GOLDEN RATIO OF DATA IN SUMMARY
VOLUME 5, ISSUE. 4 (2025)
Website: https://goldenratio.id/index.php/grdis

GOLDEN RATIO
ISSN [Online]: 2776-6411

DATA IN SUMMARY | ACCOUNTING, MANAGEMENT, BUSINESS, ECONOMICS

The Effectiveness of Monetary, Macroprudential, and Microprudential Policies on Financial Stability in Indonesia During and Post-COVID-19

Yurike Veronika[1], Bakhtiar Efendi[2]

[1,2] Department of Economic Development, Faculty of Social Sciences, Universitas Pembangunan Panca Budi, Medan, Indonesia. Email: yurikeveronika11@gmail.com[1], koneksisaya@gmail.com[2]

ARTICLE HISTORY

Received: August 13, 2025
Revised: September 11, 2025
Accepted: September 13, 2025

DOI
https://doi.org/10.52970/grdis.v5i4.1633

ABSTRACT
This study examines the impact of monetary policy (inflation and money supply), macroprudential (minimum reserve requirements and net open position), and microprudential (Capital Adequacy Ratio and Non-Performing Loan) on Indonesia's financial system stability, proxied by the exchange rate, during and post COVID-19 pandemic (2019-2024). The study employs secondary monthly time-series data and applies the Autoregressive Distributed Lag (ARDL) approach to analyze short and long-term relationships. The Wald Test is used to compare policy effectiveness across the two periods. The results indicate that Money Supply (M2), Net Open Position (NOP), and Non-Performing Loans (NPL) significantly affect the exchange rate in the long run. In contrast, Inflation, Minimum Reserve Requirements, and the Capital Adequacy Ratio (CAR) do not significantly affect. These findings suggest that M2, NOP, and NPL are the most reliable indicators for predicting Indonesia's post-pandemic financial stability. From a policy perspective, the study underscores the importance of stronger coordination among monetary, macroprudential, and microprudential policies to enhance the financial system's resilience against future shocks.

Keywords: Monetary Policy, Macroprudential Police, Microprudential Policy, Exchange Rate Stability, COVID-19 Pandemic.

I. Introduction

According to the Financial Services Authority (OJK), financial system instability can potentially increase the risk of economic vulnerability, hindering economic activity (OJK H., 2024). The Financial Services Authority (OJK) notes that the interaction between financial and monetary stability resembles two sides of the same coin that cannot be separated. Monetary policy significantly impacts financial stability, while financial stability is a cornerstone of monetary policy effectiveness (OJK, 2024). Macroprudential policy takes a top-down approach by monitoring systemic risks arising from macroeconomic conditions and capital flows, whereas microprudential policy focuses on supervising individual financial institutions (Efendi, 2019). Hu et al (2019), in their study "Modeling the Effect of Coordinating Macro-Prudential Rule and Monetary Policy," find that combining monetary and macroprudential policies in China is more effective in stabilizing the economy than using monetary policy alone.

In Indonesia, the rapid spread of the COVID-19 pandemic prompted the government to implement a lockdown in 2020 to curb transmission. As a result, economic growth contracted by -2,06%, marking a decline from the previous year.

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Table 1. Present Indonesia's macroeconomic development from 2010 to 2024

Tahun	GDP Growth (annual %)
2010	6.22
2011	6.17
2012	6.03
2013	5.56
2014	5.01
2015	4.90
2016	5.00
2017	5.10
2018	5.20
2019	5.00
2020	-2.1
2021	3.70
2022	5.30
2023	5.00
2024	5.00

Source: www.data.worldbank.org

Previous research has primarily examined monetary, macroprudential, and microprudential policies separately, with only a few studies analyzing them within a single framework, particularly in the post-COVID-19 context in Indonesia. Therefore, this study aims to address this gap by examining the impact of these three policies on financial stability, proxied by the exchange rate, during and post-COVID-19 pandemic. The research questions of this study are as follows: (1) Do monetary, macroprudential, and microprudential policies significantly affect financial system stability in Indonesia in the short and long run? (2) Can these policies identify leading indicators of financial system stability in Indonesia post-COVID-19? (3) Are there differences in the effectiveness of these policies in managing financial system stability during and post-COVID-19?

II. Literature Review and Hypothesis Development

2.1. Financial System Stability with Exchange Rate

According to Bank Indonesia (2023), financial system stability refers to a condition in which the financial system functions effectively and efficiently while being able to withstand internal or external shocks. Changes in the exchange rate are directly linked to Indonesia's financial system stability. According to Anilah et al. (2023), a weakening Indonesian Rupiah increases banking liquidity risk and decreases the capital adequacy ratio due to foreign currency mismatches. Meanwhile, according to Rangkuty et al (2024), the Indonesian Rupiah exchange rate is crucial in determining a country's economic conditions and macroeconomic variables. Therefore, the exchange rate is important for maintaining financial stability in Indonesia (Bank Indonesia, 2023).

2.2. Monetary Policy

In this research, the instruments used to implement monetary policy are inflation and the money supply. Monetary policy is important in maintaining macroeconomic stability through these two instruments (Bank Indonesia, 2025). According to Alawiyah et al. (2019), rising inflation can reduce purchasing power and disrupt exchange rate stability, while an excessive money supply can pressure the exchange rate. Their study shows that inflation and the money supply affect the exchange rate, but their impact is insignificant in the long run. Meanwhile, Nasution et al. (2022) argue that the money supply significantly affects short- and long-

ISSN [Online]: 2776-6411

term economic stability in emerging markets, including Indonesia. This is because the impact of monetary policy on financial stability requires time, leading to different outcomes during periods of crisis and recovery (Hidayati & Sugiyanto, 2020).

2.3. Macroprudential Policy

Hu et al (2019) show that combining monetary and macroprudential policies is more effective in stabilizing the economy than relying solely on monetary policy. Hidayati & Sugiyanto (2020) found that macroprudential policy stabilizes the financial system more quickly than monetary policy, particularly in controlling exchange rate volatility. In this study, the instruments used are the Minimum Reserve Requirement (MRR) and the Net Open Position (NOP). According to Tamsil (2020), the net open position is the ratio of the difference between foreign currency assets and liabilities, including administrative accounts, to the bank's total capital, all expressed in Indonesian Rupiah. Vipertiwi (2017) states that the net open position controls exchange rate risk and maintains bank liquidity against foreign currencies, while Zuhri (2022) explains that the minimum reserve requirement functions to maintain banking liquidity as regulated by Bank Indonesia.

2.4. Microprudential Policy

According to Silalahi (2018), microprudential indicators such as the Capital Adequacy Ratio (CAR) and Non Performing Loan (NPL) are key policy instruments for maintaining banking soundness and the overall stability of the financial system. According to Fajriani (2022), CAR reflects a bank's ability to provide sufficient capital to cover potential losses. NPL measures the level of problematic loans; the higher its value, the more severe the financial disruptions it can cause (Fajriani, 2022). However, the relationship between CAR and exchange rate stability has rarely been studied directly and is therefore examined in this study.

2.5. Synthesis and Research Gap

Most studies examine monetary, macroprudential, and microprudential policies separately, and few researchers have examined the impact of these policies on exchange rates during and post the COVID-19 pandemic. For instance, Hidayati and Sugiyanto (2020) examined the impact of a monetary and macroprudential policy mix on price and financial stability in Indonesia. Their findings showed that the policy mix stabilized inflation and the exchange rate, supporting both price and financial system stability. Similarly, Efendi (2019) in a study titled The Effectiveness of Macroprudential Policy on Financial System Stability in Indonesia, found stable reciprocal relationships among variables such as GDP, LTV, interest rates, LDR, IHSG, exchange rate, NPL, and inflation. The study also highlighted that LTV (Loan-to-Value) can be a leading indicator for other macroprudential policy variables. Research on the combined effects of monetary, macroprudential, and microprudential policies on financial system stability, particularly during and after the COVID-19 pandemic in Indonesia, remains limited. Furthermore, few studies have employed the ARDL approach to capture both short- and long-term effects and to identify leading indicators from each policy. Moreover, using Wald tests to compare policy effectiveness across the two periods is rare.

2.6. Conceptual Framework

This research expands the literature by combining monetary policy variables (inflation and money supply), macroprudential policies (minimum reserve requirement and net open position), and microprudential policies (capital adequacy ratio and non-performing loan) to analyze their joint impact on the stability of Indonesia's financial system, proxied by the exchange rate, during and post the COVID-19 pandemic.

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2.7. Hypotheses

Based on the explanation provided, the hypotheses of this study are formulated as follows:

H1: Inflation significantly affects the exchange rate of the Indonesian Rupiah in the short and long run.
H2: Money supply (M2) significantly affects the exchange rate of the Indonesian Rupiah in the short and long run.
H3: Minimum Reserve Requirement (MRR) significantly affects the exchange rate of the Indonesian Rupiah in the short and long run.
H4: Net Open Position (NOP) significantly affects the exchange rate of the Indonesian Rupiah in the short and long run.
H5: Capital Adequacy Ratio (CAR) significantly affects the exchange rate of the Indonesian Rupiah in the short and long run.
H6: Non-Performing Loan (NPL) significantly affects the exchange rate of the Indonesian Rupiah in the short and long run.
H7: Monetary, macroprudential, and microprudential policies can serve as leading indicators of financial system stability in Indonesia in the post-COVID-19 period.
H8: There are significant differences in the effectiveness of monetary, macroprudential, and microprudential policies during and post COVID-19.

III. Research Method

This study adopts a quantitative approach using monthly secondary time series data from January 2019 to December 2024. The data were obtained from Bank Indonesia (BI), the Financial Services Authority (OJK), and the CEIC Database. Data were processed using EViews 7. Our study employs several research variables. The dependent variable is financial system stability, which is proxied by the exchange rate. Previous research by Hudaya and Firmansyah (2023) emphasizes that the exchange rate is crucial in maintaining the financial system's stability. The independent variables include monetary policy, inflation (INF), and money supply (M2). Prior studies (Et al., 2021) identify inflation and M2 as essential monetary policy indicators. In addition, the study also incorporates macroprudential policy and microprudential policy as explanatory variables. Macroprudential policy is represented by the Minimum Reserve Requirement (MRR) and Net Open Position (NOP), both of which are commonly employed as instruments to manage liquidity and exchange rate risk (IMF, 2024). Meanwhile, microprudential policy is reflected through the Capital Adequacy Ratio (CAR) and Non-Performing Loan (NPL), which are widely recognized as measures of banking resilience, particularly in terms of capital adequacy and credit quality (IMF, 2024).

3.1. Analysis Model

This study employs the Autoregressive Distributed Lag (ARDL) model due to its advantages and suitability for hypothesis testing. Pesaran et al (2001) demonstrate that ARDL can capture short- and long-term relationships within a single analytical framework and identify leading indicators in the model. Furthermore, Ferdous and Khan (2019) apply the Wald Test within the ARDL framework as a complementary tool to analyze differences or changes in effects across two periods. The analysis steps include:

1. Test for Data Stationarity (Augmented Dickey-Fuller/ADF)
   According to Pesaran et al (2001), the ADF test is applied to check the order of integration of variables before estimating the ARDL model. Variables should not be integrated at order two or higher.

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2. Optimal Lag Test
   Shrestha and Bhatta (2018) note that the optimal lag captures short-term dynamics before testing for long-term cointegration.
3. Classical Assumption Tests These Include Normality (Jarque-Bera), Stability (CUSUM and CUSUMQ), Autocorrelation (LM test), and Heteroscedasticity. According to Nabila (2022), the heteroscedasticity test examines whether error variance differs across observations in the regression model.
4. Short Run and Long Run Estimation (Bound Test)
   Rahmawati and Laila (2020) explain that the bound test is applied to examine cointegration and determine long-run relationships among the variables in the ARDL model.
5. Wald Test
   Wald Test Wooldridge (2010) states that the Wald Test assesses whether predictor variables significantly affect the response variable.

IV. Results and Discussion

The exchange rate experienced significant fluctuations during the COVID-19 pandemic and the post-pandemic period, with the sharpest depreciation recorded in 2024. Monetary indicators, particularly Money Supply (M2), showed consistent growth, while inflation remained relatively stable, except during the recovery period in 2022. The Net Open Position (NOP) tended to decline for macroprudential indicators due to stricter foreign exchange management. At the same time, the Minimum Reserve Requirement (MRR) increased in 2022 in line with Bank Indonesia's liquidity tightening policy. Regarding microprudential indicators, the Capital Adequacy Ratio (CAR) consistently improved, while Non-Performing Loan (NPL) gradually declined after peaking during the COVID-19 pandemic.

4.1. Result of Data Stationarity Test

Table 2. Data Stationarity Results

ADF Unit Root Test			
Variable	**Prob. On Level**	**Prob On First Difference**	**Explanation**
KURS	0.0964	0.0001	Stationary
INFLASI	0.6883	0.0000	
M2	0.5672	0.0000	
MRR	0.9129	0.0000	
NOP	0.0000	0.0000	
CAR	0.4945	0.0000	
NPL	0.5782	0.0057	

The stationarity test at the level indicates that only the PDN variable is stationary, while Kurs, Inflation, JUB, GWM, CAR, and NPL have probability values greater than 0.05. Therefore, the ADF test was conducted at the first difference, showing that all variables have probability values less than 0.05. Thus, the data are stationary and suitable for ARDL estimation.

4.2. Optimal Lag Results

Table 3. Optimal Lag Test Results

No	Model	AIC
1	ARDL (4,3,4,4,3,4,1)	12.200
2	ARDL (4,2,3,4,3,4,1)	12.204
3	ARDL (4,3,4,4,3,3,1)	12.208
4	ARDL (4,3,4,4,3,3,0)	12.212
5	ARDL (4,3,4,2,3,3,0)	12.216

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The Akaike Information Criterion (AIC) determined the optimal lag length. Based on the results, the selected model is ARDL (4,3,4,4,3,4,1), indicating that the dependent variable (Y) has four lags, while the independent variables (X) have up to 4 lags.

4.3. Results of the Classical Assumptions Test

4.3.1. Normality Test

Table 4. Results of Normality Test

Jarque-Bera	0.458096
Probability	0.795290

According to Duwi Wahyuningtias et al(2019), the normality test determines whether the data are typically distributed. Using the criterion of p-value > 0.05, and with the result of 0.795, the data can be considered normally distributed.

4.3.2. CUSUM and CUSUMQ Test

According to Rahmawati and Laila (2020), the stability test aims to evaluate whether the ARDL model estimates are stable. Based on the stability test results using CUSUM and CUSUMQ, all lines remain within the 5% significance bounds. Thus, the ARDL model is considered stable.

4.3.3. Autocorrelation Test (LM Test)

Table 5. Autocorrelation Test (LM Test) Results

F-statistic	0.237139	Prob. F(2,23)	0.7908
Obs*R-squared	1.111229	Prob. Chi-Square(2)	0.5737

Source: Eviews 7 Processing Results

According to Fajriani (2022), the autocorrelation test was conducted using the Breusch-Godfrey test (Serial Correlation LM Test). The results show a Chi-Square probability value of 0.5737 (> 0.05), indicating the absence of autocorrelation.

4.3.4. Heteroskedasticity Test

Table 6. Heteroskedastic Test Results

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.347358	Prob. F(25,29)	0.2261
Obs*R-squared	33.54023	Prob. Chi-Square(25)	0.2565
Scaled explained SS	5.610313	Prob. Chi-Square(25)	1.0000

The Breusch-Pagan-Godfrey heteroskedasticity test reports an F-statistic probability value of 0.2261 and a Chi-Square probability value of 0.2565, both greater than 0.05, indicating the absence of heteroskedasticity.

4.4. Short Run and Long Run (Cointegration Bound Test)

Table 7. Cointegration Bound Test Results

F-Bounds Test				
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	4.089080	10%	1.99	2.94

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F-Bounds Test				
K	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

The Bound Test for cointegration examines the existence of a long-run relationship among the variables. The results in the Bound Test table show that the F-statistic value of 4.089 is greater than the lower and upper bounds at the 5% significance level (2.27 / 3.28) and the 10% significance level (1.99 / 2.94). Therefore, it can be concluded that a long-run relationship exists among the variables. The results of the short-run and long-run estimations are presented in the following tables:

Table 8. Short-Run Estimation Results

Variable	Coefficient	Prob.	Explanation
D(ER(-1), 2)	0.703781	0.0002	Significant
D(ER(-2), 2)	0.683125	0.0000	Significant
D(ER(-3), 2)	0.250070	0.0068	Significant
D(INFLASI, 2)	142.0063	0.1077	Not Significant
D(INF(-1), 2)	-315.1385	0.0015	Significant
D(INF(-2), 2)	-122.1316	0.1086	Not Significant
D(M2, 2)	-0.017478	0.0000	Significant
D(M2(-1), 2)	0.018923	0.0001	Significant
D(M2(-2), 2)	0.018806	0.0001	Significant
D(M2(-3), 2)	0.004992	0.0925	Not Significant
D(MRR, 2)	13.24048	0.7690	Not Significant
D(MRR(-1), 2)	51.99653	0.3078	Not Significant
D(MRR(-2), 2)	-66.97975	0.1234	Not Significant
D(MRR(-3), 2)	-79.43106	0.0498	Significant
D(NOP)	98.63902	0.0363	Significant
D(NOP(-1))	-262.8835	0.0001	Significant
D(NOP(-2))	-161.0241	0.0031	Significant
D(CAR,2)	-95.39683	0.0017	Significant
D(CAR(-1),2)	-7.305674	0.8243	Not Significant
D(CAR(-1),2)	-30.87292	0.3036	Not Significant
D(CAR(-3),2)	30.66325	0.1765	Not Significant
D(NPL,2)	-0.349574	0.0000	Significant
CointEq(-1)*	-1.708098	0.0000	Significant

From Table 8, the value of CointEq(-1) in the ARDL short-run estimation indicates the magnitude of the error correction in each period. This coefficient must be negative and statistically significant for the model to be valid.

Table 9. Long Run Estimation Results

Variable	Coefficient	Prob.	Explanation
D(INFLASI)	206.7078	0.0955	Not Significant
D(M2)	-0.022006	0.0000	Significant
D(MRR)	-35.90189	0.5619	Not Significant
NOP	166.6779	0.0030	Significant
D(CAR)	-82.03053	0.1086	Not Significant
D(NPL)	-0.139380	0.0590	Significant
C	-186.1044	0.0379	Significant

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ISSN [Online]: 2776-6411

4.5. Wald Test Results

The Wald test is applied to examine differences in the effectiveness of monetary, macroprudential, and macroprudential policies in maintaining financial system stability in Indonesia during and after the COVID-19 pandemic. The decision criteria are based on the Chi-Square and F-statistic probability values. If these values are greater than α = 0.05, it indicates no significant policy differences between the two periods. Conversely, if the values are less than α = 0.05, it suggests that significant policy differences exist across periods.

Table 10. Wald Test Results

Wald Test			
Test Statistic	**Value**	**df**	**Probability**
F-statistic	3.474414	(6, 25)	0.0123
Chi-square	20.84649	6	0.0020

4.6. Discussion

The long-run ARDL estimation results show that:

- Money Supply (M2) has a significant adverse effect on the exchange rate, consistent with Sulistya and Budirahayu (2018), suggesting that increased liquidity encourages the appreciation of the Indonesian Rupiah over the long term.
- Net Open Position (NOP) has a significant positive effect on the exchange rate, indicating that the adequacy of bank reserves can strengthen the Rupiah. Although no prior research has directly examined the impact of NOP on exchange rates, related studies on foreign exchange reserves (Ichsan, 2019) found that using reserves plays an important role in stabilizing exchange rates.
- Non-Performing Loan (NPL) has a significant adverse effect, implying that higher credit risk pressures the Rupiah's exchange rate. This study provides a new contribution since limited research directly addresses the relationship between NPL and exchange rates. However, Putri and Zakik (2023) reported results in the opposite direction, showing a significant negative relationship between exchange rates and NPL.
- Conversely, inflation, the Minimum Reserve Requirement (MRR), and the Capital Adequacy Ratio (CAR) do not significantly impact the long run. This finding is consistent with Alawiyah et al. (2019), who argued that external factors influence exchange rate movements more strongly than inflation. Nevertheless, few studies have directly examined the relationship between GWM and CAR and the exchange rate, making this study an additional contribution to the literature.

Meanwhile, the short-run ARDL estimates show significant effects at several lags, particularly for Inflation, Broad Money (M2), CAR, NOP, and NPL, indicating the presence of lagged effects in policy transmission. In contrast, the Minimum Reserve Requirement (GWM) is insignificant, suggesting that its impact on the exchange rate is indirect and operates through a longer transmission channel. As a result, the effect of GWM on the exchange rate is relatively small and overshadowed by stronger external factors. This finding may also reflect the relatively infrequent changes in GWM, which makes it difficult to capture its relationship with the exchange rate. This variable fluctuates on a daily or monthly basis.

From a policy perspective, the variables that can serve as leading indicators are:

- Monetary policy: Control of Money Supply (M2) is important for stabilizing the exchange rate.
- Macroprudential policy: Effective Net Open Position (NOP) management is crucial to reduce volatility arising from external pressures and safeguard financial system stability.

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- Microprudential policy: The Non-Performing Loan (NPL) ratio is an early warning indicator of potential financial system instability, including exchange rate fluctuations.

In addition, it can be concluded that the effectiveness of the three policies is most pronounced in maintaining financial system stability during the post-COVID-19 recovery period. Money Supply, Net Open Position, and Non-Performing Loans are the most reliable indicators for predicting Indonesia's financial stability in this phase. This finding is consistent with Abdiyanto et al (2022), who emphasize Money Supply (M2) as the key variable influencing the exchange rate after COVID-19. Similarly, Lutfiansyah et al (2024) highlight the crucial role of foreign exchange reserves in sustaining exchange rate stability through effective reserve management. Furthermore, Warasto and Janudin (2025) employ the Capital Adequacy Ratio (CAR) and Good Corporate Governance (GCG) as determinants of bank financial performance, while the present study uses CAR (capital) and NPL (credit quality), showing that NPL has a more substantial effect on financial stability than CAR. This aligns with Eldiani and Lailasarry (2024), who demonstrate that credit quality and asset management exert a greater influence on bank stability and profitability.

The Wald test results reveal a probability value < 0.05, indicating a significant difference in the effectiveness of monetary, macroprudential, and microprudential policies between the pandemic and post-pandemic periods. Although the ARDL test identifies significant variables within each policy domain, the Wald test confirms that their effectiveness varies across periods. This suggests that policy effectiveness is dynamic and must be adapted to prevailing economic conditions and systemic risks. These results align with those of Juliyanti and Yusuf (2020), who also found evidence of policy differences across distinct economic periods using the Wald test.

V. Conclusion

This study examines the effectiveness of monetary policy, represented by Money Supply (M2) and inflation; macroprudential policy, represented by the Minimum Reserve Requirement (MRR) and Net Open Position (NOP), and microprudential policy, represented by the Capital Adequacy Ratio (CAR) and Non-Performing Loans (NPL), in relation to the exchange rate as an indicator of financial system stability during and post the COVID-19 pandemic. The ARDL model is applied, complemented by the Wald Test, to capture differences in policy effectiveness between the two periods. The results show that not all policy instruments significantly affect the exchange rate in the short or long run. In the long run, Money Supply (M2) exerts a significant effect, while inflation does not, suggesting that liquidity management is more effective than price stabilization in supporting exchange rate stability, particularly under financial market pressures. Within macroprudential policy, the Net Open Position (NOP) proves significant. In contrast, Minimum Reserve Requirement (MRR) does not, indicating that managing foreign exchange exposure is more critical for reducing exchange rate risk than managing required reserves. For microprudential policy, non-performing loans (NPL) significantly influence the exchange rate. CAR does not, implying that asset quality plays a larger role in sustaining exchange rate stability than capital strength. Accordingly, M2, NOP, and NPL emerge as reliable leading indicators of exchange rate stability, especially in the post-COVID-19 recovery period. The Wald Test further confirms significant differences in the effectiveness of monetary, macroprudential, and microprudential policies across the pandemic and post-pandemic periods. This finding underscores that policy effectiveness is period-specific and varies across instruments within each policy domain. Thus, the effectiveness of policies is dynamic and time-varying, requiring continuous adjustment to prevailing economic conditions and systemic risks in Indonesia.

This study is limited to 2019–2024 using monthly data, which may not fully capture long-term structural dynamics beyond the post-pandemic recovery. The analysis also relies exclusively on secondary macro-level data from BI, OJK, and CEIC, and therefore does not reflect micro-level dynamics at the level of individual financial institutions. Furthermore, financial system stability is proxied solely by the exchange rate. In contrast, other systemic risk measures—such as the financial stability index or the credit-to-GDP gap—are

not included in the scope of this research. Future studies are encouraged to extend the research horizon to capture long-term structural effects and apply alternative econometric methods, such as VAR or VECM, for more robust analysis. Incorporating micro-level banking data, such as balance sheets or profitability indicators, would allow researchers to account for heterogeneous responses across financial institutions. In addition, employing alternative financial stability measures, including the financial stability index or broader systemic risk indicators, would provide a more comprehensive assessment of financial system resilience.

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