

FINTECH, DIGITAL BANKING, AND PROFITABILITY UNDER MACROECONOMIC PRESSURE: EVALUATING REGULATORY AND INSTITUTIONAL IMPLICATIONS FOR INDONESIA'S BANKING SYSTEM

Sri Sulasmiyati and Adilla Sari Siregar

Business Administration Department, Universitas Brawijaya, Indonesia

e-mail: sri_su_fia@ub.ac.id (corresponding author); adillas498@gmail.com

Submitted: 31 January 2025 - Last revised: 18 March 2026 - Accepted: 5 April 2026

Abstract

The digital banking era has introduced risks and opportunities that significantly affect bank profitability. This study examines 28 banks listed on the Indonesia Stock Exchange (IDX) between 2020 and 2022, focusing on the influence of credit risk, digital banking, and fintech on profitability, measured in this study by Return on Assets (ROA). Employing panel data analysis through EViews 12, two regression models were tested, one excluding and one including GDP as a control variable. Comparative results underscore Non-Performing Loans (NPLs) as the most consistent determinant, exerting a significant negative effect on ROA. While peer-to-peer (P2P) lending initially appeared to hinder profitability, its impact diminished once macroeconomic conditions were controlled for. Moreover, although mobile banking adoption continues to expand, its immediate contribution to profitability remains statistically insignificant within this sample. Overall, the findings highlight credit risk as the primary concern, suggesting that stronger regulatory frameworks and enhanced collaboration between banks and fintech firms are essential to safeguarding financial stability. These insights emphasise the need for policymakers and banking executives to prioritise credit risk management while fostering a cooperative ecosystem to navigate the complexities of the digital transformation.

Keywords: *credit risk, digital banking, financial technology, macroeconomics, profitability, regulatory governance*

I. INTRODUCTION

The rapid pace of economic change has intensified business competition, driving companies to enhance their competitiveness to achieve profitability. Return on Assets (ROA), a key indicator of profitability, reflects the extent to which a firm's assets are managed to generate profit.¹ Internally, credit

¹ Dedeh Sri Sudaryanti et al., "Analisa Pengaruh Mobile Banking terhadap Kinerja Perusahaan Sektor Perbankan yang Tercatat di Bursa Efek Indonesia," *Jurnal Ekonomi Manajemen* 4, no. 2 (2018): 96–107, <https://doi.org/10.37058/jem.v4i2.699>.

risk, assessed via the non-performing loan (NPL) ratio, represents an internal factor that can lower profitability when NPLs increase.² Across studies of both Indonesian and foreign banks, increased NPLs are regularly associated with a substantial adverse effect on ROA.³

Conversely, innovation serves as a potent internal driver for growth. The development and deployment of digital services, most notably mobile banking platforms, streamline operations, elevate customer satisfaction,⁴ and have been empirically proven to boost both profitability and efficiency in the Indonesian banking sector and across other emerging economies.⁵ This relationship is evident in Indonesia, where the surging popularity of mobile banking has spurred significant investment from banks eager to capture this segment. Beyond a firm's direct control, external factors also play a decisive role. The ascent of financial technology (fintech), particularly through peer-to-peer (P2P) lending platforms, introduces a new competitive dynamic. Recent evidence from Indonesia suggests that while P2P lending expands the financial ecosystem, it can simultaneously exert considerable competitive pressure on traditional banks, in some instances leading to a decline in their performance, an effect most noticeable among institutions with weaker capital positions.⁶

Theoretically, the relationship between credit risk, digital innovation, fintech, and profitability can be explained by signalling theory and Schumpeterian innovation theory. Signalling theory explains how banks' NPL levels serve as signals to investors, regulators, and customers. High NPL ratios signal poor credit risk management and declining profitability, reducing investor confidence. In contrast, low NPL ratios signal strong asset quality and prudent lending practices, enhancing trust and market value.⁷ Schumpeter's innovation view and the innovation theory of profit suggest that technological innovations, such as mobile banking and broader bank digitalisation, can create

² Kasmir, *Analisis Laporan Keuangan*, 1st ed. (PT Raja Grafindo Persada, 2019), 89.

³ Ayrton Psaila et al., "The Impact of Non-Performing Loans on the Profitability of Listed Euro-Mediterranean Commercial Banks," *International Journal of Economics and Business Administration* 7, no. 4 (2019): 166–196, <https://doi.org/10.35808/ijeba/338>.

⁴ Ki Soon Lee et al., "Factors Influencing the Adoption Behavior of Mobile Banking: A South Korean Perspective," *Journal of Internet Banking and Commerce* 12, no. 2 (2007): 1–9.

⁵ Isma Coryanata et al., "Digitalization of Banking and Financial Performance of Banking Companies," *International Journal of Social Service and Research* 3, no. 2 (2023): 366–371, <https://doi.org/10.46799/ijssr.v3i2.254>

⁶ Seniye Chukwudumebi Obiora et al., "The Effect of Economic Growth on Banking System Performance: An Interregional and Comparative Study of Sub-Saharan Africa and Developed Economies," *Economic Systems* 46, no. 1 (2022): art. 100939, <https://doi.org/10.1016/j.ecosys.2022.100939>

⁷ Bert Scholtens and Dick van Wensveen, *The Theory of Financial Intermediation: An Essay on What It Does (Not) Explain* (Vienna: SUERF—The European Money and Finance Forum, 2003), 7–40, <https://www.econstor.eu/bitstream/10419/163455/1/suerf-study-2003-1.pdf>.

temporary excess profits by reducing costs, expanding market reach, and generating new fee-based income streams.⁸ However, these gains depend on how quickly competitors imitate similar innovations.⁹ Fintech and P2P lending, from a competition and market-structure perspective, can play a dual role: they may erode banks' interest margins and customer base (reducing profitability), but they can also offer collaboration opportunities that increase efficiency and diversify income when banks successfully integrate fintech solutions.¹⁰ Macroeconomic factors, particularly GDP, function as control variables that shape bank performance across economic cycles. Macroeconomics focuses on external, macro-level conditions arising beyond the organisation's direct influence.¹¹ Periods of economic expansion stimulate lending activity and profitability, whereas recessions weaken loan portfolio quality.¹² Studies on both Indonesian and cross-country samples show that increases in GDP are associated with higher bank profitability and help mitigate the adverse effects of NPLs.¹³

This study focuses on conventional commercial banks listed on the Indonesia Stock Exchange, a sector that, according to Financial Services Authority (OJK) data published in *Statistik Perbankan Indonesia* (December 2022), holds the vast majority of total banking assets and thus dominates the national financial system. The 2020–2022 observation period was deliberately selected to capture the confluence of disruptions twisted by the COVID-19 pandemic. During these years, as official statistics document, bank profitability exhibited marked volatility, first contracting during the acute crisis phase, then recovering as economic activity resumed. This unique setting simultaneously heightened credit risk, triggered sharp fluctuations in profitability, accelerated digital banking adoption, and intensified fintech competition, all against a backdrop of severe macroeconomic shocks and extensive regulatory

⁸ Jairaj Gupta, Anup Srivastava, and Basim Alzugaiby, "Schumpeterian Creative Destruction and Temporal Changes in Business Models of US Banks," *International Review of Financial Analysis* 91 (2024): 102951, <https://doi.org/10.1016/j.irfa.2023.102951>

⁹ Lucio Fuentelsaz, Jaime Gómez, and Sergio Palomas, "Production Technologies and Financial Performance: The Effect of Uneven Diffusion among Competitors," *Research Policy* 41, no. 2 (2012): 401–413, <https://doi.org/10.1016/j.respol.2011.09.006>

¹⁰ Xiao Tong and Wang Yang, "Empirical Analysis of the Impact of Financial Technology on the Profitability of Listed Banks," *International Review of Economics & Finance* 98 (2025): 103788, <https://doi.org/10.1016/j.iref.2024.103788>.

¹¹ N. Gregory Mankiw et al., *Pengantar Ekonomi Mikro: Edisi Asia*, vol. 1 (Salemba Empat, 2014), 45.

¹² Dinh Hoang Bach Phan et al., Paresch Kumar Narayan, R. Eki Rahman, and Akhis R. Hutabarat, "Do Financial Technology Firms Influence Bank Performance?," *Pacific-Basin Finance Journal* 62 (September 2020): 101210, <https://doi.org/10.1016/j.pacfin.2019.101210>.

¹³ Catur Rahayu Martiningtyas and Dewi Tirtarini Nitinegeri, "The Effect of Non-Performing Loans on Profitability in Banking Sector in Indonesia," in *Proceedings of the International Conference on Management, Accounting, and Economy (ICMAE 2020)* (2020), 149–154, <https://doi.org/10.2991/aebmr.k.200915.016>

intervention. The period thus offers a compelling natural experiment for examining how NPLs, mobile banking services, and P2P lending influence ROA across phases of GDP contraction and recovery, and for assessing how macroeconomic conditions moderate these relationships within Indonesia's conventional banking sector. This work seeks to fill the identified gap by accompanying an empirical assessment of the effects of credit risk, digital banking, and financial technology on profitability. The analysis is grounded in a multi-theoretical framework encompassing signalling theory, Schumpeterian innovation theory, and foundational concepts from credit risk, digital banking, fintech, and macroeconomics. By incorporating macroeconomic factors as control variables, the study seeks to isolate the distinct contributions of these interrelated forces while accounting for the broader economic context in which they operate.

II. LITERATURE REVIEW

II.A. Theoretical Review

II.A.1. Signalling Theory

First introduced by Michael Spence in his seminal 1973 work, Signalling Theory provides a framework for understanding how information imbalances between parties can be mitigated through deliberate communication, arguing that those with access to privileged information can effectively broadcast specific signals to guide the decision-making of those without it.¹⁴ In the corporate world, Signalling Theory explains how management decisions and the disclosure of financial reports serve as deliberate signals to investors, helping bridge the persistent information gap by conveying leadership's outlook and promoting transparency for better-informed choices. This dynamic becomes especially critical in the digital banking landscape, where such signals are essential for shaping the perceptions and trust of investors, customers, and regulators alike.¹⁵

II.A.2. Schumpeterian Innovation Theory

The enduring relevance of Joseph Schumpeter's innovation theory lies in its explanation of how economic progress is forged through "new combinations" of innovations in methods, products, markets, or structures that fundamentally

¹⁴ Michael Spence, "Job Market Signaling," *The Quarterly Journal of Economics* 87, no. 3 (1973): 355–374, <https://doi.org/10.2307/1882010>.

¹⁵ Ines Setya Dini Purwanto, "Pengaruh Non-Performing Loan, Loan to Deposit Ratio dan Capital Adequacy Ratio terhadap Profitabilitas pada Perusahaan Perbankan yang Terdaftar di Bursa Efek Indonesia Periode 2014–2016," *Jurnal Perilaku dan Strategi Bisnis* 6, no. 2 (2018): 150, <https://doi.org/10.26486/jpsb.v6i2.561>

displace the old.¹⁶ This dynamic of creative destruction, as Schumpeter termed it, does not promise immediate rewards; rather, it demands significant upfront investment and organisational adaptation, often leading to a period of stagnating or even declining profitability before the anticipated efficiency gains and competitive advantages take hold. The entrepreneur is the catalyst in this process, disrupting equilibrium to set new economic cycles in motion. This framework is particularly useful for understanding the contemporary financial landscape, where the impact of emerging technologies such as digital banking and fintech on profitability is rarely immediate. Instead, these innovations must first navigate an investment-intensive and disruptive phase before yielding long-term productivity benefits. Empirical research in banking supports this view, suggesting that the performance payoff from digital adoption is gradual; long-term performance improvements observed following the implementation of infrastructure like SWIFT underscore that the true fruits of innovation are often harvested only over an extended horizon.¹⁷

II.A.3. Credit Risk

Credit risk refers to the likelihood that a bank could incur losses due to a borrower failing to fulfil their agreed-upon debt obligations. Credit risk in this study is measured by the Non-Performing Loans (NPL) ratio, a key indicator of asset quality and lending effectiveness. As outlined in OJK Regulation Number 18/POJK.03.2016, credit risk pertains to the possibility of financial losses arising from a party's inability to fulfil its obligations to banks. This risk includes various forms, such as debtor default, credit concentration, counterparty credit, and settlement risk. Lending activities, a key revenue source for banks, inherently carry significant credit risk, arising from various intentional or unintentional factors.¹⁸ As outlined in OJK Regulation No. 40/POJK.03/2019, about commercial bank asset quality, non-performing loans (NPLs) are categorised into three levels: substandard, doubtful, and loss. These classifications reflect the quantified probability of loss associated with loan repayments and help financial institutions assess and manage credit quality effectively. The NPL ratio, a key credit risk indicator, measures the extent of NPL, with ratios below 5% indicating higher profitability and profit-

¹⁶ Heinz D. Kurz, "Schumpeter's New Combinations: Revisiting His Theorie der wirtschaftlichen Entwicklung on the Occasion of Its Centenary," *Journal of Evolutionary Economics* 22, no. 5 (2012): 871–899, <https://doi.org/10.1007/s00191-012-0295-z>

¹⁷ Susan V. Scott et al., "The Long-Term Effect of Digital Innovation on Bank Performance: An Empirical Study of SWIFT Adoption in Financial Services," *Research Policy* 46, no. 5 (2017): 984–1004, <https://doi.org/10.1016/j.respol.2017.03.010>

¹⁸ Kasmir, *Analisis Laporan Keuangan*, 102.

sharing rates, while higher ratios suggest lower profitability.¹⁹ A bank's credit quality is frequently measured by its NPL ratio, measuring the proportion of nonperforming loans in its loan portfolio. A higher NPL ratio signifies deteriorating credit quality, which can adversely impact the bank's profitability.²⁰ As stipulated in Bank Indonesia Regulation (*Peraturan Bank Indonesia/PBI*), the maximum permissible NPL ratio is set at 5%. This ratio is derived by dividing total non-performing loans by total loans disbursed, then multiplying by 100 to express it as a percentage.

II.A.4. Digital Banking

Digital banking is the fusion of cutting-edge technology and traditional banking processes to enhance operations, enabling customers to access financial services through digital platforms without visiting a physical branch. As defined by the OJK,²¹ the term "digital banking" encompasses banking services delivered through bank offices utilising electronic or digital infrastructure owned by financial institutions.²² Additionally, digital banking includes self-service banking activities conducted by customers via digital platforms, enabling more efficient and accessible financial transactions. These activities include obtaining information, communicating, registering, opening and closing accounts, and conducting banking transactions. The latter includes conducting transactions and obtaining information beyond banking products.

The integration of financial innovation in banking, underpinned by technological, electronic, and digital frameworks, has the potential to enhance bank performance by means of augmenting market share, diversifying product offerings and personalising products, expanding the scope of banking services, curtailing overhead and transaction costs, and expanding the geographic reach of all activities related to profitability.²³ Digital banking services include a variety of financial tools such as Automated Teller Machines (ATMs), Electronic Data Capture (EDC), Internet Banking, SMS Banking, and Mobile Banking. Mobile banking enables users to access banking information and conduct transactions via smartphone applications, providing a convenient and efficient way to

¹⁹ Purwanto, "Pengaruh Non Performing Loan," 155.

²⁰ Göktürk Kalkan, "The Impact of Non-performing Loans on Bank Profitability: Evidence from Türkiye," *Public Governance, Administration and Finances Law Review* 10, no. 1 (2025): 121–136, <https://doi.org/10.53116/pgaftr.8114>

²¹ Otoritas Jasa Keuangan, *Digital Banking Technology Adoption and Bank Efficiency: The Indonesian Case* (Jakarta: Otoritas Jasa Keuangan, December 2018), <https://ojk.go.id/id/data-dan-statistik/research/working-paper/Documents/WP-18-01r.pdf>

²² Indonesia Fintech Association, "Otoritas Jasa Keuangan Perlu Mengenal, Membedakan dan Mengawasi Layanan Tekfin Peer to Peer Lending Secara Proporsional" (Press Release, 2018), <https://fintech.id/ideas/ideas-detail?id=571>.

²³ Lee et al., "Factors Influencing the Adoption Behavior of Mobile Banking," 5.

manage financial activities remotely. The measurement of mobile banking employs dummy variables. For the purposes of this analysis, mobile banking status is quantified on a binary scale: banks offering the facility are assigned a score of 1, while non-adopters are assigned a score of 0.²⁴

II.A.5. Financial Technology

Fintech represents the integration of IT into the financial landscape to elevate service standards. By deploying new business models and technologies, it promotes a more innovative and accessible ecosystem for banking, investment, payment, and lending activities. The current trend of increased fintech use is reflected in the growing number of start-up companies and traditional financial institutions competing to develop mobile applications and websites. These technological advances aim to provide consumers with seamless, convenient access to financial services, eliminating the need to travel and enhancing transactional convenience.²⁵

Furthermore, Makarim & Taira S. stated that several types of fintechs have emerged in Indonesia, including digital payment, financing, and investment. Fintech companies specialising in digital payments offer online transaction services that enhance convenience, speed, and cost-efficiency.²⁶ These providers often operate as virtual wallets with diverse features, enabling seamless financial transactions between consumers and business owners and facilitating business-to-business (B2B) transactions. Fintech firms in the financing and investment sector include those engaged in crowdfunding and P2P lending. These companies generally fall into two primary categories: Fintech Crowdfunding Companies, which enable collective investment in projects or businesses, and P2P Lending Companies, which connect individual borrowers with lenders. Some fintech firms integrate both crowdfunding and lending services to offer a broader range of financial solutions.

P2P lending refers to an information technology-based joint funding service. It represents a financial service model in which lending and borrowing are conducted online, enabling direct debt financing between individuals and businesses, thereby eliminating the role of traditional financial institutions.²⁷

²⁴ Nur Imamah and Dinda Ayu Safira, "Pengaruh Mobile Banking terhadap Profitabilitas Bank di Bursa Efek Indonesia," *Profit: Jurnal Administrasi Bisnis* 15, no. 1 (2021): 98, <https://doi.org/10.21776/ub.profit.2021.015.01.10>.

²⁵ Yogi Affandi et al., "Digital Adoption, Business Performance, and Financial Literacy in Ultra-Micro, Micro, and Small Enterprises in Indonesia," *Research in International Business and Finance* 70 (2024): 102376, <https://doi.org/10.1016/j.ribaf.2024.102376>.

²⁶ Makarim & Taira S., "The Rise of Financial Technology in Indonesia" (Jakarta: Makarim & Taira S. Law Firm, 2017), <https://www.makarim.com/news/the-rise-of-financial-technology-in-indonesia>.

²⁷ Alistair Milne and Paul Parboteeah, *The Business Models and Economics of Peer-to-Peer Lending* (Brussels: European Credit Research Institute, 2016), <https://ssrn.com/abstract=2763682>

This service provides a platform that facilitates meetings between funders and fund recipients. Online matching platforms bridge the gap between investors and borrowers. This system typically offers lower rates than banks for borrowers, while providing higher returns for investors. The number of active fintech lending companies can be used to assess the scale of fintech P2P lending.²⁸

II.A.6. Macroeconomics

Macroeconomics is understood as the branch of economics that studies the economy as a whole.²⁹ Macroeconomics involves the analysis of external factors that are macro in nature, namely events occurring outside the company's purview and therefore not directly controllable by it. The objective of macroeconomics is to elucidate economic changes that influence all corporate households and markets concurrently. Commonly examined macroeconomic indicators in research include inflation, exchange rates, GDP, and interest rates. This study focuses specifically on GDP, using real GDP, which represents the total value of goods and services produced domestically, measured at constant prices relative to a designated base year.³⁰ GDP is measured in rupiah.³¹

II.A.7. Profitability

Profitability ratio is a financial metric used to assess a bank's efficiency and profitability. The method for evaluating a company's profitability depends on comparing specific profits to assets or capital.³² Profitability ratios include measures such as Gross Profit Margin (GPM), Net Profit Margin (NPM), Return on Equity (ROE), and ROA. ROA serves as an indicator of how efficiently a bank's management generates overall profits. In line with Bank Indonesia Circular Letter Number 13/30/DPNP dated December 16, 2011, Kasmir explained that ROA is calculated by dividing net income by total assets, then multiplying the result by 100 to express it as a percentage.³³

²⁸ Fatimah Ath Thahirah and Rahmatina Awaliah Kasri, "Does Fintech Threaten Islamic Banking Performance in Indonesia?," *Journal of Islamic Accounting and Finance Research* 5, no. 1 (2023): 65–86, <https://doi.org/10.21580/jiafr.2023.5.1.13745>.

²⁹ Mankiw et al., *Pengantar Ekonomi Mikro*.

³⁰ Mankiw et al., *Pengantar Ekonomi Mikro*.

³¹ Badan Pusat Statistik. (2022). Pertumbuhan Ekonomi Indonesia Triwulan IV-2022. <https://www.bps.go.id/Id/Pressrelease/2023/02/06/1997/Ekonomi-Indonesia-Tahun-2022-Tumbuh-5-31-Persen.Html>.

³² Kasmir, *Analisis Laporan Keuangan*, 102.

³³ Bank Indonesia, "Peraturan Bank Indonesia tentang Penilaian Tingkat Kesehatan Bank Umum," PBI No. 13/30/DPNP (December 16, 2011), <https://ojk.go.id/id/regulasi/Pages/PBI-tentang-Penilaian-Tingkat-Kesehatan-Bank-Umum.aspx>.

II.B. Previous Research

A substantial body of empirical research has examined the interplay between credit risk, digital banking, financial technology, and macroeconomic conditions in shaping firm profitability, yet the findings across these studies remain notably inconsistent. Purwanto, for instance, investigated the determinants of profitability among banking companies listed on the Indonesia Stock Exchange over the 2014–2016 period, employing ROA as the performance metric.³⁴ Using ROA as a proxy for profitability, the study found that NPL had a significant negative effect on ROA, whereas the Loan-to-Deposit Ratio (LDR) showed a positive but not statistically significant relationship. Furthermore, although the Capital Adequacy Ratio (CAR) showed a positive association with ROA, the relationship was not statistically significant. Muhtadin et al., examining state-owned banks listed on the Indonesia Stock Exchange between 2012 and 2018, found that both the CAR and Operating Costs per Operating Income (OCOI) exerted a significant negative influence on ROA.³⁵

Studies examining digital banking adoption have yielded similarly mixed results. Mayasari et al. examined the impact of internet and mobile banking on banks' ROA from 2014 to 2019.³⁶ The study revealed that internet banking had a significant negative impact on ROA, whereas mobile banking had a significant positive impact. In a similar vein, Imamah & Safira explored the impact of mobile banking on bank profitability, using ROA, ROE, and NPM as the dependent variables.³⁷ They found that mobile banking had a positive yet insignificant effect on profitability. Phan et al. investigated the influence of fintech on the performance of 41 Indonesian banks over the period 1998–2017. The study revealed that fintech had a significant negative effect on NIM, ROA, ROE, and YEA. Even after controlling for GDP, fintech continued to have a significant adverse impact on ROA, whereas GDP itself was statistically insignificant.³⁸

In their 2023 study, Ath Thahirah and Kasri, examined how P2P lending affected the financial performance of conventional and Islamic banks during 2016–2020. The results indicated that P2P lending was positively associated with conventional bank ROA, though not significantly, whereas it was

³⁴ Purwanto, "Pengaruh Non Performing Loan," 150.

³⁵ Imam Muhtadin et al., "Determinants of Banking Profitability: The Case of State-Owned Banks Listed on the Indonesia Stock Exchange," *Journal of Accounting and Investment* 23, no. 3 (2022): 576–587, <https://doi.org/10.18196/jai.v23i3.15246>.

³⁶ Mayasari et al., "Pengaruh Internet Banking dan Mobile Banking Terhadap Kinerja Keuangan Bank," *Strategic: Jurnal Pendidikan Manajemen Bisnis* 21, no. 1 (2021): 55–72, <https://ejournal.upi.edu/index.php/strategic/article/view/36871>

³⁷ Imamah and Safira, "Pengaruh Mobile Banking," 95–103.

³⁸ Phan et al., "Do Financial Technology Firms Influence Bank Performance?" 101210.

significantly associated with Islamic bank ROA.³⁹ Meanwhile, macroeconomic variables significantly influence profitability, although their effects differ across sectors and countries. Handriani and Anggara (2025) found that economic growth improved Indonesian banks' profitability, while inflation had a negative but insignificant effect⁴⁰. In contrast, Ha et al. (2025) reported that economic growth and public investment reduced profitability in several Vietnamese sectors, whereas private investment increased it.⁴¹ Cahyani, investigating the effects of inflation, interest rates, and GDP on ROA between 2009 and 2016, found that inflation had an insignificant negative influence, interest rates imposed a significant drag on profitability, and GDP contributed a positive yet statistically negligible effect. These findings show that macroeconomic conditions do not affect profitability uniformly but depend on sectoral characteristics and firms' ability to convert economic growth and investment into productive outcomes. This pattern underscores the uneven transmission of macroeconomic conditions to banking sector performance.⁴²

II.C. Research Hypothesis

II.C.1. Impact of NPL on ROA

The fundamental role of banking institutions is to channel financial resources to the public by issuing credit.⁴³ However, before extending credit, financial institutions must assess borrowers' viability to mitigate the risk of losses arising from borrowers' inability to repay loans.⁴⁴ The NPL ratio is a critical proxy for credit risk, capturing the proportion of loans that have ceased generating income. Viewed through the prism of signalling theory, rising NPL ratios convey unfavourable information to investors about a bank's ability to manage credit, with such signals translating into reduced interest income and, consequently, weakened profitability as market confidence and lending capacity contract. In contrast, a low NPL ratio is interpreted as a positive signal, reflecting robust

³⁹ Ath Thahirah and Kasri, "Does Fintech Threaten Islamic Banking Performance," 70.

⁴⁰ Eka Handriani and Sebastian Billy Anggara, "An Analysis of Firm-Specific, Industry-Specific, and Macroeconomic Determinants Influencing Bank Profitability in Indonesia," *Jurnal Studi Manajemen Organisasi* 22, no. 1 (2025): 58–88, <https://doi.org/10.14710/jsmo.v22i1.72650>

⁴¹ Ngo Ngan Ha, Duong Hoang Anh, Le Nhu Quynh, and Trinh Trong Quyen, "Impact of Economic Growth, Public Investment, and Private Investment on Firm Performance in Some Economic Sectors in Vietnam: An SGMM Approach," *International Journal of Innovative Research and Scientific Studies* 8, no. 4 (2025): 1813–1822, <https://doi.org/10.53894/ijirss.v8i4.8240>

⁴² Yutisa Tri Cahyani, "Pengaruh Inflasi, Suku Bunga (BI Rate), Produk Domestik Bruto (PDB) terhadap ROA (Studi pada Bank Pembiayaan Rakyat Syariah (BPRS) di Indonesia Tahun 2009–2016)," *Jurnal Ekonomi dan Perbankan Syariah* 5, no. 1 (2018): 1–22, <https://doi.org/10.19105/iqtishadia.v5i1.1695>.

⁴³ Andrianto et al., *Manajemen Bank*, 1st ed. (CV. Penerbit Qiara Media, 2019), 45.

⁴⁴ Kasmir, *Analisis Laporan Keuangan*, 102.

risk management and financial stability to stakeholders, thereby reinforcing investor trust and supporting sustainable profitability.⁴⁵

The relationship between NPLs and profitability is two-sided: low NPL ratios tend to support higher profitability, while elevated NPLs have the opposite effect, eroding earnings and diminishing returns. Consequently, effective credit risk management emerges as a crucial determinant of sustained bank profitability. This relationship is empirically supported by Purwanto's investigation of banking firms listed on the Indonesia Stock Exchange, which examined the impact of NPL, LDR, and CAR on ROA. The study demonstrated that credit risk, as measured by the NPL ratio, exerted a significant adverse effect on profitability, underscoring the material consequences of asset-quality deterioration for financial performance.⁴⁶ Extending this line of inquiry, Wahyuni et al. analysed conventional commercial banks in Indonesia (2015–2019) and, using panel regression, found a strong, significant adverse relationship between NPL and ROA.⁴⁷ However, Muhtadin et al. reported that the ROA of state-owned banks is adversely affected by CAR and OCOI, identifying significant negative correlations with both variables, whereas NPL did not have a statistically significant effect on ROA.⁴⁸ Due to inconsistent findings in prior studies, the first hypothesis is H1: NPL has a significant effect on ROA.

II.C.2. Impact of mobile banking on ROA

Mobile banking enables customers to execute transactions at any time and from any location with a smartphone, provided internet connectivity is available. For banks, this investment supports broader outreach and enhances product distribution, yet it also entails long-term operational costs that can potentially constrain short-term profitability.⁴⁹ The implementation of mobile banking, as postulated by the signalling theory, is indicative of operational efficiency, technological adaptation, and a bank's commitment to competitiveness in the digital era. These signals, in turn, can enhance stakeholder confidence and contribute to improved financial performance. Mobile banking holds the potential to increase ROA through gains in operational efficiency and the

⁴⁵ Richard Arhinful et al., "Non-Performing Loans and Their Impact on Investor Confidence: A Signaling Theory Perspective—Evidence from U.S. Banks," *Journal of Risk and Financial Management* 18, no. 7 (2025): 383, <https://doi.org/10.3390/jrfm18070383>.

⁴⁶ Purwanto, "Pengaruh Non Performing Loan," 150.

⁴⁷ Wahyuni et al., "Analyzing the Impact of Non-Performing Loans and Loan-to-Deposit Ratios on Return on Assets: A Study of Conventional Commercial Banks in Indonesia," *Advances in Management & Financial Reporting* 1, no. 3 (2023): 107–118, <https://doi.org/10.60079/amfr.v1i3.124>.

⁴⁸ Muhtadin et al., "Determinants of Banking Profitability," 580.

⁴⁹ Imamah and Safira, "Pengaruh Mobile Banking," 99.

generation of new revenue streams.⁵⁰ Empirical evidence on this relationship, however, remains mixed. Mayasari et al. found that while internet banking had a significant adverse effect on ROA, mobile banking had a significant positive effect, suggesting divergent performance implications across digital channels. In a similar vein, Imamah and Safira explored the impact of mobile banking on bank profitability using the IDX as the dependent variable.⁵¹ The findings indicated that mobile banking had a positive effect on ROA, ROE, and NPM, although not statistically significant. Given this theoretical grounding and the suggestive though inconclusive empirical evidence, the present study proposes the following hypothesis H2: mobile banking significantly affects ROA.

II.C.3. Impact of P2P lending on ROA

P2P lending, a fintech innovation, provides straightforward loans that do not require collateral, thereby competing with banks, particularly small banks, and potentially decreasing profitability. Its adaptability and efficiency appeal to a growing client base, prompting banks to adopt digital services to maintain competitiveness. Signalling theory provides a useful lens for interpreting this dynamic: banks that proactively innovate by offering or integrating P2P lending capabilities signal to investors their technological agility and strategic responsiveness, thereby enhancing competitiveness and potentially profitability. Conversely, institutions that fail to adapt risk signalling stagnate, which may precipitate deterioration in financial performance. Empirical evidence on the relationship between P2P lending and bank profitability, however, yields mixed findings. Phan et al. analysed the impact of fintech on the performance of 41 banks in Indonesia from 1998 to 2017 and found that P2P lending has a significant adverse effect on ROA.⁵²

However, they also found that technological adaptation can maintain long-term profitability. Ho et al.'s (2024) working paper reports an adverse relationship between P2P lending growth and bank efficiency (including ROA), especially for both large and small banks, with results differing by branch density.⁵³ In contrast, Ath Thahirah and Kasri examined the impact of P2P lending on the performance of conventional and Islamic banks from 2016 to 2020 and found a non-significant positive effect on conventional banks' ROA, whereas P2P lending exhibited a significant positive effect on Islamic banks' ROA.⁵⁴ Given the varied empirical landscape, H3 is proposed: P2P lending significantly affects ROA.

⁵⁰ Mayasari et al., "Pengaruh Internet Banking dan Mobile Banking," 60.

⁵¹ Imamah and Safira, "Pengaruh Mobile Banking," 100.

⁵² Phan et al., "Do Financial Technology Firms Influence Bank Performance?," 101210.

⁵³ Shirley J. Ho and Yun-Shiang Huang, "The Effects of P2P Lending on Bank Performance" (working paper, SSRN, 2024), <https://doi.org/10.2139/ssrn.4682844>.

⁵⁴ Ath Thahirah and Kasri, "Does Fintech Threaten," 70.

II.C.4. The Impact of GDP on ROA

In line with signal theory, GDP serves as a vital indicator of overall economic conditions. It provides banks with valuable insights for strategic management and communicates positive signals to investors about the broader environment in which financial institutions operate.⁵⁵ Banks that demonstrate robust management by maintaining or increasing their ROA in periods of GDP decline have been shown to enhance investor confidence, signalling operational resilience and prudent risk oversight. Furthermore, GDP is an important indicator of economic growth, with rising output typically associated with higher incomes, greater savings, and greater profitability in the banking sector. Empirical evidence on the relationship between GDP and bank performance in Indonesia, however, presents a mixed picture. Growth boosted Indonesian banks, yet, along with public investment, hurt Vietnamese firms, whereas private investment helped there. These disparities highlight the critical role of sectoral traits and firms' ability to convert macro conditions into performance.⁵⁶ Additionally, inflation had an adverse but statistically insignificant effect on stock returns, whereas GDP and profitability had significant adverse effects. Cahyani's examination of the 2009–2016 period reported that inflation had an insignificant adverse effect and interest rates a significant adverse influence, while GDP showed a positive but statistically insignificant relationship with ROA.⁵⁷ Further complicating the picture, Phan et al. found significant adverse effects of fintech on Indonesian bank performance; even after including GDP as a control variable, fintech remained significantly adverse to ROA, while GDP itself proved statistically insignificant.⁵⁸ Given varied empirical findings, the fourth hypothesis is H4: GDP significantly affects ROA.

III. RESEARCH METHOD

This study adopts a quantitative explanatory framework, concentrating on conventional commercial banks listed on the Indonesia Stock Exchange (IDX)

⁵⁵ Eri Patmasari, "Analisis Faktor-Faktor yang Mempengaruhi Profitabilitas Bank Umum Syariah di Indonesia Periode 2014–2017 (Analysis of Factors Influencing the Profitability of Islamic Banks in Indonesia Period 2014–2017)," 2018, *Jurnal Ilmiah Mahasiswa FEB* 6, no. 2 (2018): 1–9.

⁵⁶ Eka Handriani and Sebastian Billy Anggara, "An Analysis of Firm-Specific, Industry-Specific, and Macroeconomic Determinants Influencing Bank Profitability in Indonesia," *Jurnal Studi Manajemen Organisasi* 22, no. 1 (2025): 58–88, <https://doi.org/10.14710/jsmo.v22i1.72650>; Ngo Ngan Ha, Duong Hoang Anh, Le Nhu Quynh, and Trinh Trong Quyen, "Impact of Economic Growth, Public Investment, and Private Investment on Firm Performance in Some Economic Sectors in Vietnam: An SGMM Approach," *International Journal of Innovative Research and Scientific Studies* 8, no. 4 (2025): 1813–1822, <https://doi.org/10.53894/ijirss.v8i4.8240>

⁵⁷ Cahyani, "Pengaruh Inflasi," 10.

⁵⁸ Phan et al., "Do Financial Technology Firms," 101210.

from 2020 to 2022. Using purposive sampling, the population of 43 banks was narrowed to a final sample of 28. The selection was based on the availability of comprehensive data across four key sources: (a) annual reports from the IDX website, (b) NPL, ROA, and mobile banking metrics from the banks' official websites, (c) P2P lending data from the OJK, and (d) GDP statistics from the Central Bureau of Statistics (BPS).

The present study employs three types of variables: one dependent variable (ROA), three independent variables (NPL, mobile banking, and P2P lending), and one control variable (GDP). The study utilises panel data analysis, a methodological framework that employs observations on individual units across multiple periods. Panel data combines cross-sectional dimensions, representing individual entities, with time-series dimensions, representing temporal observations. This integration permits the simultaneous examination of variation both between units and over time, offering greater statistical power and richer insights than purely cross-sectional or time-series designs.⁵⁹ Accordingly, the study proposes two specifications of panel regression models, formulated as follows:

Regression Model 1

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon$$

$$Y = \text{ROA}$$

$$\alpha = \text{Constant}$$

$$\beta_1 = \text{NPL Regression Coefficient}$$

$$X_1 = \text{NPL}$$

$$\beta_2 = \text{Mobile Banking Regression Coefficient}$$

$$X_2 = \text{Mobile Banking}$$

$$\beta_3 = \text{P2P Lending Regression Coefficient}$$

$$X_3 = \text{P2P Lending}$$

$$\epsilon = \text{Error Rate (error)}$$

Regression Model 2

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon$$

⁵⁹ Imam Ghozali, "Aplikasi Analisis Multivariate dengan Program SPSS," in *Analisis Multivariate dengan Program SPSS* (Badan Penerbit UNDIP, 2016), 120.

- Y = ROA
- α = Constant
- β_1 = NPL Regression Coefficient
- X1 = NPL
- β_2 = Mobile Banking Regression Coefficient
- X2 = Mobile Banking
- β_3 = P2P Lending Regression Coefficient
- X3 = P2P Lending
- β_4 = GDP Regression Coefficient
- X4 = GDP
- ϵ = Error Rate (error)

IV. RESULT

IV.A. Statistical Description Analysis

Table 1.
Statistical Description Analysis

	NPL (%)	Mobile Banking	P2P Lending	PDB (In Millions of Rupiah)	ROA (%)
Mean	2.55	0.96	118	11,184,500	1.53
Median	2.72	1	103	11,120,100	1.29
Maximum	5.70	1	149	11,710,400	4.73
Minimum	0.00	0	102	10,723,000	0.04
Std. Dev.	1.28	0.19	22.0558	408,104.8	1.15
Observations	84	84	84	84	84

As shown in Table 1, the descriptive analysis indicates that NPL ratios averaged 2.55% across the sample. Mobile banking adoption was widespread, with a mean score of 0.96. Fintech activity (P2P Lending) varied significantly, averaging 118; notably, this metric declined from a high of 149 in 2020 to a low of 102 in 2022. Regarding the macroeconomic control, GDP averaged IDR 11,120,100 million, with a standard deviation of IDR 408,104.8 million. The highest GDP was recorded in 2022 at Rp 11,710,400 million, while the lowest was in 2020 at IDR 10,723,000 million. Profitability, proxied by ROA, spans from 0.04% to 4.73%, with an average of 1.53% and a deviation of 1.15%.

IV.B. Inferential Statistical Analysis

IV.B.1. Selection of the Best Model

To determine the most appropriate panel data specification among the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random

Effect Model (REM), this study employs standard diagnostic procedures, namely the Chow test, Hausman test, and Lagrange Multiplier (LM) test, each selected to evaluate the validity of pooling restrictions sequentially, the presence of correlated unobserved heterogeneity, and the suitability of random effects estimation relative to ordinary least squares.

Table 2.
Chow Test

Redundant Fixed Effects Tests	
Equation: CHOW1	
Test cross-section fixed effects	
Effects Test	Statistic
Cross-section F	18.410734
Cross-section Chi-square	196.542331

As shown in Table 2, the Chow test yielded a p-value of less than 0.05, confirming that the FEM is the appropriate estimator.

Table 3.
Chow test 2

Redundant Fixed Effects Tests			
Equation: CHOW2			
Test cross-section fixed effects			
Effects Test	Statistic	d.f.	Prob.
Cross-section F	18.935770	(27,52)	0.0000
Cross-section Chi-square	200.130664	27	0.0000

For Model 2, the Chow test results (Table 3) show a p-value < 0.05, confirming that the FEM is the appropriate estimator

Table 4.
Hausman Test 1

Correlated Random Effects - Hausman Test			
Equation: HAUSMAN1			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	3	1.0000
* Cross-section test variance is invalid. Hausman statistic set to zero.			

Table 4 shows that the Hausman test produced a p-value of 1.0000 (> 0.05). This result confirms that the REM provides the best fit for Model 1.

Table 5.
Hausman Test 2

Correlated Random Effects - Hausman Test			
Equation: HAUSMAN2			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	4	1.0000
* Cross-section test variance is invalid. Hausman statistic set to zero.			

Since the Hausman test yielded a p-value of 1.0000 (> 0.05), the analysis concludes that the REM is the most suitable choice for Model 2.

Table 6.
LM test 1

Lagrange Multiplier Tests for Random Effects			
Null hypotheses: No effects			
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives			
	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	54.52994 (0.0000)	1.150987 (0.2833)	55.68092 (0.0000)

As indicated by the findings in Table 6, the p-value was less than 0.05, thereby falling within the 0.0000 range. Consequently, the most suitable regression model identified was REM.

Table 7.
LM test 2

Lagrange Multiplier Tests for Random Effects			
Null hypotheses: No effects			
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives			
	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	55.19633 (0.0000)	1.555556 (0.2123)	56.75189 (0.0000)

The selection of the appropriate estimation model was guided by the sequential application of the Chow, Hausman, and LM tests. For Model 1, the Hausman test yielded a p-value of 1.0000, indicating no systematic differences between the FEM and REM, thereby favouring the more parsimonious REM specification. In the case of Model 2, the LM test results, presented in Table

7 ($p\text{-value} = 0.0000$), confirmed the suitability of the REM over the CEM. Accordingly, the analysis adopts the REM for both regression equations, ensuring that the estimation strategy remains statistically defensible and appropriately accounts for unobserved heterogeneity across the sample.

IV.B.2. Classical Assumption Test

a) Test of Normality

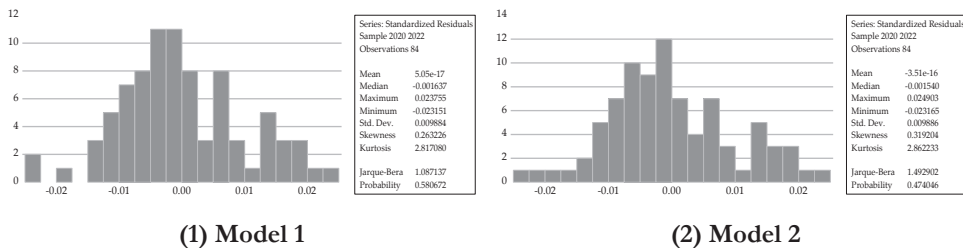


Figure 1 demonstrates a $p\text{-value}$ of 0.580672 (≥ 0.05), confirming that regression model 1 is normally distributed and passes the normality test. In parallel, Figure 2 shows a $p\text{-value}$ of 0.474046 (≥ 0.05), demonstrating that regression Model 2 similarly fulfils the normality assumption, thus validating the use of both models for subsequent interpretation.

b) Test of Multicollinearity

Variance Inflation Factors			
Date: 12/04/24 Time: 13:48			
Sample: 1 84			
Included observations: 84			
Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.000911	812.4532	NA
X1	0.007190	5.205762	1.044068
X2	3.44E-05	29.58939	1.056764
X3	3.72E-05	750.8178	1.032030

(1) Model 1

Variance Inflation Factors			
Date: 12/04/24 Time: 13:49			
Sample: 1 84			
Included observations: 84			
Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	2.607641	2308284.	NA
X1	0.007310	5.253439	1.053631
X2	3.50E-05	29.84755	1.065984
X3	0.000113	2273.963	3.125655
X4	0.002742	2191408.	3.171223

(2) Model 2

The diagnostic results reveal that both regression models meet the assumption of no multicollinearity, as all independent variables have VIF values below 10.

c) Test of Heteroscedasticity

Dependent Variable: RESABS Method: Panel EGLS (Cross-section random effects) Date: 12/04/24 Time: 13:33 Sample: 2020 2022 Periods included: 3 Cross-sections included: 28 Total panel (balanced) observations: 84 Swamy and Arora estimator of component variances				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002233	0.001216	1.836729	0.0700
X1	-0.003652	0.003416	-1.069077	0.2883
X2	0.000246	0.000236	1.039138	0.3019
X3	-0.000386	0.000246	-1.571613	0.1200

(1) Model 1

Dependent Variable: RESABS Method: Panel EGLS (Cross-section random effects) Date: 12/04/24 Time: 13:34 Sample: 2020 2022 Periods included: 3 Cross-sections included: 28 Total panel (balanced) observations: 84 Swamy and Arora estimator of component variances				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.101414	0.063749	-1.590840	0.1156
X1	-0.003129	0.003375	-0.926946	0.3568
X2	0.000210	0.000233	0.900556	0.3706
X3	0.000174	0.000421	0.412843	0.6808
X4	0.003362	0.002067	1.626157	0.1079

(2) Model 2

Based on the table, regression model 1 was tested using the Glejser method, yielding p-values of 0.2883, 0.3019, and 0.1200 for each variable. With all values surpassing 0.05, Model 1 confirms the absence of heteroscedasticity and successfully passes the diagnostic test. Likewise, regression model 2, evaluated using the Glejser test, yielded p-values of 0.3568, 0.3706, 0.6808, and 0.1709. As each of these values exceeds 0.05, the results confirm that model 2 also exhibits no heteroscedasticity and meets the assumption required by the test.

IV.C. Panel Data Regression Results

Following the model selection criteria, the REM was determined to be the most appropriate specification for Model 1. The estimated equation is presented below:

$$Y = 0.065083 - 0.347293 X1 + 0.002567 X2 - 0.009127 X3 + \epsilon$$

Interpretations can be made: the intercept value of 0.065083 indicates that when NPL (X1), Mobile Banking (X2), and P2P Lending (X3) are all zero, ROA (Y) would be 0.065083. The coefficient for NPL (X1) is -0.347293, indicating that a one-percentage-point increase in the NPL ratio is associated with a 0.347293 reduction in ROA, assuming all other factors remain constant. In contrast, the coefficient for Mobile Banking (X2) is 0.002567, implying that a one-per cent rise in mobile banking adoption is associated with an increase in ROA of 0.002567 under the same ceteris paribus condition. Lastly, the regression weight for P2P Lending (X3) is -0.009127, suggesting that a one-per cent increase in P2P lending activity leads to a 0.009127 decline in ROA, all else being equal.

In the second model, the determinants of ROA are analysed using NPL, Mobile Banking, and P2P Lending as predictors and GDP as a control variable. The REM proved to be the optimal estimator, described by the equation:

$$Y = -0.874969 - 0.328561 X1 + 0.002133 X2 - 0.004151 X3 + 0.030499 X4 + \epsilon$$

The outcomes of the panel data regression model 2 suggest the following interpretation. When all independent and control variables (NPL, Mobile Banking, P2P Lending, and GDP) are equal to zero, the predicted ROA is -0.874969. The coefficient for NPL is negative, meaning that a one-per cent increase in NPL reduces ROA by 0.328561, holding other variables constant (*ceteris paribus*). On the other hand, with a coefficient of 0.002133, mobile banking positively affects ROA, such that a 1% increase in usage results in the same percentage increase in ROA. In contrast, with a coefficient of -0.004151, P2P lending negatively affects ROA, meaning that a 1% rise in its use reduces ROA by that amount. Finally, a 1% increase in GDP is expected to boost ROA by 0.030499, indicating a positive relationship. These interpretations are made under the assumption that all other variables remain unchanged.

IV.D. Hypothesis Testing

The hypotheses were examined by calculating the coefficient of determination (R^2) for both models, indicating the extent to which the independent variables collectively account for variation in the dependent variable. The overall significance of each regression was then determined using the F-test, while the t-test was used to isolate and evaluate the statistical contribution of each individual predictor within the model.

1) Determination Coefficient (Adjusted R^2)

R-squared	0.387435	R-squared	0.405780
Adjusted R-squared	0.364464	Adjusted R-squared	0.375692
S.E. of regression	0.003758	S.E. of regression	0.003710
F-statistic	16.86615	F-statistic	13.48682
Prob(F-statistic)	0.000000	Prob(F-statistic)	0.000000

(1) Model 1

(2) Model 2

In terms of goodness-of-fit, Model 1 explains 36.45% of the variation in ROA (Adjusted $R^2 = 0.3645$) based on NPL, mobile banking, and P2P lending. When GDP is introduced as a control in Model 2, the explanatory power increases slightly to 37.57% (Adjusted $R^2 = 0.3757$). This demonstrates that while the core variables drive a significant portion of profitability, adding

the macroeconomic factor provides incremental value to the model, with the remaining variance attributed to the error term.

2) F Test (Simultaneous)

Table 8.
F Test for Model 1

Weighted Statistics			
Root MSE	0.003668	R-squared	0.387435
Mean dependent var	0.003548	Adjusted R-squared	0.364464
S.D. dependent var	0.004714	S.E. of regression	0.003758
Sum squared resid	0.001130	F-statistic	16.86615
Durbin-Watson stat	1.920596	Prob(F-statistic)	0.000000

Table 9.
F Test for Model 2

Weighted Statistics			
Root MSE	0.003598	R-squared	0.405780
Mean dependent var	0.003497	Adjusted R-squared	0.375692
S.D. dependent var	0.004695	S.E. of regression	0.003710
Sum squared resid	0.001087	F-statistic	13.48682
Durbin-Watson stat	1.905506	Prob(F-statistic)	0.000000

To evaluate the overall fit of the models, the F-statistic was compared against the F-table threshold. In both cases, the calculated statistics (16.866 for Model 1 and 13.487 for Model 2) surpassed their respective table values (2.719 and 2.487). Consequently, the probability values were well below 0.05, leading to the rejection of the null hypothesis. This indicates that the combination of credit risk, digital adoption, fintech competition, and macroeconomic conditions (GDP) serves as a significant simultaneous predictor of ROA, thereby affirming the explanatory power of the proposed framework.

3) t Test (Partial)

Table 10.
t test for Model 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.065083	0.012208	5.331298	0.0000
X1	-0.347293	0.069337	-5.008736	0.0000
X2	0.002567	0.003179	0.807496	0.4218
X3	-0.009127	0.002367	-3.855588	0.0002

Table 11.
t test for Model 2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.874969	0.612224	-1.429165	0.1569
X1	-0.328561	0.069525	-4.725834	0.0000
X2	0.002133	0.003153	0.676514	0.5007
X3	-0.004151	0.003993	-1.039540	0.3017
X4	0.030499	0.019861	1.535648	0.1286

T-test analysis reveals distinct outcomes for the two models. For Model 1, NPL and P2P Lending significantly influence ROA ($p < 0.05$), while Mobile Banking does not. In Model 2, the introduction of GDP renders P2P lending insignificant. Notably, neither Mobile Banking nor the GDP control variable showed a significant effect in the second model. Thus, the findings indicate that NPL is the sole robust predictor of ROA, remaining significant in both estimation models, even after accounting for digital adoption, fintech competition, and macroeconomic conditions.

IV.E. Discussion

The adjusted R-square comparison reveals that adding GDP as a control variable enhances explanatory power only marginally. Model 1 explains 36.45% of ROA variation, whereas Model 2 explains 37.57%, reflecting a slight increase in model fit. This modest increase of about 1.12 percentage points suggests that GDP contributes additional explanatory power to the model, although the improvement is relatively limited. The findings imply that while GDP enhances the model's comprehensiveness, the core explanatory power still lies primarily with the original independent variables, particularly NPL. The slight increase in adjusted R-squared suggests that GDP adds some value to the regression model. However, its marginal role suggests that firm-level

financial variables, such as NPL, are far more influential in determining ROA than macroeconomic indicators, such as GDP.

Comparing the F-test outcomes reveals that both regression models are statistically significant. This indicates that the independent variables jointly explain a meaningful proportion of the variation in ROA. For Model 1, the collective influence of the variables is confirmed by an F-statistic of 16.866, which surpasses the required threshold. When the control variable GDP is added to Model 2, the F-statistic slightly decreases to 13.487 but remains above the corresponding F-table threshold, confirming that the extended model, comprising both independent and control variables, continues to predict ROA significantly. Although the F-statistic is slightly lower in Model 2, this does not diminish the model's overall significance; instead, it reflects a redistribution of explained variance due to the inclusion of the control variable. Therefore, both models are valid, but Model 2 provides a more comprehensive specification by accounting for potential macroeconomic effects through GDP.

Based on the t-test, the comparison between Model 1 and Model 2 indicates that the inclusion of the control variable (GDP) shifts the significance of some predictors. In Model 1, both NPL and P2P Lending have a significant adverse effect on ROA, whereas Mobile Banking has no significant effect. However, when GDP is added as a control variable in Model 2, only NPL remains statistically significant, while both P2P Lending and Mobile Banking become insignificant. The second regression specification confirms that NPL has a negative and significant effect on ROA, regardless of the control variables included. This result suggests that the addition of GDP may absorb part of the explanatory power previously attributed to P2P Lending, potentially due to multicollinearity or overlapping effects. Moreover, GDP itself does not show a significant direct effect on ROA, indicating that although it may influence the model structure, it does not independently affect profitability. Overall, NPL is the only variable that consistently and significantly influences ROA across both models, highlighting its critical role in determining bank performance.

The initial regression model indicates that NPL has a significant negative effect on ROA, supporting Hypothesis 1 (H1). This result is in line with Purwanto⁶⁰ and Wahyuni et al.,⁶¹ but contrary to Grilseda and Riyadi,⁶² who found a positive, insignificant effect. NPL has a significant adverse impact on ROA because it represents loans that are not generating income for banks.

⁶⁰ Purwanto, "Pengaruh Non Performing Loan," 150.

⁶¹ Wahyuni et al., "Analyzing the Impact," 112.

⁶² Nadya Grilseda and Selamat Riyadi, "Pengaruh CAR, LDR, KAP dan NPL terhadap ROA Bank Go Public yang Terdaftar di BEI," *Jurnal Ilmu Manajemen* 11, no. 1 (2021): 53–67, <https://doi.org/10.32502/jimn.v10i1.3252>

When borrowers fail to meet their repayment obligations, banks experience a decline in interest income and may incur additional costs related to loan-loss provisions. This decrease in turnover and increase in expenses directly diminish the bank's profitability, as measured by ROA. Viewed through the lens of signalling theory, these findings acquire additional conceptual depth. Firms utilise signals to mitigate information asymmetry between insiders and external stakeholders; in this context, an elevated NPL ratio serves as a distinctly negative signal to investors, indicating weak credit risk management practices and foreshadowing potential losses from bad debts. Such negative signals undermine investor confidence and, by extension, constrain the bank's access to capital and market valuation. Collectively, these results underscore the imperative for banking institutions to prioritise the active management and minimisation of non-performing loans as a foundational strategy to sustain and enhance bank performance.

The first regression results indicate that mobile banking has a positive but insignificant effect on ROA, supporting the acceptance of Hypothesis 2 (H2). This finding aligns with the evidence presented by Imamah and Safira, who similarly reported a positive yet non-significant relationship between mobile banking adoption and bank profitability in Indonesia, but in contrast with the conclusions of Mayasari et al.,⁶³ who found a significant positive effect. In the second regression, after including the GDP control variable, the results remained the same. Mobile banking requires substantial investment in technology, infrastructure, and security, which may not yield immediate financial benefits. According to Imamah and Safira, mobile banking positively impacts ROA but remains insignificant, as investments in digital banking take time to enhance profitability⁶⁴. Unlike traditional banking services, mobile banking often generates minimal direct revenue due to low transaction fees. Mayasari et al. found that while mobile banking improves efficiency, its contribution to profitability remains limited in the short term.⁶⁵ According to Ritonga et al., barriers to mobile banking include mistrust in transaction security and limited technological infrastructure in some areas.⁶⁶ A study by Check Point Software Technologies found that financial institutions in Indonesia experienced 2,730 cyberattacks per week in the past six months, 252% higher than the

⁶³ Mayasari et al., "Pengaruh Internet Banking dan Mobile Banking," 65

⁶⁴ Imamah and Safira, "Pengaruh Mobile Banking," 100

⁶⁵ Mayasari et al., "Pengaruh Internet Banking dan Mobile Banking," 65

⁶⁶ Rika Umbaiyanti Ritonga et al., "Faktor Penghambat Adopsi Mobile Banking pada Generasi Milenial," *Journal of Management, Economic and Accounting (JMEA)* 2, no. 1 (2023): 23–35, <https://pusdikra-publishing.com/index.php/jisc/article/view/1078/941>.

global average.⁶⁷ Based on Schumpeterian Innovation Theory, the positive but insignificant effect of mobile banking on ROA reflects the early stage of creative destruction, in which technological innovation requires substantial upfront investment before generating measurable financial returns. Mobile banking requires substantial investment in digital infrastructure, cybersecurity, and system development, leading to short-term profitability remaining unchanged even as efficiency increases. In the Indonesian context, mobile banking has not yet reached the stage where innovation productivity exceeds investment costs,⁶⁸ which explains why its effect remains insignificant even after including GDP as a control variable.

Results from the first regression model reveal that P2P lending negatively and significantly influences ROA, leading to the acceptance of Hypothesis 3 (H3). This finding aligns with the evidence reported by Phan et al.⁶⁹ and Ho et al.,⁷⁰ both of whom documented adverse effects of fintech competition on traditional bank performance in the Indonesian context. However, it contrasts with Ath 'Thahirah and Kasri,⁷¹ who found an insignificant positive effect. Fintech with technological innovation and low cost attracts customers from banks.⁷² In the first model, this competitive dynamic directly reduces bank profitability, confirming that fintech disruption, in the absence of mitigating factors, adversely affects the financial performance of conventional banks. However, after including GDP as a control variable, the effect of P2P lending on ROA becomes negative and insignificant. According to Phan et al., economic growth (rising GDP) increases loan demand and increases interest income, while recession (falling GDP) deteriorates credit quality and reduces bank profitability.⁷³ This adverse effect could be attributed to increased competition from P2P platforms, which may reduce traditional banks' market share and pressure their profit margins. However, when GDP is included as a control variable, its influence might overshadow the direct impact of P2P lending on ROA. GDP growth generally enhances overall economic conditions, potentially improving the performance of financial institutions. As a result, the specific adverse effect of P2P lending on ROA may appear statistically insignificant

⁶⁷ Fernan Rahadi, "Lembaga Keuangan Industri Kedua Terbanyak Peroleh Serangan Siber," *Republika*, August 24, 2022, <https://rejogja.republika.co.id/berita/rh3ks2291/lembaga-keuangan-industri-kedua-terbanyak-peroleh-serangan-siber>.

⁶⁸ Otoritas Jasa Keuangan, Digital Banking Technology Adoption and Bank Efficiency, 10.

⁶⁹ Phan et al., "Do Financial Technology Firms," 101210.

⁷⁰ Ho and Huang, "Effects of P2P Lending on Bank Performance," 12

⁷¹ Ath 'Thahirah and Kasri, "Does Fintech Threaten," 75

⁷² Shafyra Nuruzzakiyya Mar'atushsholihah and Tuti Karyani, "Dampak Financial Technology terhadap Kinerja Bank Umum Konvensional di Indonesia," *Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis* 7, no. 1 (2021): 450–465, <http://dx.doi.org/10.25157/ma.v7i1.4707>.

⁷³ Phan et al., "Do Financial Technology Firms," 101210.

when GDP is accounted for in the analysis.⁷⁴ The significant adverse effect of P2P lending on ROA in the first regression model can be understood through Schumpeterian Innovation Theory, which views technological innovation as a process of creative destruction that disrupts incumbent firms. As digital lending innovations, P2P platforms introduce lower-cost, faster, and more flexible credit alternatives, thereby eroding banks' traditional intermediation advantages and reducing profitability as competition intensifies. This result aligns with Schumpeter's view that early-stage innovations often displace incumbents by capturing market share and compressing margins. However, when GDP is included in the second regression model, the effect of P2P lending becomes adverse but insignificant, suggesting that macroeconomic expansion mitigates the disruptive impact of fintech. Rising GDP improves borrowers' repayment capacity and increases lending activity, enabling banks to better absorb competitive pressures. This pattern indicates that the destructive phase of fintech-driven innovation is partly offset by favourable macroeconomic conditions, consistent with Schumpeter's argument that the impact of innovation varies across business cycles and can be moderated by broader economic growth.

The results show that GDP has a positive yet statistically insignificant effect on ROA, supporting the acceptance of Hypothesis 4 (H4). This finding aligns with the evidence reported by Cahyani,⁷⁵ who similarly documented an insignificant positive relationship between GDP and bank profitability in Indonesia, but contrary to Hadriani and Anggara,⁷⁶ who found a significant positive effect on profitability. When banks face internal problems, such as high NPLs or inefficient management, GDP growth alone is insufficient to significantly improve ROA. While GDP growth generally indicates an economy's growth, its direct impact on firm-level performance (e.g., ROA) may be limited by factors such as industry dynamics, firm-specific management strategies, and financial structure.⁷⁷ In signalling theory, GDP can serve as an indicator of economic conditions, helping banks strategies their management and communicate their prospects to external parties.⁷⁸ Research

⁷⁴ Zhen Shi et al., "The Impact of Gross Domestic Product on the Financing and Investment Efficiency of China's Commercial Banks," *Financial Innovation* 7, no. 1 (2021): 35, <https://doi.org/10.1186/s40854-021-00251-3>.

⁷⁵ Cahyani, "Pengaruh Inflasi," 12.

⁷⁶ Handriani and Anggara, "Analysis of Firm-Specific, Industry-Specific, and Macroeconomic Determinants," 71

⁷⁷ P. R. Weerathunga, Cheng Xiaofang, W. H. M. S. Samarathunga, and P. M. B. Jayathilake, "The Relative Effect of Growth of Economy, Industry Expansion, and Firm-Specific Factors on Corporate Hotel Performance in Sri Lanka," *SAGE Open* 10, no. 2 (2020), <https://doi.org/10.1177/2158244020914633>

⁷⁸ Patmasari, "Analisis Faktor-Faktor," 5.

across several countries shows that while GDP growth is related to banking metrics, its explanatory power is often weak relative to bank-specific factors. In comparative studies, GDP is often statistically insignificant when bank-level predictors (e.g., NPL, size) are included. For instance, research by Subedi in Nepal found that GDP growth had an adverse but insignificant effect on NPL, making it difficult to isolate its direct impact.⁷⁹

V. CONCLUDING REMARKS

V.A. Conclusions

From this research, we conclude that GDP positively contributes to ROA; however, the coefficient is not statistically significant, suggesting that economic growth does not directly translate into higher profitability across all firms due to sectoral differences and market conditions. While NPL exerts a significant adverse impact on ROA, GDP does not meaningfully moderate this relationship, underscoring the primacy of credit risk management irrespective of the broader economic environment. Mobile banking shows a positive but insignificant effect, likely because technology investments take time to yield results. P2P lending adversely affects ROA in one model but becomes insignificant in another, implying that economic growth may ease fintech competition for banks. However, NPL, mobile banking, and P2P lending together have a significant impact on ROA, both with and without GDP as a control variable.

Bank profitability as measured in the study by ROA is primarily driven by internal factors, especially the management of non-performing loans. External factors such as GDP growth and technological innovations (mobile banking, P2P lending) play a role but often have only a minor direct effect unless combined with strong internal governance and risk management. Thus, the key takeaway is that reducing NPLs is the most critical determinant of profitability. At the same time, mobile banking and P2P lending require strategic adaptation and long-term investment to yield measurable financial benefits. GDP growth provides supportive conditions but is not sufficient to offset internal weaknesses. These results highlight the importance of strengthening prudential policies, supervisory monitoring, and coordinated oversight between banks, fintech platforms, and macroeconomic authorities. This result will help mitigate credit-risk spillovers and ensure that digital financial innovations contribute sustainably to banking performance.

⁷⁹ Netra Prasad Subedi, "Impact of Bank-Specific and Macroeconomic Factors on Non-Performing Loans in the Banking Sector of Nepal," *Janapriya Journal of Interdisciplinary Studies* 12, no. 1 (2023): 106–127, <https://doi.org/10.3126/jjis.v12i1.62245>.

V.B. Suggestion

Based on its conclusions, the study identifies several practical and strategic implications for banking institutions, the OJK, and future research. For banking companies, this study can help evaluate management performance and identify areas for improvement. Banks should respond to P2P competition through digital innovation, partnerships with fintech firms, or by offering competitive, low-risk digital loan products to defend market share. Investors can also use this information to make better investment decisions and maximise potential profits. For the OJK, the results call for a balanced regulatory strategy. First, to directly address the major threat posed by Non-Performing Loans (NPLs) to banks' profits, the OJK should strengthen early warning systems and help banks resolve bad loans more quickly. Second, for digital banking, OJK should support innovation in mobile banking through flexible rules, while ensuring fair competition with P2P lenders by enforcing strong consumer and data protection for all. Third, given high cyber risks, OJK must enforce strict cybersecurity rules and encourage banks to share threat information. Finally, OJK should continuously monitor banks' internal health, including NPL levels, regardless of the overall economic growth, to ensure their long-term stability.

While the recommendations for OJK focus on regulatory and supervisory actions, future researchers should explore the topic in greater depth. Future studies may investigate related themes by employing alternative indicators and incorporating additional macroeconomic variables such as inflation, interest rates, and exchange rates. Utilising more advanced statistical techniques, such as panel data analysis, could strengthen evidence of causal relationships. Research models might also refine GDP as a control variable by tailoring it to firm-specific characteristics or by testing interaction effects more rigorously to better capture the broader economic impact on bank profitability. Moreover, comparing different categories of banks and integrating perspectives from banker interviews would provide a more comprehensive understanding of how these factors operate in practice.

REFERENCES

- Affandi, Yogi, M. M. Ridhwan, Irwan Trinugroho, and D. Hermawan Adiwiwono. "Digital Adoption, Business Performance, and Financial Literacy in Ultra-Micro, Micro, and Small Enterprises in Indonesia." *Research in International Business and Finance* 70 (2024): 102376. <https://doi.org/10.1016/j.ribaf.2024.102376>.
- Andrianto, Fatihuddin, D., & Firmansyah, M. A. *Manajemen Bank*. 1st ed. Sidoarjo: CV. Penerbit Qiara Media, 2019.

- Arhinful, Richard, Bright Akwasi Gyamfi, Leviticus Mensah, and Hayford Asare Obeng. "Non-Performing Loans and Their Impact on Investor Confidence: A Signaling Theory Perspective—Evidence from U.S. Banks." *Journal of Risk and Financial Management* 18, no. 7 (2025): 383. <https://doi.org/10.3390/jrfm18070383>.
- Ath Thahirah, Fatimah, and Rahmatina Awaliah Kasri. "Does Fintech Threaten Islamic Banking Performance in Indonesia?" *Journal of Islamic Accounting and Finance Research* 5, no. 1 (2023): 65–86. <https://doi.org/10.21580/jiafr.2023.5.1.13745>
- Cahyani, Yutisa Tri. "Pengaruh Inflasi, Suku Bunga (BI Rate), Produk Domestik Bruto (PDB) terhadap ROA (Studi pada Bank Pembiayaan Rakyat Syariah (BPRS) di Indonesia Tahun 2009–2016)." *Jurnal Ekonomi dan Perbankan Syariah* 5, no. 1 (2018): 1–22. <https://doi.org/10.19105/iktishadia.v5i1.1695>.
- Coryanata, Isma, Elisa Hawalia Ramli, Lisa Martiah Nila Puspita, and Halimatusyadiah. "Digitalization of Banking and Financial Performance of Banking Companies." *International Journal of Social Service and Research* 3, no. 2 (2023): 366–371. <https://doi.org/10.46799/ijssr.v3i2.254>.
- Bank Indonesia. "Peraturan Bank Indonesia tentang Penilaian Tingkat Kesehatan Bank Umum." PBI No. 13/30/DPNP, December 16, 2011. <https://ojk.go.id/id/regulasi/Pages/PBI-tentang-Penilaian-Tingkat-Kesehatan-Bank-Umum.aspx>.
- Badan Pusat Statistik. "Pertumbuhan Ekonomi Indonesia Triwulan IV-2022." Press Release, February 6, 2023. <https://www.bps.go.id/id/pressrelease/2023/02/06/1997/ekonomi-indonesia-tahun-2022-tumbuh-5-31-persen.html>.
- Fuentelsaz, Lucio, Jaime Gómez, and Sergio Palomas. "Production Technologies and Financial Performance: The Effect of Uneven Diffusion among Competitors." *Research Policy* 41, no. 2 (2012): 401–413. <https://doi.org/10.1016/j.respol.2011.09.006>
- Ghozali, Imam. "Aplikasi Analisis Multivariate dengan Program SPSS." In *Analisis Multivariate dengan Program SPSS*. Semarang: Badan Penerbit UNDIP, 2016.
- Grilseda, Nadya, and Selamat Riyadi. "Pengaruh CAR, LDR, KAP dan NPL Terhadap ROA Bank Go Public yang Terdaftar di BEI." *Jurnal Ilmu Manajemen* 11, no. 1 (2021): 53–67. <https://doi.org/10.32502/jimn.v10i1.3252>
- Gupta, Jairaj, Anup Srivastava, and Basim Alzugaiby. 2024. "Schumpeterian Creative Destruction and Temporal Changes in Business Models of US Banks." *International Review of Financial Analysis* 91: 102951. <https://doi.org/10.1016/j.irfa.2023.102951>

- Ha, Ngo Ngan, Duong Hoang Anh, Le Nhu Quynh, and Trinh Trong Quyen. "Impact of Economic Growth, Public Investment, and Private Investment on Firm Performance in Some Economic Sectors in Vietnam: An SGMM Approach." *International Journal of Innovative Research and Scientific Studies* 8 no.4 (2025): 1813–1822. <https://doi.org/10.53894/ijirss.v8i4.8240>
- Handriani, Eka, and Sebastian B. Anggara. "An Analysis Of Firm-Specific, Industry Specific, And Macroeconomic Determinants Influencing Bank Profitability In Indonesia." *JURNAL STUDI MANAJEMEN ORGANISASI* 22, no. 1 (2025): 58-88. Accessed July 27, 2026. <https://doi.org/10.14710/jsmo.v22i1.72650>
- Imamah, Nur, and Dinda Ayu Safira. "Pengaruh Mobile Banking Terhadap Profitabilitas Bank di Bursa Efek Indonesia." *Profit: Jurnal Administrasi Bisnis* 15, no. 1 (2021): 95–103. <https://doi.org/10.21776/ub.profit.2021.015.01.10>.
- Indonesia Fintech Association. "Otoritas Jasa Keuangan Perlu Mengenali, Membedakan dan Mengawasi Layanan Tekfin Peer to Peer Lending Secara Proporsional." Press Release, 2018. <https://fintech.id/ideas/ideas-detail?id=571>.
- Kalkan, Göktürk. "The Impact of Non-performing Loans on Bank Profitability: Evidence from Türkiye." *Public Governance, Administration and Finances Law Review* 10, no. 1 (2025): 121–136. <https://doi.org/10.53116/pgaftr.8114>
- Kasmir. *Analisis Laporan Keuangan*. Edisi Pertama. Jakarta: PT Raja Grafindo Persada, 2019.
- Kurz, Heinz D. "Schumpeter's New Combinations: Revisiting His Theorie der wirtschaftlichen Entwicklung on the Occasion of Its Centenary." *Journal of Evolutionary Economics* 22, no. 5 (2012): 871–899. <https://doi.org/10.1007/s00191-012-0295-z>
- Lee, Ki Soon, Hyung Seok Lee, and Sang Yong Kim. "Factors Influencing the Adoption Behavior of Mobile Banking: A South Korean Perspective." *Journal of Internet Banking and Commerce* 12, no. 2 (2007): 1–9.
- Makarim & Taira S. "The Rise of Financial Technology in Indonesia." Jakarta: Makarim & Taira S. Law Firm, 2017. <https://www.makarim.com/news/the-rise-of-financial-technology-in-indonesia>.
- Mankiw, N. Gregory, Euston Quah, and Peter Wilson. *Pengantar Ekonomi Mikro: Edisi Asia*. Vol. 1. Jakarta: Salemba Empat, 2014.
- Mar'atushsholihah, Shafyra Nuruzzakiyya, and Tuti Karyani. "Dampak Financial Technology terhadap Kinerja Bank Umum Konvensional di Indonesia." *Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis* 7, no. 1 (2021): 450–465. <http://dx.doi.org/10.25157/ma.v7i1.4707>.
- Martiningtiyas, Catur Rahayu, and Dewi Tirtarini Nitinegeri. "The Effect of Non-Performing Loans on Profitability in Banking Sector in Indonesia." *Proceedings*

- of the International Conference on Management, Accounting, and Economy (ICMAE 2020), 2020, 149–154. <https://doi.org/10.2991/aebmr.k.200915.016>.
- Mayasari, Yusuf Murtadlo Hidayat, and Gita Esa Hafitri. “Pengaruh Internet Banking dan Mobile Banking Terhadap Kinerja Keuangan Bank.” *Strategic: Jurnal Pendidikan Manajemen Bisnis* 21, no. 1 (2021): 55–72. <https://ejournal.upi.edu/index.php/strategic/article/view/36871>
- Milne, Alistair, and Paul Parboteeah. *The Business Models and Economics of Peer-to-Peer Lending*. Brussels: European Credit Research Institute, 2016. <https://ssrn.com/abstract=2763682>
- Muhtadin, Imam, Faris Rahman Zain, Edi Purwanto, and Tiyas Puji Utami. “Determinants of Banking Profitability: The Case of State-Owned Banks Listed on the Indonesia Stock Exchange.” *Journal of Accounting and Investment* 23, no. 3 (2022): 576–587. <https://doi.org/10.18196/jai.v23i3.15246>.
- Novika, Soraya. “Pinjaman Online ke Fintech Meroket di Masa Pandemi.” *Detikfinance*, September 3, 2020. <https://finance.detik.com/fintech/d-5158115/pinjaman-online-ke-fintech-meroket-di-masa-pandemi>.
- Obiora, Seniye Chukwudumebi, Yani Zeng, Qing Li, Hao Liu, Peter Darko Adjei, and Thomas Csordas. “The Effect of Economic Growth on Banking System Performance: An Interregional and Comparative Study of Sub-Saharan Africa and Developed Economies.” *Economic Systems* 46, no. 1 (2022): art. 100939. <https://doi.org/10.1016/j.ecosys.2022.100939>.
- Otoritas Jasa Keuangan. *Digital Banking Technology Adoption and Bank Efficiency: The Indonesian Case*. Jakarta: Otoritas Jasa Keuangan, December 2018. <https://ojk.go.id/id/data-dan-statistik/research/working-paper/Documents/WP-18-01r.pdf>
- Patmasari, Eri. “Analisis Faktor-Faktor yang Mempengaruhi Profitabilitas Bank Umum Syariah di Indonesia Periode 2014–2017 (Analysis of Factors Influencing the Profitability of Islamic Banks in Indonesia Period 2014–2017).” 2018. <https://download.garuda.kemdikbud.go.id/article.php?article=754042&val=6467&title=ANALISIS%20FAKTOR-FAKTOR%20YANG%20MEMPENGARUHI%20PROFITABILITAS%20BANK%20UMUM%20SYARIAH%20DI%20INDONESIA%20PERIODE%202014-2017>
- Phan, Dinh Hoang Bach, Paresk Kumar Narayan, R. Eki Rahman, and Akhis R. Hutabarat. “Do Financial Technology Firms Influence Bank Performance?” *Pacific-Basin Finance Journal* 62 (September 2020): 101210. <https://doi.org/10.1016/j.pacfin.2019.101210>
- Psaila, Ayrton, Jonathan Spiteri, and Simon Grima. “The Impact of Non-Performing Loans on the Profitability of Listed Euro-Mediterranean

- Commercial Banks.” *International Journal of Economics and Business Administration* 7, no. 4 (2019): 166–196. <https://doi.org/10.35808/ijeba/338>
- Purwanto, Ines Setya Dini. “Pengaruh Non Performing Loan, Loan to Deposit Ratio dan Capital Adequacy Ratio terhadap Profitabilitas pada Perusahaan Perbankan yang Terdaftar di Bursa Efek Indonesia Periode 2014–2016.” *Jurnal Perilaku dan Strategi Bisnis* 6, no. 2 (2018): 122–136. <https://doi.org/10.26486/jpsb.v6i2.561>.
- Rahadi, Fernan. “Lembaga Keuangan Industri Kedua Terbanyak Peroleh Serangan Siber.” *Republika*. August 24, 2022. <https://rejogja.republika.co.id/berita/rh3ks2291/lembaga-keuangan-industri-kedua-terbanyak-peroleh-serangan-siber>.
- Ritonga, Rika Umbaiyani, Muhammad Irwan Padli Nasution, and Sri Suci Ayu Sundari. “Faktor Penghambat Adopsi Mobile Banking pada Generasi Milenial.” *Journal of Management, Economic and Accounting (JMEA)* 2, no. 1 (2023): 23–35. <https://pusdikra-publishing.com/index.php/jisc/article/view/1078/941>.
- Scholtens, Bert, and Dick van Wensveen. *The Theory of Financial Intermediation: An Essay on What It Does (Not) Explain*. SUERF Studies, no. 2003/1. Vienna: SUERF—The European Money and Finance Forum, 2003. <https://www.econstor.eu/bitstream/10419/163455/1/suerf-study-2003-1.pdf>.
- Scott, Susan V., John Van Reenen, and Markos Zachariadis. “The Long-Term Effect of Digital Innovation on Bank Performance: An Empirical Study of SWIFT Adoption in Financial Services.” *Research Policy* 46, no. 5 (2017): 984–1004. <https://doi.org/10.1016/j.respol.2017.03.010>
- Shi, Zhen, Shijiong Qin, Yung-ho Chiu, Xiaoying Tan, and Xiaoli Miao. “The Impact of Gross Domestic Product on the Financing and Investment Efficiency of China’s Commercial Banks.” *Financial Innovation* 7, no. 1 (2021): 35. <https://doi.org/10.1186/s40854-021-00251-3>.
- Spence, Michael. “Job Market Signaling.” *The Quarterly Journal of Economics* 87, no. 3 (1973): 355–374. <https://doi.org/10.2307/1882010>
- Subedi, Netra Prasad. “Impact of Bank-Specific and Macroeconomic Factors on Non-Performing Loans in the Banking Sector of Nepal.” *Janapriya Journal of Interdisciplinary Studies* 12, no. 1 (2023): 106–127. <https://doi.org/10.3126/jjis.v12i1.62245>
- Sudaryanti, Dedeh Sri, Nana Sahroni, and Ane Kurniawati. “Analisa Pengaruh Mobile Banking terhadap Kinerja Perusahaan Sektor Perbankan yang Tercatat di Bursa Efek Indonesia.” *Jurnal Ekonomi Manajemen* 4, no. 2 (2018): 96–107. <https://doi.org/10.37058/jem.v4i2.699>.
- Tong, Xiao, and Wang Yang. “Empirical Analysis of the Impact of Financial Technology on the Profitability of Listed Banks.”

- International Review of Economics & Finance* 98 (2025): 103788.
<https://doi.org/10.1016/j.iref.2024.103788>
- Wahyuni, Ismail Badollahi, Nurhidayah, and Wahyu Mardiasuti. "Analyzing the Impact of Non-Performing Loans and Loan-to-Deposit Ratios on Return on Assets: A Study of Conventional Commercial Banks in Indonesia." *Advances in Management & Financial Reporting* 1, no. 3 (2023): 107–118.
<https://doi.org/10.60079/amfr.v1i3.124>
- Weerathunga, P. R., Cheng Xiaofang, W. H. M. S. Samarathunga, and P. M. B. Jayathilake. "The Relative Effect of Growth of Economy, Industry Expansion, and Firm-Specific Factors on Corporate Hotel Performance in Sri Lanka." *SAGE Open* 10, no. 2 (2020). <https://doi.org/10.1177/2158244020914633>

This page is intentionally left blank