UAD Universitas Ahmad Dahlan
Optimum: Jurnal Ekonomi dan Pembangunan
Vol. 14, No. 2, September 2024, pp. 272-281
DOI:10.12928/optimum.v14i2.9451
ISSN 2613-9464

COVID-19 pandemic and housing demand mortgage: Partial adjustment model approach

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ARTICLE INFO

Received : 08-12-2023
Revised : 08-02-2024
Accepted : 16-08-2024
Published : 30-09-2024

Keywords
Housing demand mortgage
Partial adjustment model
Income
Loan interest rate

ABSTRACT

One of the efforts to encourage the fulfillment of housing needs is the provision of housing both from the government and the private sector by considering the community's purchasing power. The background of this research is that the fulfillment of housing needs by both the government and the private sector has yet to be maximized while the demand for housing is relatively high. This research is still necessary because the demand for housing is still high. Increased housing demand will push house prices due to limited housing land. The problems faced focus on the relatively high demand for mortgages because even in the conditions of the COVID-19 pandemic, people still make houses their top priority. This study aims to analyze the effect of people's income, loan interest rates, the amount of housing finance, and dummy before and during the COVID-19 pandemic on housing demand mortgage. The data analysis technique in this study used multiple regression Partial Adjustment Model (PAM). The results showed that the variables of income as proxy for GDP and loan interest rates significantly affected housing demand mortgage. In contrast, the amount of housing finance and the COVID-19 dummy had no significant impact. The research implication that researchers can provide to the government is to provide policy recommendations regarding the Housing Finance Liquidity Facility (FLPP) program, which is intended for low-income communities.

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1. Introduction

Housing is one of the three basic human needs. Adequate shelter is the most important indicator for human survival after food provision. The home an individual lives in reflects status, a measure of social achievement and acceptance, an expression of personality, and a barometer indicating the size, the way the individual views himself, and how the larger society perceives him. This measure reflects all the good or bad things in life to come (Siyan, et al, 2019). The current COVID-19 pandemic is a global problem that can hurt global economic growth in most countries. The pandemic has also directly affected the real estate and housing market, which has disrupted the supply of raw materials and human resources (Ha, 2021). Fulfilling housing needs in Indonesia is still the main problem because, until now, housing needs have yet to be met equally for all community groups, especially the MBR (Low-Income Communities). People can own a house with cash or credit in the property market, both primary and secondary. The primary market provides new housing needs for the community through government and private developers, while the secondary market provides a choice of houses that have been used (Ayuningtyas, 2022). COVID-19 has impacted almost all business sectors in Indonesia, including the real estate industry.

The real estate industry, especially property, has led to reduced house construction, decreased house prices, low housing demand, layoffs, and evictions (Lazuardi & Rahadi, 2021). Macroprudential policies are needed to resolve problems related to the housing market and credit availability (Constantinescu & Lastauskas, 2018). Khoirudin & Kurniawan (2023) states the response of interest rates to fluctuations in housing prices is stronger than the response of housing prices to fluctuations in interest rates. It indicates that the interest rate stimulus is more reactive to changes in housing prices as an accommodation of housing price volatility. Kurniawan et al (2023) argued that strong monetary operation through interest rates can maintain public expectations of prices, especially property prices.

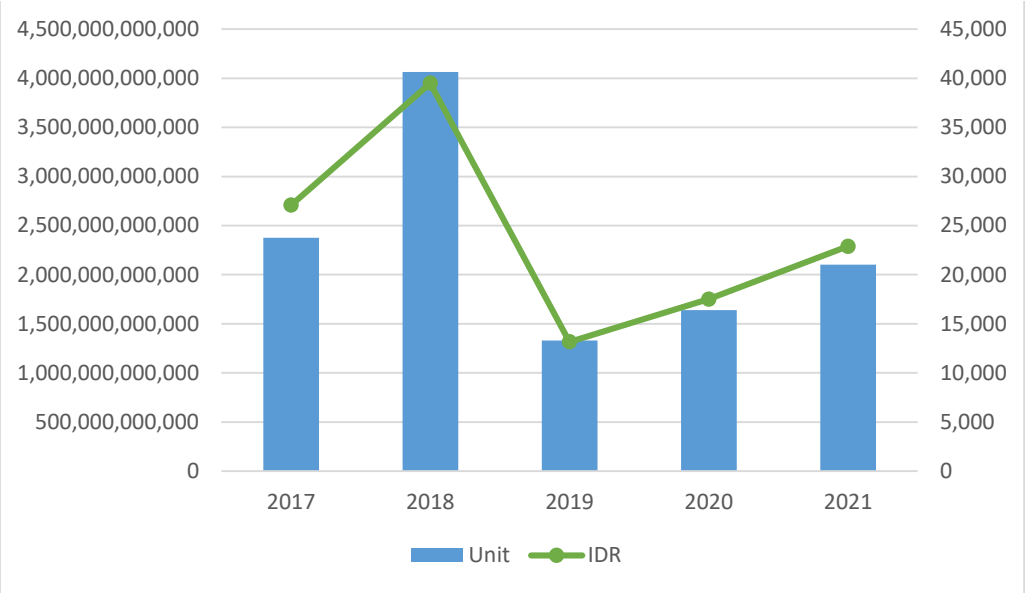

Figure 1. Realisation of Housing Finance Liquidity Facility in 2021

The provision of housing for the community is not only prioritized on quantity but also a quality that, pays attention to quality feasibility even at a more affordable price. One of the housing finance assistance through subsidized mortgages is the Housing Finance Liquidity Facility. Housing financing assistance aims to provide mortgage interest rate relief for MBR debtors affected by COVID-19. The following is the realization of the distribution of Housing Financing Liquidity Facility mortgages during 2021 as shown in Figure 1. The financing of residential property development still relies on financing from non-banks. Property development financing comes from the developer's internal funds amounting to 65.45 percent of the total capital requirement. The main source of financing for the purchase of residential properties is through mortgage facilities, as reflected in the results of a consumer survey in the first quarter of 2021 using mortgage facilities amounting to 73.67 percent of the total financing. Meanwhile, other sources of property purchases came from gradual cash (18.26 percent) and cash (8.07 percent). Furthermore, the housing financing disbursement in the first quarter of 2021 is IDR 2,289 trillion. This number decreased by 33.10 percent (YoY), or a growth contraction of -18.89 percent (YoY) compared to the previous quarter (Bank Indonesia, 2021).

The emergence of the housing market bubble and the subprime crisis led to an increase in individual incomes, which resulted in an increase in the number of mortgage loans demanded, especially for the middle class. Empirical results show that there was a decrease in the income elasticity of demand for mortgage loans in the years before 2007, especially in the middle of 2007. This finding implies that the increase in house prices is not matched by an increase in the income of loan applicants (Delis et al., 2019). The greater availability of housing loans will increase the burden on household mortgage payments, resulting in a reduction in other consumption expenditures. The increasing availability of housing loans is accompanied by a shift away from fixed interest rates to variable interest rates on housing loans. This prompted the government to tighten monetary policy by raising interest rates on the variable rate of housing loans (Horioka & Niimi, 2020). Dajcman (2022) explores the determinants of demand for housing mortgage loans across 13 countries in the Euro area. Empirical results show that housing price growth is positively related to changes in demand for housing mortgage loans. A positive relationship was also found between GDP growth and changes in demand for mortgage loans. Housing mortgage interest rate growth and changes in bank credit standards for housing mortgage loans are negatively related to changes in demand for housing

mortgage loans. Empirically the demand for housing mortgage loans generally becomes more significant after the start of the subprime mortgage crisis in the US than before the crisis.

The increasing volume of commercial bank residential mortgage lending business is rapidly increasing, pushing the risk of prepayment more open. Prepayments will have a major impact on the duration and convexity of residential mortgages on commercial bank loans, which then causes the bank's asset and liability management to experience difficulties. Therefore, changes in market interest rates are very important for commercial banks to manage their exposure to interest rate risk. Based on the options analysis of the characteristics of prepaid residential mortgage loans, the CIR model with GARCH (1,1) was chosen to describe the change in path interest rates, while computer simulation methods were used to calculate OAS and calculate the effective duration and effective convexity of residential mortgage loans under different prepaid rates, to understand the interest rate risk of residential mortgage loans (Tang, 2021). Rojas (2021), in his research, found a positive relationship between mortgage credit and borrower income from 1993 to 2009. However, from 1998 to 2006, the relationship was significantly less positive, which means that mortgage credit growth was most substantial for low-income borrowers during that period. The growth in credit obtained by borrowers who previously had the most limited access to mortgage credit is disproportionate to the housing crisis of the mid-2000s triggered by a dramatic expansion in the supply, or availability, of mortgage credit and this expansion beginning in the late 1990s.

The ARDL model was used by Humbatova & Hajiyev (2021) as a research model to analyze the relationship between world oil prices and mortgage lending and real estate lending in the Republic of Azerbaijan over the last ten years (2010M01−2020M01). In addition to the ARDL model, variable stationarity tests (ADF, PP, KPSS) were also carried out, and the Engle-Granger cointegration equation was evaluated using FMOLS and DOLS, as well as CCR. Theoretically, the results of the analysis prove that there is a certain positive correlation between world oil prices, mortgage loans, and real estate loans. Studies conducted by Chen et al., (2020) on a number of households during the reform period (1998–2001) and after the reform period (2002-2009) show that the savings rate of Chinese urban households has increased, accompanied by an increase in home ownership. Fauzia, et al., (2019) found that in the short term, the demand for housing loans was influenced by income, while housing prices, income, and in the long term, the LTV ratio has a significant impact on mortgage demand. Study Ebekozien et al., (2019) used oral interview techniques with 40 Malaysian LIEs. The results of the study stated that at 70%, the rate of LIEs housing loan applications was rejected, independent institutions managing self-rental schemes were not managed by the government, and special housing schemes were granted only to LIEs because the scheme was more affordable.

The factor behind this research is the inability of many debtors to make housing loan payments. The COVID-19 pandemic has impacted decreasing people's income and decreasing the distribution of home ownership credit. Providing housing needs does not only prioritize quantity but also pays attention to quality, even at an affordable price. Based on the information and data described, problems can be formulated regarding the demand for housing credit. The main problems with the demand for housing credit are weakening people's incomes, high interest rates on housing loans, decreasing disbursement of housing finance funds, and people's purchasing power to own a house. The weakening of people's income due to the COVID-19 pandemic has resulted in people's inability to meet their housing needs. High credit interest rates result in high installment costs, so people are not interested in taking out mortgages—reduced disbursement of banking funds for housing credit financing. This research to identify the development of mortgages in Indonesia in depth, considering several factors that affect the demand for housing loans in Indonesia. These factors include low community income, high interest rates on housing loans, reduced distribution of housing finance funds, and people's purchasing power to own a house. This study aims to identify the factors influencing the demand for housing loans in Indonesia.

2. Literature Review

Homeownership is the main focus of the household. One of the efforts to achieve home ownership can be through mortgage loans or additional accumulated wealth as a down payment (Naoi et al., 2018). The loan will be used to purchase real estate assets, so mortgage financing will affect real estate prices (Bian et al., 2018). Since the early 2000s, macroprudential policy has become part of the regulatory and supervisory framework. Among macroprudential tools, the purpose of the loan-to-value ratio (LTV) is to limit mortgage loan applications. Research conducted using a sample of

more than 4,000 banks from 46 countries analyzed the effectiveness of LTV on mortgage loan moderation. These findings indicate that the LTV policy has successfully limited mortgage lending (Morgan et al., 2019). Types of mortgages are classified according to the characteristics of the payment model, the frequency of payments, the calculation of the interest rate, and the equity share of the property. The fixed interest rate payment method means that the lender is sure of the certainty of the amount that will be paid by the borrower regularly. This method is unprofitable when market interest rates are increasing because it devalues the value of the lender's mortgage capital. Another method is market fluctuation-adjustable interest rates, whereby the borrower can repay the mortgage according to current market conditions, although rising market rates can result in the borrower defaulting (Ampofo, 2020).

Chen et al (2020) proves the importance of the interaction between interest rates and household liquidity constraints to assess the effect of monetary policy on mortgage refinancing activities. When many households experience liquidity problems, refinancing behavior becomes insensitive to changes in interest rates, especially in the face of pressure on housing collateral values or high debt service ratios. Monetary easing policy when there is an economic downturn, i.e., when aggregate income decreases, causes mortgage refinancing activity to be more substantial than the standard model predicted, which is based only on changes in interest rates unless accompanied by an additional tightening of lending standards. Karpestam & Johansson (2019) conducted an analysis of the long-term and short-term relationship between mortgage payments and real house prices, the number of property sales, and Mortgage payable. The findings of this study are that nominal housing payments, including mortgage payments, have a negative and significant effect, while user convention fees do not have a significant effect. The availability of mortgage-secured loans directly affects household portfolio choices, housing and asset prices, rates of home ownership, and monetary policy transmission. This paper uses the variable quantity of credit available to borrowers at the individual level (Anenberg et al., 2019).

Siyan et al (2019) examines the development of mortgage financing in Nigeria and its impact on economic growth. Housing finance aggregate data from banks and non-financial financial institutions are used to measure housing finance. Other variables considered include financial debt proxied by M2 per capita, financial volatility, interest rates, and capital market development measured by market capitalization. The results of the analysis show that there is a relationship between mortgage financing and economic growth. Mortgage financing has proven to be a significant determinant of the long-term pattern of economic growth. Applicants who have low incomes may be relatively more sensitive to premium reductions. This is due to two reasons. First, low-income borrowers have higher DTI ratios and tend to be rejected. These lower premiums have a more significant effect on the probability that the applicant's loan is approved. Second, low-income households may have a more price-elastic demand for housing. In this case, the premium reduction will bring more low-income applicants to the market (Bhutta & Ringo, 2021).

3. Method

The type of research used is quantitative with data collection methods, that is documentation. The method of collecting data with documentation is to collect data from various documents obtained from the agency. Sources of research data were obtained from the publication of the Residential Property Price Survey published by Bank Indonesia, Gross Domestic Product (GDP) published by the Badan Pusat Statistik (BPS), and Indonesian Banking Statistics published online by the Otoritas Jasa Keuangan (OJK). The population in this study are conventional commercial banks consisting of state-owned banks, regional government banks, national private banks, as well as foreign and joint venture banks. The sampling method used the saturated sampling method, where the entire population was used as the research sample. The total number of samples used in this study was 31 samples.

The data analysis technique used the Partial Adjustment Model (PAM). The theory that explains the geometric lag is the inventory adjustment model or the partial adjustment model (Gujarati, et al., 2019). The Partial Adjustment Model has the advantage of forming a static empirical economic model into a dynamic one by taking into account the role of time. This model can also see the response of the influence of the dependent variable to one unit change in the value of the variable that explains both the short term and the long term. The specifications of the research model for housing demand mortgage are as follows:

$$MD_t^* = \beta_0 + \beta_1 GDP_t + \beta_2 KPRPA_t + \beta_3 HF_t + \beta_4 COV_t + MD_{t-1} + \varepsilon_t \quad (1)$$

Where MD_t^* is the notation for the change of housing demand mortgage with the equation as follows:

$$MD_t - MD_{t-1} = \delta(MD_t^* - MD_{t-1}) \quad (2)$$

Where $MD_t - MD_{t-1}$ is the change in actual mortgage value and $MD_t^* - MD_{t-1}$ is the change in the value of KPR that expected. Therefore the housing demand mortgage can write as follows:

$$MD_t = \delta MD_t^* + (1 - \delta)MD_{t-1} \quad (3)$$

The equation (3) including in the equation for PAM model as follows:

$$MD_t = \delta\beta_0 + \delta\beta_1 GDP_t + \delta\beta_2 KPRPA_t + \delta\beta_3 HF_t + \delta\beta_4 COV_t + (1 - \delta)MD_{t-1} + \delta\varepsilon_t \quad (4)$$

The equation is then formed in the following semi-logarithmic model, which aims to reduce data variance and equalize units as follows:

$$LMD_t = \delta\beta_0 + \delta\beta_1 LGDP_t + \delta\beta_2 KPRPA_t + \delta\beta_3 LHF_t + \delta\beta_4 COV_t + LMD_{t-1} + \delta\varepsilon_t \quad (5)$$

Where LMD_t is the housing demand mortgage (natural logarithm); $LGDP_t$ is gross domestic product and proxy for income (natural logarithm); $KPRPA_t$ is the consumer credit interest rate KPR/KPA (percent); LHF_t is the total housing finance (natural logarithm); COV_t is the dummy before and during the pandemic COVID-19 (0 = before; 1 = during); LMD_{t-1} is the housing demand mortgage period previous year; ε_t is the error term; β_0 is the constanta and $\beta_1 - \beta_4$ is the coefficient of independent variables.

4. Results and Discussion

This study applies the unit root test with Augmented Dickey-Fuller (ADF) approach to test the presence of non-stationary stochastic in time-series data. Table 1 shows the most of the data on these variables are not stationary at the level except KPRPA variables because the absolute value of the ADF statistic is smaller than the critical value of MacKinnon. The non-stationary data transform to first difference unit root test method or Integration of order one I(1). The test results show that the GDP, KPRPA, and HF data are stated to be stationary where the absolute value of the ADF statistic is greater than the critical value of MacKinnon. All data not to transform on second difference to avoid the spurios regression on result of the model (Kurniawan, 2020).

Table 1. Result of Stationery Test

Variables	ADF t-statistics for I(0)	ADF t-statistics for I(1)
LMD	-2.882	-2.964***
LGDP	-1.246	-3.574***
KPRPA	-3.402***	-3.568***
LHF	-0.927	-3.581***

Source: data processed

After testing the stationarity of the data, then proceed with the classical assumption test. The classical assumption need to make the model of regression based for PAM model unbiased. PAM model has the advantage to revise their estimates with reference of housing demand mortgage (Akinaga et al., 2023). Table 2 shows the classical assumption diagnoses as a whole meet the BLUE regression criteria (best linear unbiased estimator). The normality test shows that the data is normally distributed because the probability value of Jarque Bera is greater than = 0.05. The autocorrelation and heteroscedasticity tests also have a probability value greater than = 0.05, so they are declared free from autocorrelation and heteroscedasticity problems. Meanwhile, the linearity test showed that the linear model was the right model to be used in this study. The multicollinearity test method uses the client method by comparing the main model R^2 with the regression of each independent variable (auxiliary regression). Overall R^2 auxiliary is smaller than the main regression, so it can be concluded that the research model is free from multicollinearity problems.

Table 2. Result of Classical Assumption

Classical Asuumption Test	Method	Probability	Result
Normality	JB test	0.2962**	Normally distributed
Autocorrelation	Bresuch-Godfrey	0.1819**	No Autocorrelation
Heteroscedasticity	White	0.4225**	No Heteroscedasticity
Linearity	Ramsey Reset	0.8180**	Has linear
	Multicollinearity		
Regression Model	Auxiliary Regression		Result
$R^2 = 0.9987$	$R^2_{LR, LHF, COV} = 0.8044$		No Multicollinearity
	$R^2_{LGDP, LHF, COV} = 0.8799$		No Multicollinearity
	$R^2_{LGDP, LR, LHF} = 0.1407$		No Multicollinearity
	$R^2_{LGDP, LR, LHF} = 0.6643$		No Multicollinearity

Source: data processed

Table 3 shows the short-term equation was then subjected to statistical tests, including partial, simultaneous, and coefficient determination tests. The following is a statistical test for the above equation model, which can be described in detail as follows. The t-statistic test explains the effect of the independent variable on the dependent variable. The community income variable (LGDP) has a positive effect on the housing demand mortgage (MD), while the interest rate for consumption credit for KPR/KPA (KPRPA) has a negative effect, which is indicated by the probability value being smaller than the significance level = 0.05. The variable amount of housing finance (LHF) and the COVID-19 pandemic (COV) did not significantly affect the housing demand mortgage because the probability value was more significant than the significance level = 0.05. The LMD(-1) variable proved to have a positive and significant effect on the housing demand mortgage. A simultaneous significance test (F-test) was conducted to determine the effect of the independent variables on the dependent variable together. The F-statistical probability value of 0.000 is smaller than = 0.005, so it rejects Ho. This means that there is a joint influence of community income variables (LGDP), interest rates for KPR/KPA (KPRPA), the amount of housing finance (LHF), and the COVID-19 pandemic (COV) on housing demand mortgage (LMD). The coefficient of determination (R2) is used to determine how much influence the independent variable has on the dependent variable.

Table 3. Result of Short-run Estimation

Variables	Coefficient
C	-0.205
	(-0.298)
LGDP	0.202
	(2.801)***
KPRPA	-0.020
	(-4.340)***
LHF	0.001
	(0.438)
COV	-0.006
	(-0.926)
LMD(-1)	0.801
	(17.990)***
Diagnostic Tools	
Adjusted R^2	0.9987
F-stat	4473.03***

Source: data processed

The value of the coefficient of determination (R^2) is used to measure the magnitude of the influence of the independent variable on the dependent variable in the PAM regression equation, that is Adjusted-R^2. The Adjusted-R^2 value in the equation is 0.9987, which means that a 99.87 percent change in the behavior of the housing demand mortgage variable is influenced by the behavior of the independent variable community income, mortgage/KPA consumption credit interest rates, the amount of housing finance, and the COVID-19 pandemic. 19, while the remaining 0.13 percent is influenced by other variables that are not included in the model contained in random errors. The long-term coefficient is calculated by dividing the coefficient of the independent, variable or the short-term

coefficient by its adjustment coefficient. Table 4 shows the value of the adjustment coefficient for the housing demand mortgage model is 0.1987 (1-0.8013), where there is a difference between the expected housing demand mortgage and the actual value of 19.87 percent, which can be adjusted and can be eliminated within one quarter. The long-term coefficient values for the LGDP and KPRPA variables have a significant relationship to LMD, while the LHF and COV-19 variables are not significantly related. People's income has a positive impact on the housing demand mortgage. In the short term, if there is an increase in income of 1 percent, it will increase the housing demand mortgage by 0.20 percent. In the long term, if there is an increase in income of 1 percent, the housing demand mortgage will increase by 1.02 percent with the assumption of ceteris paribus. This means that the Indonesian people have been able to meet the needs of their own homes in accordance with the income they receive.

Table 4. Result of Long-term Estimation

Variable	Adjustment Coefficient	Long-term Coefficient
C		-1.0311
LGDP		1.0188
KPRPA	0.1987	-0.1003
LHF		0.0031
COV		-0.0297
LMD(-1)		

Source: data processed

The study's results align with the hypothesis, which states that there is a positive influence between income and housing demand mortgage. The size of income will determine consumption and investment. The greater the income, the greater the tendency of people to consume and invest so that it will encourage people to have the purchasing power to meet their housing needs. People who wish to have housing needs are trying to fulfill one of them through housing demand mortgage. This research is in line with Naoi et al., (2018), which state that there is a positive relationship between income and the demand for housing loans. The analysis results show that the UK's income elasticity for mortgage demand is the highest among other countries, Australia and Japan. This suggests that the relatively small income elasticity of demand for mortgages in Japan reflects that mortgage grants in Japan tend to respond less to increases in household income levels) as well as to provide relief to lenders who experience default. This finding also aligns with the theory, which states that the demand for a good is determined by income. Income and demand are directly proportional, meaning that the higher the income, the higher the demand for a good.

The trends observed in the housing market during the economic crisis and pandemic have not affected poor households, low incomes, and social inequality and wealth have disproportionately. Housing is a significant factor in increasing inequality because its investment function becomes more prominent during periods of high inflation (Khurami & Sarı, 2022). Interest rates have a negative effect on the demand for housing loans. In the short term, when there is an increase in interest rates by 1 percent, it will reduce the demand for housing loans by 0.02 percent. In the long term, if interest rates increase by 1 percent, the demand for housing loans will decrease by 0.10 percent with the assumption of ceteris paribus. This can be interpreted that housing loans proposed by the public tend to be driven more by credit interest rates, especially KPR/KPA. Interest rates reflect conditions in the lending market to control monetary policy shocks. Net borrowing is a proxy for the importance of a bank's lending activity (that is, capital tied to the purpose of the loan) (Morgan et al., 2019). According to post-Keynesian thinking, interest rates can influence the number of loans demanded by households to purchase consumer goods and housing. An increase in interest rates will reduce the purchasing power of borrowers. In this case the interest rate is proxied as a price, where a decrease in the cost of housing loans or consumer goods will increase the suitability of demand (Deleidi, 2018). The amount of housing finance in this study showed insignificant results, which means that there is no effect of the amount of housing finance on demand for housing loans. The estimation results indicate that housing financing still requires processes and efforts to increase the demand for housing loans in the long term. This research also proves Keynes' theory, which states that credit interest rates are negatively related to credit demand, which means that an increase in credit interest rates will reduce credit demand.

The COVID-19 condition does not have a significant impact, which means that the current COVID-19 pandemic has not caused an increase or decrease in the demand for housing loans. This is

presumably due to the loan-to-value (LTV) ratio policy which applies the down payment rule for mortgage applications of zero percent. The policy is contained in Bank Indonesia Regulation Number 20/8/PBI/2018 concerning a loan to value ratios for property loans, financing-to-value ratios for property financing, and advances for loans or motor vehicle financing. COVID-19 has changed lives and work patterns since the beginning of 2020. This condition will continue to impact all sectors of the economy, including the real estate market. This is because economic development is closely related to the housing market; meanwhile, the monetary policies applied to the cycles of the housing market and real estate industry are unable to overcome the considerable uncertainty caused by COVID-19 (Li & Zhang, 2021).

5. Conclusion

A house is a basic human need that must be met to support daily activities. However, not all people can fulfill their housing needs. Increasingly expensive house prices can cause this in line with the significant demand for housing. The housing sector in Indonesia plays an essential role in increasing demand for housing needs. However, in reality, the government and the private sector need help to meet housing needs optimally, especially for low-income people. The COVID-19 pandemic has impacted the sluggish property business, where there has been a decline in house buying and selling activity because houses still need to be considered a priority. The conclusion from this research is that income and interest rates have a significant effect on the demand for housing loans. The greater the income, the greater the people's desire to consume and invest. This encourages people to have the purchasing power to meet their housing needs. Low interest rates will increase the growth of mortgage loans because the interest on loans charged to the public is still quite affordable.

One of the sources of housing financing comes from public savings. Public savings are influenced by income, so if the income received is low enough, the banks need more funds to channel credit funds in the form of mortgages from these public deposits. The condition of the COVID-19 pandemic is the cause of the decline in income, so people cannot access financing from banks. The government should be able to formulate policies by lowering the benchmark interest rate so that it can provide opportunities for people who need housing finance. This policy also aims to give people from various groups the opportunity to buy houses at affordable prices. Different housing finance policies can be obtained through housing assistance programs, including Housing Finance Liquidity Facility (FLPP), Down Payment Assistance Subsidy (SBUM), Savings-based Housing Financing Assistance (BP2BT), and Public Housing Savings (Tapera). For further research, you can increase the sample size by extending the observation period to get better estimation results.

Acknowledgment

We would like to thank the Research and Community Service Institute of Amikom University Yogyakarta for providing funding assistance so that the author can produce research outputs in the form of journals. The creation of this journal is also inseparable from the support of the Central Bureau of Statistics Republic of Indonesia (BPS), The Central Bank of The Republic of Indonesia (BI), and *The Financial Services Authority* (OJK) as data providers. statistics during the research process. In addition, we would also like to express our gratitude to the Economics Study Program, Faculty of Economics and Social, Amikom University Yogyakarta, and all parties who contributed and provided motivation in this research activity.

Declarations

Author contribution	:	Each author made equal contributions to the primary content of this paper. Furthermore, all authors have carefully reviewed and endorsed the final manuscript.
Funding statement	:	This research was not financially supported by any external parties or funding agencies.
Conflict of interest	:	The authors have disclosed that there are no conflicts of interest to declare.
Additional information	:	There is no further information accessible regarding this paper.

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