Signifikan: Jurnal Ilmu Ekonomi
Volume 13(1), 2024: 41 - 58
P-ISSN: 2087-2046; E-ISSN: 2476-9223
https://doi.org/10.15408/sjie.v13i1.37419

Impact of COVID-19 Vaccination and Financial Policies on Indonesia's Property Loan Growth

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JEL Classification:
C22
C51
C52
C53
C54

Received: 28 January 2024

Revisions: 27 August 2024

Accepted: 18 September 2024

Available online: October 2024

ABSTRACT

Research Originality: This study provides a novel examination of the impact of COVID-19-related financial policies on property loan growth in Indonesia, a critical area with limited prior quantitative research.

Research Objectives: The purpose of this research is to assess how interventions such as Loan-to-Value (LTV) over Finance-to-Value (FTV) ratio (LTV/FTV) relaxation, COVID-19 vaccination as a metric for public activity restrictions, and changes in deposit insurance rates have influenced property loan dynamics during the pandemic.

Research Methods: Using monthly banking data from January 2016 to May 2022, this study employs ARIMA Intervention Analysis to capture the effects of these policies.

Empirical Results: The empirical results reveal a significant positive shift in property loan growth ten months after the first intervention and a notable impact two months after the third intervention, whereas the second intervention shows limited influence.

Implications: These findings imply that integrating COVID-19 vaccination targets into public policy and adjusting deposit insurance rates are effective strategies for sustaining the property loan sector during economic crises. These results provide insights into the role of vaccination targets and financial adjustments in supporting the property loan sector during economic disruptions, offering valuable considerations for future policymaking in similar contexts.

Keywords:

property loans; loan to value; deposit insurance rate; COVID-19 vaccination.

How to Cite:

Forestryani, V., & Prastyo, D. D. (2024). Impact of Covid-19 Vaccination and Financial Policies on Indonesia's Property Loan Growth. *Signifikan: Jurnal Ilmu Ekonomi*, *13*(1), 41-58. https://doi.org/10.15408/sjie.v13i1.37419.

INTRODUCTION

The COVID-19 outbreak in Indonesia severely impacted human life and material resources, profoundly affecting socio-economic fabric and public welfare. Furthermore, the pandemic has adversely affected Indonesia's financial system, as evidenced by the decline in various domestic economic activities. Key metrics reflecting this downturn include GDP contraction, Business Activity Survey results, the Manufacturing Index (PMI), the Retail Sales Index, and financial services performance (Lehmann, 2023). A collaborative effort between the Financial System Stability Committee and the Government is imperative to mitigate these impacts.

The stability of Indonesia's financial system can be assessed using a dual framework of macroprudential and macroprudential indicators. Microprudential indicators focus on individual institutions and include banking capital adequacy ratios, asset quality, profitability, liquidity, and market-based indicators. In contrast, macroprudential indicators take a systemic perspective, encompassing broader economic factors like GDP growth, balance of payments, inflation rates, interest rates, and foreign exchange rates (Warjiyo & Juhro, 2022).

During the pandemic, banking loan indicators in Indonesia also experienced fluctuations due to restrictions on public activities. The property sector's contribution to Indonesia's GDP is only 3.0%, which is lower than that of the Philippines (3.8%, Thailand at 22.3%, Malaysia at 38.4%, and Singapore (44.8%. This data indicates that Indonesia's housing sector development needs to catch up. Following the 1998 economic crisis, the Global Financial Crisis (GFC) happened in 2008, primarily due to the high volume of non-performing housing loans in the United States. The collapse of the American economy had a significant impact, reducing foreign investment in Indonesia and leading to unstable exchange rates, weakening the Indonesian Rupiah. This situation increased systemic risks, including a higher dependency on imports, rising commodity prices, reduced food supply, and ultimately eroding the economic resilience of Indonesia (Ardiyono & Patunru, 2023; Liang, 2022).

Indonesia has adopted accommodative macroprudential policies to facilitate loan recovery and economic revitalization. These include the relaxation of loan-to-value (LTV) over financing-to-value (FTV) ratios for property financing and the introduction of zero-down payment requirements for vehicle financing through PBI Number 23/2/PBI/2021 (Peraturan Bank Indonesia, 2021). Furthermore, the Indonesia Deposit Insurance Corporation (IDIC) has incrementally lowered the Deposit Insurance Rate, a move aimed at bolstering the financial system's stability and facilitating national economic recovery. In a notable decision at the Board of Commissioners Meeting on May 25, 2022, LPS established a historical low by lowering the Deposit Insurance Rate to 3.50% for Rupiah-denominated deposits in Commercial Banks, 0.25% for foreign currency deposits in Commercial Banks, and 6.00% for Rupiah deposits in Rural Banks. This policy adjustment is crucial, considering the property sector's high potential and significant employment absorption, which exhibits strong forward and backward linkages (Balcilar et al., 2021).

In the public health domain, the Indonesian Government has implemented a comprehensive COVID-19 vaccination program and the 3M health protocol (masking,

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social distancing, hand washing) to curb the virus's spread, aiming to reduce transmission rates, decrease infections and fatalities, and achieve herd immunity, thereby safeguarding socio-economic productivity. Additionally, remote working policies, widespread rapid testing, and large-scale social restrictions have been instrumental in managing the pandemic's impact. The integration of vaccination achievement targets in determining the level of Public Activity Restrictions or *Pemberlakuan Pembatasan Kegiatan Masyarakat* (PPKM) in Java and Bali is outlined in the Minister of Home Affairs Instruction No. 42 of 2021, exemplifying the comprehensive public health policy mix.

Extensive research has been conducted on the Indonesian Government's policy response to COVID-19. Suryahadi et al. (2021) explored the dual impact of the pandemic and social protection programs on poverty in Indonesia, highlighting the critical role of government interventions in mitigating poverty during the crisis. Their findings underscore the importance of timely and targeted social protection measures, although they also point to limitations in reaching all vulnerable populations. Cross-country analysis using daily vaccination data and high-frequency economic activity indicators across 46 countries from December 16, 2020, to June 20, 2021, revealed a significant correlation between increased per capita vaccination and enhanced economic activity. This study also found evidence of a non-linear effect of vaccination, with greater marginal economic benefits at higher vaccination rates (Deb et al., 2022). Dorlach (2023) delves into the tensions within individualized funding policies for older and disabled persons, offering insights into the broader implications of personalization and collaboration in social policy during crises.

Previous research has investigated the effects of macroprudential policies on property markets, focusing on the loan-to-value (LTV) ratio as a key regulatory tool. Paramitha et al. (2020) analyzed the impact of the LTV ratio policy on property development. Their findings indicate that changes in LTV ratios significantly influence market dynamics, affecting both property developers' behavior and the property sector's overall growth. Additionally, Zhao and Liu (2023) analyzed the real estate market affected by housing policies, emphasizing the significant role of LTV ratios in shaping housing demand and price stability. Fischer et al. (2021) explored the dynamic effect of monetary policy on regional housing prices. They demonstrated that regional differences in housing market responses can be substantial, with varying impacts based on local regulatory environments and housing supply elasticities. Several studies have also analyzed the impact of the COVID-19 outbreak on various economic sectors, particularly the real estate and housing markets. Cui (2023) comprehensively analyzed how the pandemic has led to significant disruptions in real estate markets, with varying effects depending on regional and economic contexts.

Similarly, Balemi et al. (2021) reviewed the broader impacts of COVID-19 on global real estate markets, noting a marked shift in market dynamics and investor behavior due to the crisis. Svobodová & Hedvičáková (2021) further examined the specific impacts of the pandemic on mortgage loans, highlighting how the crisis affected borrowers' ability to obtain loans and the subsequent implications for financial institutions. Their research provides insight into the challenges the housing credit sector faced during the global pandemic, emphasizing the critical role of policy interventions in mitigating these effects. These

studies underscore the importance of understanding the specific effects of policy relating to COVID-19 on the housing sector, particularly in emerging markets like Indonesia.

However, quantitative research analyzing COVID-19 policy impacts in Indonesia remains limited, primarily focusing on qualitative (Ayuningtyas et al., 2021; Mahendradhata et al., 2022; Maison et al., 2021; Yuda & Qomariyah, 2022) or legal, conceptual, or descriptive quantitative approaches (Grogan, 2022). While previous studies have extensively explored the impacts of macroprudential policies, such as loan-to-value (LTV) ratios and financial interventions, as well as the broader effects of COVID-19 on various sectors, including real estate and housing, limited quantitative research has focused on the combined effects of specific financial and public health policies during the COVID-19 pandemic in Indonesia. Most existing research has either taken a qualitative approach or focused on legal, conceptual, or descriptive quantitative methodologies.

There needs to be a more comprehensive quantitative analysis that examines how the relaxation of LTV/FTV ratios, vaccination rates as a public health metric, and changes in the Indonesia Deposit Insurance Corporation (LPS) deposit insurance rates have collectively influenced property loan growth during the pandemic. This gap is particularly relevant in Indonesia's emerging market, where the property sector's contribution to GDP is notably lower than in other Southeast Asian countries. Thus, the current study addresses this gap by providing an inferential and nuanced quantitative assessment of the effectiveness of these combined policy interventions on Indonesia's property loan sector, contributing new insights into the effectiveness of financial policies in maintaining economic resilience during global crises.

METHODS

This study meticulously uses monthly banking property loan data spanning January 2016 to May 2022, publicly provided by Bank Indonesia. The dataset, which is presented in Billion Rupiah, underwent a thorough preprocessing stage to ensure data integrity and consistency, which involved cleaning, normalization, and handling of missing values, if any, to prepare it for rigorous analysis. The careful selection and processing of the data ensures the reliability and validity of the findings, offering significant insights into economic resilience and policy effectiveness. The variables in this research are listed in Table 1.

Table 1. Research Variables

Variable	Description	Unit
Response	Property loans (y_1)	Billion Rupiah
Predictor (Dummy)/ Intervention Variables	Time from first COVID-19 case reported to WHO (Intervention I (x_1)	Binary (December 2019)
	Time of Initiation of Relaxation Policy on Loan-to-Value (LTV) over Financing-to-Value (FTV) rasio (Intervention II (x_2)	Binary (March 2021)
	Time of vaccination as a metric for public activity restriction (PPKM) levels in Java and Bali and decrease in deposit insurance rate (Intervention III (x_3)	Binary (September 2021)

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This study employs an Intervention Analysis, extending the univariate ARIMA model, to measure the impact of policy changes on time-dependent variables using the data presented in Table 2.

Table 2. Research Data Structure

No	Time	Total Loan (the Billion Rupiah)	Loan Growth The (Billion Rupiah)	x_1	x_2	x_3
1	16-Jan	609727,6618	-10736,3882	0	0	0
2	16-Feb	614168,159	4440,4972	0	0	0
⋮	⋮	⋮	⋮	⋮	⋮	⋮
47	19-Nov	1021859,564	-2442,5889	0	0	0
48	19-Dec	1029588,43	7728,8659	0	0	0
** First COVID-19 Case Reported to the WHO						
49	20-Jan	1013459,519	-16128,9108	1	0	0
50	20-Feb	1016499,755	3040,2364	1	0	0
⋮	⋮	⋮	⋮	⋮	⋮	⋮
** Implementation of LTV/FTV relaxation policy **						
63	21-Mar	1069467,836	8351,6611	1	1	0
64	21-Apr	1070515,289	1047,4533	1	1	0
⋮	⋮	⋮	⋮	⋮	⋮	⋮
** Start of PPKM implementation with vaccination drives and decrease in deposit insurance rate**						
69	21-Sep	1107734,777	9662,8426	1	1	1
70	21-Oct	1104708,821	-3025,9558	1	1	1
⋮	⋮	⋮	⋮	⋮	⋮	⋮
76	22-Apr	1135512	2476,978	1	1	1
77	22-May	1141232	5719,984	1	1	1

The ARIMA model is expressed in Equation (1).

$$Y_t = \alpha + \sum_{i=1}^{p} \phi_i Y_{t-i} + \sum_{j=1}^{q} \theta_j e_{t-j} + e_t \quad (1)$$

The ARIMA is employed to forecast property loan trends before interventions. Predictor variables *(X)*, represented as dummy variables, mark significant policy events and interventions, such as the onset of COVID-19, relaxation of the LTV/FTV policy relaxation, and PPKM implementation with vaccination drives. Y_t represents the property loan at a time *t*, α is a constant, ϕ_i are the coefficients of the autoregressive part, Y_{t-i} are the lagged values of the series, θ_j are the coefficients of the moving average terms, and e_t the error term at the time *t* (Wei, 2019). The careful selection and definition of these variables (Table 1) are pivotal to accurately capturing the essence and impact of these policy interventions. This study also integrates Transfer Function models to analyze the interventions' impact *(X)* where the dependent variable *Y* is a function of its past values and past errors *(e)* (Wei, 2019).

$$Y_t = \frac{\omega_s(B)}{\delta_r(B)} B^b X_t + e_t \quad (2)$$

Where:

$\omega_s(B) = \omega_o + \omega_1 B + \omega_2 B + \cdots \omega_s B^s$ X_t : Intervention variables

$\delta_r(\mathrm{B}) = 1 - \delta_1 \mathrm{B} - \cdots - \delta_r \mathrm{B}^r$ e_t : Noise/error that follows the ARIMA model

B : Backshift operator

The $\omega(B)$ and $\delta(B)$ represent the transfer function weights. The impact of an intervention, represented in terms of duration, is denoted by b^*, s, and r. The term b is the time required for the intervention to have its initial effect, s is the additional time during which the effects of the intervention are still felt but cannot be represented by a function, and r is the additional time during which the effects are still felt more gradually and thus can be described by a function. To estimate the values of b, s, and r, the response function Y_t^* is used as follows:

$$Y_t^* = Y_t - n_t = \frac{\omega_s(B)}{\delta_r(B)} B^b X_t \quad (3)$$

Where:

Y_t: Actual data

n_t: Forecast results from the ARIMA modeling of pre-intervention data (Y_t)

This model allows the study to assess the impact of interventions on property loans by considering both the immediate and lagged effects of policy changes.

The analysis involves identifying government policies (interventions) related to property loans, comparing pre- and post-intervention trends, testing the stationarity of property loan data, and evaluating the significance and duration of the intervention effects. The final phase involves a comprehensive evaluation of the models based on residual analysis and statistical metrics like R-squared values and the Akaike Information Criterion (AIC).

RESULTS AND DISCUSSION

The findings of this study are significant, showing that while the relaxation of LTV/FTV had a minor impact, significant loan growth occurred with the introduction of COVID-19 measures, especially during vaccination-based restrictions and reductions in deposit insurance rates. This suggests that combining financial policies with public health measures can effectively support the property loan market during crises. Policymakers should continue integrating these approaches, using vaccination progress to guide restrictions and financial interventions to boost market confidence. The details of the empirical results is written in the following paragraphs.

This study reveals significant shifts in Indonesia's property loan market dynamics during the COVID-19 pandemic, with a marked decline in loan growth immediately following the pandemic's onset, followed by a delayed but substantial recovery influenced by governmental interventions. The most prominent finding is a 46.5% decrease in average

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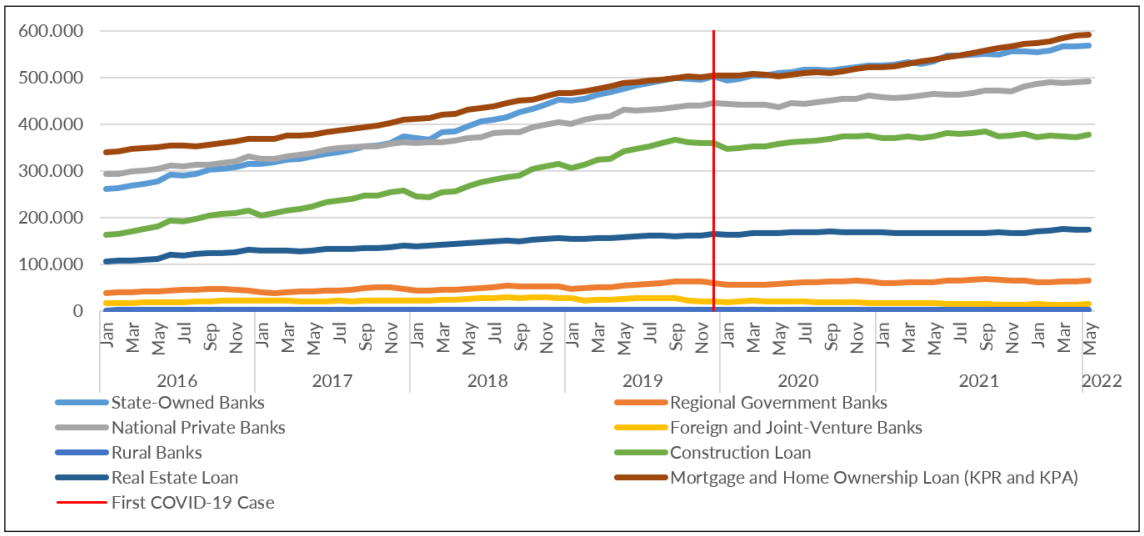
property loan growth post-COVID-19 compared to pre-COVID-19 levels, which was statistically significant (). Additionally, the ARIMA model identified a significant positive impact on loan growth following policy interventions, particularly the PPKM vaccination metric and Deposit Insurance Rate reduction.

These findings indicate that while the initial impact of the pandemic on property loan growth was severe, effective government policies were instrumental in stabilizing and eventually increasing loan growth. The effect of these interventions was observed to be permanent, with Intervention I (pandemic onset) leading to an increase in property loan growth by Rp 11,256.3 billion and Intervention III (PPKM and Deposit Insurance Rate reduction) contributing an additional Rp 9,773.3 billion.

Figure 1. Position of Commercial and Rural Bank Property Loans from January 2016 to May 2022



Since 2016, there has been a steady increase in loans across all categories, with the highest loan value in mortgage (KPR) and KPA categories reaching Rp 590,638 billion, and the highest among banking groups being state-owned banks at Rp 568,032 billion as of May 2022. This resilience is evident even in the face of the COVID-19 pandemic, as shown in Figure 1, which indicates a flattening trend in loan growth. In Figure 2, differences in mean and variance between the pre- and post-COVID-19 phases indicate significant shifts in property loan market dynamics during the pandemic, but also underscore its resilience.

Despite the significant 46.5% decrease in average property loan growth post-COVID-19 relative to pre-COVID-19 ($p = 0.006$), as revealed by a t-test with unequal variances, there is potential for recovery. The normality of both data phases was confirmed using the Kolmogorov-Smirnov test (pre-COVID-19: $p = 0.07$, post-COVID-19: $p = 0.143$). These results, while indicating a decline, also point towards a potential recovery in property loan growth following the pandemic. Besides that, table 3 identified the property loan trends and its mean levels.

Figure 2. Property Loans Growth Month-to -Month

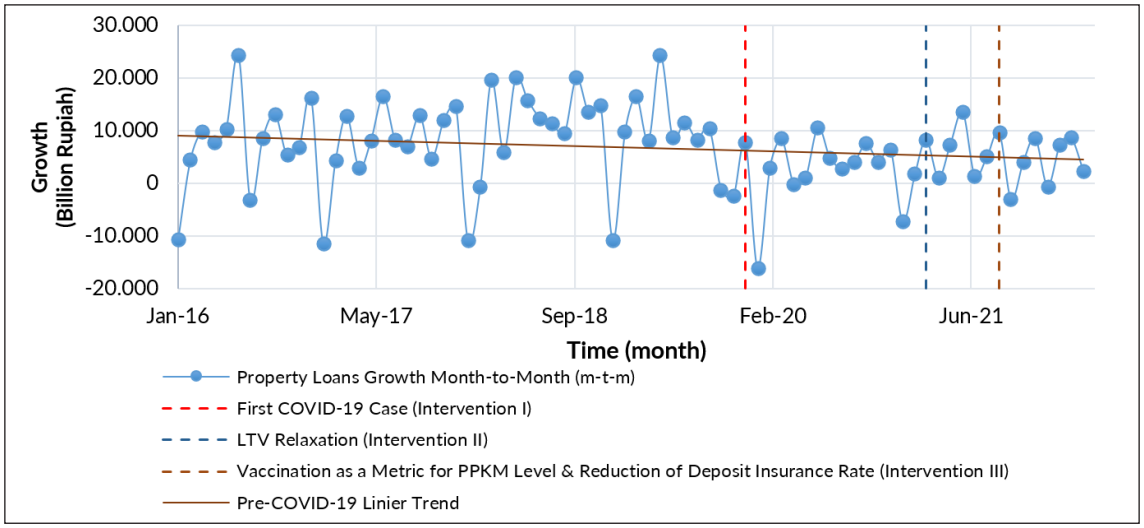


Table 3. Identification of Property Loan Trends and Mean Levels

No.	Segment Phase	Stationarity Test			Trend	Mean Level
		statistics	p-value	Conclusion		
1	Pre-COVID-19	-7.182	0.01	Stationary	Constant	- (Rp 8,540 Billion)
2	Pre-LTV/FTV Relaxation (Post COVID-19)	-4.2353	0.01505	Stationary	Constant	< No. 1 (Rp 2,617 Billion)
3	Post- LTV/FTV Relaxation	-2.0608	0.5492	Not Stationary	Upward	> No. 2 (Rp 6,159 Billion)
4	Post-vaccination Metric for PPKM Levels and Deposit Insurance Rate Reduction	-4.8523	0.01	Stationary	Constant	< No. 3 (Rp 4,796 Billion)

The government implemented various policies to react to the post-COVID-19 decline in property loans and other economic indicators. Figure 2 shows a segmented linear trend based on these policy interventions across the four phases. The vaccination as a metric for PPKM levels in Java and Bali and the Deposit Insurance Rate (Intervention III) reduction is analyzed, anticipating an increase in bank loan demand as public confidence is restored with declining COVID-19 cases and stable banking liquidity.

Figure 3 illustrates a rising linear trend (blue line) in the pre-COVID-19 era, indicating growth from January 2016 to November 2019. This phase also exhibits a seasonal pattern with a recurring decrease in loan growth each January. Post-COVID-19, the three segments — pre-intervention II, post-intervention II, and post-intervention III

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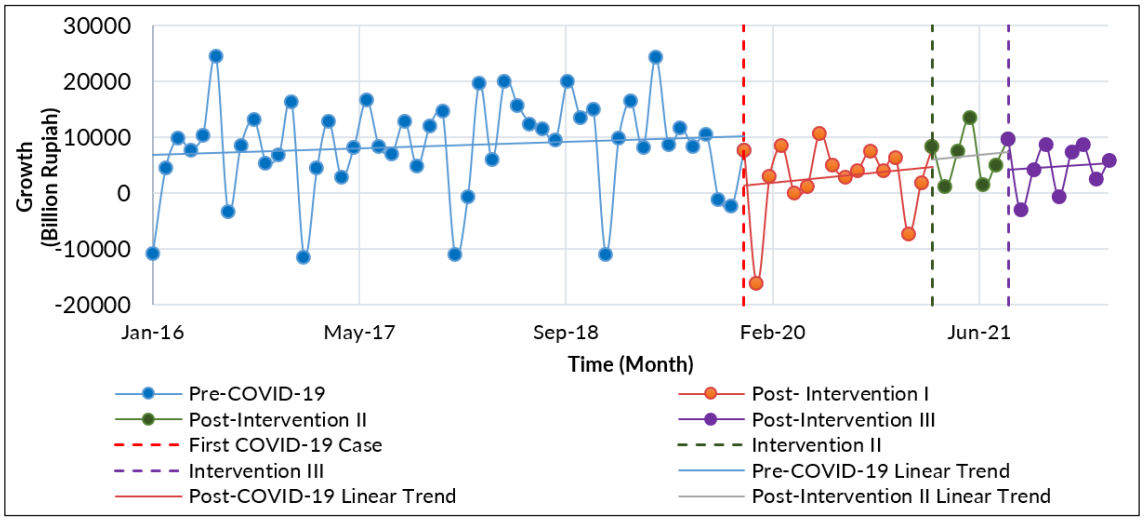
— exhibited rising trends (orange, green, and purple lines), with each phase showing varying mean levels compared to the preceding phase.

Based on the Dickey–Fuller test results, the initial indications of an increasing trend in the second and fourth segments are refuted. It is concluded that the Post-COVID-19 and subsequent Intervention III phases have a stable or constant property loan growth trend despite a decrease in the mean level. The movement patterns of the other two segments were consistent with prior indications.

Figure 3. Month-to-month Property Loan Growth According to Policy Phases



In the second phase of the research, a time series intervention analysis is used to examine the growth of property loans in banking. First, pre-Intervention I data (50 observations) is modeled using the Box-Jenkins procedure. Decomposition methods are employed to identify trends, cyclical, seasonal, and irregular patterns in the time series. Based on Figure 4, there is an increasing trend in pre-COVID-19 data, necessitating regular differencing of 1, although the Dickey-Fuller test shows that the trend increase is not significant. Seasonal differencing of 12 is then applied, as Figure 3 also indicates a seasonal pattern with loan growth declining every January during the pre-COVID-19 pandemic period. After differencing, stationarity testing for the mean is conducted using the Dickey-Fuller Test, resulting in a p-value of 0.01 < 0.05, leading to the rejection of H_0 and concluding that the data remain stationary. ARIMA model identification is then performed using correlogram observations, comparing the ACF and PACF plots of the data with theoretical ACF and PACF plots (Figure 5).

The ACF and PACF plots (Figure 5) after differencing were examined, leading to the selection of several model candidates. These are then tested for parameter significance and goodness-of-fit. $ARIMA(0,1,1)(0,1,0)^{12}$ model was selected as the best fit due to all significant parameters, meeting the white-noise and normal-distribution assumptions, and having the lowest AIC value. It also achieved an R^2 of 0.613. This result indicating that the model explains 61.3% of the variance in Indonesia's loan growth data, while the

remaining 38.7% is influenced by other variables excluded from the model. Consequently, the $ARIMA(0,1,1)(0,1,0)^{12}$ model is utilized for forecasting post-Intervention I data.

Figure 4. Decomposition of Pre-intervention I Data

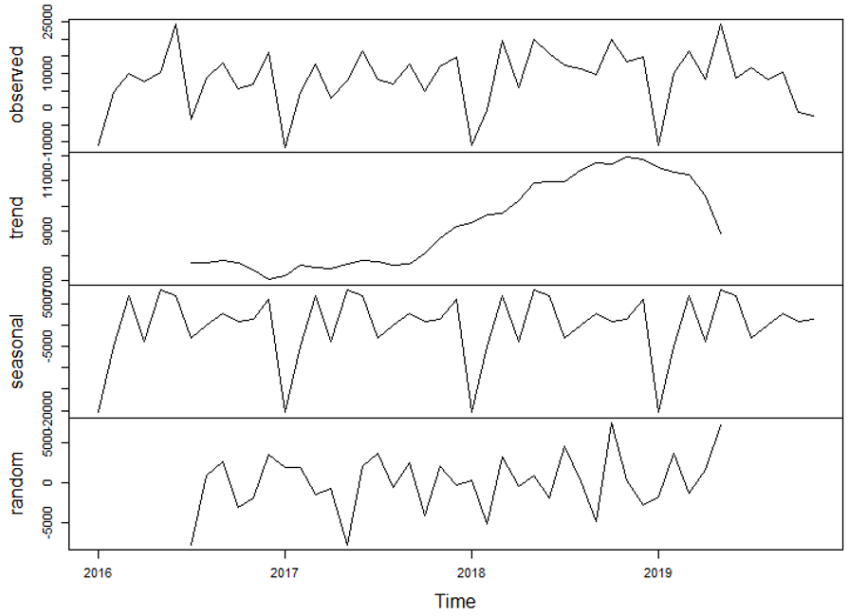
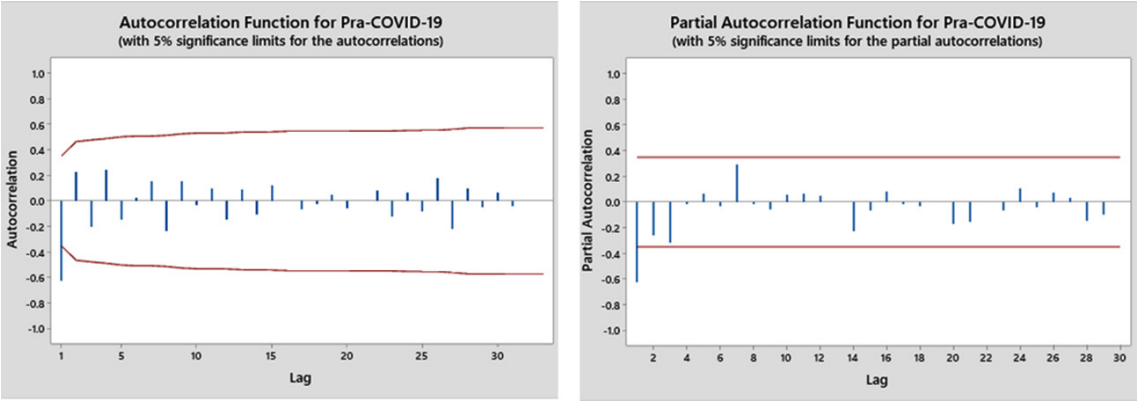


Figure 5. ACF and PACF Plots of Pre-Intevention I Data



The graph in Figure 6, derived from equation (3), spans T-5, five months before Intervention I (July 2019), to T+14, fourteen months after Intervention I (February 2020). Upper and lower bounds were calculated using $3\times\sigma$ (RMSE of modelN_t), yielding ±17,628.26. These bounds (horizontal red lines) help estimate the orders of *b*, *s*, and *r*, while the vertical lines indicate the start of the intervention. The response function, the difference between the forecast from the pre-Intervention I model and actual data, visualizes the effect of Intervention I. Forecasted data represent scenarios in which the intervention did not occur (counterfactual), with bounds determining the reasonableness of the difference or effect.

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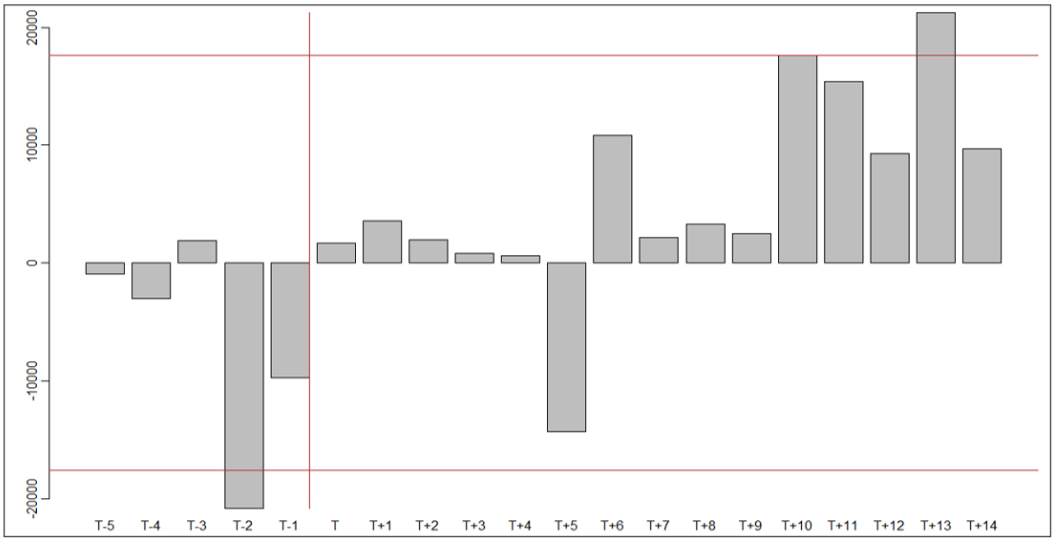
Table 4. The Parameter Significance Test of the Model Candidate $N_{t.0}$

Model Candidate $N_{t.0}$	Parameter Significance					Residual Assumptions	**GoF
	Type	Estimation	SE	t-value	p-value	*White Noise & Normal Dist.	AIC
ARIMA(1,1,0) $(0,1,0)^{12}$	AR 1	-0.622	0.137	-4.53	0.000	√	704.65
ARIMA(0,1,1) $(0,1,0)^{12}$	MA 1	0.746	0.167	-4.46	0.000	√	702.38
ARIMA(1,1,1) $(0,1,0)^{12}$	AR 1 MA 1	-0.292 0.596	0.270 0.291	-1.08 2.05	0.287 0.049	√	702.78
ARIMA(2,1,1) $(0,1,0)^{12}$	AR 1 AR 2 MA 1	-1.553 -0.621 -0.895	0.238 0.168 0.231	-6.53 -3.70 -3.87	0.000 0.001 0.001	√	704.69

* √ Assumption Fulfilled, × Assumption Not Fulfilled
** Goodness of fit

Figure 6. Graph of the Response Function for Forecasting Data $N_{t.0}$



The graph analysis estimates the orders as b_I =10, s_I = 0, and r_I = 0. Parameter significance is tested with hypotheses H_0 : ∅ or θ = 0 (ARIMA model parameters are not significant) and H_1 : ∅ or θ ≠ 0 (ARIMA model parameters are significant), at α = 5%. All parameters of $ARIMA(0,1,1)(0,1,0)_{12}$ and the orders of b_I, s_I, and r_I are significantly impactful, meaning Intervention I's effect on Indonesia's property loan growth is significant at T+10 (October 2020), with a permanent effect as the intervention function follows a Step function. Here, are the estimated parameter results.

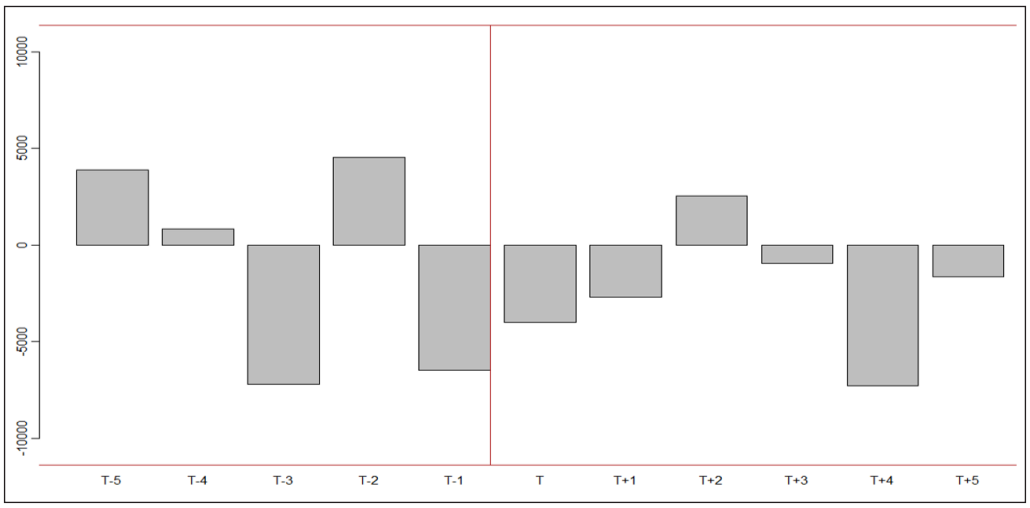
The model indicates no significant changes in property loan growth during the COVID-19 pandemic, from December 2019 to September 2020, compared with the counterfactual forecast. This implies relative stability in property loan growth despite the onset of Intervention I (the pandemic) until a marked increase in October 2020. Contrary to the general economic downturn after the COVID-19 pandemic, property

loans experienced an increase. The post-Intervention I model is then employed to predict data following Intervention II, with a response function graph depicted in Figure 7.

Table 5. The Parameter Significance Test of the Model Candidate $N_{t.0}$

Post-Intervention I Model ($N_{t.0}$)	Parameter Significance					Residual Assumptions	GoF
	Type	Estimation	SE	t-value	p-value	White Noise & Normal Dist.	Type
ARIMA(0.1.1) $(0.1.0)^{12}$ with $b_I = 10.s_i = 0.r_I = 0$	MA 1 (θ_1)	0.77470	0.167	7.39	0.0001	√	805.13
	($\omega_{0.I}$)	11904.8	4734.1	2.51	0.016		

Figure 7. Response Function for Forecasting Data $N_{t.1}$



The response function spans T-5 (five months prior to Intervention II (October 2020), to T + 5, five months following Intervention I (August 2021). The response displayed in Figure 8 implies that post-Intervention II, from March to August 2021, there were no significant changes surpassing the established bounds on Indonesia's property loan growth. This indicates two possible scenarios: first, the LTV/FTV relaxation policy did not significantly enhance loan growth during March-August 2021; second, significant effects of post-Intervention II may emerge after the post-Intervention III period ($T + a.a > 5$). assuming post-Intervention III effects are negligible. For the first scenario, the post-Intervention I model is employed to estimate the post-Intervention III model because of the insignificant effects of post-Intervention II. The forecast results for post-Intervention III are then used to derive the response function $Nt._2$, Thus, the post-Intervention I period spans from December 2019 to August 2021, marking the start of Intervention III.

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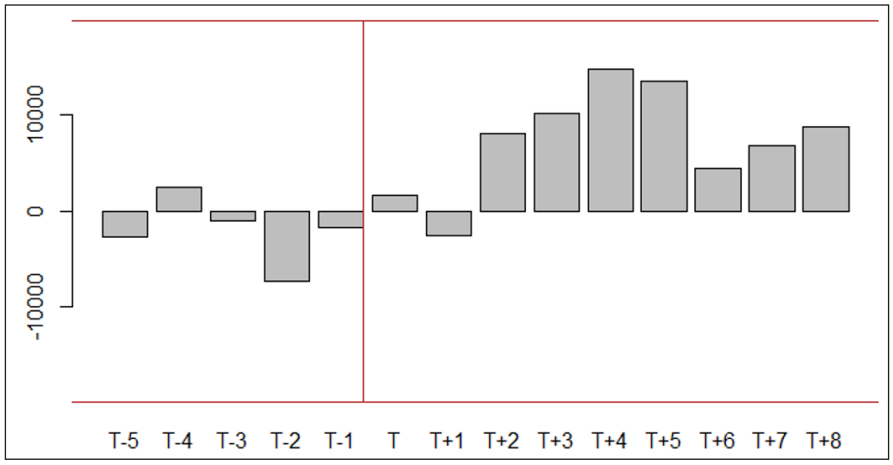
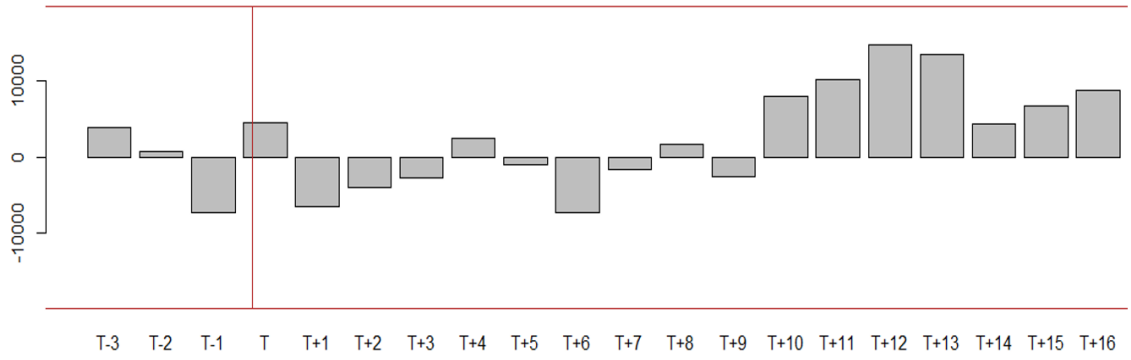
Figure 8. Response Function for Forecasting Data $N_{t.2}$ in the first scenario model



Based on Figure 8, no significant changes were observed in Indonesia's property loan growth post-Intervention III from September 2021 to May 2022. However, a noticeable and consistent spike in the graph from T+2 to T+8 prompts a test of significance for the orders $b_{III} = 2.s_{III} = 0.$ and $r_{III} = 0$ in the model. Subsequent testing and parameter estimation affirm the significant influence of all $ARIMA(0.1.1)(0.1.0)^{12}$ parameters and the specified orders for Interventions I and III, meaning that Intervention I's effect on property loan growth was significant at T+10, and Intervention III's effect was significant at T+2. Both interventions had delayed but permanent effects.

Figure 9. Response Function for Forecasting Data $N_{t.3}$ in the Second Scenario Model



In the second scenario, the post-Intervention I model estimates the post-Intervention II model, assuming Intervention III's insignificance, covering the period from March 2021 to May 2022. Figure 9 presents a response function graph from T-3 three months before Intervention II (December 2020) and until the end of Intervention II (May 2022). The graph shows no significant changes in Indonesia's property loan growth after Intervention II. However, due to the noticeable spikes from T+10 to T+16, the orders b_{II} = 9,10 or 11; s_{II} = 0; and r_{III} = 0 are tested for significance. Testing and parameter estimation reveal no significant impact on any potential orders for b (9, 10, or 11), s, and r in

Intervention II. Consequently, Intervention II's (LTV/FTV relaxation) effect on property loan growth in Indonesia is not felt significantly, regardless of Intervention III's effects. The results of the significance test for the two model scenarios are presented, with the second scenario displaying the model with the lowest AIC value for orders *b, s,* and *r*.

All parameters in the final model were found to be significantly impactful. The effects of Intervention I (COVID-19 cases) became significant from T+10, or ten months after the intervention, in October 2020, and the effects of Intervention III (Time of vaccination's role as a metric for Public Activity Restrictions (PPKM) levels in Java and Bali & Decrease in Deposit Insurance Rate) became significant from T+2 or two months after, in November 2021. Both interventions had permanent effects.

The significant and lasting impact of the COVID-19 on property loan growth in Indonesia, as identified in this study, contrasts with several pre-pandemic studies that suggested that economic downturns typically lead to a reduction in property loans. For example, (Paramitha et al., 2020) found that financial instability or uncertainty generally suppresses loan growth during normal economic conditions. However, the resilience observed in Indonesia's property loan market during the pandemic aligns with findings by (Cui, 2023), who noted that crisis-driven economic policies could stabilize or even stimulate property markets under certain conditions. The observed increase in loan growth ten months after the pandemic's onset also supports theories of delayed economic responses, in which initial shocks are mitigated by subsequent policy interventions, leading to a recovery in lending activities.

Table 6. Parameter Significance Test for Final Model Candidates

Final Model	Parameter Significance					Residual Assumption	GoF
	Type	Estimation	SE	t-value	p-value	White Noise & Normal Dist.	AIC
First Scenario *ARIMA*(0.1.1)(0.1.0)^{12} with	MA 1 (θ_1)	0.777	0.088	8.79	0.0001	×	1102.1
$b_I = 10.s_I = 0.r_I = 0$	($\omega_{0.I}$)	11879.4	3436.9	3.46	0.011		
$b_{III} = 2.s_{III} = 0.r_{III} = 0$	($\omega_{0.III}$)	11646.2	4793.5	2.43	0.0187		
Second Scenario *ARIMA*(0.1.1)(0.1.0)^{12} with	MA 1 (θ_1)	0.777	0.088	8.79	0.0001	×	1103.8
$b_I = 10.s_I = 0.r_I = 0$	($\omega_{0.I}$)	11879.4	3436.9	3.13	0.003		
$b_{II} = 9.s_{II} = 0.r_{II} = 0$	($\omega_{0.II}$)	10088.5	3227.6	2.00	0.051		

Furthermore, the results resonate with the findings of Svobodová and Hedvičáková (2021), who highlighted the role of targeted financial policies in mitigating the economic impact of global crises, particularly in sectors like real estate. This suggests that the Indonesian government's early and ongoing policy measures, such as deposit insurance

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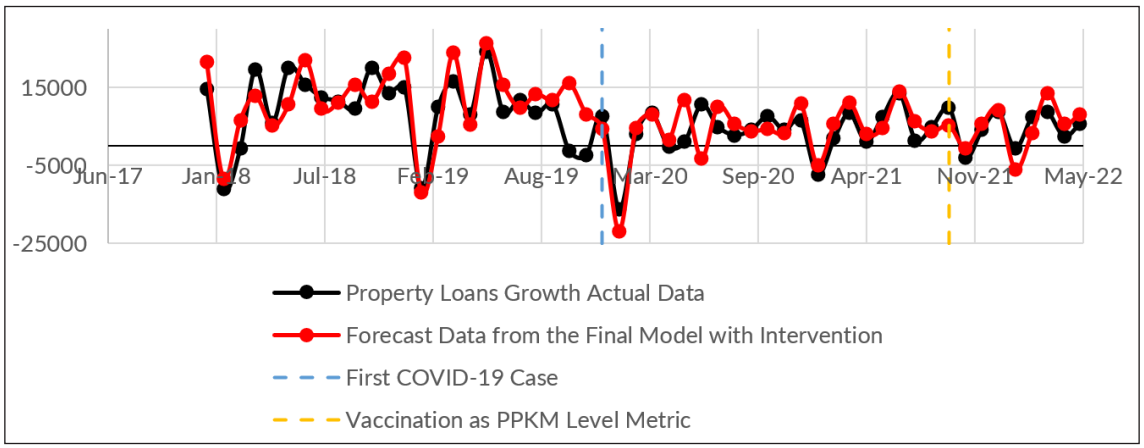
rate adjustments, played a crucial role in maintaining confidence and liquidity in the property loan market, thereby mitigating the expected downturn.

Table 7. Parameter Significance Test of the Final Model

Final Model	Type	Parameter Significance			Residual Assumption	GoF
		White Noise & Normal Dist.	SE	p-value	White Noise & Normal Dist.	AIC
First Scenario *ARIMA*(0.1.[1.7.8]) $(0.1.0)_{12}$ with	MA 1 (θ_1)	0.686	0.106	0.0001	√	1095.61
	MA 1,2 (θ_7)	-0.346	0.139	0.016		
	MA 1,3 (θ_8)	0.447	0.134	0.002		
$b_I = 10.s_I = 0.r_I = 0$	($\omega_{0.I}$)	11256.3	3561.4	0.003		
$b_{III} = 2.s_{III} = 0.r_{III} = 0$	($\omega_{0.III}$)	9773.3	4820.2	0.019		

According to the final model, Interventions I and III have indirect and permanent impacts of Rp 11,256.3 billion and Rp 9,773.3 billion, respectively. This indicates an increase in property loan growth post the COVID-19 pandemic onset in October 2020 of Rp 11,256.3 billion. Additionally, the PPKM policy, with vaccination achievements and the reduction in deposit insurance rates, significantly stimulated property loan growth from November 2021 to Rp 9,773.3 billion.

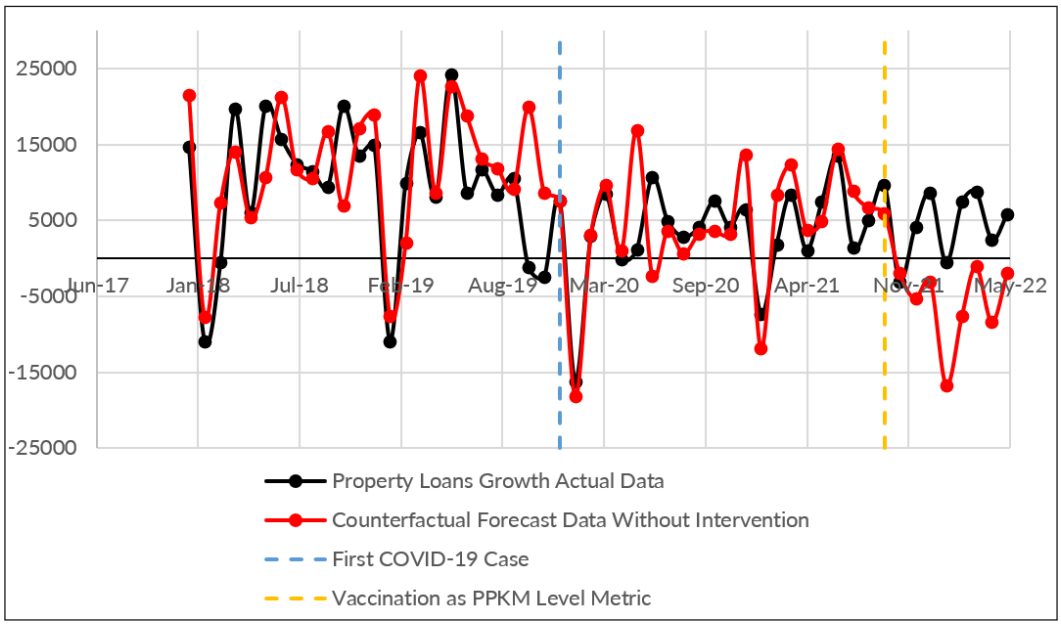
Figure 10. Time Series Plot of Fitted Values of Final Model vs. Actual Data on Indonesia's Property Loan Growth



This study's ARIMA model analysis further confirms the significance of these policy interventions, showing that the effects of the COVID-19 on property loan growth were not only delayed but also sustained over time. The government's proactive measures, such as the reduction in Deposit Insurance Rates, have likely bolstered public confidence, contributing to a recovery in the property loan sector. This resilience contrasts with some

earlier predictions of long-term downturns, underscoring the effectiveness of well-timed policy responses.

Figure 11. Time Series Plot of Counterfactual Forecast vs. Actual Data on Indonesia's Property Loan Growth



The time series plot of the forecasted data assuming no intervention (counterfactual) and actual property loan growth data are presented in Figure 10. Meanwhile, Figure 11 displays a time series plot of the fitted values (estimated results) from the model alongside actual property loan growth data for Indonesia. The data are presented from December 2017 to May 2022. Visually, adding Intervention I (x_1) and III (x_3) variables improve the model, making forecasts more closely resemble actual data. The comparison of these two graphs indicates that Intervention I and III variables have a significant impact.

CONCLUSION

This study examined the impact of COVID-19-related financial policies on Indonesia's property loan market, focusing on LTV/FTV ratio relaxation, vaccination-based public activity restrictions, and changes in deposit insurance rates. The findings reveal that while LTV/FTV relaxation had a limited effect, substantial loan growth occurred following COVID-19 measures, particularly during vaccination-based restrictions and deposit insurance rate reductions. The results highlight that combining financial policies with public health measures can effectively support the property loan market during crises.

Policymakers should consider maintaining this integration, using vaccination achievements as a metric for public restrictions alongside financial interventions like deposit insurance rate cuts to stabilize market confidence. Further research is recommended to explore borrower risk levels and collaboration with property stakeholders, which may

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explain the limited impact of LTV/FTV relaxation. Understanding these factors could provide deeper insights for future policy improvements.

ACKNOWLEDGMENT

The author expresses profound gratitude to LPS for their essential support, which played a crucial role in facilitating the research presented in this paper. Additionally, the author would like to extend sincere thanks to the Department of Statistics at Institut Teknologi Sepuluh Nopember (ITS) for their valuable assistance and resources throughout the research process.

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