



Sustainability of Loan-To-Value Policy and Mortgage Market in Indonesia: Supply-Demand Analysis

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ABSTRACT

We examine the effectiveness of Loan-to-Value (LTV) ratio policy in shifting the mortgage market in Indonesia through the supply-demand framework. The observation falls in the period of 2012-2022 and analysed using two-stage least square (2SLS) methods. The results indicate that the demand side is indicated to be more responsive towards the LTV policy and the biggest difference happened when the market were in bust. by the LTV than the supply side. Furthermore, it is found the indication the most effective LTV happened when supply and demand moved in parallel. However, it is indicated that the LTV will only be effective when there is surplus in mortgage market, not in equilibrium. This finding is different from prevailing studies about LTV policy and demand for mortgage.

Keywords: Mortgage, LTV, Supply, Demand

1. INTRODUCTION

The Loan-to Value (LTV) ratio is a ratio between the credit value provided by the bank and the value of collateral in the form of property at the time of granting credit based on the actual appraisal results. This instrument is countercyclical to the credit cycle and house prices (Claessens et al., 2013). When excessive credit growth occurs, the LTV ratio is tightened to prevent house price bubbles. In this way, these regulations can reduce the buildup of systemic risks and increase financial stability. When systemic risk materializes, the LTV ratio is relaxed, to prevent a sharp decline in credit demand, a fall in house prices and a sharp decline in the banking sector. Therefore, LTV policy is said to be effective if it is able to work countercyclically to market cycles (Liu and Molise, 2019).

The Ministry of Public Works showed that in 2019 there was still a housing backlog which continued to increase every year. The cause of the housing backlog could be due to the increase of housing demand without being matched by the availability of housing. If not handled, a house price bubble will occur which will have systemic impacts. According to a survey conducted by Bank Indonesia from 2012 to 2022, the use of mortgage in home financing still dominates with a share of around 70% of total financing. Because the share

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of mortgage use is still the majority, the LTV policy is considered to be able to help overcome this problem.

In this study, we examine the effectiveness of LTV policy towards mortgage market in Indonesia in 2012-2022. We breakdown the market into supply-demand framework. This is done to see more clearly the factors that influence the movement of the market. Also, there are indications that the effectiveness of LTV doesn't work the same way on both side. In February 2021 the LTV ratio policy was relaxed to 90-100%. This easing policy succeeded in growing mortgages from an average of 3% six months before the policy to 5% after six months of the policy. However, as can be seen in Figure 1, the relaxation policy did not change mortgage growth as much as the tightening policy. This provides an indication that easing LTV is not more effective than tightening policies.

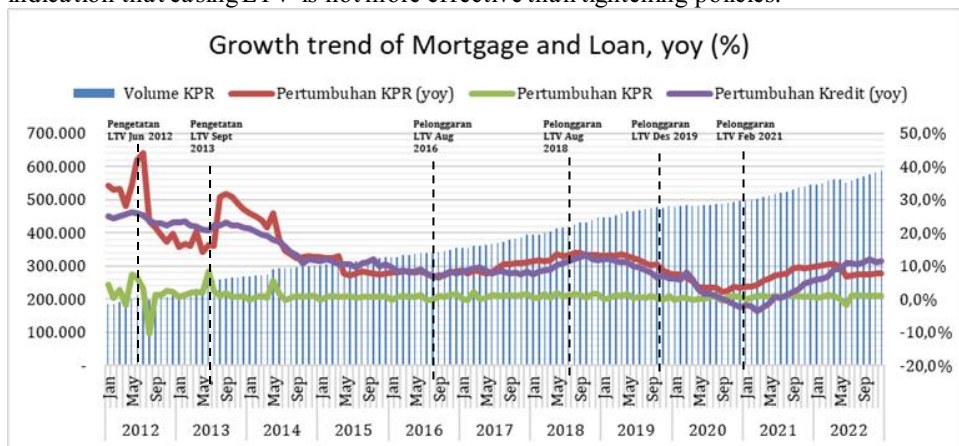


Figure 1: Growth trend of Mortgage and Loan (Source: SPI OJK (2012-2022))

In the other hand, Lim and Nugraheni (2017) found that LTV in Indonesia is only effective in influencing mortgages and house prices in the short term. Considering the LTV easing that reached 100% of ratio, Forster and Sun (2022) found that an LTV policy implemented aggressively would reduce utility. This could be an additional possibility for the suboptimal LTV policy in Indonesia. Because the empirical impact and current research provide large room for improvement, LTV becomes interesting to research.

2. LITERATURE REVIEW

The balance between supply and demand is a basic concept in economic theory, which deals with how market prices and quantities of goods and services are determined in a market. When supply is greater than demand, then there is a surplus. In these cases, the supply side tends to lower the price to attract more buyers so that the surplus can be reduced. Conversely, if demand exceeds supply, there is a deficit. In this situation, the price tends to rise because the supply side can take advantage of limited availability to make maximum profits. Supply-demand equilibrium occurs when at the point of confluence between the supply curve and the demand curve. At this point, the quantity offered is equal to the quantity requested.

The balance of supply and demand for a mortgage (Home Ownership Credit) refers to the point at which the amount of credit offered by the financial institution (offer) is equal to the amount of credit desired by the prospective borrower (demand). The mortgage offering side is driven by capital availability, regulations, risk tolerance, and lending criteria (Case et al., 2020). On the demand side, income levels, unemployment rates, creditor confidence, and expectations regarding future interest rates and house prices are driving factors (Mishkin, 2019).

The equilibrium of supply and demand is affected by the following factors, namely:

1. **Interest**
The interest rate is the price of the money borrowed. When interest rates are low, loans become cheaper, increasing mortgage demand. On the contrary, high mortgage prices will reduce demand. Banks will adjust mortgage offers based on interest rates in managing risks and benefits (Hubbard and O'Brien, 2021).
2. **Economic Conditions**
Overall economic conditions also play an important role. When the economy is growing and optimistic, the demand for mortgages tends to increase as more people feel confident about buying a home. On the other hand, in times of economic uncertainty, mortgage demand can decline (Case et al., 2020).
3. **Credit Requirements**
Credit requirements imposed by financial institutions also affect the balance. If the requirements are strict, the mortgage request may be lower because not everyone can qualify for credit. Conversely, if the requirements are looser, demand may increase (Hubbard and O'Brien, 2021). LTV is one of the credit requirements.
4. **House Prices**
House prices are a crucial factor in the movement of mortgages. Rising house prices will lead to an increase in loans to acquire a home. On the contrary, low house prices will reduce mortgage demand (Mishkin, 2019).
5. **Monetary Policy**
Central banks influence interest rates through monetary policy. Lowering interest rates can lower mortgage interest rates, encouraging the demand side to apply for mortgages. On the contrary, rising interest rates will reduce mortgage demand (Mishkin, 2019).
By analyzing the dynamics of the balance of mortgage supply and demand, stakeholders can navigate the mortgage market more effectively (Mankiw, N. G., 2020).

The LTV ratio is an indicator of mortgage availability and has become an effective tool for managing mortgage supply and house prices (Forster and Sun, 2022). LTV policy is said to be effective when it works countercyclically (Liu and Molise, 2019). Duca et al., (2011) finds that a 10% decrease in the LTV ratio is associated with a 10% decrease in house prices. Kim et al., (2015), employed the actual LTV ratio in the global cross-sectional VAR model. The results show that a 10% reduction in the LTV limit reduces mortgage growth by 2%, house prices by 3%, and GDP by 0.8% in the long term.

Del Giovane et al., (2010) found that the slowdown in mortgage market was caused by a tightening of the LTV ratio, while the easing of LTV increased interest income at banks, causing supply to increase (Wong et al., 2014). This means that both policies, easing and tightening LTV, can influence the supply side. Wong et al., (2014) found a negative relationship between tightening LTV ratios and mortgage demand. Kim and Oh (2021) found that easing the LTV ratio could encourage mortgage demand. Borgersen (2017) finds that LTV relaxation does not affect the demand side during a bust. This indicates a difference in the impact of LTV on the demand side. However, Forster and Sun (2022), found that the LTV policy affects the demand side.

Wong et al., (2014) found that new LTV policies will be effective when the supply and demand sides are the driving factors of the mortgage market. In addition, when the market reaches equilibrium, credit will move stably, making policy that's translated into credit terms effective (Guren, 2019), reducing the systemic risk of a credit bubble.

3. METHODOLOGY

The data used in this research is secondary data obtained from several sources. The data covers the period of January 2012 – December 2022 with a monthly frequency. The type of data used for this research is time-series. The data taken has been processed into variables and has been analyzed with descriptive statistics below

Table 1: Descriptive Statistics

	Mean	Median	Max	Min	Std. Dev.	Skewness
Q_t	0,127	0,105	0,021	0,439	0,082	1,673
LTV	0,809	0,750	0,700	1,000	0,112	0,906
$RAROC(rt)$	1,223	1,207	0,232	2,403	0,595	0,209
PPG	0,041	0,032	0,014	0,135	0,031	1,476
CD	0,008	0,007	-0,021	0,036	0,011	-0,061
CAR	0,113	0,042	0,078	0,957	0,250	2,779
RHE	0,131	0,122	0,034	0,299	0,046	1,093
DSR	0,169	0,067	0,047	0,648	0,198	1,438
U	0,058	0,059	0,049	0,071	0,005	0,174
$rKPR$	0,098	0,103	0,114	0,076	0,012	-0,337
Δr_{t+1}^+	0,000	0,000	-0,002	0,001	0,001	0,231
$-\Delta r_{t+1}^-$	0,000	0,000	0,000	-0,000	0,000	0,228

Source: author's work

The data is then tested using classical assumptions and treatment is carried out according to the results.

Wong et al., (2014) used mortgage as the dependent variable in analyzing the impact of LTV. In accordance with the direct aim of LTV, namely tightening credit access in order to

reduce systemic risk (Claessens and Laeven, 2017), this research uses mortgage volume Q_t as the dependent variable.

Then the estimation is carried out using 2SLS with the following specifications,

$$SS_t = \beta_0 + \beta_1 Q_t SS + \beta_2 r_t + \mu_t^S \quad (1)$$

$$DD_t = \alpha_0 + \alpha_1 Q_t DD + \alpha_2 r_t + \mu_t^D \quad (2)$$

$$Q_t = \min(DD_t, SS_t) \quad (3)$$

$$\Delta r_{t+1} = \gamma(DD_t - SS_t) \quad (4)$$

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SS_t represents supply DD_t is demand that cannot be observed at t . $Q_t SS$ and $Q_t DD$ are vectors from independent variables for the supply and demand equation. r_t is mortgage interest rate which assumed to have a positive effect on SS_t ($\beta_2 < 0$) and negative effect on DD_t (cth. $\alpha_2 < 0$), and μ_t^D and μ_t^S are disturbance conditions which are assumed not correlated and is a meaningless random variable.

The equilibrium framework departs from the actual growth of mortgage (Q_t). Q_t is not determined by equating SS_t and DD_t at the equilibrium r_t , but rather at the minimum value of SS_t and DD_t as specified by equation (3) which means that it allows for, but does not cause, excess supply or demand that occurs in interest rates. Equation (3.4) assumes changes in mortgage interest rates in the following period are proportional to the level of excess demand in the current period. The coefficient γ , which measures the speed of mortgage price adjustment, is assumed to be positive. This model is widely used in banking literature (Wong et al., 2014). Fair and Jaffee (1972), Maddala and Nelson (1974), and Laffont and Garcia (1977) consider the estimators of the TSLS method to be consistent. In TSLS estimation, Δr_{t+1}^- , Δr_{t+1}^+ , and variables involving Q_t are instrumented through their lags.

The system of equations cannot be directly estimated because SS_t and DD_t are not observable. However, the parameters can be estimated using the following method: assume time t $r_{t+1} < r_t$, so the equation becomes:

$$Q_t = \beta_0 + \beta_1 X_{it}^S + \beta_2 r_t + \frac{\Delta r_{t+1}^+}{\gamma} + \mu_t^S \quad (5)$$

Similar treatment applies on the demand side. With $r_{t+1} > r_t$, where excess demand occurs, it implies $Q_t = SS_t$. Substituting $Q_t = SS_t$ into equation (5) produces $DD_t = \frac{\Delta r_{t+1}^-}{\gamma + Q_t}$, then the demand equation becomes:

$$Q_t = \alpha_0 + \alpha_1 X_{it}^D + \alpha_2 r_t - \frac{\Delta r_{t+1}^-}{\gamma} + \mu_t^D \quad (6)$$

All parameters can be estimated using all data by adjusting $\Delta r_{t+1}/\gamma$ in equations (5) and (6) by redefining the two equations sequentially to:

$$Q_t = \beta_0 + \beta_1 X_{it}^S + \beta_2 r_t + \frac{\Delta r_{t+1}^-}{\gamma} + \mu_t^S \quad (7)$$

Where

$$\Delta r_{t+1}^- = \begin{cases} \Delta r_{t+1}, & \text{if } r_{t+1} < r_t, \\ 0, & \text{otherwise} \end{cases} \quad (8)$$

And

$$Q_t = \alpha_0 + \alpha_1 X_{it}^D + \alpha_2 r_t - \frac{\Delta r_{t+1}^+}{\gamma} + \mu_t^D \quad (9)$$

Where

$$\Delta r_{t+1}^+ = \begin{cases} \Delta r_{t+1}, & \text{if } r_{t+1} > r_t, \\ 0, & \text{otherwise} \end{cases}$$

The supply specifications are as follows:

$$Q_t SS = \beta_0 + \beta_1 LTV_t + \beta_2 RAROC_t(r_t) + \beta_3 PPG_t + \beta_4 CD_t + \beta_6 DSR - \frac{\Delta r_{t+1}^-}{\gamma} + \mu_t^S \quad (10)$$

Kent (1980), Stiglitz, and Weiss (1981) state that the actual price of a mortgage is determined not only from the mortgage interest rate, but also from contractual conditions, such as the LTV ratio and maturity. Therefore, without a change in the mortgage interest rate, banks can change the mortgage supply by adjusting the LTV ratio. According to Wong et al., (2014), the increase in $RAROC(rt)$ on mortgage is expected to have a positive impact on mortgage supply. The value of the collateral is assumed to have a positive impact on mortgage offers. In this research, changes in collateral value are determined by the annual growth of property prices (PPG). This specification is consistent with the financial acceleration theory, namely that an increase in property prices causes an increase in the value of collateral, which has an impact on an increase in loan supply. Annual growth in consumer deposits, which represents changes in bank liquidity, is assumed to have a positive impact on mortgage supply. A similar specification was adopted by Arsenaault et al. (2012) in researching the mortgage market in the United States and Wong (2014) in researching the mortgage market in Hong Kong. Research conducted by Rahayu et al., (2019) shows that an increase in CAR can reduce the bank's ability to provide loans so that this variable is used as an estimate of mortgage supply.

And the demand specifications are as follows:

$$Q_t DD = \alpha_0 + \alpha_1 LTV_t + \alpha_2 RHE_t(LTV_t, r_t) + \alpha_3 DSR10 + \alpha_4 DSR + \alpha_5 U_t - \frac{\Delta r_{t+1}^+}{\gamma} + \mu_t^D \quad (11)$$

There are two main channels through which the LTV ratio influences mortgage demand. First, a lower market LTV ratio implies a higher down payment requirement, which forces marginal home buyers out of the property market (Zumpano et al., 1986). A higher liquidity hurdle (i.e. a lower LTV ratio) reduces mortgage demand, thereby implying a positive relationship between the market LTV ratio and mortgage demand. Second, from the perspective of property investors, lower market LTV ratios limit investors' ability to take higher leverage to increase return on home equity (*RHE*) for property investments, thereby contributing to lower property demand (Wong et al., 2014).

From a property investor's perspective, lower market LTV ratios limit investors' ability to take higher leverage to increase *RHE* for property investments, thereby contributing to lower property demand. Thus, *RHE*, which is partly determined by the LTV ratio, is considered as one of the determinants of mortgage demand. By removing the time subscript, *RHE* is defined as:

$$RHE = \frac{(V * GPR - L * R)}{E} = \frac{1}{1 - LTV} (GPR - LTV * r)$$

Where *V* and *L* are the value of the property and the mortgage amount respectively. *E* is the equity value derived from $E = V - L$. *GPR* is the gross return on a property, defined as the annual growth rate of the property price. The first term on the right-hand side is the ratio of property value (*V*) to equity (*E*) or the leverage ratio for property investments expressed in LTV, while the second term is the net annual property return. This research suspects a positive relationship between *RHE* and mortgage demand. Lower *RHE*, whether due to lower market LTV ratios (i.e. lower leverage), falling property prices and rental yields, or rising mortgage interest rates, is expected to reduce mortgage demand. Note that *r* which serves as the price for mortgage loans is included in the demand equation via the *RHE* term rather than as a separate explanatory variable. By definition, as long as *RHE* is expected to have a positive impact on demand for mortgages, *r* is negatively correlated with the amount demanded for mortgages. Because other policy measures, such as debt service ratio (*DSR*) limits can also influence the demand for mortgage loans (Wong et al., 2014) and can capture the influence of prudential measures, this variable is included in the equation to disentangle the effect of LTV policies on demand mortgage loans from other policies. The *DSR* calculation is as follows:

$$DSR_{j,t} = \frac{i_{j,t}}{(1 - (1 + i_{j,t})^{-S_{j,t}})} \times \frac{D_{j,t}}{Y_{j,t}}$$

Where $D_{j,t}$ is total outstanding debt taken from total consumer credit, $Y_{j,t}$ is income taken from GDP, $i_{j,t}$ is the average debt interest rate taken from 3 -months JIBOR, and $S_{j,t}$ is the average remaining debt maturity which is assumed to be 13 years. This calculation comes from the Bank for International Settlement 2023 publication.

After that, a second model is created by eliminating the LTV variable on both sides. Then the difference is calculated between the estimates from the first model and the second model to examine its effectiveness.

4. DISCUSSION

Model 1 is an estimate of supply and demand with LTV. Model 2 eliminates all variables that are not significant. Model 3 is an estimate of model 1 by removing the LTV variable. This is done to capture how big the changes are. The results are shown on the table 2 below:

Table 2: Results

	Model 1	Model 2	Model 3
Supply			
<i>(Constant)</i>	[-5,617]	[-5,754]	[-1,682]
	0,000	0,000	0,095
<i>LTV</i>	[-6,742]	[-6,994]	
	0,000	0,000	
<i>PPG</i>	[3,571]	[5,498]	[4,017]
	0,005	0,000	0,000
<i>RAROC_{rt}</i>	[0,522]		[1,910]
	0,602		0,058
<i>CD</i>	[0,589]		[-0,412]
	0,556		0,680
<i>CAR</i>	[2,603]	[2,786]	[1,784]
	0,010	0,006	0,076
<i>rKPR</i>	[-4,613]	[4,599]	[-1,197]
	0,000	0,000	0,233
Δr_{t+1}^+	[1,261]		[-0,025]
	0,209		0,979
R square	0,602	0,596	0,457
Demand			
<i>(Constant)</i>	[-3,041]	[-3,313]	[-0,645]
	0,029	0,001	0,520
<i>LTV</i>	[-5,089]	[-7,839]	
	0,000	0,000	
<i>RHE</i>	[-0,019]		[-0,953]
	0,098		0,342
<i>U</i>	[1,889]	[1,844]	[2,344]
	0,061	0,067	0,206
<i>DSR</i>	[-0,726]		[-5,028]
	0,469		0,000
<i>rKPR</i>	[-3,277]	[-3,672]	[-1,237]
	0,001	0,000	0,218

	Model 1	Model 2	Model 3
$-4r_{t+1}^-$	[2,010]	[2,006]	[1,797]
	0,465	0,046	0,074
R square	0,484	0,482	0,378

Source: author’s work

Model 1 shows that LTV is significant to mortgage growth on the supply and demand sides, making the findings of Kent (1980), Stiglitz and Weiss (1980) still relevant. Meanwhile, an insignificant CD can mean that the mortgage offer from the bank does not depend on liquidity sourced from customer funds and allows funds from other parties as a source of funds to be channeled for mortgages. CAR as an indicator of bank prudence is not significant, this allows other factors to be trade-offs, such as a more positive perception of returns. However, there are abnormalities in the CAR data that allow for biased results. It can be seen that the RAROC (rt) variable is not significant, this variable is the return on capital for the mortgage. The insignificance of this variable indicates that the return in the form of interest has no effect on the debtor in distributing mortgages. Significant PPG may be the reason that the benefits obtained from rising house prices are more attractive than the interest return for debtors in distributing mortgages. On the demand side, LTV and other variables are significant, while RHE and DSR variables are insignificant. The insignificance of RHE may be caused by the motive of buying property in Indonesia which is dominated by consumption motives and not for investment. Data from BPS (2022) shows that the community home ownership rate is 80%. This means that only 20% are renting. This makes the size of investment opportunities smaller. The DSR, which shows the ratio of debt to public income, is not significant to the growth of mortgages on the demand side

This means that the value of the mortgage proposed by prospective creditors is not based on income which may be caused by the impact of other policies such as tax tiering, subsidies, and various mortgage schemes

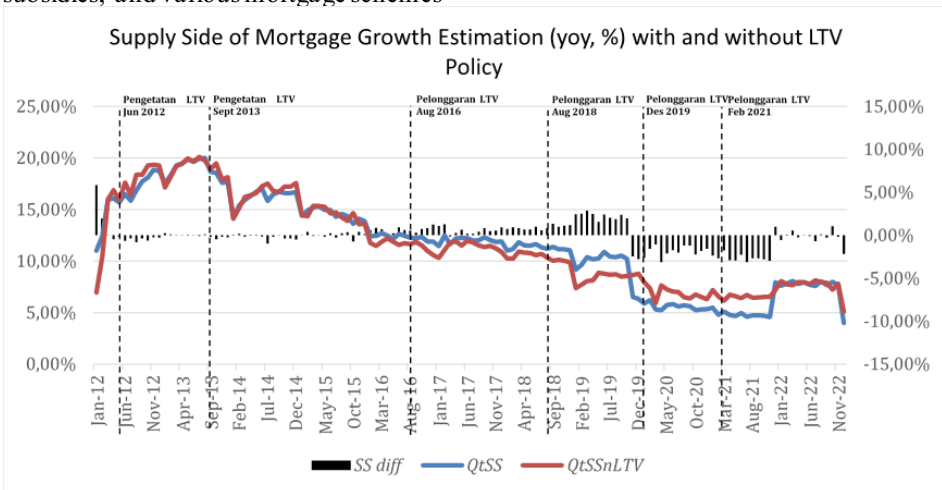


Figure 2: Supply Side of Mortgage Growth Estimation with and without LTV policy.

Source: author’s work

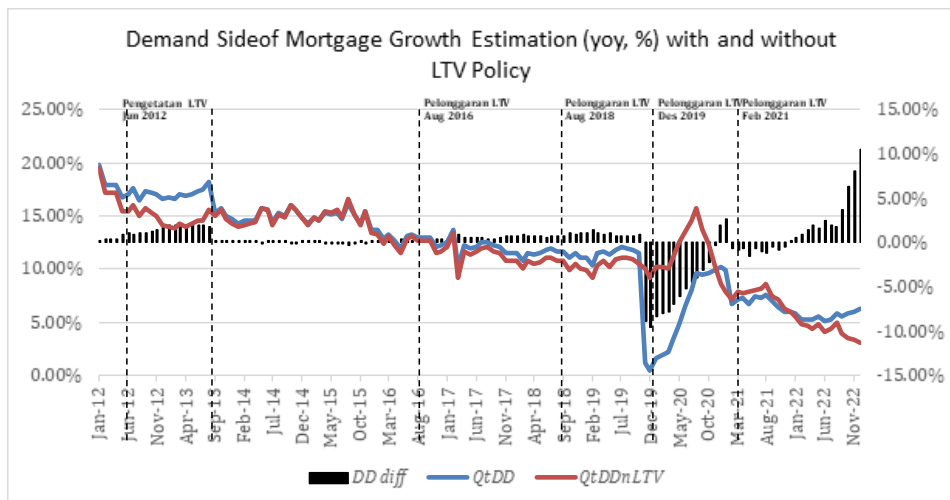


Figure 3: Demand Side of Mortgage Growth Estimation with and without LTV policy
Source: author's work

In Figure 2, $QtSS$ is the estimated growth of supply-side mortgages with an LTV policy and $QtSSnLTV$ is an estimate of the growth of supply-side mortgages without an LTV policy. In figure 3, $QtDD$ is the estimated growth of demand-side mortgages with an LTV policy and $QtDDnLTV$ is an estimate of demand-side mortgage growth without an LTV policy. The black line in figures 2 and 3 is the difference between the estimated mortgage growth with the LTV policy and without the LTV policy.

In the absence of extreme conditions, Figures 2 and 3 show results consistent with previous studies, namely that LTV policies should work *countercyclically* (Claessens et al., 2013). In addition, it can be seen clearly that the difference between the estimate and without the LTV policy is the largest on the demand side. This indicates that the LTV policy is more effective on the demand side. However, when the easing policy was enacted in December 2019, there was an anomaly between the LTV policy and credit growth. Instead of successfully maintaining or increasing credit growth, the figure shows a sharper decline compared to the absence of LTV easing on the demand side. This finding is in line with Borgersen's (2017) research which found that easing policies will not have an impact on the demand side. Another factor that allows for the ineffectiveness of this easing is the moment that is adjacent to the emergence of the Covid-19 virus news. The perception of the demand side of the mortgage can be affected by the news. In addition, the increase immediately after the enactment of the easing occurred in parallel in both conditions with and without the LTV policy. This indicates that the increase in the mortgage cycle at that time was not caused by the easing of LTV, but other factors.

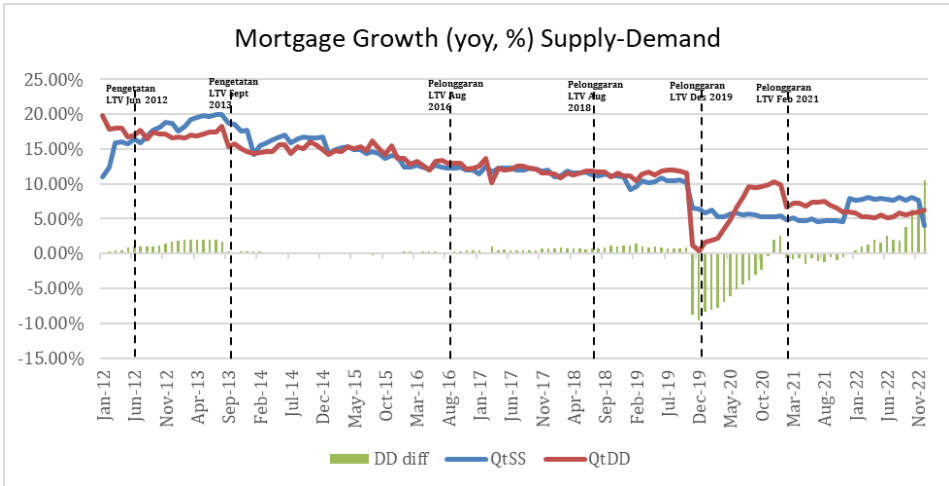


Figure 4: Growth trend Estimation of Mortgage: Supply-Demand
 Source: author’s work

A green line above 0 indicates excess supply and a green line below 0 indicates excess demand. It can be seen in Figure 4 that supply and demand are almost always close to equilibrium, except at the end of 2019 to mid-2022.

During the first policy tightening in July 2012, excess demand in the mortgage market responded downwards. However, the supply side is responding upwards. This event is different from research by Del Giovane et al., (2010) which found that tightening LTV will reduce supply. The likelihood is that the LTV implemented first will cause a greater adjustment in the market than the subsequent LTV change. This is in accordance with the findings of Foster and Sun (2022) where LTV utility will decrease when aggressive policies are implemented.

In the second tightening, supply and demand move down simultaneously. During the first policy easing in August 2016, there was no visible response to the increase in mortgages on either side. The same thing happened in August 2018. When this is done, there is an excess of demand in the mortgage market. This finding is different from the findings of Kim and Oh (2021) who stated that easing the LTV ratio can boost the demand side of mortgages. However, conditions were found that were in accordance with the findings of Kim and Oh (2021). The demand side seems to respond well to the easing of LTV in December 2019 until there was an excess of demand from mid-2020. Then, when there was another decline at the end of 2020, LTV was relaxed again in February 2021. There is little response on both sides, supply and demand.

While the demand side appears to be more responsive to LTV policies, the two LTV policies that bring the biggest changes to the trend occur when there is an oversupply. In line with the law of market equilibrium, that when there is a surplus, prices will fall. Low mortgage prices will stimulate the demand side to rise. This phenomenon complements the findings of Kim and Oh (2021) that the good response from the demand side to the easing

of LTV may be due to lower prices so that the affordability of mortgages for those with lower incomes increases. It was also found that LTV policies are most effective when the supply and demand sides move in parallel. This is in accordance with the research of Wong *et al.*, (2014) which found that LTV policies will be effective when the market is driven by both supply and demand.

There is a fundamental difference in the supply and demand sides. In the context of this study, the supply side is banking that is bound by rigid rules related to risk, while the demand side is individuals whose decision-making is more flexible and not always rational. In addition, mortgages also have other dimensions such as interest rates, interest types, and payment periods. The demand side is often also more concerned with other factors such as home price growth, market perception, and their ability to pay off mortgages rather than LTV ratios. This difference allows inconsistencies on the demand side in responding to LTV policies (Shiller, 2020).

6. CONCLUSION AND RECOMMENDATION

This study examines the effectiveness of LTV policies on the supply and demand sides. In addition, the factor contributing to the effectiveness of the LTV policy on the overall mortgage and the balance of the mortgage market was also studied. The 2SLS method is used to analyze data and variables. Conventional commercial banks are the object of research because banks that have systemic strength are included in this category. Other systemic banks of different types of banks are not considered because there are differences in the dimensions of mortgages. The year 2012-2022 is the research period because it is the first year that LTV has been implemented until a gap of one year after the last LTV was implemented. In this period, Indonesia has experienced an increase and decrease in the credit cycle, so this period is ideal for research.

1. This study found that the demand side is more responsive compared to the supply side. In addition, the biggest response to demand-side ties occurs when the market is sluggish. When the magnitude of the change in trend after LTV is applied becomes an effectiveness parameter, it can be indicated that there is a difference in effectiveness on both sides.
2. The study also found that LTV is indicated to be most effective when there is a surplus which implies that LTV and market balance are not correlated. Nevertheless, the highest LTV effectiveness indicated to occur when both supply and demand sides move in parallel. This is a new finding in research on LTV and mortgages.

The finding that there may be a state-dependent effect of the LTV policy on credit growth underscores the difficulties in deploying this instrument to boost or dampen credit growth. The state-dependent feature implies that calibrating this tool to target credit growth needs and an accurate estimate of both loan demand and supply. These variables, however, are unobservable, which means that calibration needs to rely heavily on model estimates. Operationally, the potential risks model could pose challenges for policymakers. Inconsistent impacts on LTV policies in this study may also be due to economic factors and policy mix not being considered. Therefore, further research can broaden the outlook also measure the time needed until the market responds to LTV policies and quantify the direct

relationship between LTV and mortgage growth.

REFERENCES

- Agarwal, S., Green, R.K., Rosenblatt, E. and Yao, V. (2014), "Collateral pledge, sunk-cost fallacy and mortgage default", *Journal of Financial Intermediation*, Vol. 24 No. 4, pp. 636-652.
- Arsenault, M., Clayton, J. and Peng, L. (2012), Mortgage Fund Flows, Capital Appreciation, and Real Estate Cycles, *The Journal of Real Estate Finance and Economics* (online version), <http://dx.doi.org/10.1007/s11146-012-9361-4>.
- Borgersen, T.A. (2015), Mortgage Supply, LTV and Risk Pricing, available at SSRN:<http://ssrn.com/abstracts>
- Borgersen, T.A. and Greibrokk, J. (2012), "Reflections on LTV, risk and incentives in mortgage markets", *Journal of European Real Estate Research*, Vol. 5 No. 3, pp. 199-210.
- Borgersen, T.A. and Robertsen, K. (2012), "A comment on mortgage procyclicality", *Global Business and Economic Review*, Vol. 14 No. 4, pp. 274-282.
- Case, K. E., Fair, R. C., & Oster, S. M. (2020), "Principles of Economics" (pp. 456-458). Pearson.
- Claessens, S., Gosh, S.R. and Mihet, R. (2013), "Macro-prudential policies to mitigate financial system vulnerabilities", *Journal of International Money and Finance*, Vol. 39, pp. 153-185.
- Del Giovane, P., Eramo, G. and Nobili, A. (2010). Disentangling demand and supply in credit developments: a survey-based analysis for Italy, *Bank of Italy working Papers*, number 764.
- Duca, J.V., Muellbauer, J. and Murphy, A. (2011), "House prices and credit constraints: making sense of the US experience", *The Economic Journal*, Vol. 121, pp. 533-551.
- Forster and Sun. (2022), "Taming the Housing Crisis: an LTV Macroprudential Policy." Elsevier, *Economic Modelling* 108 (2022) 106761.
- Guren, Krishnamurthy, Mcquade December (2019) "Mortgage Design in an Equilibrium Model of the Housing Market", Boston University Center for Finance, Law, and Policy.
- Fair, R.C. and Jaffee, D.M. (1972), *Methods of Estimation for Markets in Disequilibrium*, *Econometrica*, 40, 3, 497-514.
- Hubbard, R. G., & O'Brien, A. P. (2021), "Economics", (pp. 345-347). Pearson.
- Kent, R.J. (1980), Credit Rationing and the Home Mortgage Market, *Journal of Money, Credit and Banking*, 12, 3, 488-501.
- Kim and Oh. (2021), "Effects of Easing LTV DTI Regulations on the Debt Structure and Credit Risk of Borrowers.", *KDI Journal of Economic Policy* 2021, 43(3): 1-32.
- Laffont, J.J., and Garcia, R. (1977), *Disequilibrium Econometrics for Business Loans*, *Econometrica*, 45, 5, 1187-1204.
- Lim and Nugraheni. (2017), "Loan-to-Value Ratio and Housing Price Cycle: Empirical Evidence from Indonesia.", *Jurnal Ekonomi Pembangunan*, 18 (2), 225-238.
- Liu and Molise (2019), "The Effectiveness of the Countercyclical Loan-to-Value Regulation: Generic vs Sector-Specific Rules" Stellenbosch Economic Working Paper: WP21/2019.

- Maddala, G.S., and Nelson, F.D. (1974), Maximum Likelihood Methods for Models of Markets in Disequilibrium? *Econometrica*, 42, 6, 1013–1030.
- Mankiw, N. G. (2020), “Principles of Economics”, (9th ed.pp.123-125). Cengage Learning.
- Mishkin, F. S. (2019), “The Economics of Money, Banking, and Financial Markets” (pp. 234-236). Pearson.
- Rahayu, Mulyaningsih, Cahyadin (2019), “Determinants of Credit Market in Indonesian Banking Industry” *Jurnal Ekonomi Malaysia*, 53(3) 2019 11-21
- Shiller, R. J. (2000), “Irrational Exuberance”, Princeton University Press.
- Stiglitz, J.E. and Weiss, A. (1981), Credit Rationing in Markets with Imperfect Information, *American Economic Review*, 71, 3, 393–410.
- Wong, E., Tsang, A. and Kong, S. (2014), “How does loan-to-value policy strengthen banks’ resilience to property”
- Zumpano, L.V., Rudolph, P.M. and Cheng, D.C. (1986), The Demand and Supply of Mortgage Funds and Mortgage Loan Terms, *Real Estate Economics*, 14, 1, 91–109.

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