

SPATIAL EFFECTS OF P2P LENDING ON BANKING PERFORMANCE: A STUDY ACROSS INDONESIAN PROVINCES

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ABSTRACT

This study examines the impact of Peer-to-Peer (P2P) Lending on banking performance across 33 provinces in Indonesia, including its spatial effects and its relationship with MSME Lending. The novelty of this study lies in combining dynamic panel analysis and spatial approaches to examine Fintech disruption in Indonesia. This study also highlights Indonesia as an emerging archipelagic economy with substantial regional disparities in financial inclusion and digital infrastructure. Unlike previous studies that mainly focus on the national-level effect, this research provides evidence on whether the impact of Fintech differs spatially across regions. The study employs aggregate monthly banking data from January 2020 to June 2025, resulting in 2,178 observations analyzed using the Generalized Method of Moment (GMM). The results suggest that P2P Lending significantly affects banking performance at the national level. However, no significant spatial differences are identified across regions, suggesting that Fintech disruption is systemic and nationally pervasive rather than regionally concentrated. Meanwhile, P2P Lending does not significantly influence SMEs credit performance either nationally or spatially, indicating that Fintech platforms currently complement rather than substitute the intermediary role of banks. Theoretically, this study contributes by strengthening the Fintech-bank collaboration. Practically, the findings provide policy implications for integrated Fintech supervision to support financial stability and inclusive economic development in Indonesia.

Keywords: P2P lending, Bank Performance, Collaboration, MSMEs credit, Spatial Effect

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1. INTRODUCTION

Although Indonesia's economy cannot yet be considered fully recovered from the prolonged impact of the pandemic, its growth trajectory shows propitious signs. After contracting by -2.07% in 2020, Indonesia's economy managed to rebound, recording growth of 3.69% in 2021 and rising further to 5.3% in 2022 (BPS, 2023). However, this recovery has not been evenly distributed across the nation. One of the main reasons for this imbalance lies in Indonesia's geographical settings as an island nation. Java Island continues to dominate the national economy, contributing around 57.89% of Indonesia's total Gross Domestic Product (GDP). This figure, which represents more than half of the country's GDP, implies that the majority of economic activities are still exclusive to Java.

Among the various economic sectors, the role of Micro, Small, and Medium Enterprises (MSMEs) stands out as particularly important and worthy of attention. According to data from the Ministry of Cooperatives and SMEs (2021), this sector contributes approximately 61.07% to national GDP and employs around 97% of Indonesia's workforce. Despite this significant contribution, the growth of MSMEs remains subpar. One of the major obstacles is limited access to banking services and financing. Many MSMEs struggle to meet the stringent credit requirements set by banks (Pizzi et al., 2021), (Xu et al., 2022), (Mushtaq et al., 2021). Consequently, the proportion of bank lending directed to MSMEs remains relatively low, reaching sheer 19% of total bank credit.

The Financial Services Authority (OJK), to address this issue, stipulated Regulation No. 14 of 2021, mandating that banks allocate at least 20% of their lending portfolios to the MSME sector. Additionally, OJK proposed the Digital Financial Inclusion Roadmap 2021–2025, aimed at encouraging the use of technology-based financing solutions such as peer-to-peer (P2P) lending. This initiative is expected to serve as an alternative channel for MSME financing and to strengthen digital inclusion in Indonesia's evolving financial landscape.

Peer-to-peer (P2P) lending services have gained immensely from the rapid advancement of information and communication technology (ICT). P2P lending symbolizes an innovation in credit distribution driven by fintech development. Traditionally, most debtors have experienced difficulties in accessing formal lending services, but with technological progress, obtaining loans has become extremely streamlined and expedited (Jünger & Mietzner, 2020), (Vives, 2019b), (Ferrari, 2016). Nevertheless, the emergence of fintech is likely to disrupt the conventional role of banking institutions, as both operate within the same intermediation function (Berger et al., 2009), (Beck et al., 2016), (Thakor, 2020). In response to these alterations, multiple banks have begun adopting digital technologies to maintain competitiveness and enhance performance (Coetzee, 2018), (Chipeta & Muthinja, 2018).

Unfortunately, fintech development in Indonesia also has geographical inequality. As much as 80% of P2P credit in the last three years has targeted Java Island (OJK, 2023). Similarly, in its measurement by the ICT Development Index (IP-TIK), ICT infrastructure is much larger in Java compared to other islands (BPS, 2022). This implies that digital financial inclusion and technology adoption are not yet even, possibly widening regional economic gaps (Kanungo and Gupta, 2021; Bollaert et al., 2021).

The emergence of fintech and digital financial platforms has reshaped traditional models of financial intermediation. (Christensen, 2000) with the theory of disruptive innovation and (Diamond, 1984) with the theory of financial intermediation provide useful frameworks for rationalising this phenomenon: new financial intermediaries can leverage information technology to reduce information asymmetry and lower transaction costs. In developing countries such as Indonesia, the implementation of digital platforms mitigates information asymmetry by directly connecting creditors and debtors. The advancement of technology in the banking and fintech sectors is capable of creating not only competitive dynamics but also complementary relationships (Hornuf et al., 2020).

Although empirical work has thus far taken into account the impact of fintech on bank performance (Thakor, 2020), (Vives, 2019b), all of them do so either nationally or in an aggregate manner. They ignore spatial heterogeneity that characterizes emerging economies like Indonesia, where digital infrastructure, financial literacy, and economic activity are strongly discerned at a regional level. Consequently, the effects of P2P lending do not have to be uniform in space; fintech may replace or supplement banks in markets where ICT infrastructures are well developed, but replace them in other places with unsubstantial digital readiness. The motivation of this study is to determine whether spatial variations exist in the relationship between fintech and banking. Moreover, the study aims to identify whether disparities in technological development across geographically diverse and archipelagic regions influence the performance of financial intermediation. The unique spatial variations in digital development across different regions of Indonesia make this issue particularly interesting to investigate. The findings of this research are expected to address this gap by examining how peer-to-peer (P2P) lending affects banking performance and MSME lending across several major islands in Indonesia.

Consequently, the current research addresses three significant questions:

1. Does P2P lending growth decrease or increase banking performance (in terms of profitability and credit growth)?
2. Is the spatial effect of P2P lending heterogeneous across Indonesian islands?
3. What is the effect of P2P lending on MSME lending in the banking industry?

2. LITERATURE REVIEW

Information technology and digitization have brought about a significant transformation in the banking sector. This is demonstrated by the increasing adoption of fintech, particularly in peer-to-peer (P2P) financing. Fintech provides alternative transactional services to those traditionally offered by banking institutions. According to several studies, digital transformation is boosting innovation in the financial industry and increasing the competitiveness of fintech firms (Brandl & Hornuf, 2020). This scenario is a perfect illustration of the academic debate regarding the interaction between fintech, specifically peer-to-peer lending, and traditional banking systems. Does P2P lending function as a market that monitors bank credit or just as a tool that promotes awareness of financial matters?

Most research indicates that P2P lending can be utilized as a substitute for bank credit. According to (Thakor, 2020), P2P lending allows the financing business to be more competitive. This proposal has significant implications for the structure of the currency market. (Berger et al., 2009) posit that increasing one's level of competence can reduce a bank's market power, improve one's profit margin, and stabilise the market. Cutthroat competition in the financial sector is plausible to increase vulnerability to systemic shocks, according to the theory discussed by (Beck et al., 2016) and (Vives, 2019b).

Empirical findings in several countries support the point in question. Studies by (Phan & Daly, 2020); (Khan et al., 2018); (Dang & Huynh, 2021)) indicate that there is a negative correlation between P2P lending activity and bank profitability. The results show that P2P lending involves more than just acting as a middleman for bank money; it also allows banks to strengthen their competitive edge. As a result, this law underscores the concept of competitive fragility: a state in which consistently high levels of competence threaten the stability of the financial industry.

However, in this sense, literature is not entirely separate. Numerous researchers have concluded that fintech can improve access to financial resources, increase efficiency, and improve financing, especially in unexplored territories by banks (Hewa Wellalage et al., 2021); (Kanungo & Gupta, 2021); (Bollaert et al., 2021). Fintech is the term for the use of digital technology to remove regional limits on currency access services, accelerate verification, and trim transaction expenses. Fintech thus marks a significant advancement in financial inclusion, especially for the general public and small enterprises that traditional banking procedures have traditionally underserved.

This literature accentuates the dual nature of fintech: a competitor to reduce bank profitability and as a potential tool to enhance financial literacy. Thus, fintech's role in the ambivalent economy is significant in the context of businesses, infrastructure maintenance, and regulatory activities that take place in every country.

One of the most important topics in fintech literature is the decline in access to financing, particularly for micro, small, and medium-sized businesses (SMEs). Many analysts claim that SMEs regularly have bank credit issues as a result of administrative irregularities, an unclear financial history, and warranty restrictions. P2P lending via fintech provides more rapid, flexible, and specific solutions (Soni et al., 2022); (Xu et al., 2022); (Correia et al., 2022).

Faster credit availability, less information asymmetry, and a quicker transaction procedure are all enabled by fintech. This contribution is particularly relevant since the SME sector forms the backbone of the economies of emerging countries. The results of the national study, though, differ considerably. Fintech can be used to protect the public interest and increase transparency, according to (Ćehajić & Košak, 2022) and (Pizzi et al., 2021). On the other hand, technological adoption and higher capital risk may have a significant impact on banks, especially those with sensitive operational capabilities (Jun & Yeo, 2016).

Accordingly, the literature related to SMEs suggests that the institutional and infrastructure contexts cannot adequately exposit the fintech impact. In one scenario, fintech has a role in increasing SMEs' understanding of finance, yet in other scenarios, operational and cost risks that are incurred can also contribute to the stability of traditional financial institutions.

The literature continues to emphasize the potential for cooperation between banks and fintech as a means to mitigate risk and enhance efficiency. Such collaboration can promote synergy through joint ventures, the integration of credit scoring systems, or the creation of hybrid goods that combine digital technology and banking procedures, as claimed by (Murinde et al., 2022) and (Banna et al., 2021). Partnership can also better service quality, especially for SMEs that are often unflagged by banks.

Nonetheless, there are still many unanswered methodological concerns in this field of study. The impact of such partnerships on the stability of the monetary system in emerging countries, especially in developing countries, has been the subject of numerous studies. The effectiveness of bank-fintech partnerships is significantly impacted by regulatory constraints, supervisory capabilities, and the performance of debtor information systems, as posited by (Yue et al., 2021) and (Kautonen et al., 2020). Therefore, collaboration will tackle management and public policy concerns in addition to business issues.

It is generally agreed upon in literature that fintech has the advantages of increasing financial literacy while also demonstrating bank competency. Literature, however, is short of expectations in analyzing its impact on bank stability. It underlines both the possibility of competitive fragility and the importance of collaboration in fostering understanding and economic advancement. Several variables, such as data variability, methodological variations, and different country circumstances, contributed to the study's contradictory findings.

This implies that the study aims to establish a strong link between banks and fintech in a developing country, utilizing longitudinal and micro data. Besides, assessing the effectiveness of the bank-fintech collaboration model in enhancing financial literacy remains essential while maintaining financial system stability. Such research is imperative for providing a more comprehensive understanding and is also relevant for regulators in enforcing flexible regulations regarding the growth of the digital currency industry.

The literature cited above suggests that the growth of fintech, especially P2P lending, has a long-term effect on the function of middlemen and bank stability. When contrasted with the research factors, such as bank productivity and the quantity of credit accessible through peer-to-peer lending, this becomes substantial. Investigations on competitive fragility (Berger et al., 2009), (Beck et al., 2016), (Vives, 2019b) indicate that as the amount of credit disbursed by P2P lending platforms increases, so does the amount of banking services that banks provide. This piece of information can be traced in bank performance indicators, including profitability, operational efficiency, and asset quality. Accordingly, the variable of the total number of P2P loans can be used as a measure of the external lending threshold that banks face in the credit market.

3. METHODOLOGY

The sample in this study involved banks across 33 Indonesian provinces. The study period began in January 2020 and was completed in June 2025, based on the identification of about 2.178 observations (see Table 2). The study period was determined by the availability of P2P lending

performance data in Indonesia, which was released privately by the OJK in 2020. Furthermore, data used in the study included aggregate bank and peer-to-peer lending statistics for each province. Aggregate data were exploited due to a lack of access to individual data at the bank or peer-to-peer lending levels. Therefore, the analysis of the study's results would be more accurate in comparing the average of the variables at the industrial level to the specific actions of each entity. This would result in a potential for heterogeneity at the individual level that is less pronounced than in aggregate data. The goal is to minimize the consequences by using GMM as an estimation method. The GMM is more robust in terms of endogeneity and heteroskedasticity; therefore, the estimation results are consistent, even when based on aggregate data.

The researchers extended the time period to 66 months to minimize the likelihood of biased results resulting from the COVID-19 pandemic. This period would illustrate the dynamics of the relationship between banks and peer-to-peer lending, including the impact of the COVID-19 pandemic. Consequently, it would increase the external validity of the study because the estimation results are not affected by the crisis, which means that the pattern will be more stable and representative. However, the possibility of any pandemic-related residual effects cannot be ruled out, suggesting that the COVID-19 pandemic may have slowed the adoption of financial technology and reduced consumer spending and financial interactivity.

The following presents descriptive statistics of the variables used in the study.

Table 1: Descriptive Statistics

Variable	N	Mean	Std. Dev	Min	Max
LnCredit	2,178	11.03818	1.210434	9.038798	15.2354
Lnp2p_outstanding	2,178	9.338127	7.259524	2.25399	28.9868
LnSMEs	2,178	9.927489	1.078366	7.742402	12.3327
LnNon-SMEs	2,178	151788.7	519047.4	12569.4	3982867
LDR	2,178	1.029916	0.421659	0.35419	2.85192
Branch	2,178	105.882	113.0111	16	471
ICT	2,178	1.655647	0.47526	1	2
Lnp2p_island1	2,178	2.873186	5.969627	0.000	26.57709
Lnp2p_island2	2,178	1.934574	4.920215	0.000	28.9868
Lnp2p_island3	2,178	1.133019	3.980631	0.000	25.63602
Lnp2p_island4	2,178	1.639342	4.706057	0.000	26.45067
Lnp2p_island5	2,178	7.580121	7.505266	0.000	28.9868
Lnp2p_SMEs_island1	2,178	68163	167058.4	0.000	1486680
Lnp2p_SMEs_island2	2,178	239503.1	664400.6	0.000	4287216
Lnp2p_SMEs_island3	2,178	22361.81	75053.37	0.000	582242.3
Lnp2p_SMEs_island4	2,178	26491.41	97004.92	0.000	1041469
Lnp2p_SMEs_island5	2,178	356519.4	648424.2	0.000	4287216

Source: Data processed

The estimation method used the dynamic GMM Arellano-Bond estimator panel. It was chosen because it is effective in addressing endogenous issues that frequently arise in economic models. Instrument validation using the Sargan test ensures that the results do not correlate with the error term. In addition, Arellano-Bond was applied to detect residual autocorrelation. The optimum results are AR (1) significant but AR (2) not significant, hence, the instrument lag may be stated

clearly. These two studies demonstrate that the instrument is valid and that the GMM estimations produced are reliable and consistent.

Bank performance was proxied by growth in bank lending. Meanwhile, P2P lending proxies used the outstanding amount distributed. Then, the control variables used in this study comprised MSME credit, non-MSME credit, LDR, Branch, and IT. This study also examined the effect of P2P lending on the performance of banking credit distribution spatially. Spatial testing was conducted by assigning categories (1: Sumatra Island; 2: Java-Bali Island; 3: Kalimantan Island; 4: Sulawesi Island; 5: Nusa Tenggara, Maluku, and Papua Islands).

The stages in the Arellano-Bond GMM analysis began with an overidentification test to observe whether the instruments used in the model remain valid (Labra Lillo & Torrecillas, 2018). The autocorrelation and unfamiliarity tests were carried out in the second stage with a robust two-step Windmeijer (WC). The best estimate model was obtained based on the trial of the three phases. The following is the research model:

$$Y_{it} = \alpha + \beta_1 Y_{it-1} + \beta_2 P2Plending_{it} + \beta_3 SMEs + \beta_3 NonSMEs + \beta_4 LDR + \beta_5 Branch + \varepsilon_{it} \dots (1).$$

$$Y_{it} = \alpha + \beta_1 Y_{it-1} + \beta_2 P2Plending_{it} + \beta_3 SMEs + \beta_3 NonSMEs + \beta_4 LDR + \beta_5 Branch + \beta_6 ICT + \varepsilon_{it} \dots (2).$$

$$Y_{it} = \alpha + \beta_1 Y_{it-1} + \beta_2 P2Plending_{it} + \beta_3 SMEs + \beta_3 NonSMEs + \beta_4 LDR + \beta_5 Branch + \beta_6 P2PLending * SMEs + \beta_7 P2PLending * non - SMEs Credit + \varepsilon_{it} \dots (3).$$

$$Y_{it} = \alpha + \beta_1 Y_{it-1} + \beta_2 P2Plending_{it} + \beta_3 SMEs + \beta_3 NonSMEs + \beta_4 LDR + \beta_5 Branch + \beta_6 P2PLendingIsland1 + \beta_7 P2PLendingIsland2 + \beta_8 P2PLendingIsland3 + \beta_9 P2PLendingIsland4 + \varepsilon_{it} \dots (4)$$

$$Y_{it} = \alpha + \beta_1 Y_{it-1} + \beta_2 P2Plending_{it} + \beta_3 SMEs + \beta_3 NonSMEs + \beta_4 LDR + \beta_5 Branch + \beta_6 P2PLendingIsland1 + \beta_7 P2PLendingIsland2 + \beta_8 P2PLendingIsland3 + \beta_9 P2PLendingIsland4 + \beta_{10} P2PLending * SMEsIsland1 + \beta_{11} P2PLending * SMEsIsland1 + \beta_{12} P2PLending * SMEsIsland1 + \beta_{13} P2PLending * SMEsIsland1 + \beta_{14} P2PLending * SMEsIsland1 + \varepsilon_{it} \dots (7)$$

Note:

1. Models 4 and 5 have been formed as supplement explanation of model 3. In Model 4, we examined the differentiation among the islands.
2. In Model 6, we added variable interaction between the impact of ICT and SMEs

The following displays the operational definitions of the variables in Table 2

Table 2: Operational Definitions

Variable	Operational definition	Source
Credit	Growth in bank lending	OJK
P2P ending	Growth in outstanding loan distribution	OJK
LDR	Credit disbursed to the total funds received	OJK
Branch	Log number of branch offices	OJK
Non-SMEs	Percentage of non-SME loans to total loans disbursed by banks	OJK
SMEs	Percentage of SME loans to total loans disbursed by banks	OJK
ICT	Standard measure that shows the level of information and communication technology development in each province, which includes ICT access, use and expertise.	BPS
Island category	Category 1: Sumatra, 2: Java, 3: Kalimantan, 4: Sulawesi, and 5: Nusa Tenggara, Maluku, and Papua	BPS

4. RESULTS AND DISCUSSION

4.1. *Instrument test result*

The validity of the instrument used in the study's estimation model was assured. The Sargan and autocorrelation tests support these results (Table 3). The Sargan test results for every research model have a p-value > 0.05, indicating that the instrument is valid and relevant. The autocorrelation results for every model have a p-value greater than 0.05, suggesting that the instrument is consistent and unbiased. The two test results signify that the instrument used is genuine and that the GMM estimation is reliable and consistent.

Table 3: Instrument Test Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance
Sargan Test (Chi2)	1591.561 (0.2538)	1590.744 (0.2585)	1588.43 (0.2839)	1467.202 (0.4642)	1587.69 (0.2762)	1596.928 (0.2299)	1466.004 (0.4730)
Autocorrelation test (ordo 2)	0.3566 (0.721)	0.3762 (0.7068)	0.3590 (0.7196)	0.6128 (0.5400)	0.3602 (0.7187)	0.3548 (0.7227)	0.6214 (0.5343)

Table 4 presents the results of bank performance estimation using the seven tested models. Models 1 and 2 show the impact of P2P Lending on bank performance in aggregate. Model 3 shows the impact of P2P Lending on bank performance based on the type of credit disbursed, namely SMEs credit and non-SMEs credit. Model 4 shows the impact of P2P Lending on bank performance spatially. Lastly, Model 7 shows the impact of P2P lending on bank performance by island category and credit segment.

Table 4: Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance
Credit Bank	0.9847*** (0.000)	0.9849*** (0.000)	0.9856*** (0.000)	0.9830*** (0.000)	0.9848*** (0.000)	0.9825*** (0.000)	0.9819*** (0.000)
P2P Lending	-0.00014*** (0.003)	-0.00015*** (0.004)	-0.00005 (0.538)	-0.00026 (0.242)	-0.00005 (0.525)	-0.00013*** (0.004)	-0.0002 (0.352)
SMEs Credit	0.00267** (0.019)	0.00264** (0.019)	0.00317*** (0.009)	0.0033** (0.011)	0.0033*** (0.006)	0.0014 (0.266)	0.0017 (0.391)
Non-SMEs Credit	0.00266** (0.029)	0.0000** (0.032)	0.0000 (0.972)	0.0000** (0.038)	0.0000** (0.026)	0.0000* (0.064)	0.000 (0.447)
LDR	0.00529 (0.111)	0.0054 (0.103)	0.0591* (0.076)	0.0048 (0.182)	0.0059* (0.078)	0.0067* (0.050)	0.0062 (0.107)
Branch	0.00040*** (0.000)	0.0004*** (0.000)	0.0004*** (0.000)	0.0004*** (0.000)	-0.0004*** (0.000)	-0.00036*** (0.000)	-0.00035*** (0.000)
ICT		-0.0038 (0.647)					
P2P Lending*SMEs Credit			-0.0000 (0.355)		-0.0000 (0.103)		-0.0000 (0.423)
P2P Lending*Non-SMEs Credit			0.0000 (0.739)				0.0000 (0.325)
P2P Lending island 1				0.00025 (0.342)			0.0002 (0.637)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance
P2P Lending island 2				-0.00029 (0.375)			0.0006 (0.399)
P2P Lending island 3				0.0001 (0.619)			-0.0006 (0.271)
P2P Lending island 4				0.0002 (0.621)			0.0004 (0.392)
SMEs Credit*ICT						0.000* (0.070)	0.000* (0.051)
P2P Lending*SMEs Credit island 1							0.0000 (0.480)
P2P Lending*SMEs Credit island 2							-0.0000 (0.874)
P2P Lending*SMEs Credit island 3							0.000* (0.091)
P2P Lending*SMEs Credit island 4							-0.000 (0.786)
_cons	0.1859*** (0.000)	0.1889*** (0.000)	0.1700*** (0.000)	0.2012*** (0.000)	0.178*** (0.000)	0.2121*** (0.000)	0.2198*** (0.000)
<i>N</i>	2,112	2,112	2,112	2,112	2,112	2,112	1,928

p-value in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Researchers added a robustness test to assert that the main research findings remain consistent and valid despite changes in assumptions or variables. The robustness test was conducted using two methods: a proxy for non-SMEs credit and from January 2020 to June 2025. However, the second method used a shorter study period, January 2020 – April 2022. The robustness test results are presented in Tables 5 and 6.

Table 5: Robustness Test (Method 1)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance
Credit Bank	0.9845*** (0.000)	0.9847*** (0.000)	0.9849*** (0.000)	0.9841*** (0.000)	0.9849*** (0.000)	0.9827*** (0.000)	0.9848*** (0.000)
P2P Lending	-0.00014*** (0.003)	-0.00015*** (0.004)	-0.00003 (0.706)	-0.00027 (0.234)	-0.00006 (0.436)	-0.0001*** (0.005)	-0.0003 (0.350)
SMEs Credit	0.00245** (0.033)	0.00244** (0.034)	0.00283* (0.026)	0.00286 (0.028)	0.00288* (0.017)	0.00159 (0.217)	0.0008 (0.692)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance
Non-SMEs Credit	0.000*	0.0000*	0.0000	0.0000	0.0000*	0.0000	-0.000*
	(0.050)	(0.056)	(0.048)	(0.165)	(0.063)	(0.170)	(0.011)
LDR	0.0054	0.0055	0.0059*	0.0057	0.0059*	0.0066*	0.0055
	(0.108)	(0.101)	(0.074)	(0.107)	(0.077)	(0.053)	(0.146)
Branch	-0.00037***	-0.00036***	-0.0004***	-0.00036	-0.0004***	-0.0004***	-0.00047***
	(0.000)	(0.000)	(0.000)	(0.156)	(0.000)	(0.000)	(0.000)
ICT		-0.00347					
		(0.673)					
P2P Lending*SMEs Credit			0.000		-0.0000		-0.000
			(0.673)		(0.150)		(0.347)
P2P Lending*Non-SMEs Credit			0.0000				0.000***
			(0.282)				(0.003)
P2P Lending island 1				0.00023			0.00019
				(0.406)			(0.545)
P2P Lending island 2				-0.00026			0.0005
				(0.433)			(0.513)
P2P Lending island 3				0.000176			-0.0004
				(0.550)			(0.460)
P2P Lending island 4				0.00021			0.00034
				(0.541)			(0.423)
SMEs Credit*ICT						0.000	0.000***
						(0.109)	(0.004)
P2P Lending*SMEs Credit island 1							0.0000
							(0.542)
P2P Lending*SMEs Credit island 2							-0.0000
							(0.877)
P2P Lending*SMEs Credit island 3							0.000
							(0.190)
P2P Lending*SMEs Credit island 4							0.000
							(0.750)
_cons	0.1851***	0.1878***	0.1700***	0.1875***	0.1752***	0.207***	0.2156***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	2,112	2,112	2,112	2,112	2,112	2,112	1,920

p-value in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

To ensure the stability of the relationship between the variables and the validity of the estimated results, the variable non-SMEs credit in the model is compared with consumer credit in Table 5 as a robustness check. It is important because consumer credit is presented as a segment of home improvement that differs from non-SMEs product credit, allowing one to determine whether other variables, such as P2P lending, SMEs, LDR, and the number of branches, have an impact on the total amount of bank credit that is consistent with alternative specifications. Suppose the estimation results show a range and significance of the coefficient that correspond to the initial model. In that case, the relationship between the variables is vigorous and not sensitive to changes in the credit component definition. In addition, it is necessary to ensure the validity of the empirical model when credit is being denied at the provincial level.

Table 6: Robustness Test (Method 2)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance
Credit Bank	0.7398*** (0.000)	0.7388*** (0.000)	0.7118*** (0.000)	0.6581*** (0.000)	0.699*** (0.000)	0.7291*** (0.000)	0.5389*** (0.000)
P2P Lending	-0.00075*** (0.000)	-0.00139** (0.029)	-0.00298*** (0.000)	-0.00191* (0.056)	-0.003*** (0.000)	-0.0001 (0.765)	0.0102 (0.548)
SMEs Credit	0.6088*** (0.000)	0.6262*** (0.000)	0.7541*** (0.000)	0.7706*** (0.000)	0.7768*** (0.000)	0.0525*** (0.000)	0.1867 (0.776)
Non-SMEs Credit	0.000*** (0.000)	0.0000*** (0.000)	0.0000*** (0.000)	0.0000*** (0.000)	0.0000*** (0.000)	0.0000*** (0.000)	0.000*** (0.000)
LDR	0.01158** (0.022)	0.0098* (0.068)	0.0137 (0.361)	0.00171 (0.760)	0.0134*** (0.010)	0.0149*** (0.009)	0.0133 (0.399)
Branch	0.00275*** (0.000)	0.0029*** (0.000)	0.0021*** (0.000)	0.00187 (0.156)	0.00215*** (0.000)	0.0025*** (0.000)	-0.00057 (0.742)
ICT		-0.0081 (0.291)					
P2P Lending*SMEs Credit			-0.0148*** (0.000)		-0.0155*** (0.000)		-0.0397 (0.556)
P2P Lending*Non-SMEs Credit			0.0000* (0.044)				
P2P Lending island 1				0.00197* (0.058)			0.00147 (0.932)
P2P Lending island 2				0.0013 (0.325)			0.0098 (0.759)
P2P Lending island 3				0.00126 (0.213)			0.0223 (0.397)
P2P Lending island 4				0.00057 (0.596)			-0.0549 (0.147)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance	Bank Performance
SMEs Credit*ICT						0.034*	0.3117
						(0.072)	(0.108)
P2P Lending*SMEs Credit island 1							0.0159
							(0.822)
P2P Lending*SMEs Credit island 2							-0.0077
							(0.952)
P2P Lending*SMEs Credit island 3							-0.0736
							(0.500)
P2P Lending*SMEs Credit island 4							0.2357
							(0.129)
_cons	2.3801***	2.3913***	2.7707***	3.3793***	2.8534***	2.5248***	4.9282***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
<i>N</i>	858	858	858	858	858	858	780

p-value in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The second robustness test reduced the study period to 27 months (January 2020–April 2022), or, depending on initial data availability. This method was used to reduce the risk of biased estimates arising from COVID-19. This was done to strengthen the external validity of the study, as the estimation results from the shorter 27-month period (858 data points) were consistent with the results from the longer 66-month study (2,112 data points).

4.2. *The effect of P2P lending on bank performance*

The effect of P2P lending on credit distribution for all models exhibited a negative sign (Table 3). The aggregate of P2P Lending influence on bank performance is presented in models 1 and 2. In addition, the two robustness test results presented in Table 5 and Table 6 are consistent across models 1 and 2. This denotes that the presence of P2P Lending has great potential to reduce credit distributed by banks.

The results indicate aggregate of P2P lending could reduce the credit disbursed by banks. As a fintech company, in fact, focusing on credit services, the presence of P2P lending can be an alternative financing. Based on Porter's Five Forces theory, competition surfaces from both old and new competitors. P2P lending, included in the non-bank financial industry, appears as a new competitor for other financial services industries (OJK), especially the banking industry. It occurs because most fintech companies serve credit (Hornuf & Haddad, 2019). Moreover, P2P lending fintech companies in Indonesia have the highest market potential (44%) among other fintech services. As a new player with advantages in technological innovation, P2P lending will also encourage fierce competition in financing services.

Subsequently, the intense competition will impact the decline in banking profits. In this regard, P2P lending technology innovation provides users convenience, speed, and flexibility. The advantages offered by P2P lending make their services more appealing. Thus, the more attractive and superior P2P lending is, the more opportunities are available for P2P lending to become a substitute product for banking financing services. Moreover, the red tape, stringent regulations, and the length of the financing process are antecedents for the shift in the use of financing services with P2P lending.

The negative leverage of P2P lending on banking performance is corresponding with research conducted by (Vives, 2019b); (Thakor, 2020); and (Brandl & Hornuf, 2020). P2P lending, as a new player in the financial services industry, encourages competition in credit services

4.3. *The Spatial Influence of P2P Lending on Bank Performance*

The results of the study on the effects of P2P lending, presented spatially, are shown in Table 4 (Models 4 and 7). The five islands that make up the spatial influence are Sumatra, Java-Bali, Kalimantan, Sulawesi, Nusa Tenggara, and Papua. The islands used as comparisons in the spatial test were Nusa Tenggara, Maluku, and Papua because, statistically, they have the smallest values. The results of the study suggest that there are no discrepancies in the effects of P2P lending on bank operations across geographic regions. The decline in banking performance resulting from P2P lending credit distribution is only visible in the aggregate at the national level (Model 1 and 2), although its spatial effects are inconspicuous (Model 4).

The features of digital-based, nationally integrated financial technology account for the comparatively similar effects of P2P lending on banking performance nationally. P2P lending systems operate via an online platform that transcends geographical borders, overcoming physical barriers to communication between creditors and debtors. Users across Indonesia can access the same services, credit scoring algorithms, and operating standards, owing to the uniform penetration pattern enabled by technology. (Zhao et al., 2024) claim that fintech has cross-regional spillover effects and directly enhances bank performance.

Institutionally, the Financial Services Authority (OJK) and Bank Indonesia's regulatory and supervisory systems are nationwide, with no regional variations. These standardized rules, which apply to all fintech lenders in Indonesia, control consumer protection, lending limits, transparency, and governance. This guarantees that the system in which the fintech and banking industries interact has a uniform operational and regulatory framework throughout all regions (Hornuf & Haddad, 2019).

From a structural standpoint, the operational network of the Indonesian banking sector is decentralized but nationally integrated. With centrally decided risk management and loan allocation regulations, large and medium-sized banks are available in almost every province. Accordingly, both local and national business strategies influence the competitive effect of P2P lending on banks' intermediation services, interest margins, and operational efficiency. These national effects absorb minor regional differences in the impact of P2P lending since bank performance is evaluated at the institutional aggregate level (Koranteng & You, 2024).

Additionally, the geographic disparity in the use of digital financial services has been reduced due to advances in information technology and rising levels of digital literacy. Internet and smartphone use have enabled people outside Java to access fintech services comparable to those available to residents of major economic centers, notwithstanding regional differences in economic growth (Puspitasari & Ishii, 2016).

4.4. *The Effect of P2P Lending on Bank Performance in Disbursing MSME Loans*

P2P lending has a spatially insignificant impact on bank performance in granting MSME credit, as indicated by the statistical tests reported in Table 4, Model 7. The insignificant influence of P2P lending on bank credit distribution in the MSME segment reflects fundamental differences between the structure of the digital financing market and conventional banking-sector financing mechanisms. Conceptually, P2P lending functions as a non-bank alternative that provides financing access for micro and small businesses that do not satisfy the administrative condition, collateral, or credit track record required by banks. Therefore, the target market for P2P lending is structurally different from the banking credit market. Banks likely prioritize borrowers with low-risk profiles and formal eligibility, while P2P lending serves non-bankable groups with small-scale loans and short tenors. This difference in segmentation is why the increase in financing through P2P lending does not directly shift or affect the volume of credit disbursed by banks to SMEs (Wang et al., 2021);(Lu et al., 2020).

Compared to the overall amount of credit the banking industry disburses, the role of peer-to-peer lending in funding SMEs remains relatively minor in either scope or intensity. Even with P2P lending's recent explosive expansion, banks' financing capacity still outweighs the nominal value and volume of financing provided to SMEs. Furthermore, P2P lending has a subtle effect on long-term bank loan dynamics because it is short-term, focused on daily working capital needs. As a result, overall changes in fintech funding are too small to have a significant effect on bank lending practices, especially for SME clients (Coakley & Huang, 2023).

Furthermore, structural factors in the banking sector also explain the weak relationship between P2P lending and bank SME credit. Most banks in Indonesia still face obstacles in expanding financing to SMEs due to limited debtor information, high administrative fee, and higher perceived risk compared to corporate loans. Conservative internal bank policies and prudential banking regulations limit banks' flexibility in responding to the development of fintech lending. In other words, banks' decisions to disburse credit to SMEs are more influenced by risk management strategies and regulatory policies than by competition with fintech. This reinforces the empirical finding that increased P2P lending activity has not significantly influenced bank lending behavior (Trinugroho et al., 2014).

Spatial analysis also shows that P2P lending has a negligible impact on bank MSME credit across Indonesia's five central regions: Sumatra, Java-Bali, Kalimantan, Sulawesi, and Nusa Tenggara-Maluku-Papua. Although fintech penetration is more progressive in Java-Bali, the banking structure in that region is relatively strong and stable; thus, substitution pressure from P2P lending remains low. Due to inadequate financial infrastructure and limited computer literacy, P2P lending still has a small market share and has not had a significant impact on bank lending outside Java. The results' regional consistency shows that bank SME loans and peer-to-peer lending complement rather than replace one another. According to Abbasi et al. (2021), P2P lending plays a supplementary role in financial intermediation, expanding access to financing for small businesses, but has not yet been able to shift the dominance of banks in the national financing structure. P2P Lending, on the other hand, being a new capital provider, has its merits in technological advancement, innovative business practices, and quick, easy, and flexible loan processing (Sanga & Aziakpono, 2023).

5. CONCLUSION

The development of P2P lending has the potential to reduce banking performance in aggregate through competition mechanisms and the shift of particular financial intermediation functions to the non-bank sector. However, spatially, this impact is inconsequential across regions in Indonesia. This illustrates a digital ecosystem that transcends national borders and is unrelated to local economic processes. The effects of P2P lending on banks are more macro-structural than spatial-territorial. Furthermore, the still-dominant characteristics of the banking sector, differences in the level of financial technology penetration, and variations in financial market depth across regions unevenly distribute the competitive effects of fintech on bank performance.

Meanwhile, when testing the influence of P2P lending on SME credit distribution by banks, both nationally and spatially, it was found to be insignificant. Nationally, this reflects that the growth of financing through fintech platforms is not yet notable enough to influence bank lending behaviour to the SME segment, which remains the primary domain of banks. Meanwhile, spatially, the uniform insignificance across Indonesia, including Sumatra, Java-Bali, Kalimantan, Sulawesi, and Nusa Tenggara-Maluku-Papua, indicates that the pattern of the relationship between P2P lending and bank SME credit is relatively homogeneous. This phenomenon suggests that P2P lending has not yet served as a substitute for bank SME credit, but only completes the financial intermediation function on a limited scale. Also, these findings are relevant to the achievement of the Sustainable Development

Goals (SDGs), particularly SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure), as the expansion of digital financial services can promote financial inclusion and support innovation in the financial sector without significantly disrupting conventional banking intermediation. In addition, the complementary role of P2P Lending toward SME financing may contribute to SDG 1 (No Poverty) and SDG 10 (Reduced Inequalities) by expanding alternative access to financing for underserved economic groups and regions.

Although using aggregate data poses limitations when analyzing individual behavior, this study remains relevant as it may illustrate the general relationship between the banking and peer-to-peer lending industries. Nevertheless, if data at the particular bank or P2P lending level are available, they could be a starting point for further endeavour. An individual analysis will provide more detailed examples of the differences between banks and peer-to-peer lending.

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