







# “Fintech credit growth and commercial bank lending: Substitute or complement?”

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# FINTECH CREDIT GROWTH AND COMMERCIAL BANK LENDING: SUBSTITUTE OR COMPLEMENT?

## Abstract

One of the fundamental functions of commercial banks is providing credit to the public; however, with advancements in digital technology, this function is increasingly being performed by fintech lending companies as well. Accordingly, this study seeks to examine whether the growth of fintech credit in Indonesia acts as a substitute for or a complement to credit extended by commercial banks. The analysis utilizes monthly data from January 2018 to February 2023 and employs the Autoregressive Distributed Lag (ARDL) model to capture both short-run and long-run relationships between fintech lending and bank credit growth. The results indicate that the expansion of fintech credit exerts a positive and significant effect on the growth of bank lending, showing that fintech financing functions as a complement rather than a substitute. An increase in fintech credit is associated with an expansion of bank credit, implying that fintech lending enhances overall financial intermediation by reaching underserved segments and supporting credit distribution through formal banking channels. These findings suggest that fintech development does not crowd out bank lending but instead strengthens Indonesia's credit ecosystem. The findings offer important guidance for regulators and other stakeholders in formulating suitable policies to respond to the rapid advancement of fintech services. With a balanced regulatory framework, effective oversight, constructive collaboration, and adequate digital infrastructure, Indonesia's financial ecosystem has the potential for inclusive, efficient, and sustainable financial development.

**Keywords** fintech, commercial bank, credit, ARDL, interest rate

**JEL Classification** G21, G23, O33, C22

## INTRODUCTION

Advances in technology, information, and communication have now become a very important aspect for all countries in the world. A country that can effectively utilize these technological advances can produce new innovations that will support the country's growth towards a better direction very quickly. The financial sector, particularly banking, has been significantly influenced by technological advancements, leading to the emergence and rapid growth of technology-driven innovations known as financial technology, or fintech (Frame et al., 2018). Non-brokered peer-to-peer (P2P) lending, cryptocurrencies, and smart contracts represent key components of a new landscape of technology-enabled financial services designed to offer more customized solutions (Thakor, 2020). Although the concept of fintech in connection to financial services is not new, it has received a lot of attention lately.

Fintech refers to technology-driven financial innovations that can produce new business models, applications, processes, or products, all of which have substantial impacts on financial institutions, financial markets, and the way services are delivered (Li et al., 2020). In Indonesia, the development of fintech is still relatively new, and the percentage is smaller than that of traditional finance, but the Indonesian economy is thought to be impacted by fintech (Narayan,

2019). According to Boot et al. (2021), financial technology is believed to intensify banking risk-taking mainly due to the emergence of online lending services available that will directly impact commercial banks' lending business. However, the complementary impact of fintech innovation on banks' business models indicates that fintech can lower risks for commercial banks (Begenau et al., 2018; Cheng & Qu, 2020). Other researchers suggest that traditional finance and fintech will collaborate and compete in related industries (Li et al., 2020).

## 1. LITERATURE REVIEW

The use of financial technology today has experienced a very rapid development with creative innovations that provide ease of use. Fintech companies, in particular, have provided focused solutions to limitations or inefficiencies in traditional bank financial intermediation, such as providing services to unbanked populations (Tang, 2019). Depending on whether banks and fintech platforms compete for the same customers, there can be a reciprocal interaction between the two types of financial intermediaries. Fintech lending companies will satisfy credit demands that commercial banks are unable to complete, or fintech credit will be made available to clients who already have bank loan access (De Roure et al., 2016; Dolson & Jagtiani, 2021; Jagtiani & Lemieux, 2018; Li et al., 2023). As a result, the existence of fintech credit may pose a threat to conventional banking practices.

Banks' responses to the digital revolution might range from defensive (protective) measures to preserve their market share to the use of financial technology itself (Hodula, 2022). In addition, banks may still underestimate the risks to their business due to financial technology innovation, which will also affect bank performance if its existence is ignored. Fintech companies can reduce commercial banks' revenue, lower their payment service fees, pose liquidity risks due to customers switching accounts and difficulty in maintaining customer loyalty and cross-selling products, as well as fintech companies becoming direct competitors of banks.

Credit fintech companies that are growing today can be an alternative for borrowers who need funds (Wei, 2023). The quality and ease of access of the services provided can compete with those provided by commercial banks. De Roure et al. (2016), however, contend that fintech firms can en-

hance the services offered by commercial banks by, for example, increasing borrowers' access to credit who are underserved by commercial banks. Conventional banks are also attempting to integrate financial technology innovations into their operations (Chen et al., 2022; Lee et al., 2021). To prevent a steep drop in loan volumes following the entry of fintech into the market, traditional banks may develop their own platforms, acquire existing ones, or form partnerships with fintech providers (Nguyen, 2019; Thakor, 2020; Zhao et al., 2023).

Fintech credit platforms have the capacity to either supplement or replace commercial banks' credit services. When the financial industry is more stable, liquid, and less concentrated, fintech typically serves as a complement to provide services to the same customers. If the banking industry is more consolidated and less stable, then fintech acts more as a substitute for credit services by commercial banks (Hodula, 2022; Phan et al., 2020). One of the major fintech credit platforms, peer-to-peer lending, is expected to have a negative impact on domestic lending banks (Zhang et al., 2019). Tamara et al. (2021) examined the relationship between small banks and peer-to-peer lending in both the pre-pandemic and pandemic periods. The findings indicate that peer-to-peer lending was chosen by unbanked customers who could not access banks before the pandemic, while during the pandemic or crisis, borrowers who had access to banks also considered loans from peer-to-peer lending platforms. In addition, Cole et al. (2019) stated explicitly that fintech crowdfunding and banks' relationship is a complement, not a substitute. In fact, fintech has a relatively smaller negative impact on big banks (Sapulette et al., 2021).

Peer-to-peer fintech lending platforms are not expected to substitute commercial bank credit due to the strong segmentation present in the credit market (Thakor, 2020), yet banks are likely to lose part of their market share to these platforms. When

borrowers do not have collateral, then this role can be taken over by fintech platforms, or commercial banks can acquire or partner with fintech lending platforms. When commercial banks adopt fintech innovations, it will increase cost efficiency, and the improved services provided will increase customer loyalty (Lee et al., 2021). Similarly, Kowalewski and Pisany (2022) argued that fintech lending platforms serve as a supplement to bank credit in developing nations, in which bank consumer lending is expanding concurrently with the growth of fintech credit markets.

The literature presents contrasting views on the interaction between fintech lending and bank lending. While some studies emphasize a complementary relationship, Tang (2019) finds that peer-to-peer lending supports bank lending for modest loans but acts as a substitute for infra-marginal borrowers, as the quality of borrowers switching from bank loans to fintech loans is lower than that of borrowers who continue to obtain bank loans. Wei (2023), Cornaggia et al. (2018), and Yuan et al. (2023) also suggest that fintech companies will compete and replace profitable products provided by conventional banks. FinTech loans more often replace lending from off-market or large banks than from small banks within the credit market (Balyuk et al., 2020), and they also substitute high-risk consumer loans that banks are either unwilling or unable to provide (De Roure et al., 2016). FinTech loans to small businesses appear to carry lower risk when they substitute for credit previously provided by large banks, and this shift may also generate broader implications for the wider credit market (Bömer & Maxin, 2018).

Li et al. (2017) identify three types of interaction between fintech and the banking industry. First, a substitution relationship arises when fintech services function primarily as alternatives to traditional banking products, leading to a significant negative effect on banks. Second, a complementary relationship occurs when fintech supports or enhances banking activities, producing a positive and significant effect. Lastly, an insignificant impact suggests that fintech has not yet exerted a meaningful influence on the banking sector, or that the substitution and complementary effects offset one another. Based on these theoretical perspectives, this study proposes the hypothesis that

fintech credit growth may act either as a complement to, or a substitute for, commercial bank lending.

Building on the previously outlined potential roles of fintech in shaping commercial bank lending, this study seeks to determine whether the growth of fintech credit in Indonesia serves to complement or substitute for conventional bank credit expansion. To evaluate this hypothesis, the study utilizes the Autoregressive Distributed Lag (ARDL) method. This method is adopted from research by Deheri (2022) and Nyasha and Odhiambo (2015), which analyzed whether variables act as complements or substitutes, and it also enables the examination of both long-term and short-term relationships among the research variables.

This study is anticipated to enhance the broader understanding of how fintech firms and commercial banks interact in delivering credit to the public in Indonesia, thus serving as a valuable reference for future research. The results of this analysis will likewise provide insights into the interaction between fintech and the traditional banking sector, which can serve as a useful foundation for policymakers in relevant institutions as they formulate suitable regulatory and strategic responses.

This study aims to provide empirical evidence on the relationship between fintech lending and commercial bank lending in Indonesia, with particular emphasis on whether fintech lending complements or substitutes traditional bank credit.

## 2. RESEARCH METHODOLOGY

This study employs time-series data spanning from January 2018 to February 2023, comprising 62 observations. Monthly data are utilized because they more effectively capture dynamic fluctuations and yield more accurate analytical outcomes. The chosen period reflects the availability of financial technology data, which became accessible starting in 2018. All data were sourced from the official websites of the Financial Services Authority and Bank Indonesia, and are expressed in percentage terms. The variable used in this study is bank credit growth as the dependent variable, measured using the formula in equation (1).

$$BCG_t = \frac{BC_t - BC_{t-1}}{BC_{t-1}} \cdot 100\%, \tag{1}$$

where  $BCG_t$  is the current period bank credit growth;  $BC_t$  is the current period bank credit;  $BC_{t-1}$  is the previous period bank credit.

Then, in equation (2), there is a calculation formula for the main independent variable, namely fintech credit growth.

$$FCG_t = \frac{FC_t - FC_{t-1}}{FC_{t-1}} \cdot 100\%, \tag{2}$$

where  $FCG_t$  is the current period bank credit growth;  $FC_t$  is the current period bank credit;  $FC_{t-1}$  is the previous period bank credit.

In addition to incorporating fintech credit growth, this study includes several control variables that reflect key banking characteristics such as liquidity, lending interest rates, the loan-to-deposit ratio, and asset ratios, as outlined in Table 1. The main goal is to assess whether fintech credit acts as a substitute for or a complement to traditional bank lending in Indonesia. To examine this relationship, the analysis employs the Autoregressive Distributed Lag (ARDL) approach using EViews 9 software. The ARDL framework is selected because it allows for efficient and consistent parameter estimation while mitigating potential endogeneity issues arising from the inclusion of lagged dependent and independent variables (Pesaran et al., 1999).

Data processing using the ARDL model must go through an important procedure first. First, the research variables must pass the test formulated by Dickey and Fuller (1979), namely the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron test (Phillips & Perron, 1988). The test is conduct-

ed to state that the data do not experience drastic changes, with the data fluctuating between the range of average values, or the data are declared to be stationary before the application of econometric models for time series. The second is to use the Johansen cointegration test to determine whether study variables cointegrate (Johansen, 1988). After conducting the cointegration test, researchers can continue data processing to obtain the results of the direction of the correlation between the increase of commercial bank credit and fintech credit.

This study employs the ARDL approach to analyze the relationships among the research variables, as this method is appropriate when the regressors are integrated of order zero, I(0), first order, I(1), or fractionally integrated. However, the ARDL model is not suitable if any variable is integrated of order two, I(2). Considering the sample size and the goal to assess fintech credit's impact on commercial bank lending, the researchers also intend to test the stability of the results in both the short and long term. Therefore, the ARDL framework is deemed highly appropriate for this analysis. The functional equation used to examine the effect of fintech credit and other explanatory variables on commercial bank credit over these time horizons is shown in equation (3).

$$BCG_t = f(FCG_t, IRC_t, LAR_t, LDR_t), \tag{3}$$

where  $BCG_t$  is bank credit growth;  $FCG_t$  is fintech credit growth;  $IRC_t$  is interest rate credit;  $LAR_t$  is loan asset ratio; and  $LDR_t$  is loan to deposits ratio.

In addition, researchers also use several variables that contribute to lending by commercial banks, such as IRC, as the interest rate credit, which is the central bank's benchmark lending rate. The function in equation (3) is transformed into a research model written in equation (4).

**Table 1.** Data descriptions

Source: Author compilation (2023).

Variables	Notation	Description	Data Source
Bank Credit Growth	BCG	Growth of Credit Disbursed by Commercial Banks	OJK
Fintech Credit Growth	FCG	Growth in Total Accumulated Lending by Fintech Lending	OJK
Credit Interest Rate	IRC	Lending Facility and Financing Facility Interest Rate	BI
Liquid Assets Ratio	LAR	The Ratio of a Company's Liquid Assets to Its Current Liabilities	OJK
Loan to Deposits Ratio	LDR	The Measure of Bank Profitability to Its Total Assets	OJK

$$BCG_t = \beta_0 + \beta_1 FCG_t + \beta_2 IRC_t + \beta_3 LAR_t + \beta_4 LDR_t + e_t, \quad (4)$$

where  $\beta_0$  is the parameter coefficient value;  $\beta_1$ ,  $\beta_2$ ,  $\beta_3$ , and  $\beta_4$  are the coefficients of each independent variable; and  $e_t$  is the confounding variable.

From equation (4), the coefficient of each independent variable indicates its impact on the dependent variable ( $\beta_1$ ,  $\beta_2$ ,  $\beta_3$ ,  $\beta_4$ ) with a direction that can be negative or positive. Meanwhile, equation (5) is a reformulation of the ARDL bound test model equation from equation (4).

$$\begin{aligned} \Delta BCG_t = & \gamma_0 + \alpha_0 BCG_{t-1} + \alpha_1 FCG_t \\ & + \alpha_2 IRC_t + \alpha_3 LAR_t + \alpha_4 LDR_t \\ & + \sum_{i=1}^n \rho_0 \Delta BCG_{t-1} + \sum_{i=1}^n \rho_1 \Delta FCG_{t-1} \\ & + \sum_{i=1}^n \rho_2 \Delta IRC_{t-1} + \sum_{i=1}^n \rho_3 \Delta LAR_{t-1} \\ & + \sum_{i=1}^n \rho_4 \Delta LDR_{t-1} + e_t, \end{aligned} \quad (5)$$

where  $\beta_0$  is the Parameter Coefficient Value;  $\beta_1$ ,  $\beta_2$ ,  $\beta_3$ , and  $\beta_4$  are the coefficients of the variable in the long term;  $\alpha_0$ ,  $\alpha_1$ ,  $\alpha_2$ ,  $\alpha_3$ , and  $\alpha_4$  are the coefficients of the variable in the short term;  $e_t$  is the error.

Equation (5) of the ARDL model captures both the long-term and short-term reactions, with  $t$  being the time. ECT is the Residuals obtained from Estimation Cointegration, where a different equation is shown in equation (6).

$$\begin{aligned} \Delta BCG_t = & \vartheta_0 + \sum_{i=1}^n \gamma_{0i} \Delta BCG_{t-1} \\ & + \sum_{i=1}^n \gamma_{1i} \Delta FCG_{t-1} + \sum_{i=1}^n \gamma_{2i} \Delta IRC_{t-1} \\ & + \sum_{i=1}^n \gamma_{3i} \Delta LAR_{t-1} + \sum_{i=1}^n \gamma_{4i} \Delta LDR_{t-1} \\ & + \delta ect_{t-1}, \end{aligned} \quad (6)$$

where  $\vartheta_0$  is the parameter coefficient;  $\gamma_{0i}$ ,  $\gamma_{1i}$ ,  $\gamma_{2i}$ ,  $\gamma_{3i}$ , and  $\gamma_{4i}$  are the Effect in the Short Run;  $\delta$  is the Coefficient for the Error Correction Term;  $ect_{t-1}$  is the Imbalance in Period  $t - 1$ .

The symbol  $\delta$ , representing the coefficient of the error correction term, shows the speed at which the disequilibrium is corrected in the following period to reach equilibrium. This error correction

term coefficient is negative and statistically significant. The disequilibrium in period  $t - 1$ , as described in equation (3), is measured by  $ect_{t-1}$ .

### 3. RESULTS AND DISCUSSION

Table 2 shows that the standard deviation of bank credit growth exceeds its mean value, indicating a relatively high level of variability within the data. The maximum observed growth rate of bank credit is 0.030, while the minimum is  $-0.020$ . In contrast, the standard deviation of fintech credit growth is smaller than its average, indicating that the data show relatively low variability. Additionally, the Jarque-Bera test verifies that the variables employed in this study follow a normal distribution.

As previously noted, the ARDL model cannot be applied to variables that are integrated at the second order,  $I(2)$ . However, it can accommodate time-series variables that are stationary at different orders of integration. To verify this requirement, the stationarity of all variables in this study was examined using the Phillips-Perron and Augmented Dickey-Fuller (ADF) tests, with the results summarized in Table 3. Both tests consistently indicate that Bank Credit Growth (BCG) is stationary at level, or  $I(0)$ , while the main variable, FCG, along with the additional variables IRC, LAR, LDR, and ROA, are stationary at the first difference, or  $I(1)$ . Importantly, none of the variables are integrated at the second order. These findings confirm that all variables meet the criteria necessary to proceed with the initial stage of the ARDL estimation process.

The Akaike information criterion (AIC) is used to calculate the ideal lag length for this study variable, which can be seen from the automatic choice by the summary of the ARDL model choices in the EViews software in the form of a graph in Table 4. Where the maximum lag length chosen is 4, 0, 2, 0, 0 in sequence according to these numbers referring to Bank Credit Growth (BCG), Fintech Credit Growth (FCG), interest rate credit (IRC), loan assets ratio (LAR) and loan to deposits ratio (LDR).

Table 4 presents the results of the ARDL bounds test. The estimated F-statistic exceeds the critical upper bound values at the 5% significance level,

**Table 2.** Descriptive statistics

Statistics	BCG	FCG	IRC	LAR	LDR
Mean	0.005574	0.091148	5.295082	17.10607	86.43115
Median	0.010000	0.070000	5.000000	16.39000	85.38000
Maximum	0.030000	0.270000	6.750000	21.67000	96.19000
Minimum	-0.020000	0.020000	4.250000	14.15000	76.20000
Std. Dev.	0.012183	0.061890	0.945943	2.107727	6.790230
Jarque-Bera	0.765087	18.12571	6.141727	5.516852	7.499100
Probability	0.682124	0.000116	0.046381	0.063391	0.023528
Observations	61	61	61	61	61

**Table 3.** Unit root test

Variable	Augmented Dickey-Fuller		Phillips-Perron		Decision
	level	1 <sup>st</sup> difference	level	1 <sup>st</sup> difference	
BCG	-8.54*	-13.10*	-8.53*	-21.88*	I(0)/I(1)
	(0.00)	(0.00)	(0.00)	(0.00)	
FCG	-2.05	-12.30*	-1.67	-14.84*	I(1)
	(0.26)	(0.00)	(0.44)	(0.00)	
IRC	-1.47	-3.58*	-1.15	-3.55*	I(1)
	(0.54)	(0.01)	(0.69)	(0.01)	
LAR	-1.40	-8.25*	-1.44	-8.23*	I(1)
	(0.58)	(0.00)	(0.56)	(0.00)	
LDR	-0.02	-5.89*	-0.36	-6.01*	I(1)
	(0.95)	(0.00)	0.91	(0.00)	

Note: \*, \*\*, and \*\*\* represent significance levels at 1%, 5%, and 10%, respectively.

specifically, it is greater than both the I(0) and I(1) thresholds of 7.90. This indicates rejection of the null hypothesis and confirms the presence of cointegration in the model. Furthermore, the Johansen and Juselius (1990) cointegration test, shown in Table 4, reinforces this conclusion, as both the trace statistic and maximum eigenvalue surpass their respective 5% critical values, also leading to rejection of the null hypothesis. Taken together, these findings verify cointegration within the research model. Accordingly, the analysis may proceed to estimating the long-run and short-run dynamics of the ARDL framework.

Table 5 presents the estimation results for both the long-run and short-run models (Panels A and B), while Panel C reports the diagnostic test outcomes. Panel A, which summarizes the short-run estimates with commercial bank credit growth as the dependent variable, shows that the error correction term (-3.5581) is statistically significant at the 1% level. This implies that any deviation from the long-run equilibrium is corrected within approximately 3.56 months. In the short run, commercial bank credit growth (BCG) at lags 1, 2, and 3 exerts a positive and statistically significant influence on current credit growth. The key explana-

**Table 4.** Cointegrated ARDL bound test

Model	Lag Selection	F-Stat.	Decision
$BCG_t = f(FCG_t, IRC_t, LAR_t, LDR_t)$	4, 0, 2, 0, 0	7.90*	Cointegrated
Critical Value Bounds	I(0)	I(1)	
10%	2.45	3.52	Cointegrated
5%	2.86	4.01	
2.5%	3.25	4.49	
1%	3.74	5.06	

Note: \*, \*\*, and \*\*\* represent significance levels at 1%, 5%, and 10%, respectively.

**Table 5.** ARDL short and long run

<b>Panel A: Short-Run Bank Credit Growth (BCG)</b>			
<b>Variable</b>	<b>Coef.</b>	<b>t-Stat.</b>	<b>Prob.</b>
$ECT_{t-1}$	-3.5581	-6.7543	0.0000*
$\Delta(BCG(-1), 2)$	1.6451	3.6486	0.0007*
$\Delta(BCG(-2), 2)$	0.7173	2.4139	0.0199**
$\Delta(BCG(-3), 2)$	0.2731	2.0172	0.0497**
$\Delta(FCG, 2)$	0.1748	2.2266	0.0310**
$\Delta(IRC, 2)$	-0.0050	-0.4350	0.6656
$\Delta(IRC(-1), 2)$	0.0334	2.9675	0.0048*
$\Delta(LAR, 2)$	0.0044	2.1820	0.0344**
$\Delta(LDR, 2)$	0.0048	2.6893	0.0100**
<b>Panel B: Long-Run Bank Credit Growth (BCG)</b>			
$\Delta FCG_t$	0.0491	2.1625	0.0359**
$\Delta IRC_t$	-0.0037	-1.3625	0.1798
$\Delta LAR_t$	0.0012	1.9907	0.0526***
$\Delta LDR_t$	0.0013	2.5262	0.0151**
Constant	0.0004	0.7913	0.4329
<b>Panel C: Diagnostic Test</b>			
<b>Tests</b>	<b>F-stat.</b>	<b>Prob.</b>	
LM Test	1.9295	0.0997	
Jarque-Bera Normality Test	1.9330	0.3804	
Heteroscedasticity Test	1.4889	0.1766	
Ramsey RESET Test	2.6058	0.1136	

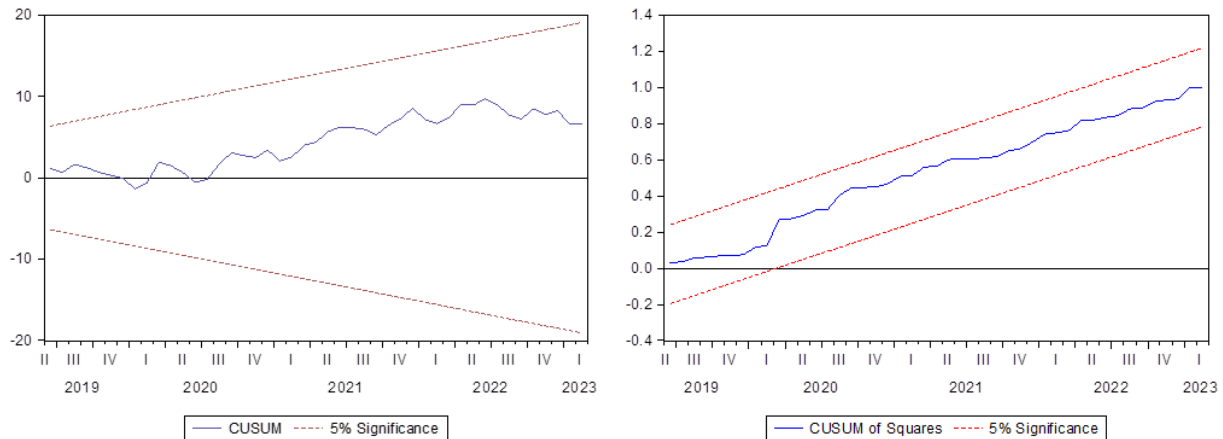
Note: \*, \*\*, and \*\*\* represent significance levels at 1%, 5%, and 10%, respectively.

tory variable – fintech credit growth (FCG) – also displays a positive and significant coefficient, indicating that, in the short term, fintech credit acts as a complement to commercial bank lending rather than a substitute. Regarding the control variables, the credit interest rate (IRC) has a negative but insignificant effect in the current period (lag 0). However, at lags 1 and 2, IRC becomes positive (0.0334) and statistically significant, suggesting that lending rates exert their short-term impact on bank credit growth with a one- to two-month delay. Additionally, in the short run, the loan-to-assets ratio (LAR) shows a positive (0.0044) and significant effect on commercial bank credit growth in the subsequent two-month period. The loan-to-deposit ratio (LDR) also plays a role, as discussed in the continuation of the model results.

Panel B in Table 5, which displays the long-run estimation's findings with the dependent variable of commercial bank loan growth, shows consistent results where the main regressor variable of fintech loan growth (FCG) in the long run acts as a complement to commercial bank loan growth because at the 5% confidence level, the coefficient value is significant and positive (0.0491). In addition,

the loan interest rate variable in the long run has no significant effect on commercial bank loan growth, with a possible negative relationship direction. In the long run, the growth of commercial bank loans is positively and significantly impacted by LAR and LDR variables.

Table 5 also displays the findings of the diagnostic tests, where the study model has passed the LM test, indicating that the model does not have autocorrelation symptoms. This research model is also normally distributed, as indicated by the Jarque-Bera test probability value exceeding the 5% significance level, meaning the null hypothesis is not rejected. Then this research model also does not have heteroscedasticity symptoms with the Breusch-Pagan-Godfrey heteroscedasticity test value above 0.05, which denotes that the null hypothesis is rejected, indicating that the model is homogeneous. Judging from the probability value of the Ramsey reset test, it is known that the model is linear with a probability above 0.05. Additionally, the researchers performed a stability test using the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests, as shown in Figure 1. From Figure 1, it is evident



**Figure 1.** Stability test of CUSUM and CUSUM of the square graph

that the model is stable, since the plots for both CUSUM and CUSUMSQ remain within the error bounds corresponding to the 5% confidence level.

To further verify the robustness and consistency of the study’s findings, a robustness check was

performed by incorporating an additional control variable, return on assets (ROA), into the previously specified model. The robustness test results shown in Table 6 confirm that the main findings remain consistent and dependable, fintech credit growth continues to have a positive

**Table 6.** Robustness check

Panel A: Short-Run Bank Credit Growth (BCG)			
Variable	Coef.	t-Stat.	Prob.
$ECT_{t-1}$	-3.1478	-6.0392	0.0000***
$\Delta(BCG(-1), 2)$	1.3068	2.9820	0.0048***
$\Delta(BCG(-2), 2)$	0.5107	1.7846	0.0817*
$\Delta(BCG(-3), 2)$	0.1864	1.4583	0.1524
$\Delta(FCG, 2)$	0.1628	2.1211	0.0400**
$\Delta(IRC, 2)$	-0.0096	-0.8345	0.4088
$\Delta(IRC(-1), 2)$	0.0412	3.3818	0.0016***
$\Delta(IRC(-2), 2)$	-0.0142	-1.2950	0.2026
$\Delta(LAR, 2)$	0.0043	2.2759	0.0281**
$\Delta(LDR, 2)$	0.0040	2.1523	0.0373**
$\Delta(ROA, 2)$	-0.0128	-1.6913	0.0984*
$\Delta(ROA(-1), 2)$	-0.0190	-2.4139	0.0203**
Panel B: Long-Run Bank Credit Growth (BCG)			
$\Delta FCG_t$	0.0517	2.0470	0.0471**
$\Delta IRC_t$	-0.0027	-0.9243	0.3607
$\Delta LAR_t$	0.0014	2.0282	0.0491**
$\Delta LDR_t$	0.0013	2.1035	0.0416**
$\Delta ROA_t$	0.0023	0.4996	0.62
Constant	0.0003	0.6155	0.5417
Panel C: Diagnostic Test			
Tests	F-stat.		Prob.
LM Test	2.4455		0.2944
Jarque-Bera Normality Test	1.5278		0.4658
Heteroscedasticity Test	12.6550		0.5539
Ramsey RESET Test	2.1576		0.0807
CUSUM		Stable	
CUSUM of Squares		Stable	

Note: \*, \*\*, and \*\*\* represent significance levels at 1%, 5%, and 10%, respectively.

and statistically significant effect on commercial bank credit growth in both the short and long term. These findings further support the validity and durability of the initial conclusions. Even with the inclusion of ROA, fintech credit growth consistently acts as a complement to commercial bank lending. This stronger evidence highlights the crucial role fintech credit plays in influencing the development of commercial bank credit growth.

The advancement of financial technology innovation is currently having a significant impact on the role of commercial banks in providing credit. In this modern era, innovative companies are increasing, such as Peer-to-Peer (P2P) Lending, Crowdfunding, Digital Wallet Credit, Marketplace Lending, and others (Feyen et al., 2021; Linawati et al., 2020). The increase in sources of credit services can affect the role of commercial banks in lending (Gomber et al., 2018), either as a complement or as a substitute. Initially, credit was extended traditionally through financial organizations, including credit cooperatives, commercial banks, and others (World Bank, 2018). However, the credit application process at that time was more conventional, with regulations and supervision that were quite strict compared to today.

The study's results indicate that the growth of fintech credit positively and significantly influences the credit growth of commercial banks in Indonesia. These results indicate that fintech credit appears to complement commercial bank credit, not replace it. Although fintech credit companies have emerged as new competitors in the financial industry by offering more inclusive and innovative solutions, peer-to-peer lending and micro-loans that are more accessible to individuals and small businesses (Batunanggar, 2019; Suryono et al., 2021). This offers convenience to the public in obtaining credit services that were previously difficult to reach by commercial banks, such as those with bad credit history or those who do not have sufficient collateral assets. (Bank Indonesia, 2021; Beck, 2020; Murthy et al., 2019). Fintech credit companies can assess creditworthiness in different ways through analysis of alternative and non-traditional data (Wijaya, 2023). Despite fintech lend-

ing offering significant advantages in improving financial literacy and inclusion, commercial banks continue to hold a crucial role in supplying credit to various economic sectors and cannot be replaced by fintech.

A literature argues that fintech lending tends to complement rather than substitute commercial bank lending. According to Haddad and Hornuf (2019), commercial banks retain important competitive advantages, including strong financial resources, sophisticated risk assessment capabilities, extensive networks, and established customer trust. Furthermore, commercial banks can provide large amounts of financing so they can support complex infrastructure projects and provide a variety of other banking services (Dong et al., 2020; Yoshino & Hesary, 2018). Good collaboration between credit fintech and commercial banks that complement each other can be a mutually beneficial synergy for each institution. Commercial banks can utilize or adopt fintech technology to speed up the creditworthiness analysis and approval process so as to provide better service to customers (Li et al., 2022). On the other hand, fintech credit companies can benefit from the experience of commercial banks and leverage their financial resources to broaden their reach and offer larger loans (Horváth et al., 2022).

The realization of healthy collaboration between credit fintech and commercial banks requires appropriate regulations. The supervision of fintech credit activities needs to be tightened and must ensure adequate consumer protection, transparency, market integrity, and risk mitigation. The regulations should be able to accommodate ever-evolving technological innovations and developments while preserving the financial system's stability. These two institutions could collaborate through incentives, cooperative facilities, or joint initiatives aimed at sharing knowledge, technology, and expertise to enhance lending efficiency and effectiveness while expanding financial access to boost financial inclusion in Indonesia.

In addition, government authorities can also develop digital infrastructure so that internet connectivity becomes more reliable and widespread

to facilitate credit by fintech and commercial banks, as well as customers in need. Fast and affordable access is crucial to the community's economic development. By implementing the right policies, the government and related institutions can create an environment that supports the role of fintech credit to commercial banks to create a healthy collaboration. This can help

increase financial inclusion, speed up the procedure for applying for a loan, and offer wider access to finance for the community. Moreover, individuals can enjoy a diverse range of financial services tailored to their needs and preferences, with commercial banks and fintech lenders complementing each other to offer wider and more sustainable access to financing.

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## CONCLUSION

This study aims to examine whether the growth of fintech credit in Indonesia complements or substitutes commercial bank credit. The results show that fintech credit growth acts more as a complement than a substitute in Indonesia. This is indicated by the positive and significant results, where an increase in fintech credit will also increase commercial bank credit. This shows that the presence of fintech lending does not threaten the existence of commercial banking loans but plays a complementary role in ensuring public access to finance. While fintech lending offers convenience and speed to obtain loans, commercial bank lending remains important as it can offer more complex financial services and many other banking products. The additional role of credit fintech is also visible from the perspective of financial inclusion, where fintech can serve market segments that were previously hard to reach by commercial banks, but not take customers from these institutions. Therefore, a collaborative relationship between credit fintech and commercial banks is essential to build a more inclusive and sustainable financial ecosystem, providing people with a broad range of financial services that meet their needs and preferences. To maximize the positive potential of fintech credit, it is important for regulators and relevant stakeholders to ensure that there is a clear and fair framework. Appropriate policies are needed to protect consumers, promote fair competition, and maintain overall financial system stability. Despite these contributions, this study has several limitations that open opportunities for future research. Further studies could extend the analysis by incorporating firm-level or micro-level data to better capture heterogeneous effects across different types of fintech platforms and banking institutions.

## AUTHOR CONTRIBUTIONS

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