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Household Debt Behavior and Response to Interest Rates and LTV Policy*

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Abstract

Household debt has a significant role in influencing financial stability. This study aims to determine the impact of household characteristics and interest rates on household credits. Furthermore, determine the impact of the amount of LTV policies on interest rates on growth and potential risks of home loans and household credits. The study uses data from the Financial Services Authority (OJK), namely Financial Institution Information System, and data Household Balance Survey from 2017 to 2019. This study uses two steps: ordinary least squares (OLS) and autoregressive distributed lag (ARDL). In the OLS regression, household credit is the dependent variable, and collectability and income class are independent dummy variables. Analysis with time series regression using ARDL. The estimation results show that the increase in household credit is influenced by the characteristics of income, age, and interest rates. For household credits above quantile 0.75, interest rates do not affect the household. In the short term, loosening LTV will increase home loan growth and encourage an increase in potential credit risk. In the long term, losing LTV will increase housing loan growth and the potential threat. The study recommends using interest rates and LTV to encourage household credit, including home loans.

Keywords: Household Saving, Borrowing, Debt, and Wealth, Household Behavior, Interest Rates, Loan to Value

1. Introduction

1.1 Introduce the Problem

The global financial crisis in 2008 showed that the household sector had a significant role in influencing financial system stability. The crisis was caused by the household's excessive increase in home loans. The accumulation of credit distribution, especially subprime home loans, to the household sector that is not prospective in large numbers

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* The results and opinions expressed in this paper are the authors' own and do not necessarily represent those of Central Bank of Indonesia.

quickly causes instability and leads to a crisis. Based on the crisis, more analysis and monitoring of the vulnerability of the household sector has been carried out. In addition to its role as a source of financing, the household sector is also the primary user of financing for banking financial institutions. The household importance role was explored by Jensen and Johansen (2017). The global financial crisis in 2007 led to a reduction in household credits and savings in banking, which caused the recovery crisis process to be more difficult. Household debt also plays a role in aggregate spending behavior, so it is very important to improve economic performance, such as economic recovery after a shock (Zabai, 2017). One of the reasons for the growing trend of household debt in Indonesia is the growth of credit cards and information technology-based lending and borrowing services or Fintech.

1.2 Explore the Importance of the Problem

Indonesia's household debt which continues to increase every year will impact the country's economic decline. This is because the household sector is facing a situation that makes it more vulnerable to the risk of debt entanglement due to the difficulty of making loan payments. The ratio of household debt to Gross Domestic Product (GDP) has increased significantly, increasing 10.27% in December 2018. However, the ratio of Indonesian household debt to GDP is still relatively low, occupying the fifth-lowest position among countries G20. Although Indonesia's household debt ratio is still relatively low, this needs to be watched out for so that there is no shock to financial stability. In addition, several factors significantly contribute to the substantial expansion of household debt from both the demand and supply sides. One of them is related to asset prices, especially housing prices, which often contribute to increasing household loans (Bank for International Settlements. et al., 2009).

Moreover, households with high debt levels can increase vulnerability to financial system stability. Therefore, the government has an essential role in housing security efforts, such as through the LTV policy. In addition, the household's behavior and characteristics are also important. This study examines the impact of household characteristics and commercial interest rates on household credits, the Impact of LTV policies and interest rates on growth, and the potential risks of home loans and household credits. An impact evaluation analysis complements the impact estimate.

1.3 Describe Relevant Scholarship

1.3.1. Household Credit

The role of household credit is significant in maintaining financial stability. On the one hand, household credit can relieve a household's financial shock while being a source of investment in high-returning assets such as housing and education. On the other hand, a household's high credit is also followed by increased potential risks that increase the household's vulnerability and the entire economy. Zabai (2017) conducted an in-depth study of the household debt challenges on the macroeconomic and financial stability, including some options for dealing with it. Macroeconomic and financial stability can be implicated by the level and distribution of household debt that affects the responsiveness of aggregate demand and aggregate supply in the wider economy to shocks. A household's debt stock affects its ability to deal with an unanticipated deterioration in its circumstances, such as lower income, lower asset prices, or higher interest rates. Zabai (2017) explained some things to consider. First, draw down savings. Second, the more illiquid the wealth financed through debt, the higher the cut in consumption. Third, the interest rate sensitivity of a household's debt service burden is likely to matter. Lastly, high debt (relative to assets) can make a household less mobile and hence less able to adjust by finding a new or better job in another town or region.

In addition, research results show a boost-bust pattern. Higher debt boosts growth in the near term but reduces it over a longer horizon. In the long-run effects, household debt significantly negatively affects GDP growth. Zabai (2017) also suggests that there could be a complementarity between current macroprudential measures seeking to dampen household credit growth and future expansionary monetary policy. Macroprudential instruments such as loan-to-value caps (on the borrower side) or credit growth caps (on the lender side) are designed to force borrowers

and lenders to internalize the impact of large credit expansions on the probability of a systemic crisis, thereby aligning private and social incentives. So, this research will analyze more in-depth household behavior to other macroeconomics variables related to a macroprudential instrument (loan to value), including analysis during the pandemic.

1.3.2. Loan to Value Ratio (LTV)

Several studies have analyzed the impact of LTV on the financial system's stability. Bian et al. (2018) in the United States showed that loosening LTV up to 95% pushed the increase in home loans up to 15.01% compared to if there was no LTV policy. Morgan, Regis, and Salike (2015) showed that tightening the LTV ratio can decrease mortgage growth. In other words, the loosening LTV ratio increases the portion of bank credit distribution, thus potentially increasing the nominal amount of loans or credits disbursed. Morgan, Regis, and Salike (2015) conducted in 10 Asian countries showed that a 1% tightening of LTV can decrease credit by 5.6%. Other LTV studies also analyzed the impact of LTV policies on mortgage risk. Craig and Hua (2011), Gerlach and Peng (2005), and Wong et al. (2004) showed that tightening LTV has the potential to reduce credit growth and increase the resilience of the banking sector. In other words, the loosening LTV can potentially increase the disturbing credit. If less is followed by good risk management, the increase in credit can increase the potential for credit risk.

The LTV policy in Indonesia for home loans (including motor vehicle loans) was first enacted in Indonesia in 2012. This provision is stated in Bank Indonesia Circular Letter No.14/10/DPNP dated March 15, 2012, concerning the Application of Risk Management to Banks That Provide Home Loans and Motor Vehicle Loans. The LTV ratio is set at a maximum of 70%. LTV policies in the later period are applied following economic developments with a *countercyclical* approach.

This study is expected to provide results regarding the impact of LTV policies on the risk and growth of both household credit and homes in Indonesia. This research discusses home loans and household credits in Indonesia related to the growth and risks using macroeconomic variables, such as inflation, GDP, interest rates, growth in export commodity prices, annual growth in the housing price index, and LTV as a macroprudential instrument. Impact estimation equipped with impact evaluation analysis.

1.3.3. Household Characteristics

The use of components that become household characteristics can be different in the research. Differences in household characteristics such as household head age and income also show differences in behavior in credit demand from banks, including credit risk. Swain (2008) shows that net wealth owned, family size, and dependency ratio affect India's demand and credit supply for agricultural households.

A household's characteristics in the form of age become one-factor determining credit demand. The higher the age, the preference for risk from financing becomes different, thus impacting the demand for financing. Fortin and Leclerc's study (2007) showed that the increase in age is in line with the decrease in productivity and the ability to pay, thus lowering the chances of receiving banking credit.

Characteristics of households in this research are age, income, and collectability. However, commercial interest rates are also included in the modeling, which is expected to affect household credit negatively.

1.4 State Hypotheses and Their Correspondence to Research Design

This research is expected to answer the objectives, and the results are by the hypothesis. Interest rates, including policy rates, household, home loans, and commercial, are expected to affect household credit negatively. The higher the income group is expected to increase household credit related to household characteristics. Contrarily, collectability is expected to give the opposite direction to household credit. The higher the housing price index, it is estimated that the need for home loans will also increase household credit. Annual growth in export commodity prices is also expected to be in line with the increase in household credit growth. Finally, the higher LTV is

expected to have a positive relationship, which means loosening LTV will increase home loans to be effective as a countercyclical household credit.

2. Method

2.1 Data Preparation

This study used both micro and macro data of household financial data. The data used for the first objective was sourced by *Sistem Informasi Lembaga Keuangan* (Financial Institution Information System) from *Otoritas Jasa Keuangan* (Financial Services Authority). This study used sample data that represents the entire data. Sampling was carried out on SLIK data for December 2017, 2018, and 2019. The sampling method used is Proportional Stratified Random Sampling. The amount of sample was based on the Slovin formula in Sugiono (2011). The total number of SLIK data was more than 450 million; the cleaning process reduced the number of samples to 9,056. SLIK data used in this study were household credit installments, household income, customer age, household credit collectability, and interest rates.

The data used for the second objective is data related to macro indicators. Data on household credit, home loan, loan at risk for household credit, loan at risk for a home loan, household savings, household credit interest rates, and home loan credit rates are sourced from *Laporan Bulanan Umum* (General Monthly Report) Central Bank of Indonesia. Central Bank of Indonesia sources exchange rates, BI-7 Day Reverse Repo Rates, and LTV policies. Indonesia's economic growth and inflation data are extracted from *Badan Pusat Statistik* (Central Bureau of Statistics). Indonesian Export Commodity Price Index data from Bloomberg. The data used is quarterly time-series data from 2010 to 2020.

Furthermore, data for impact evaluation is sourced from Survey *Neraca Rumah Tangga* (Household Balance Survey) from 2017 to 2019. The data is longitudinal for the same respondents during the observation period. This study's most widely used SNRT information is home credit installments and home purchases without credits.

The SNRT data cleansing process resulted from 2,692 longitudinal respondent data each year, where previously the data was 4000 in 2017, 5000 in 2018, and 6000 in 2019. Data preparation for the first objective analysis is done by arranging longitudinal respondents into two groups. The first group is respondents who buy houses with credit, represented by increased installments with 137 respondents. The second group is respondents who do not have a home loan. A random sampling of 137 respondents is carried out because many respondents. Thus, only 274 respondents are used in the analysis.

2.2 Modelling Estimation

The analysis in this study is divided into two stages. The first stage is to estimate the impact of different household characteristics on household credits based on SLIK data using ordinary least square (OLS) regression with dummy variables. This approach does not attach a time dimension. Therefore, each individual is considered a different observation. OLS regression is one of the methods in simple and multiple regression equations. The independent dummy variables used in the OLS estimation are collectability and income class. So, the right model to use is dummy regression. The second stage is analysis with a time-series regression approach based on macroeconomic indicator data.

2.2.1. Ordinary Least Square

OLS regression basic equation:

$$Y_i = \alpha + \beta X_i + \varepsilon_i \tag{1}$$

Given the relatively large variation in household credits, this study estimates a quantile regression approach to estimate the effects of household characteristics on various groups of household credits.
Quantile regression equation:

$$Y_i = \eta_\theta X_{\cdots i} + \varepsilon_{\theta i} \tag{2}$$

The household credit equation model refers to the research of Lin et al. (2019) and Morgan et al. (2015):

$$\ln(\text{household credit})_i = f(\text{income, age, collectability, interest rate, commercial interest rate} \qquad (3)$$

ln(household credit) is personal loan debit balance value. Income is income group dummy (lowest to highest, group 1 (base) – group 7). Age is expressed in years. Collectability is dummy (collectability 1 (fluent) (base) – collectability 5 (lost)). Commercial interest rate is interest rate expense weighted relative to loan size (%).

2.2.2. Autoregressive Distributed Lag

Analysis in the second stage uses autoregressive distributed lag (ARDL) and ordinary least squares (OLS).

ARDL regression equation:

$$Y_t = \beta_0 + \emptyset_1 Y_t - 1 + \cdots + \emptyset_p Y_t - p + \beta_0 X_t + \beta_1 X_t - 1 + \cdots + \beta_q X_{t.q} + \varepsilon \qquad (4)$$

Estimated household and home loan models:

$$\text{GHousehold\_credit}_i = f(\text{GSavings}_t, \text{PR}_t, \text{GNT}_t, \text{Inflasi}_t, \text{GIHKEI}_t) \qquad (5)$$

$$\text{GHousehold\_credit}_i = f(\text{GSavings}_t, \text{HHIR}_t, \text{GNT}_t, \text{Inflasi}_t, \text{GIHKEI}_t) \qquad (6)$$

$$\text{GHomeloan\_credit}_i = f(\text{GSavings}_t, \text{PR}_t, \text{GNT}_t, \text{GIHPR}_t, \text{GIHKEI}_t, \text{LTV}_t) \qquad (7)$$

$$\text{GHomeloan\_credit}_i = f(\text{GSavings}_t, \text{HLIR}_t, \text{GNT}_t, \text{GIHPR}_t, \text{GIHKEI}_t, \text{LTV}_t \qquad (8)$$

GHousehold_credit is the annual growth of household credits (%), GHomeloan_credit is home loan annual growth (%), GSaving is a yearly growth of individual savings (%), PR is the policy interest rate (BI7DRRR), HHIR & HLIR is weighted average commercial interest rates for household credits and home loans (%), GNT is an annual growth of the Rupiah exchange rate against the US dollar (%), inflation is yearly inflation rate (%). GIHPR is the housing price index annual growth (%), GIHKEI is the yearly growth in Indonesia's export commodity prices, LTV is dummy (2017=1 (2016 loosening LTV), other periods=0)

Credit risk model:

$$\text{LAR\_HH}_i = f(\text{GHousehold\_credit}, \text{DNT}_t, \text{GGDP}_t, \text{Inflation}_t, \text{HHIR}_t) \qquad (9)$$

$$\text{LAR\_HL}_i = f(\text{GHomeloan\_credit}, \text{GGDP}_t, \text{Inflation}_t, \text{HHIL}_t, \text{LTV}_t \qquad (10)$$

LAR_HH dan LAR_HL is loan at risk, a proxy for household and home loan credit risk. GHousehold_credit and GHomeloan_credit are annual growth of household credits and home loans (%). DNT is the exchange rate deviation in Rupiah. GGDP is national economic growth (%). Inflation is the annual inflation rate (%). HHIR & HLIR is weighted average commercial interest rates for household credits and home loans (%). LTV is dummy (2017=1 (2016 loosening LTV), other periods=0)

The estimation steps for impact evaluation of a policy, which in this study is the LTV policy, especially when there is a loosening using the DID approach. This approach analyzes the impact of economic policy by comparing before and after the policy on groups affected by the policy and not affected by the policy as a counterfactual.

The estimation method of the DID approach in this study refers to Albouy (2004):

$$\hat{\delta}_{DD} \; \bar{Y}_1^T - \bar{Y}_0^T - (\bar{Y}_1^C - \bar{Y}_0^C)$$

The general form of DID estimators:

	Pre	Post	Post-Pre-Difference
Treatment	$\bar{Y}_0^T$	$\bar{Y}_1^T$	$\bar{Y}_1^T - \bar{Y}_0^T$
Control	$\bar{Y}_0^C$	$\bar{Y}_1^C$	$\bar{Y}_1^C - \bar{Y}_0^T$
T-C Difference	$\bar{Y}_0^T - \bar{Y}_0^C$	$\bar{Y}_1^T - \bar{Y}_1^C$	$\bar{Y}_1^T - \bar{Y}_1^C - (\bar{Y}_0^T - \bar{Y}_0^C)$

The treatment group in this study are SNRT respondents who have home loan installments, while the counterfactuals are respondents who buy a house in cash.

3. Results

3.1. First Stage - the impact of different household characteristics on household credits

3.1.1. Household credits

Household credit behavior is when policy interest rates tend to be high; household credits tend to decline. In contrast, household credits increase when policy interest rates are low, except in 2020, due to the impact of the COVID-19 pandemic.
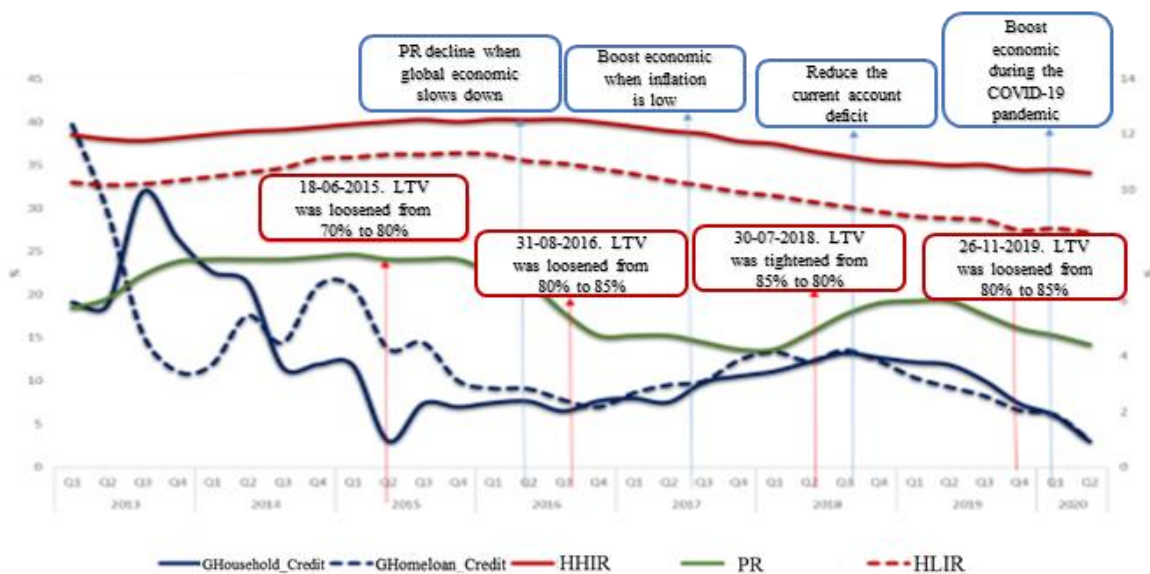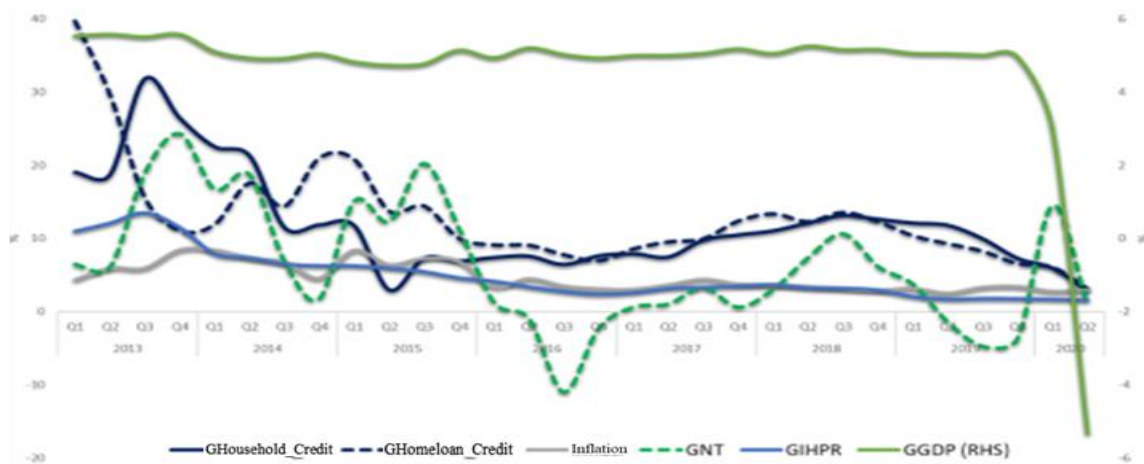

Figure 1: Developments in household and home loan credit growth in response to interest rate and LTV policy
Source: Central Bank of Indonesia and Central Bureau of Statistics (2020)

The LTV loosening in the middle of 2015 has not been able to encourage the growth of home loans. Therefore, a rebound was made in 2016 to increase the growth of home loans. In 2018, LTV was again tightened to suppress home loan growth. Meanwhile, efforts to push back credit through loosening LTV at the end of 2019 were hampered by the COVID-19 pandemic. In line with developments in macroeconomic conditions, household credits and home loans showed a pattern in line with the exchange rate in the 2015 to 2019 period. An increase in exchange rate growth (depreciation) tends to be followed by an increase in household credit and home loan growth. In general, the growth of household credit and home loans from 2018 to 2020 tends to decline in line with the slowdown in the growth of the Residential Property Index Price (GIHPR), inflation, and economic growth (GGDP). The declaration in IHPR from 2013 is estimated to represent property sluggishness. The Central Bank of Indonesia pushed for increased home loans to boost property performance through three LTV loosening policies in 2015, 2016, and 2019.

Figure 2: Developments in household credit growth and home loan credit when there are changes in economic growth, inflation, IHPR, and exchange rate

Source: Central Bank of Indonesia and Central Bureau of Statistics (2020)

In addition, this study also analyzes the relationship between policy interest rates and commercial interest rates at the customer level. The results of the analysis answer issue of the policy interest rates influence the behavior of household credits and home loans. Suppose policy interest rates significantly affect commercial interest rates for household credits and home loans. In that case, it can be concluded that changes in policy interest rates also affect the behavior of household credits and home loans.

3.1.2. Estimation of the impact of different household characteristics on household credit

Table 1: OLS results with variable lag policy interest rate and household interest rate

Variable	Coefficient	
Dependent Variable	Household Interest Rate	
Constant	9.2728	***
PR	0.1531	
PR(-1)	-0.0434	
PR(-2)	-0.1972	
PR(-3)	0.5366	**

Note : Statistically significant at α *:10%, **:5%, ***:1%
Source: Processed data

Based on estimation results, the policy interest rate (PR) significantly positively affects the household commercial interest rate (HHIR). OLS regression results with variable lag show that the probability value of the policy interest rate regression p-value on household commercial interest rate is 0.048 or less than the 5% significance level, and the positive regression coefficient is 0.537 at lag 3 (Table 1). Policy interest rates positively affect household credit interest rates at a 3-quarter lag.

Table 2: OLS results with variable lag policy interest rate and home loan interest rate

Variable	Coefficient	
Dependent Variable	Home Loan Interest Rate	
Constant	6.2318	***
PR	0.3053	
PR(-1)	-0.0453	
PR(-2)	-0.2522	
PR(-3)	0.6578	**

Note : Statistically significant at α *:10%, **:5%, ***:1%
Source: Processed data

The estimation results show that policy interest rate (PR) significantly positively affects home loan interest rate (HLIR) at lag 3. OLS regression results with a variable lag show that the p-value of policy interest rate regression on home loan interest rate is 0.017 ($< 5\%$). The positive regression coefficient value is 0.658 at lag 3 (Table 2). This means that policy interest rates positively affect home loan interest rates with a 3-quarter lag.

The impact of household characteristics and commercial interest rates can be seen from the ordinary least square estimation results with and without quantile applications.

Table 3: OLS results with a dummy variable

Variable	Coefficient	
Dependent Variable	ln(Household Credit)	
Constant	17.026	***
Commercial Interest Rate	-1.449	***
Income	0.216	***
Collectability	-0.208	***
Age	0.033	***

Note: Statistically significant at α *:10%, **:5%, ***:1%

Source: Processed data

The estimation results show that commercial interest rates and collectability negatively and significantly affect household credits. The p-value is smaller than the 1% alpha significance level. The coefficient value of the commercial interest rate variable is -1.449, while the collectability is -0.208 (Table 3). Thus, it can be concluded that the higher the commercial interest rate and collectability, the more household credit will decline. Meanwhile, income and age variables positively and significantly affect household credit. The p-value is smaller than the 1% alpha significance level. The coefficient value of the income variable is 0.216, while the age variable is 0.033 (Table 3). This means that the higher the income and age, the household credit will tend to increase.

Table 4: Estimation results based on quantile regression

Dependent Variable	ln(Household Credit)	
Quantile 0.25		
Variable	Coefficient	
Constant	17.625	***
Weighted Interest Rate	-10.142	***
Income	0.0997	***
Collectability	-0.2171	***
Age	0.0313	***
Quantile 0.5		
Variable	Coefficient	
Constant	17.8222	***
Weighted Interest Rate	-6.4635	***
Income	0.1582	***
Collectability	-0.1689	***
Age	0.0275	***
Quantile 0.75		
Variable	Coefficient	
Constant	17.6125	***
Weighted Interest Rate	-0.1794	
Income	0.2533	***
Collectability	-0.0791	***
Age	0.0272	***

Note: Statistically significant at α *:10%, **:5%, ***:1%

Source: Processed data

The estimation results of quantile regression for further analysis of independent variable influence variation on the dependent variable show a different effect of the independent variable on the quantile 0.75. At quantile 0.25 and 0.50, interest rate and collectability significantly affect household credits with a significance of 5% in a negative direction, while income and age are in a positive order. At quantile 0.75, the interest rate variable is not significant.

This shows that the very large nominal household credits expected to be made by high-income customers no longer consider the amount of loan interest rates.

3.2. Second stage – time-series regression approach based on macroeconomic indicator

3.2.1. Impact of LTV and Policy Interest Rate on Household Credit and Home Loan Growth

In selecting the best model, consider the estimation results most in line with the theory and have the highest R Square and the lowest AIC.

Table 5: Comparison of ARDL and LS estimation results on household credit

	Model 1		Model 2	
	ARDL	LS	ARDL	LS
	Growth	Growth	Growth	Growth
	Household Credit	Household Credit	Household Credit	Household Credit
GSaving	0.3387***	0.7542**	1.0582***	0.7577*
PR	-3.3293**	-0.067		
HHIR			-1.9894**	0.331
GNT	0.9355***	-0.117	0.5375***	-0.115
Inflation	1.5618**	2.196	1.7406***	2.105
GHKEI	0.0481	0.0554	0.0660**	0.060
C	17.3604**	-3.160	16.642**	-7.126
RSquare	0.9367	0.676	0.9604	0.381
RSquare Adj	0.8920	0.635	0.9283	0.252
AIC	4.4722		4.4689	

Note: Statistically significant at α *:10%, **:5%, ***:1%

Source: Processed data

Based on the estimation results using the ARDL method, model 2 is the best model based on the criteria of the highest R-square Adj (0.9283) and the lowest AIC (4.4689).

Table 6: Estimation results short term of household credit

Variable	Coefficient	
Dependent Variable	Growth of Household Credit	
D(GHousehold_credit(-1))	0.464	***
D(GHousehold_credit (-2))	0.353	***
D(GHousehold_credit(-3))	0.415	***
D(GSaving)	0.220	
D(HHIR)	-1.428	***
D(GNT)	0.124	***
D(GNT(-1))	-0.306	***
Variable	Coefficient	
Dependent Variable	Growth of Household Credit	
D(Inflation)	1.249	***
D(GIHKEI)	-0.010	
Cointeq	-0.717	***

Note: Statistically significant at α *:10%, **:5%, ***:1%

Source: Processed data

The estimation results show that household commercial interest rate has a significant and negative impact on household credit growth in the long term. In addition, saving growth, GNT, inflation, and GIHKEI positively and significantly impact household credit growth (Table 5). Meanwhile, in the short term, current household credit growth is influenced by the current household commercial interest rate, current GNT, one quarter ago, and current inflation (Table 6).

Table 7: Comparison of ARDL and LS estimation results on home loan

	Model 1		Model 2	
	ARDL	LS	ARDL	LS
	Growth of Home Loan Credit	Growth of Home Loan Credit	Growth of Home Loan Credit	Growth of Home Loan Credit
GSaving	0.1788*	0.6023*	0.0588**	0.617**
PR	-1.5316***	0.559		
HHIR			-1.5877*	-3.509***
GNT	-0.0139	0.0843	0.1369**	-0.0135
GIHPR	0.5715**	13.646	0.3537	2.7446***
GHKEI	0.0272*	0.0237	0.0817***	0.0551
LTV	3.2865***	4.3402*	18.457	10.037
C	63.971	-10.046	24.584	19.440**
RSquare	0.9880	0.5735	0.9881	0.7765
RSquare Adj	0.9571	0.4390	0.9506	0.7059
AIC	28.448		29.087	

Note : Statistically significant at α *:10%, **:5%, ***:1%
Source: Processed data

Based on the estimation results using the ARDL estimation method, model 1 is the best model based on R-square Adj (0.9571) and the lowest AIC (28.448).

Table 8: Estimation result equation short term of home loan

Dependent Variable	GHousehold Credit	
Variable	Coefficient	Probability
D(GSaving)	0.1431*	0.080
Dependent Variable	GHousehold Credit	
Variable	Coefficient	Probability
D(PR)	0.0772	0.760
D(PR(-1))	1.9076***	0.009
D(GNT)	0.0737***	0.002
D(GNT(-1))	-0.1097***	0.007
D(GIHPR)	-2.1382***	0.000
D(GIHPR(-1))	-2.4320***	0.000
D(GIHKEI)	-0.0290**	0.023
D(LTV)	2.7915***	0.009
D(LTV(-1))	1.2850**	0.022
Cointeq	-0.8002***	0.000

Note: Statistically significant at α *:10%, **:5%, ***:1%
Source: Processed data

The estimation results show that the policy interest rate has a negative and significant impact on home loans in the long term. In addition, saving growth, GIHPR, GIHKEI, and LTV loosening variables positively and significantly impact home loan growth in the long term. Meanwhile, a home loan is affected by saving growth in the short term, the policy interest rate at lag 1 quarter, current GNT and lag 1 quarter, GIHPR at lag 1 quarter, and GIHKEI at lag 1 quarter, and current LTV and LTV variable at lag 1 quarter.

Table 9: Comparison of the impact of LTV policy on the home loan estimation result

No	Literature	Country	LTV Impact
1	Morgan, Regis, & Salike (2015)	10 Asian Country	LTV tightening 1% → KPR reduction to 5.6%
2	Lam, Dunsky, & Kelly (2013)	US	LTV tightening 1% → KPR reduction 0.3%
3	Jacome & Mitra (2015)	5 Country (Brazil, Hongkong SAR, Korea, Malaysia, Poland, and Romania)	LTV tingtening 1% → KPR reduction 0.07%
4	Krznar & Morsink (2014)	Canada	LTV tightening 1% → KPR reduction 0.4% - 0.5%

| 5 | Bian, Lin, & Liu (2018) | US | LTV loosening 1% will boost 9% credit increase |
| | Study Result Comparison | Indonesia | LTV loosening 1% increase 0.66% home loan for long-term |

Research shows that the magnitude impact of loosening the LTV policy by 5% encourages an increase in a home loan in the long term by 3.29% or 0.66% at 1% loosening. A research comparison of the Impact of LTV on home loans is summarized in Table 9.

3.2.2. The Impact of LTV Policy and Interest Rates on Household Credit and Home Loans

The estimation results using ARDL and Least Square are shown in Table 12 and Table 13.

Table 10: Comparison of ARDL and LS to household credit risk and the home loan estimation result

	Household Credit Risk		Home Loan Credit Risk	
	ARDL	LS	ARDL	LS
	Growth of Household Credit	Growth of Household Credit	Growth of Home Loan Credit	Growth of Home Loan Credit
GHousehold_Credit	0.0048	0.0085		
GHomeloan_Credit			0.0020	-0.0077
DNT	0.0002*	0.0002**		
GGDP	-0.4808**	-0.836***	-1.5841***	
				1.1215***
Inflation	-0.0893	-0.0226	-0.1442	-0.1664*
HHIR	0.3693**	0.4339***		
HLIR			0.1293	0.1085
LTV			0.6870**	0.5685
C	6.2660***	6.8316***	18.8774***	17.396***
RSquare	0.9285	0.9172	0.9089	0.9021
RSquare Adj	0.9074	0.9034	0.8913	0.8868
AIC	1.5018		2.5712	

Note: Statistically significant at α *:10%, **:5%, ***:1%

Source: Processed data

The Impact of LTV policy and interest rates on household credit and home loans could be shown in the loan at risk of household credit long-term equation model. DNT and household commercial interest rates positively and significantly impact loans in household risk (Table 10). Meanwhile, the current household interest rate significantly impacts loans at risk of household credit in the short term. National economic growth (GGDP) and current inflation are also significant but negatively impact loans at risk of household credit (Table 13).

Table 11: Estimation equation of short-term household credit risk and housing

	Household Credit Risk		Home Loan Credit Risk	
	Loan at Risk of Household Credit		Loan at Risk of Home Loan	
	Coefficient	Probability	Coefficient	Probability
D(GHousehold_Credit)	0.0038	0.660		
D(GHomeloan_Credit)			0.0015	0.8971
D(GGDP)	-0.9027***	0.000	-1.1654***	0.0000
D(Inflation)	-0.0714*	0.094	-0.1061	0.2004
D(DNT)	0.00017	0.125		
D(HHIR)	1.5038***	0.009		
D(HLIR)			0.0951	0.4163
D(LTV)			0.5054**	0.0275
Cointeq	-0.0802***	0.000	-0.7357***	0.0000
RSquare	0.9285	0.9172	0.9089	0.9021
RSquare Adj	0.9074	0.9034	0.8913	0.8868
AIC	1.5018		2.5712	

Note: Statistically significant at α *:10%, **:5%, ***:1%

Source: Processed data

Variables that significantly affect home loan risk in the long term are real economic growth in the opposite direction and LTV loosening in the same direction (Table 10). 5% of loosening LTV will increase home loan risk by 0.69% in the long term. Meanwhile, in the short term, home loan risk is influenced by national economic growth (GGDP) and LTV loosening (Table 11).

Table 12: DID estimation result

Outcome Variable	y	Standard Error	After	Diff
Before				
Control	0.486			
Treated	0.724			
Diff(T-C)	0.238	0.069	3.44	0.001***
After				
Control	0.477			
Treated	1.000			
Diff(T-C)	0.523	0.090	5.79	0.000***
Diff-in Diff	0.285	0.114	2.50	0.013**

Dependent Variable is Household Credit Risk and Home Loan Credit Risk

Source: Processed data

DID estimation results show that the magnitude of DID estimator is 0.285 with a p-value of 0.013, which is smaller than the 5% alpha significance value (Table 12). This shows a significant behavior difference between respondents who have home loans and those who do not. Respondents who have a home loan relatively increase their ownership of housing assets when there is LTV loosening, which is indicated by an increase in house purchases in full and installments compared to their counterfactual respondents.

4. Discussion

The impact of household characteristics and commercial interest rates on household credits is that income has a significant positive effect, and age and commercial interest rates significantly affect household credits. In relatively large household credits (quantile 0.75 and above), income characteristics have a significant positive effect, age is not significant (quantile regression approach), and commercial interest rates still have a negative and significant effect on groups with high credit groups.

LTV Loosening has the potential to increase home loans. In the short term, 5% loosening LTV will boost home loan growth of 4.07% with a lag of up to 1 quarter and will encourage an increase in the credit risk of 0.5%. In the long term, loosening LTV by 5% will increase home loan growth by 3.29% but will encourage a LAR of 0.687%. The Impact of LTV loosening is relatively slightly lower than loosening LTV impact in the United States based on research by Bian, Lin, and Liu (2018), where 1% LTV loosening has the potential to increase credit to 0.9%.

In the long term, savings growth and inflation significantly affect household credit growth. In addition, variables that significantly affect home loan growth apart from interest rates are growth in savings, exchange rates, and an increase in house prices. In the short term, household credits are affected by savings growth and inflation with a 2-quarter lag, commercial interest rates for household credits, and the exchange rate with a 1-quarter lag. Meanwhile, savings growth, commercial home loan interest rates, exchange rates, and inflation affect home loans with a lag of up to 2 quarters.

Long-term factors influencing household credit risk are exchange rate fluctuations, real economic growth, and commercial interest rates on household credits. Home loan risk is influenced by the LTV ratio and real economic growth. In the short term, household credit risk is affected by real economic growth, inflation, and commercial interest rates on household credits. Meanwhile, home loan risk is influenced by real economic growth and the LTV ratio. There are differences in behavior between the groups affected by the LTV loosening policy and the counterfactual groups. The counterfactual group did not increase house purchases when LTV loosened. However, this conclusion has limitations due to potential sample selection bias.

The study results recommend that interest rate and LTV instruments be used to encourage household credits, including home loans. However, given the relatively small impact compared to previous studies, other policies that potentially promote home loan growth include tax easing but require further study.

Acknowledgments

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