for the three bank types.

Correlation Matrix

This study uses a correlation matrix to demonstrate the relationship between independent and control variables. If there is a high correlation between the independent variable and the control variable, the results of the regression test will be biased. In this correlation test, it is known that all independent variables have a strong correlation, so at the time of the regression test, this variable must be separated because its value is 1.00 > 0,6.

Table 3. Correlation Matrix

	Fintech	Size	dBUMN	dBSN	dBA	ROA	Capital	Credit Risk	Ex. Man	Liquidity	Inflation	Eco. Growth
Fintech	1.0000											
Size	0.5457	1.0000										
dBUMN	0.1786	0.5616	1.0000									
dBSN	-0.0300	-0.2714	-0.3086	1.0000								
dBA	0.1714	-0.0750	-0.2620	-0.6872	1.0000							
ROA	0.0203	0.2091	0.2062	0.0440	-0.1699	1.0000						
Capital	0.0112	0.0665	0.1389	0.0951	-0.1147	0.7238	1.0000					
Credit Risk	0.0479	0.0454	0.0684	0.0657	-0.0915	0.0110	-0.0281	1.0000				
Expense Management	0.1291	0.2519	-0.0210	0.0629	-0.1145	0.0009	-0.0144	-0.0194	1.0000			
Liquidity	0.0838	0.0146	-0.0469	-0.0206	0.0737	-0.0435	-0.0219	-0.0026	-0.0107	1.0000		
Inflation	-0.2467	-0.0750	-0.0000	0.0000	-0.0000	-0.0619	-0.1610	0.0450	-0.0831	-0.0370	1.0000	
Economic Growth	-0.1646	-0.0497	0.0000	-0.0000	0.0000	-0.0069	-0.0777	0.0967	0.0220	-0.0425	0.5488	1.000

Source: Output Stata

Classical Assumption Test

This study employed a classical assumption test in processing statistical information in an attempt to make the data objective (Gujarati & Porter, 2003). The standard assumption test for the Random Effect Model (REM) includes two preconditions: the residuals must be normally distributed, and there must be no multicollinearity between the independent variables. In addition, since the Random Effect model uses the General Least Square (GLS) approach, testing for autocorrelation and heteroscedasticity is unnecessary. This study's classical assumption testing yielded the following results:

Table 4. Normality Test

Variable	Observation	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Residue	266	0.8921	0.1443	2.17	0.3387

Source: Output Stata

The normality test in this study used the skewness-kurtosis statistical test. The method used is the One Sample Kolmogorov-Smirnov test method, with residuals that are normally distributed if the significance value is more than 0.05 (Priyatno, 2014). Based on table 3, the p-value is 0.3387 > 0.05 which indicates that the normality assumption is met.

Table 5 Multilolinearity Test VIF 1/VIFU Variable The skewness-kurtosis statistical test was utilized in this study to determine normality. If the significance value is greater than 0.05, the One-Sample Sample

Kolmogorov-Smirnov test is applied, with residuals that are normally distributed (Priyatno, 2014). The p-value in table 3 is 0.3387 > 0.05, indicating that the normality assumption is fulfilled.

Table 5. Multilolinearity Test

Variable	VIF	1/VIF
Econmic Growth	203.61	0.004911
Size	192.13	0.005205
Capital	14.35	0.069689
dBSN	9.88	0.101234
dBA	8.76	0.114166
Fintech	8.08	0.123817
Inflation	6.24	0.160382
Expense Management	5.18	0.193134
ROA	4.29	0.233129
Dbumn	3.30	0.302671
Credit Risk	1.16	0.862688
Liquidity	1.04	0.965644
Mean VIF	38	.17

Source: Output Stata

The Tolerance Value (TOL) and Variance Inflation Factor (VIF) were used in this study to demonstrate multicollinearity (VIF). Multicollinearity does not occur if VIF < 10 and Tolerance value > 0.10, since the maximum VIF limit used to test collinearity is 10 and the Tolerance value is less than 0.10, hence if VIF > 10 and Tolerance value < 0.10, there is multicollinearity. According to table 4, all variables in the study, apart from economic growth, capital, and size, have a VIF value < 10 and a tolerance value > 0.10, indicating that the multicollinearity assumption test is not met. The value of VIF economic growth, size, and capital is extremely high. Furthermore, the relationship between these three variables will be shown. Table 6 shows the correlation results for the three variables with a VIF value > 10. Based on table 5, the correlation value between the three variables is very low, implying that there is no multicollinearity.

Table 6. Variable Correlation Value with VIF>10

	Ecgrowth	Size	Capital
Ecgrowth	1		
Size	-0.0497	1	
Capital	-0.0777	0.0665	1

Source: Output Stata

According to Table 7, all fintech adoption proxies have a positive and significant impact on bank efficiency. This study indicates that the more fintech services a bank offers, the more efficient it is. This study's findings are consistent with (Y. Wang et al., 2021a) research, which shows that the use of fintech in banks can improve bank efficiency by reducing operational expenses, improving service efficiency, strengthening risk control capabilities, and creating models. The bank's overall competitiveness will increase as a result of the bank's increased attractiveness to clients. In addition, Lee et al. (2021) and Li et al. (2021) demonstrate that fintech innovation not only improves bank efficiency, but also the technology employed by banks.

This test also includes control variables, the test result regresion of the inflation have effect on the dependent variable, thus if the inflation variable increase, the bank's efficiency will decreases. The results of this study are consistent with research by (Fang et al., 2019) which states that higher inflation is associated with higher loan interest rates, which will increase bank profitability which has a positive impact on bank efficiency. So that the increasing inflation rate will force banks to be more efficient.

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Table 7. Regression Results of Cross-Sectional Time Series Feasible Generalized Least Square

Variable	Bank Efficiency											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	0,890***											
	(2,46)											
Fintech	0,037***											
	(2,87)											
Size		0,001										
		(0,08)										
Dbumn			0,053									
			(0,47)									
dBSN				-0,057								
				(-0,61)								
dBA					-0,088							
					(-0,93)							
ROA						0,013						
						(1,59)						
Capital							-0,421					
							(-1,56)					
Credit Risk								0,008				
								(0,07)				
Expense Management									0,001			
									(0,42)			
Liquidity										0,000		
										(0,30)		
Inflation											0,016***	
											(3,57)	
Economic Growth												-0,065
												(-1,31)
N observation	266	266	266	266	266	266	266	266	266	266	266	266

***p<0,01,**p<0,05,*p<0,1

The outcomes of this study demonstrate the importance of fintech in banking, indicating that banks cannot maintain their market share if they cannot keep up with the growth of fintech innovation. In Indonesia, banks do not implement fintech due to a lack of internal innovation capabilities (Drasch et al., 2018); therefore, banks must engage in internal Research and Development by gaining external knowledge through mergers and acquisitions (M&A) and external collaboration (Phillips & Zhdanov, 2013). In addition, banks are constrained by high investment costs and lengthy fintech adaptation times. Thus, this improvement in efficiency is due to the availability of infrastructure (Leong et al., 2017) and the digitization of bank services (Makina, 2019). For instance, big data analytics apps, block chain technology, and financial service automation enable financial institutions to simplify bank processes, ultimately enhancing their efficacy.

CONCLUSION

This study attempted to investigate the impact of fintech adoption on the efficiency of conventional Indonesian commercial banks. Researchers discovered a significant and positive relationship between fintech adoption and bank efficiency. The findings of this study also indicate that the bank will be more efficient the more fintech services it adopts. This study's findings demonstrate that a bank's decision to implement fintech results in enhanced production and promotes organizational efficiency. The greater a company's efficiency and productivity, the greater its capacity to compete and control the market. In addition, the success of banks in adopting fintech is strongly dependent on the availability of infrastructure held by banks; banks that lack the ability to implement fintech must do research and development through mergers, acquisitions, or partnerships with external parties.

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