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HOW DO MACROECONOMIC SHOCKS AFFECT BANKS' NET INTEREST MARGIN? EVIDENCE FROM A DYNAMIC PANEL OF INDONESIAN BANK

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ABSTRACT

This study investigates how macroeconomic shocks—specifically policy rate changes, exchange rate fluctuations, and real economic growth—affect banks' Net Interest Margin (NIM) in Indonesia. Utilizing a monthly panel of 91 banks from 2012 to 2023, we estimate a Panel Vector Autoregression (PVAR) model and apply a dynamic multiplier framework to trace the temporal effect of each macro shock on NIM. The results indicate that NIM adjusts to these shocks in a time-limited and convergent manner, typically over a 6–12 month horizon. Notably, increases in the policy rate or real GDP growth are associated with a short-run decline in NIM, whereas exchange rate changes do not exert a statistically significant influence. Additional analyses across bank ownership types, size segments, and the COVID-19 period reveal considerable heterogeneity in shock transmission patterns. These findings emphasize the importance of differentiating bank-specific attributes and market contexts in understanding the pricing behaviour of financial intermediation under macroeconomic stress.

Keywords: Net Interest Margin, Macroeconomic Shocks, Panel VAR, Dynamic Multiplier, Indonesian Banks

Studi ini menginvestigasi bagaimana guncangan makroekonomi—khususnya perubahan suku bunga kebijakan, fluktuasi nilai tukar, dan pertumbuhan ekonomi mepengaruhi Net Interest Margin (NIM) perbankan di Indonesia. Dengan menggunakan data panel bulanan dari 91 bank selama periode 2012 hingga 2023, penelitian ini mengestimasi model Panel Vector Autoregression (PVAR) dan menerapkan kerangka pengganda dinamis untuk menelusuri efek temporal dari masing-masing guncangan makro terhadap NIM. Hasil penelitian menunjukkan bahwa NIM menyesuaikan diri terhadap guncangan-guncangan tersebut secara terbatas waktu dan konvergen, umumnya dalam rentang horizon 6–12 bulan. Secara khusus, kenaikan suku bunga kebijakan atau pertumbuhan PDB riil dikaitkan dengan penurunan NIM dalam jangka pendek, sementara perubahan nilai tukar tidak memberikan pengaruh yang signifikan secara statistik. Analisis tambahan berdasarkan jenis kepemilikan bank, segmen ukuran, dan periode COVID-19 mengungkapkan heterogenitas yang signifikan dalam pola transmisi guncangan. Temuan ini menekankan pentingnya membedakan atribut spesifik bank dan konteks pasar dalam memahami perilaku penetapan harga intermediasi keuangan di bawah tekanan makroekonomi.

Kata Kunci: Net Interest Margin, Guncangan Makroekonomi, Panel VAR, Pengganda Dinamis, Perbankan Indonesia

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Introduction

The Net Interest Margin (NIM) stands at the core of banking profitability, reflecting how efficiently financial institutions intermediate funds amid varying market conditions. In volatile macroeconomic environments, NIM acts not only as a profitability metric but also as a proxy for banks' strategic and risk-adjusted pricing decisions (Ariefianto et al, 2026). This role is particularly salient in emerging economies, where monetary policy transmission is often less predictable and financial intermediation remains bank-dominated (Alamsyah et al., 2005 and Claessens et al., 2018). Understanding how NIM evolves in response to macroeconomic shifts is thus critical for evaluating the robustness of banking systems in such contexts.

Banks adjust their NIM in response to macroeconomic fluctuations through various channels, including interest rate

repricing, funding cost adjustments, credit risk assessments, and foreign exchange exposure management (Owjimehr & Meybodi, 2025). When monetary authorities revise policy rates, for example, banks must determine how and when to transmit these changes to borrowers and depositors. Similarly, movements in the exchange rate or changes in economic activity levels may alter the balance between lending opportunities and funding pressures. These dynamic adjustments are embedded within banks' day-to-day risk-pricing strategies and can vary significantly across institutions and over time.

While a substantial literature has examined macro-financial interactions using aggregate indicators, relatively few studies explore the dynamic adjustment path of NIM to multiple macroeconomic shocks at the bank level. Most existing research either treats NIM as a static function of interest rates or focuses on developed markets with more predictable policy environments (Owjimehr & Meybodi, 2025). In contrast, Indonesia presents a compelling case for such an investigation: its financial system is predominantly bank-based, monetary policy plays a pivotal role, and macroeconomic volatility remains elevated relative to regional peers (Khan et al., 2016 and IMF, 2022).

Against this backdrop, our paper offers new insights by modelling the time-path of NIM responses to shocks of key macroeconomic variables (policy rate, exchange rate, and growth). We employ a Panel Vector Autoregression (PVAR) framework to estimate the joint dynamics of NIM and related bank-level variables, allowing for heterogeneous responses while maintaining a system-based structure. A dynamic multiplier analysis is then used to trace how NIM adjusts over time following exogenous shocks to these macro indicators.

Our contribution is twofold. First, we focus specifically on Net Interest Margin as the outcome variable of interest, unlike prior studies that examine broader interdependencies among bank fundamentals. This narrower focus allows us to isolate the transmission mechanism from macro shocks to bank pricing behaviour, offering new insights into how banks adjust their interest margins in response to economic and policy disturbances. By treating macroeconomic variables as exogenous shocks within a PVAR framework, we can estimate both the immediate and lagged effects of these shocks on NIM and evaluate the duration and magnitude of their impact.

Second, we explore how this transmission process may vary across different bank types, sizes, and periods of economic stress. Specifically, we conduct subsample analyses based on ownership structure (foreign, government, and private banks), bank scale, and the COVID-19 period. This heterogeneity analysis reveals patterns in strategic behaviour that may not be visible in aggregate response, especially in an emerging market where institutional diversity and policy constraints shape bank conduct in subtle ways.

This study thus contributes to three strands of literature: (1) empirical work on the determinants of NIM in banking (e.g., Barik & Raje, 2019; Agoraki & Kouretas, 2018), (2) the growing body of research using dynamic panel methods to study macro-financial interactions (e.g., Blankson et al., 2022 and Ekinci & Ersan, 2024), and (3) recent debates on how emerging-market banks respond to monetary and economic shocks under uncertainty (Harir & Bel Mkaddem, 2025 and El Khadi & Firano, 2026).

The remainder of this paper is organized as follows. Section 2 reviews the relevant literature and develops testable hypotheses. Section 3 outlines the data and estimation methodology, including the construction of the PVAR model and dynamic multiplier analysis. Section 4 presents the main findings, including both baseline and subgroup analyses. Section 5 concludes with a summary of results and policy implications.

Literature Review and Hypothesis Construction

Net Interest Margin (NIM) is a core measure of how efficiently banks perform their

intermediary function—transforming deposits into loans and earning returns while managing associated risks. Beyond profitability, NIM reflects strategic decisions around cost coverage, capital allocation, and risk pricing (Barik & Raje, 2019). Its dynamics are shaped by both operational factors (e.g., cost structure, asset-liability management) and broader macroeconomic conditions.

From a theoretical standpoint, banks adjust their interest spreads to cover actual costs (e.g., funding, operations) and expected losses, particularly from credit and liquidity exposures (Lin & Yang, 2016, Ariefianto et al, 2026). A higher NIM often serves as a buffer, enabling banks to absorb external shocks and maintain solvency (Nguyen & Nguyen, 2022 and Owjimehr & Meybodi, 2025). This insurance -like property of NIM is especially relevant in economies with volatile macroeconomic conditions.

Empirical studies highlight that banks actively manipulate NIM to account for credit and liquidity risk (Agoraki & Kouretas, 2018; Ghenimi et al., 2017). NIM adjustments often reflect banks' forward-looking views on risk exposure and funding stability, allowing for strategic repositioning in response to changing economic conditions (Fraser, 2019; Ariefianto et al., 2024).

The sensitivity of NIM to macroeconomic fluctuations is grounded in monetary transmission theory. Banks play a central role in the pass-through of policy rates to lending and deposit rates (Bofinger et al., 2001; Devereux et al., 2006). In emerging markets, this transmission can be uneven or delayed due to structural factors like market concentration, regulatory constraints, or limited competition (Claessens et al., 2018).

A well-documented empirical finding is that increases in the policy rate often led to a narrowing of NIM, particularly in banks with a high share of fixed-rate loans or sluggish deposit repricing (Entrop et al., 2015; Klein, 2020; Hinton & Polson, 2021). However, there are contrasting views suggesting that anticipatory pricing or active risk management can offset these effects, possibly leading to temporary increases in NIM (Altavilla et al., 2020; Breyer et al., 2023).

H1: An increase in the policy rate leads to a short-term decline in NIM.

Foreign exchange fluctuations also influence NIM through multiple pathways. Depreciation can raise operational costs for banks with foreign liabilities or FX mismatches, but banks may respond by adjusting loan pricing to maintain profitability (Avdjiev et al., 2019; Kumar & Rani, 2024). The net effect depends on banks' hedging strategies and their ability to pass through increased costs to borrowers. Ekinci & Ersan (2024) and Owjimehr & Meybodi (2025) document evidences that banks in developing countries typically failed to pass through exchange rate loss to the customers.

H2: A depreciation in the exchange rate decreases NIM due to cost pass-through.

Real economic growth affects bank behaviour primarily through the lending channel. During economic expansions, intensified competition among banks can compress lending margins, lowering NIM (Nicolo & Lucchetta, 2011; Islam & Nishiyama, 2016). Conversely, strong growth may also ease credit risk and allow banks to sustain lending volume with lower margins. The net outcome remains empirically ambiguous.

H3: Higher real GDP growth reduces NIM due to stronger lending competition.

Method and Data.

This study employs a Panel Vector Autoregression (PVAR) framework to model the dynamic interplay between Net Interest Margin (NIM) and selected macroeconomic and bank-specific variables. PVAR is a natural extension of standard VAR models, tailored for panel datasets. It accommodates fixed effects across banks while capturing the temporal dependencies and inter-variable feedback mechanisms that are essential to understanding dynamic adjustments in bank behaviour (Stock & Watson, 2001 and

Abrigo & Love, 2016).

The core advantage of using a PVAR lies in its capacity to model endogeneity among multiple dependent variables in a unified system. Each bank in the panel contributes observations to the estimation while retaining unique intercepts that absorb time-invariant heterogeneity. We follow the two-step system GMM approach for estimation and inference, allowing for efficient handling of dynamic panel bias and ensuring robustness against potential autocorrelation and heteroskedasticity.

Let Y_{it} denote a k×1 matrix of endogenous bank-level variables for bank i at time t, potentially including their own lags on the right-hand side. The PVAR(p) model takes the form:

$$Y_{it} = Y_{it-1}A_1 + \ldots.. + Y_{it-p}A_p + X_{it}B + \alpha_i + e_{it}$$

where each A_1(for j=1,…,p) is a k×k coefficient matrix, X_{it} is an m×1 vector of exogenous controls with parameter matrix , B, $\alpha_i$captures bank-specific fixed effects, and e_{it} *i*s the idiosyncratic error vector. The lag order is chosen based on information criteria and moment selection techniques.

The endogenous variable set includes Net Interest Margin (NIM): Net interest income divided by average interest-earning assets. Liquidity Ratio (LIQ): Total deposits relative to total loans. Non-Performing Loan Ratio (NPL): Non-performing loans as a percentage of total loans. Return on Equity (ROE): Net profit divided by shareholders' equity. Our variables of interests are Macroeconomic shocks—treated as exogenous—comprise: Policy Rate Change (D_POLRATE): Monthly change in Bank Indonesia's benchmark interest rate. Exchange Rate Change (FX_D): Monthly change in the Rupiah per USD exchange rate. Real GDP Growth (GROWTH): Monthly growth in real gross domestic product. Lastly, we incorporate the following exogenous control variables: Bank Size (SIZE): Natural logarithm of total assets, Cost-to-Income Ratio (CIR): A measure of operating efficiency, Capital Adequacy Ratio (CAP): Total equity over total assets. The variable selection follows prior studies including Phung et al. (2021), Ekinci & Ersan (2024) and Ariefianto et al (2024), with model structure adapted to the dynamic nature of NIM responses.

Our dataset comprises monthly observations for 91 Indonesian commercial banks over the period January 2012 to January 2023, resulting in 12,103 bank-month observations. Bank-specific data are sourced from Indonesia's Financial Services Authority (OJK), while macroeconomic indicators are obtained from Bank Indonesia.

To mitigate the influence of extreme values, continuous variables are winsorized at the 5th and 95th percentiles, following the approach of Sullivan et al. (2021). Observations with absolute values falling beyond three standard deviations are replaced by the respective bounds to maintain data quality without excessive truncation.

The PVAR model estimation follows three main preparatory steps. First, stationarity is tested using the cross-sectionally augmented Dickey–Fuller test (Pesaran, 2003) for panel variables and standard ADF tests for macro variables. The optimal number of lags is determined via the moment selection criteria of Andrews and Lu (2001), including MBIC, MAIC, and MQIC. Next, we conduct panel Granger causality tests to inform the causal ordering of variables for simulation purposes.

Before conducting dynamic analysis, we verify that the PVAR satisfies the stability condition, ensuring all eigenvalues of the companion matrix lie inside the unit circle (Lütkepohl, 2005; Enders, 2014). Only stable models are used to simulate the response of NIM to macroeconomic shocks via the Dynamic Multiplier (DM) technique introduced by Stein and Song (2002). We simulate dynamic responses over a 20-month horizon with 500 Monte Carlo replications for statistical inference.

As part of robustness analysis, we estimate the model on subsamples based on: Bank ownership (government, private, foreign-controlled), bank scale (top 20%, mid 60%, bottom 20% by equity) and Pre-During-COVID-19, using March 2020 as the cutoff. The Dynamic Multipliers are repeated for subsamples PVAR each is

accompanied with stability checks. These additional estimations allow us to assess whether the impact of macroeconomic shocks on NIM varies by institutional characteristics or whether the outcome is substantially altered by COVID pandemic.

Results and Discussion

Table 1 presents descriptive statistics for the full sample. On average, Net Interest Margin (NIM) stands at a moderate level, with limited skewness, suggesting stability in pricing practices among Indonesian banks. The macroeconomic indicators showed relatively mild volatility, consistent with Indonesia's post-2010 monetary framework (Widjaja & Ariefianto, 2022).

Stationarity tests confirm that all panel series meet the required conditions for PVAR estimation. Specifically, results from the cross-sectionally augmented Dickey–Fuller test (Pesaran, 2003) show that all bank-level variables are stationary at conventional significance levels. ADF tests on macroeconomic variables support the same conclusion. These findings ensure the validity of impulse response tracing through the dynamic multiplier approach.

We determine the optimal lag order using the moment selection criteria of Andrews and Lu (2001), with four lags selected based on minimum values of MBIC, MAIC, and MQIC. Granger causality tests validate the endogeneity of NIM, ROE, LIQ, and NPL, while size and macro shocks are treated as exogenous variables (see table 2). This structure aligns with our theoretical framework of macro-to-bank transmission. Endogeneity among selected bank level financial indicators are well supported by Granger Causality test reported in table 3.

Table 2 reports Andrews and Lu (2001) Optimal moment and lag length selection procedure of Panel VAR model as described in equation 1. The reported statistics are number of lags, Cross Section Dependence, J statistics and its p value, Modified Bayesian Information Criteria (MBIC), Modified Akaike Information Criteria (MBIC) and Modified Hannan-Quinn Information Criteria (MBIC). Table 3 reports Granger Causality test on selected VAR specifications: NIM NPL LIQ ROE. Null hypothesis is Excluded equation does not granger cause Equation variables.

PVAR regression estimates is reported in table 4. This result is quite complex and not easily interpreted. Our PVAR satisfies the stability condition. We can see from figure 1, all roots of the companion matrix are within a unit circle.

Table 4 reports panel VAR estimation results for selected specification. Selection of reported specifications is based on meeting the stability requirements as stated in last row of the table. Estimation is performed using Abrigo and Love (2016) method using lag 4 based on Andres and

Table 1.
Descriptive statistics

Stats	NIM	NPL	LIQ	ROE	CAP	CIR	SIZE	FX_C	D_POL RATE	GRO WTH
Mean	0.032	0.028	1.191	0.067	0.266	4.467	6.613	0.411	-0.002	0.004
p50	0.026	0.024	1.166	0.038	0.203	3.254	6.548	0.135	0.000	0.004
SD	0.024	0.020	0.304	0.076	0.153	3.565	0.755	2.426	0.546	0.013
Min	0.004	0.001	0.617	-0.005	0.115	1.001	4.991	-9.049	-2.500	-0.037
Max	0.091	0.076	1.899	0.280	0.661	14.024	9.628	13.668	2.250	0.042
p5	0.004	0.001	0.617	-0.005	0.115	1.001	5.424	-2.927	-1.000	-0.018
p95	0.091	0.076	1.898	0.280	0.661	14.024	7.974	4.236	1.000	0.022
Unit Root	-2.898***	-1.942***	-2.852***	-2.756***	-2.728***	-2.068**	-2.160**	-4.821***	-7.214***	-6.825***
N	12103	12103	12103	12103	12103	12103	12103	12103	12012	12103

Lu moment selection procedure. Size and macro-economic variables are treated as exogenous variables. The table only reports panel VAR specification that meet stability requirement.

Dynamic Multiplier: Full Sample

Figure 2 presents the results of the DM analysis for the baseline specification: NIM, NPL, LIQ, ROE, based on the full sample (estimated PVAR regression is presented in the appendix, Table 4). Here, we observe that all macroeconomic shocks have a transitory effect on NIM, stabilizing over a period of 6-12 months.

Figure 2a shows that an immediate reduction follows a unit deviation shock in D_Pol Rate in NIM. The dynamic adjustment process appears volatile initially (for approximately 6 months) but eventually stabilizes around the pre-shock level. This initial reduction in NIM following a policy rate shock may be due to the lag in repricing, influenced by asymmetrical interest rate adjustments, as suggested by Karsinah (2019), Klein (2020) and Hinton & Polson (2021). Our finding differs from those of Altavilla (2020) and Breyer et al (2023).

In Figure 2b, a shock in the foreign exchange rate shows an immediate positive but not significant impact on NIM. This finding is somewhat contradicting our hypothesis i.e. failure to loss pass through. This temporary impact could increase NIM due to the pass-through effect, where higher actual and potential costs are passed on to customers, as suggested by Owjimehr & Meybodi (2025), Mauleman & Vennet (2020) and Kumar & Rani (2024). Empirical support for this notion has been documented by Wójcik-Czerniawska (2018), Karyani et al. (2020) and Niepmann & Schmidt-Eisenlohr (2022).

The finding of insignificant dynamic impact to NIM finding is notable. Due to relatively limited resources of foreign exchange typically in a developing economy, depreciation should have permanent impact to NIM as bank would perform risk repricing. However, perhaps due to substantial improvement in macro economy management since 1997 in Indonesia shocks from exchange rate has now a much-diminished role.

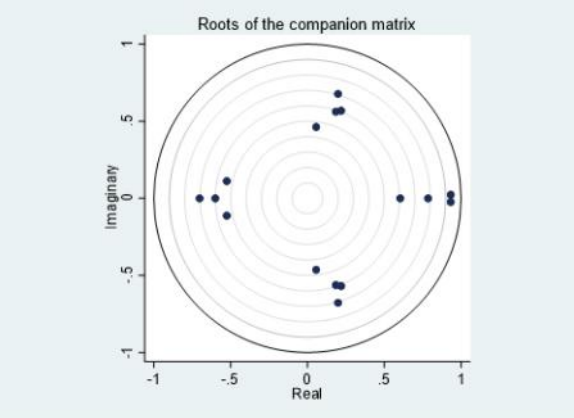


Figure 1.
Stability Condition: Baseline PVAR

Table 2.
Optimal Moment and Lag Length Selection

Lag	CD	J stats	p value	MBIC	MAIC	MQIC
1	0.979187	91.81967	0.000144	-347.8348	-4.18033	-120.8
2	0.6910141	31.14962	0.50942	-261.9534	-32.8504	-110.597
3	-0.186177	9.544734	0.681072	-100.062	-18.2745	-44.4933
4	-9.986177	6.544734	0.781072	-140.0068	-25.4553	-64.3285
5	109.995341	16.21881	0.987012	16.21515	16.21801	16.21704

Table 3.
Granger Causality Test

Equation	Excluded	chi2	df	Prob > chi2	Equation	Excluded	chi2	df	Prob > chi2
NIM					LIQ				
	NPL	54.399	4	0		NIM	70.626	4	0
	LIQ	180.675	4	0		NPL	24.199	4	0
	ROE	86.737	4	0		ROE	54.408	4	0
	ALL	327.065	12	0		ALL	314.798	12	0
NPL					ROE				
	NIM	24.788	4	0		NIM	245.648	4	0
	LIQ	5.204	4	0.267		NPL	17.244	4	0.002
	ROE	6.985	4	0.137		LIQ	175.855	4	0
	ALL	88.669	12	0		ALL	459.844	12	0

Figure 2c illustrates that a unit deviation shock in economic growth causes an immediate negative impact on NIM. Therefore, our findings support the assertion by Meuleman and Vennet (2020) and Islam & Nishiyama (2016) that economic growth leads to increased competition in the lending market, subsequently reducing NIM. Our DM simulation provides supporting evidence

Table 4.
Baseline Panel VAR estimation

VARIABLES	NIM	NPL	LIQ	ROE
L.NIM	0.218***	-0.0237***	0.313**	-0.692***
	(0.0233)	(0.00869)	(0.157)	(0.0528)
L2.NIM	-0.0365*	-0.0148*	0.599***	-0.0390
	(0.0204)	(0.00813)	(0.137)	(0.0472)
L3.NIM	-0.288***	0.0258***	0.414***	-0.181***
	(0.0186)	(0.00799)	(0.133)	(0.0428)
L4.NIM	0.177***	-0.0212***	0.762***	0.0447
	(0.0188)	(0.00779)	(0.133)	(0.0424)
L.NPL	0.186***	0.745***	-0.302	0.136*
	(0.0287)	(0.0196)	(0.202)	(0.0708)
L2.NPL	-0.0604**	0.0457**	-0.0956	-0.229***
	(0.0305)	(0.0218)	(0.209)	(0.0732)
L3.NPL	-0.0107	-0.0861***	-0.225	0.00631
	(0.0301)	(0.0214)	(0.225)	(0.0706)
L4.NPL	0.0722***	0.193***	-0.503**	-0.0858
	(0.0256)	(0.0205)	(0.210)	(0.0595)
L.LIQ	-0.0147***	0.000284	0.575***	-0.0453***
	(0.00179)	(0.000650)	(0.0192)	(0.00521)
L2.LIQ	0.0217***	0.000477	0.171***	0.0686***
	(0.00190)	(0.000724)	(0.0180)	(0.00536)
L3.LIQ	-0.0148***	0.00105	0.0396**	-0.0287***
	(0.00192)	(0.000807)	(0.0174)	(0.00538)
L4.LIQ	0.000585	-0.000469	0.128***	0.00255
	(0.00168)	(0.000659)	(0.0180)	(0.00427)
L.ROE	0.0284***	0.00499*	-0.104**	0.681***
	(0.00834)	(0.00295)	(0.0526)	(0.0231)
L2.ROE	-0.00316	0.00283	-0.120**	0.00583
	(0.00869)	(0.00310)	(0.0545)	(0.0244)
L3.ROE	0.0444***	-0.000305	0.352***	-0.0238
	(0.00802)	(0.00298)	(0.0529)	(0.0210)
L4.ROE	0.0144**	-0.000651	-0.274***	0.157***
	(0.00692)	(0.00257)	(0.0462)	(0.0175)
CAP	0.0267***	-0.0122***	-0.576***	-0.141***
	(0.00691)	(0.00358)	(0.0689)	(0.0171)
CIR	-0.000547***	0.000312***	0.00802***	-0.00153***
	(0.000139)	(6.50e-05)	(0.00114)	(0.000368)
SIZE	-0.00322	0.00493***	0.164***	0.0344***
	(0.00214)	(0.00110)	(0.0204)	(0.00506)
FX_C	5.53e-05	3.99e-05	-0.00201***	6.83e-06
	(6.35e-05)	(2.83e-05)	(0.000470)	(0.000169)
D_POLRATE	-0.000696*	-0.00114***	-0.0277***	-0.00747***
	(0.000365)	(0.000181)	(0.00261)	(0.00101)
GROWTH	-0.177***	0.00281	0.958***	-0.221***
	(0.0150)	(0.00661)	(0.106)	(0.0394)
Observations	11,620	11,620	11,620	11,620

along with Moudud-Ul Huq (2021) and Olszak and Kowalska (2023). Our finding is not aligned with those of Altavilla (2020), Borio et al. (2017), and Gomez et al. (2021).

To assess economic significance, we express the estimated dynamic multiplier relative to the historical variation in NIM. A one-standard-deviation shock to the policy rate change (54.6 basis points) reduces NIM by 0.8 basis points, equivalent to one-third of a standard deviation of NIM (SD = 2.4 pp). Relative to the mean NIM of 3.2%, this represents a 25% decline, indicating a substantial economic effect On the other hand, a one-standard-deviation positive shock to Growth (1.3 percentage points) produces a peak negative effect on NIM of 1.8 percentage points, representing 75% of one standard deviation of NIM and a 56% decline relative to mean NIM. This economically substantial effect reflects the procyclical nature of net interest margins during economic expansions, when increased competition and lower credit spreads compress margins.

Bank Ownership Analysis

Government banks exhibit a different dynamic response compared to the baseline and other types of banks. Figure 4a shows that a policy rate shock does not significantly impact NIM in government banks, which is quite in contrast to foreign (see Figure 3a) and private (see Figure 5a) banks. We suppose that this could be due to the political inclination of government-appointed officials to maintain the status quo.

Jermann and Quadrini (2012) and Bhattacharjee and Han (2014) suggest that managers in government-owned companies may respond modestly to macroeconomic shocks due to conservatism. They may perceive macroeconomic shocks as having complex and unpredictable implications that are perceived differently by various stakeholders. Therefore, managers appointed by political authorities in government banks tend to adopt a more cautious and modest response strategy. Empirical support for this notion has been compiled by Arham et al. (2020), Fang et al. (2023), among others. These studies suggest that under political oversight, government bank managers exhibit behaviours that prioritize stability and caution in response to economic shocks, which may explain the muted impact of policy rate shocks on NIM observed in Figure 3a.

Another notable characteristic of government banks is their tendency to pass through foreign exchange shocks to customers (see Figure 4b). A unit deviation shock in foreign exchange rates caused a temporary and statistically significant rise in NIM for government banks. In contrast, this impact was not significant for private (see figure 5b) and foreign banks (see figure 3b). Government bank managers may perceive foreign exchange shocks as more critical due to their inherent risk aversion. Sheedy & Lubojansky (2018) and Ongena et al. (2022) have found evidence of higher risk aversion among politically appointed bank managers compared to non -politically appointed ones. This risk aversion could lead government bank managers to pass on higher operating costs incurred from foreign exchange fluctuations directly to customers, thereby temporarily boosting NIM. This behaviour

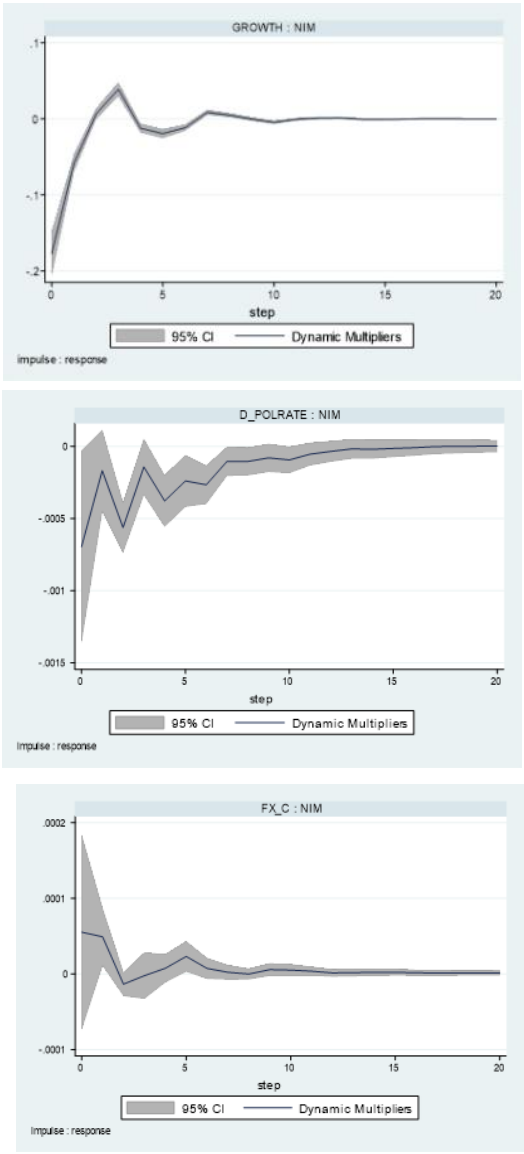


Figure 2.
DM – Full sample

contrasts with private and foreign banks, which may have different risk management strategies and customer relationship dynamics.

Lastly, we can see a uniform dynamic response to shock in growth regardless of bank types (see Figure 3c, 4c, and 5c). A unit deviation shock led to reduced NIM. Relating to our previously mentioned hypothesis (see section 3.1 and 4.3), we think competition is the main factor behind the mechanism (as suggested by Islam & Nishiyama (2016) and Nicolo & Lucchetta (2011).

Bank Scale Analysis

We analysed the impact of policy rate shocks on banks' NIM, focusing specifically on large-sized banks, which exhibit a different dynamic response than the baseline and other bank types. As shown in Figure 6a, NIM did not respond significantly to policy rate shocks in large banks. This phenomenon may be attributed to the stronger capital bases of large banks, which can make them more resilient to policy rate shocks. As suggested by Fraisse et al. (2019) and Bui et al. (2017), larger banks, with their robust capital reserves, are better equipped to absorb economic shocks than smaller banks. Strong capital reserves act as a buffer, enabling these banks to withstand changes in policy rates without causing significant disruptions to their operational stability. Empirical studies supporting this idea are Oordt & Zhou (2019), and Mueleman & Van Vennet (2020).

The dynamic response of NIM to a foreign exchange shock is similar across

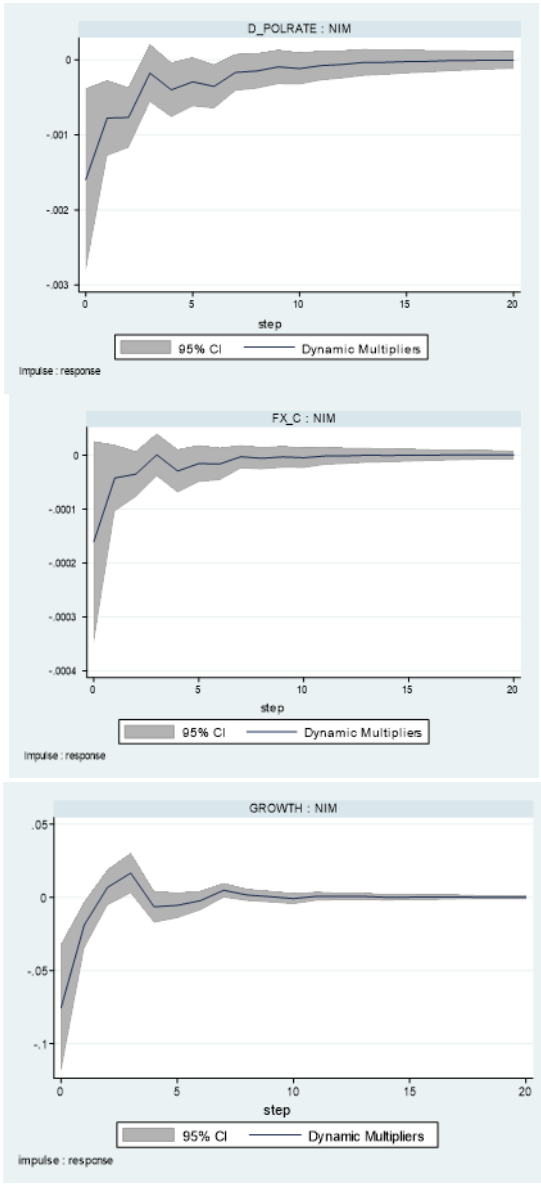


Figure 3.
DM: Foreign Banks

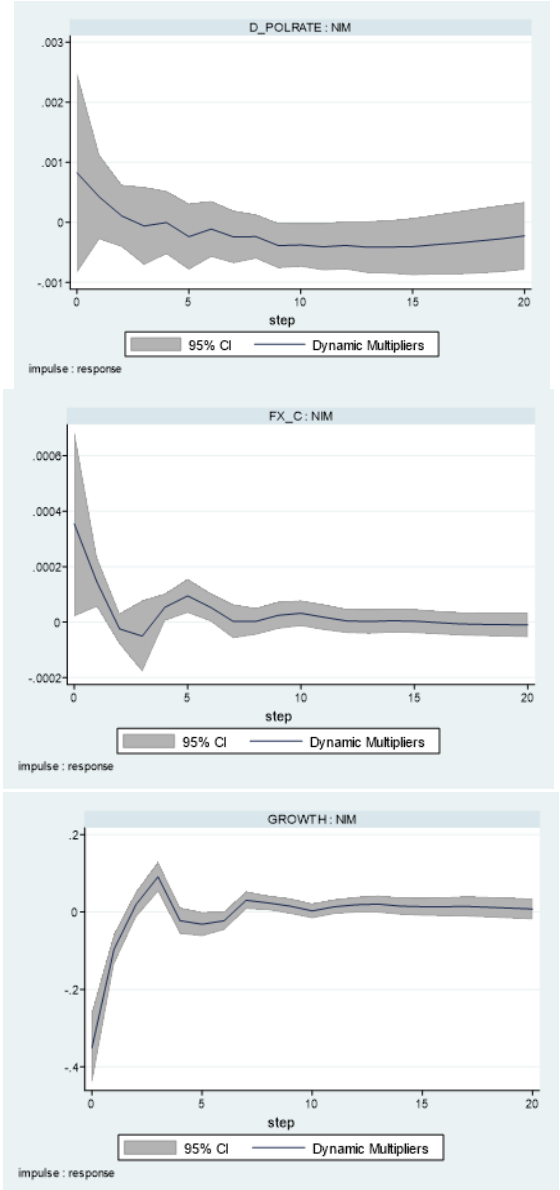


Figure 4.
DM: Government Banks

bank scales (see figure 6b, 7b and 8b). A unit deviation shock cause insignificant immediate impact to NIM. Therefore, further analysis on bank scales does not support our hypothesis hence different to those studies of Ngambou Djatche (2022) and Devereux et al (2015).

Figure 7 describes DM using the PVAR subsample: Medium. The impulses are macro-economic shocks (D_POL Rate, FX_C, and Growth), and the response is NIM. We found uniform dynamic response of NIM to a unit shock in growth is negative across bank scale (see figures 6c, 7c, and 8c). This evidence strongly supports the notion that competition intensity may be intense and similar across banks of different scales. The homogeneity of the competition's role in NIM could be attributed to the fungible nature of bank products (Freixas & Rochet, 2008 and Greenbaum & Thakor, 2019). Our findings corroborate previous studies such as Tan (2020), Olzak and Kowalska (2023) and Moudud Ul-Huq (2021).

Figure 8ndescribed DM using PVAR subsample: Small. The impulses are macro-economic shocks (D_POL Rate, FX_C and Growth), and the response is NIM1.

Pre-COVID and During COVID Analysis

In the subsample during the COVID-19 period (see Figure 10a), we observe that a unit deviation in the policy rate shock is now immediately followed by an increase in NIM instead of a reduction in pre-COVID (see Figure 9a). We hypothesize that this pattern reflects anticipatory behaviour.

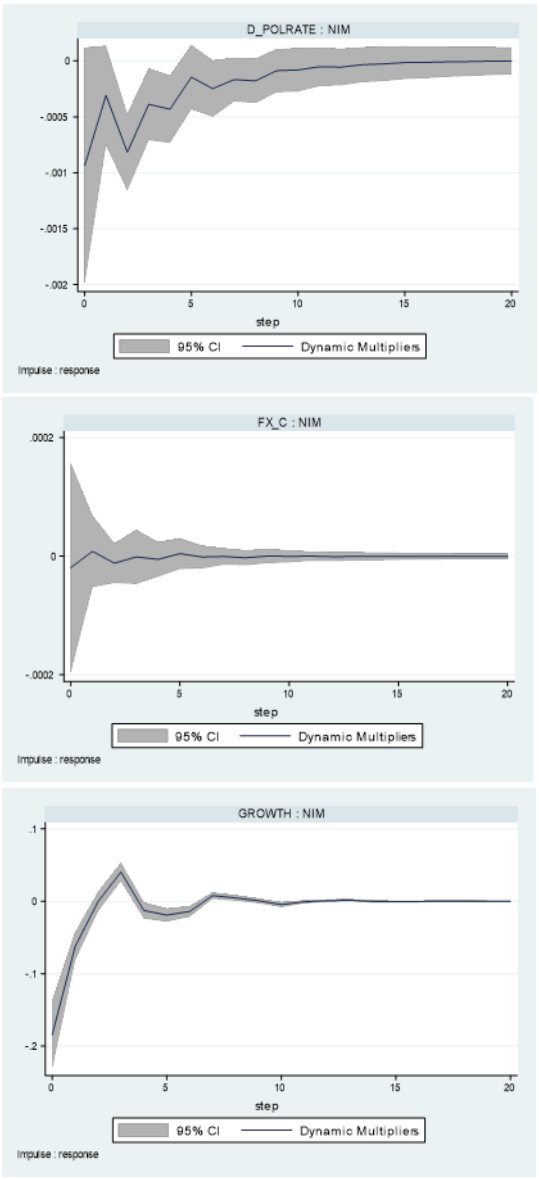


Figure 5.
DM: Private Banks

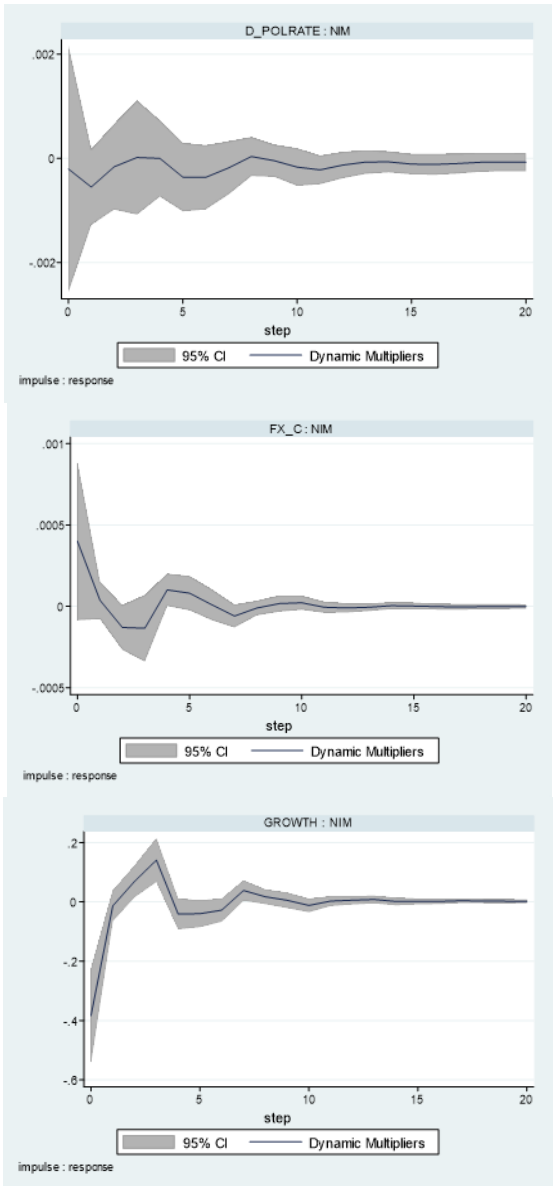


Figure 6.
DM: Large

Due to the uncertainty surrounding the duration of COVID-19, bank managers anticipate potential 'extra' business costs, particularly in terms of credit and liquidity risks, in their intermediation pricing (NIM). This anticipatory approach enhances bank resilience (Hale et al., 2020; Kumar & Rani, 2024). Figure 9 describes DM using the PVAR subsample: pre-COVID. The impulses are macroeconomic shocks (D_POL Rate, FX_C and Growth), and the response is NIM1.

Lastly, it is interesting to note that in Covid Period rather than passing through to customers, banks chose to absorb the foreign exchange shock, resulting in reduced NIM (see figure 10b). This finding suggests a substantive shift in the mix of business strategies. During Covid-19, banks passed on shocks from policy rates and growth to customers but absorbed them from foreign exchange. Colak and Oztekin (2021), Demir and Danisman (2021), and Gomez et al (2021) found that banks adjusted their strategies during the COVID-19 pandemic. Further research into the specific considerations for this strategic decision could be a fruitful avenue for future study. Figure 10. DM: COVID-19 describes the Dynamic Multiplier using the PVAR subsample COVID-19. The impulses are macroeconomic shocks (D_POL Rate, FX_C, and Growth), and the response is NIM1.

The immediate response of NIM to a growth shock is positive in the COVID period (see figure 10c), which contrasts with the pre-COVID period (see figure 9c).

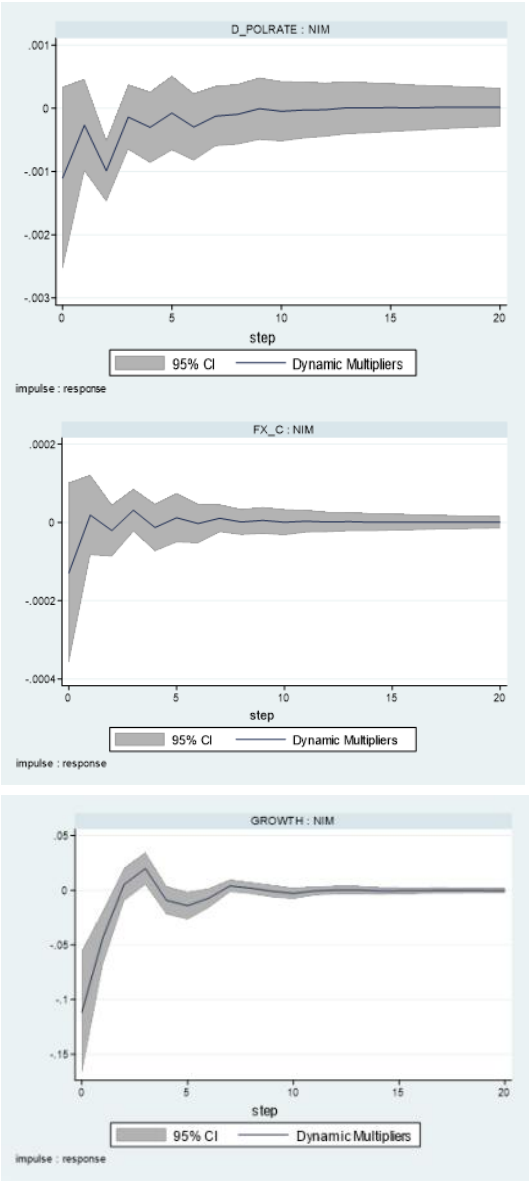


Figure 7.
DM: Medium Banks.

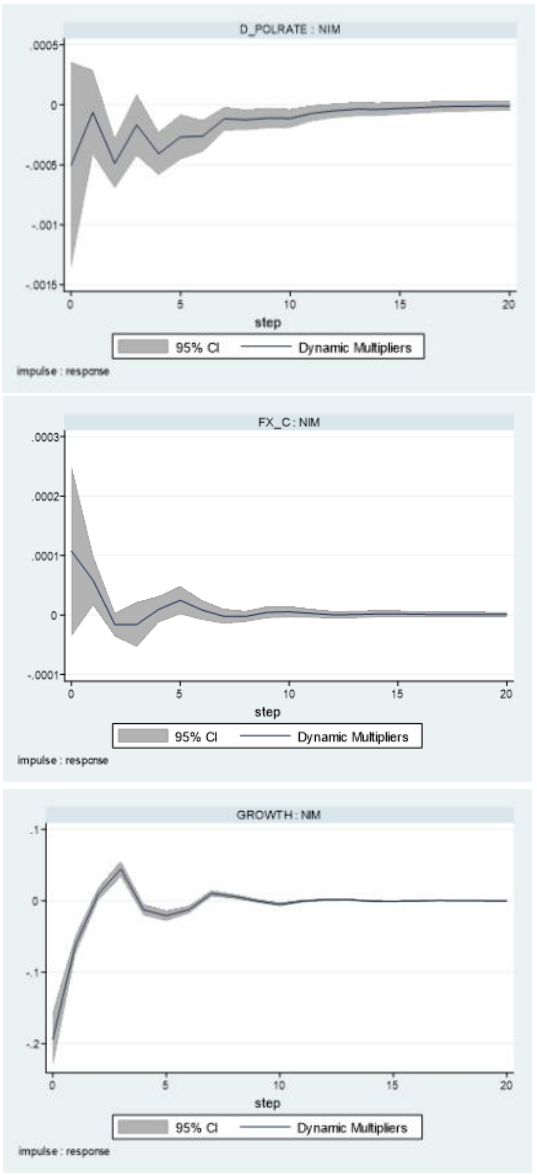


Figure 8.
DM: Small Banks

We believe that following the outbreak, most banks adopted a cautious stance, leading to a sharp reduction in competition. Faced with excess demand, NIM naturally increased. Cross-country studies by Colak and Oztekin (2021) and Danisman et al. (2021) have documented decreases in competition due to COVID-19.

Robustness checks

The previous exercises (subsampling estimations) serve as robustness checks in themselves. We observe that macro shocks have only a temporary—and ultimately stabilizing—impact across all subsamples. Furthermore, as shown in Figure 11, all subsamples pass the stability test, providing additional support for the robustness of our findings.

Conclusion

This study explores how macroeconomic shocks affect banks' Net Interest Margin (NIM) in Indonesia. Employing a Panel Vector Autoregression (PVAR) framework and dynamic multiplier analysis on a comprehensive panel of 91 banks from 2012 to 2023, we trace the time path of NIM adjustments in response to external disturbances.

Our findings suggest that NIM responses are short-lived and generally stabilizing. Policy rate increases and positive growth shocks lead to a temporary contraction in NIM, consistent with the

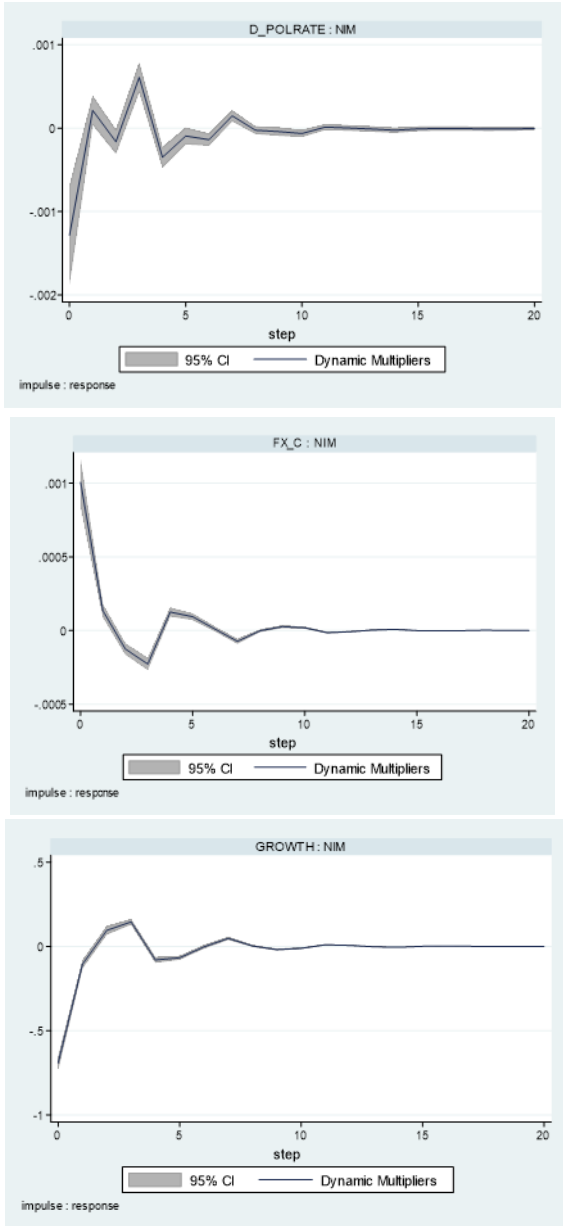


Figure 9.
DM: pre-COVID

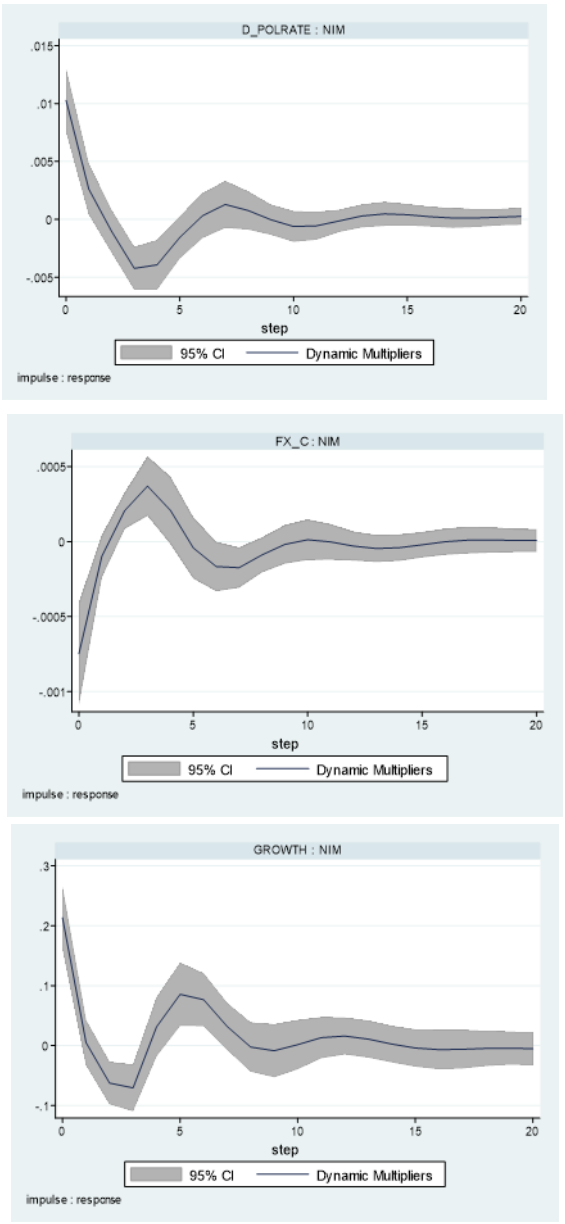


Figure 10.
DM: COVID-19

repricing lag in loan-deposit dynamics and heightened competition during economic upturns. In contrast, exchange rate movements appear to exert no significant or consistent effect on NIM, pointing to effective risk management or regulatory insulation in foreign currency exposure.

These dynamics are not uniform across banks. Ownership structure, asset scale, and crisis periods shape the responsiveness of NIM to macro shocks. Government-owned banks show limited sensitivity to policy signals; possibly due to political constraints or conservative strategies. Large banks, due to superior capital buffers, appear more insulated from interest rate changes. Notably, during the COVID-19 pandemic, banks adopted more anticipatory and protective pricing strategies, highlighting the adaptive nature of NIM as a strategic tool under uncertainty.

These findings yield several policy implications. First, the effectiveness of monetary transmission through the bank channel is likely asymmetric, particularly across ownership types and bank sizes. Tailoring monetary policy communication and supporting mechanisms—such as liquidity facilities or tiered reserve requirements—may improve transmission efficiency. Second, bank-level resilience depends not only on capital and liquidity positions but also on pricing agility. Regulators should encourage practices that enhance NIM flexibility, especially under crisis scenarios.

Finally, the evidence that banks adjust NIM differently in response to the same macro shocks underscores the importance of micro-level supervision. Broad macroprudential measures may be complemented with bank-specific oversight to ensure sound intermediation during volatile periods.

We have to disclose limitations of our study. First, the use of interpolation method for real economic growth proxies. Second, bank level data though is obtained from the authoritative source (OJK website), however the data is known to be prepared for regulatory purpose with a short time period (i.e. February 2017 report must be submitted by April 2027 at the latest). This condition might cause a trade off speed over quality for some banks and some ocassions.

This study opens several concrete

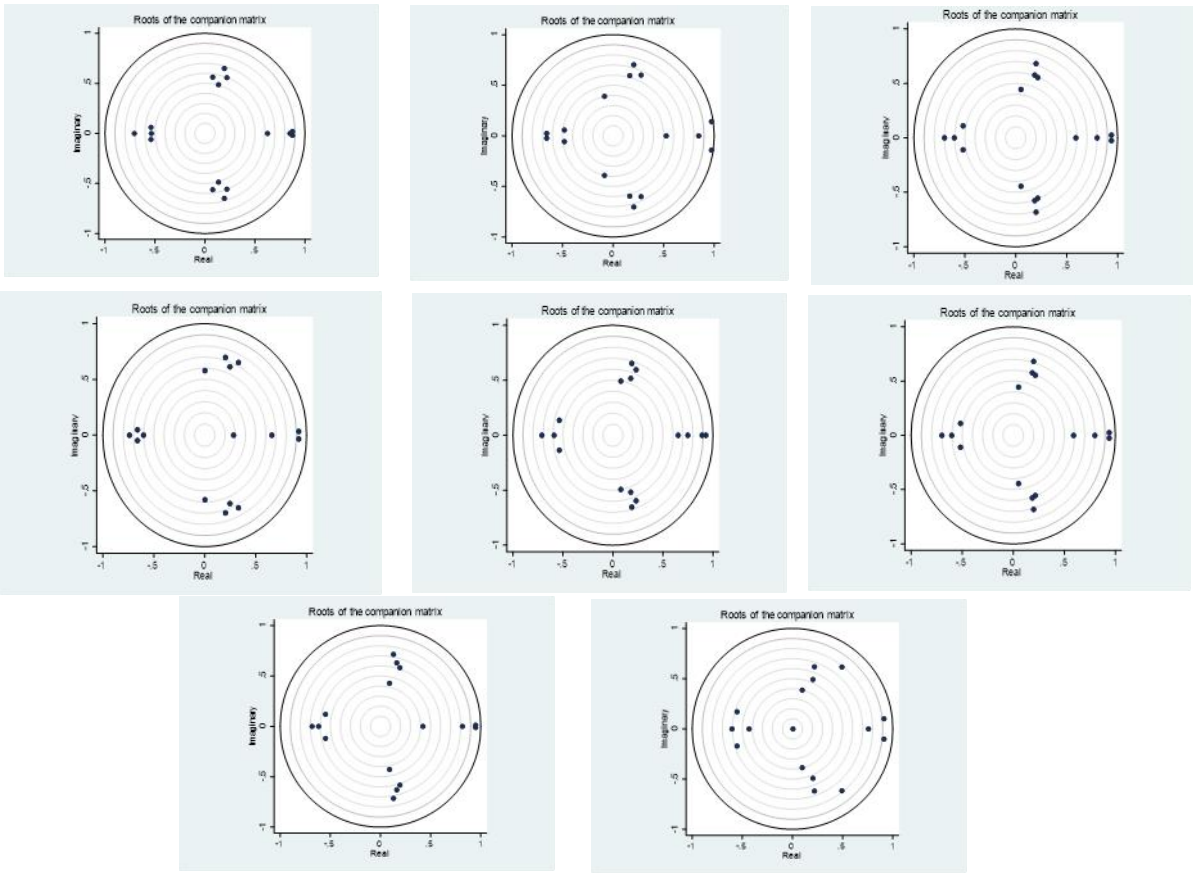


Figure 11.
Stability Check: Subsamples

avenues for future investigation. First, cross-country panel VAR analysis incorporating Southeast Asian economies (Thailand, Malaysia, Philippines, Vietnam) would reveal whether our findings on ownership-based asymmetries and crisis-period adaptation are region-specific or generalizable. Second, our finding that government banks do not pass through policy rate shocks but do transmit exchange rate shocks raises questions about politically-influenced pricing mechanisms.

Third, the COVID-19 subsample reveals strategic reorientation; from absorbing to passing through certain shocks. Future research should employ regime-switching PVAR models to formally identify structural breaks and characterize distinct states of bank behaviour under crisis versus normal conditions.

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