

HOW TO CONTROL THE HOUSE PRICES THROUGH THE DEMAND SIDES?

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ABSTRACT

This study aims to examine and analyze the factors, which influence house prices from the demand side in developed and developing countries. It was tested using the Generalized Method of Moments with the dependent and the independent variable of the house price index involving real interest rates, credit, economic, and population growth. This study uses 54 panel data which is divided into 31 sub-groups of developed countries and 23 developing countries from 2005 to 2017. This research tries to contribute in observing the role of macroprudential and monetary policies in controlling housing prices globally in both developed and emerging markets as well as looking for the relationship between credit growth and house prices because credit is the closest macroprudential and monetary policy channel to the real sector. The results showed that interest rates, credit, economic, and population growth significantly effect housing prices. Interest rate variables have a negative effect, while credit, economic growth, and population growth have a positive effect on house prices. The influence coefficient's magnitude is different from developed countries to have a more significant influence than developing countries. Another result show that improvement of house price index caused by credit growth enhancement in developed countries greater than in developing countries. Furthermore, the study provides suggestions for policymakers to control house prices due to a reduction, which causes financial crisis. Therefore, the government needs to enter into financial institutions to increase prudence in the housing finance system.

Keywords: house prices, real interest rates, money supply, credit growth, economic growth

JEL Classification: E21, E43, E51, G12, G21

1. Introduction

The house price is a very crucial variable in the economy. This is because the house is a basic human need to prioritize personal and household finances. In addition to meeting basic needs, the trend of rising house prices also encourages people to make their homes or residences as investment commodities (Yao and Zhang, 2005). Because of the dominant portion in the household or business budget, the increase in house prices can, of course, quickly affect the rise in prices for other goods and services in an area (Goeltom, 2008). Therefore, the movement of house prices is one of the main concerns for the government, especially in maintaining economic stability in the region.

It is not uncommon for several developed and developing countries to face economic crises due to house prices movements. The subprime mortgage crisis in America in 2008/2009 is proof of how strong the influence of house prices is in shaking the economic stability of this superpower country. Mihaylovski (2017) states that changes in house prices can easily and quickly

affect economic conditions. This is because the house is one of the main cost components in business so that an increase in house prices will be able to drastically increase production costs and impact the rise in goods and services produced.

In addition, because housing prices are high, home purchases are often made on credit and long-term. Therefore, the house automatically becomes the most attractive collateral for banks because if their customers default on their payments, they can benefit from the collateral acquisition. After all, the relative value of the house continues to rise. If house prices have an upward trend, then the loan size to the bank for housing will automatically increase (Goodhart & Hofmann, 2008). However, when during the installment period, it turns out that the economy is sluggish, the people's purchasing power will decrease so that it will also impact the ability of bank customers to repay their mortgage installments. Of course, this directly affects banks' financial condition (Baker, 2008; Duca, Muellbauer, & Murphy, 2010; Edey, 2009). If this happens massively and affects banks that have systemic risk, then in aggregate, it can have an impact on the disruption of a country's financial stability, which of course, can lead to an economic crisis. (Reavis, 2012).

Global housing prices, which continued to creep up and out of control since 2000, turned out to suddenly drop from 2008 to 2010 due to the subprime mortgage crisis. The lack of prudence in housing loans was one of the leading causes of the crisis. Indeed, the fact is that the price spread of a home business is very tempting for banks, investors, and the public as buyers. The global crisis experience does not seem to deter the three economic actors from being active in the property business. This can be seen from the movement of house prices, which have been creeping up again since 2012 until they almost matched the highest prices before the 2008 crisis.

Central banks in various countries have implemented macroprudential policies mixed with monetary policy to recur the global crisis triggered by housing credit. Various studies have shown that macroprudential policies alone or combined with monetary policies have been displayed to control house prices changes after the 2008 global crisis, primarily until the early 2010s. However, with the drastic increase in house prices since 2014, macroprudential policies towards house prices need to be re-analyzed. This is important as a precautionary measure to prevent a recurrence of the crisis due to rising house prices in future periods.

Thus, this study tries to observe the role of macroprudential and monetary policies in controlling housing prices globally in both developed and emerging markets. This study's results are expected to provide information about the characteristics of the policy in the period 2005 to 2017, during which period house prices have increased and decreased drastically. Besides, this research also contributes to finding the relationship between credit growth and house prices. This is important, considering that credit is the closest macroprudential and monetary policy channel to the real sector. By knowing the relationship between the two, the information will be obtained whether house prices result from a reaction from a credit or vice versa.

2. Literature Review

Several previous studies have analyzed the factors that influence house prices from the demand side. De Vries and Boelhouwer (2005); Lee (2009); Zhang, Hua, and Zhao (2012); and Erdem, Coskun, and Oruc (2013); and Sing (2018) suggest that interest rates have an essential role in the formation of house prices. The higher the real interest rate, the more expensive property investment costs will be. From the customer side, high-interest rates make them reluctant to buy houses on credit because household expenses are more significant to pay loan interest (Ahuja, Cheung, Han, & Porter, 2010). IMF (2003) and Kim & Min (2011) suggest that an increase in real interest rates will usually be accompanied by a fall in house prices. This occurs because the community's high cost cannot be reached by the community, so aggregate demand has decreased. Meanwhile, housing supply tends to be rigid so that this condition impacts the decline in house prices itself (Tan, 2010; Ong, 2013; Zeren, Erguzel, and Ass, 2015).

From the demand side, house prices are highly dependent on people's purchasing power, shown by high incomes. When the economy can grow well, this can boost people's intention and ability to buy a house. As a result, the demand for houses has increased so that house prices have also crept up (Piros and Pito, 2013). Apart from income, the high population in an area also positively impacts house prices (Str, Germany, & Mulder, 2006). Myrmo (2012) states that an increase in population growth will lead to an increase in demand, thus triggering higher house prices and can lead to the formation of bubbles in the economy.

Hördahl and Packer (2007), Yin et al. (2017), Gimeno & Martinez-Carrascal (2010), Zhu (2016), and Constantinescu & Lastauskas (2018) stated that the high house prices could not be separated from the increase in credit facilities extended to the public. The high level of credit opened to the public could be due to monetary policy easing by lowering interest rates (Hofmann, 2003; Collins & Senhadji, 2002; Oikarinen, 2009). Besides, from a macroprudential policy point of view, this high credit could result from the increase in the standard of loan to the central bank's value to boost the economy.

Since the global crisis triggered by the subprime mortgage in America in the 2008s, the monetary policy authority has been increasingly concerned with macroprudential policies, especially for controlling house prices. Some studies like Mendicino and Punzi (2014) in the G7 countries, Jung and Lee (2017) in Korea, Cronin and McQuinn (2016) as well as Kelly, McCann, & O'Toole (2018) in Ireland, and Funke, Kirkby, and Mihaylovski (2018) in New Zealand have been proven that with the macroprudential policy, house prices can be relatively under control.

This study tries to contribute to the existing literature by analyzing the role of macroprudential policy and several other supporting variables in influencing house prices in developed and developing countries more broadly. Therefore, the hypothesis of this study is as follows:

- H1. *The macroprudential index has a negative effect on house prices*
- H2. *The real interest rate has a negative effect on house prices*

- H3. Economic growth has a positive effect on house prices
 H4. Population growth has a positive effect on house prices
 H5. Credit growth has a positive effect on house prices

3. Research Methodology

To find out how macroprudential and monetary policies and several other variables such as economic growth, population, and credit growth play a role in controlling housing prices globally, this study uses panel data from 54 countries divided into 31 sub-groups of developed and 23 developing countries in 2005 to 2017. Developed countries are countries with a gross national income per capita of US \$ 12,235 or more. Meanwhile, the emerging group countries are countries with a gross national income per capita (GNI) between the US \$ 1,006 - US \$ 12,235 (World Bank, 2018).

The macroprudential index data in this study refers to the research data set by Cerutti et al. (2017). There are 12 macroprudential policy instruments, namely Loan to Value Ratio (LTV), Debt to Income Ratio (DTI), Dynamic Loan Loss Provisioning (DP), General Countercyclical Capital Buffer / Requirement (CTC), Leverage Ratio (LEV), Systemically Important Financial Institution (SIFI), Limit on Interbank Exposures (INTER), Concentration Limits (CONC), Limits on Foreign Currency Loans (FC), Reserve Requirement Ratios (RR), Limit on Domestic Currency Loans (CG), and Financial Institution Tax (TAX). If a country in a certain period has one of the macroprudential policy instruments, it will be given a score of 1, vice versa. The macroprudential index is then obtained by adding up the scores of the 12 instruments. In detail, the variables used in this study can be seen in the following table:

Table. Identification of Variables

| Variable | Definition | Source |
|-------------------------------|--|---|
| Real Housing Price Index (HP) | $\frac{NHP}{CPI} \times 100$ NHP: Nominal Housing Price CPI: Consumer Price Index with 2010 as a base year | Bank for International Settlements (BIS) |
| Macroprudential Index (MPI) | LTV + CAP + DTI + DP + CTC + LEV + SIFI + INTER + CONC + FC + RR + REV + CG + TAX | Cerutti et al. (2017) |
| Real Interest Rate (RIR) | Lending rate minus inflation | World Bank and Central Bank |
| Economic Growth (Ec) | $\frac{Nominal\ GDP}{Deflator\ GDP} \times 100\%$ GDP: Gross Domestic Product | World Bank |
| Population Growth (Pop) | $\frac{Population_t - Population_{t-1}}{Population_{t-1}} \times 100$ | World Bank |
| Credit Growth (CR) | $\frac{Credit_t - Credit_{t-1}}{Credit_{t-1}} \times 100$ | Bank for International Settlements (BIS), International Monetary Fund (IMF) |

Furthermore, to estimate the effect of macroprudential policy, monetary policy, economic growth, population growth, and credit growth on house prices, the study used the Generalized Methodology Method (GMM) on panel data in groups of developed and developing countries. This is because house prices, as the dependent variable, are very susceptible to being influenced by house prices in the previous period. Dynamic adjustments are needed to estimate the panel data used (Gujarati, 2012). More specifically, this study uses a quantitative approach to the dynamic panel econometric model, characterized by a lag between the dependent variable. Namely, GMM-SYS (Generalized Method of Moments-System) and adding instrument variables (IV) and control variables to determine the effect of independent variables and control variables on the dependent variable, which is positive or negative. The instrument variable (IV) is used so that the resulting estimated value is not biased. Thus, the equations used in this study are as follows:

$$HP_{it} = \gamma_0 + HP_{it-1} + \gamma_1 RIR_{it} + \gamma_2 Pop_{it} + \gamma_3 Ec_{it} + \mu_{it} \dots \dots \dots (1)$$

and

$$HP_{it} = \alpha_0 + \alpha_1 CR_{it} + \varepsilon_{it} \dots \dots \dots (2)$$

where

| | |
|-----------------------------------|------------------------------|
| HP_{it} | = House Prices |
| HP_{it-1} | = House Price Lag |
| RIR_{it} | = Real Interest Rate |
| Pop_{it} | = Population Growth |
| Ec_{it} | = RealGross Domestic Product |
| CR_{it} | = Credit Growth |
| μ_{it} and ε_{it} | = Error Term |

In this research, the credit variable will be separated from the four variables previously mentioned. This is done to avoid autocorrelation between independent variables, considering that credit is one of the monetary and macroprudential policy transmission channels.

4. Results and Discussion

In general, Table 2 displays descriptive statistics of all variables used in this study during the period 2005 to 2017. In the descriptive statistics for the subgroups of developed countries, each variable has 299 total observations. The house price index has an average of 101.60, a standard deviation of 21.53, a minimum value of 50.15, and a maximum of 173.47. The real interest rate has a standard deviation of 7.68, an average value of 5.78, a minimum value of -14.29, and a maximum value of 44.64. Credit growth has an average of -3.99, a standard deviation of 2.84, minimum and maximum values of -13.88 and 1.57, respectively. The real gross domestic product (GDP) has a maximum value of 32.23 and 19.39, the standard deviation, and the mean are 2.92 and 24.62, respectively. Descriptive statistics for the population, namely 0.56 for the average value,

Meanwhile, in the descriptive statistics for the developing country subgroup, the house price index is 105.87 for the average value, the maximum value is 209.43, and the minimum value is 67.26 with a standard deviation of 20.07. The real interest rate has an average of 2.94, a standard deviation of 2.73, a minimum value of -6.62, and a maximum of 19.88. Credit growth has an average of -1.25, a standard deviation of 4.92, with maximum and minimum values of 54.09 and -11.26, respectively. Then the Gross Domestic Product (GDP) has an average of 22.73, the standard deviation of the Gross Domestic Product (GDP) is 2.60, then it has the minimum and maximum values, respectively, of 17.91 and 30.40. The population has a maximum value of 5.32 and a mean of -2.08. The population variable has a standard deviation and a mean of -0.81 and 0.69, respectively.

Table 2. Descriptive Statistics of Developed Countries and Developing Countries Subgroup

| Variable | Number of Observation | Mean | Standard Deviation | Min | Max |
|----------------------|-----------------------|--------|--------------------|--------|--------|
| Developed countries | | | | | |
| <i>House Price</i> | 299 | 101.60 | 21.53 | 50.15 | 173.47 |
| RIR | 299 | 5.78 | 7.68 | -14.29 | 44.64 |
| <i>Credit Growth</i> | 299 | -3.99 | 2.84 | -13.88 | 1.57 |
| GDP | 299 | 24.62 | 2.92 | 19.39 | 32.23 |
| Population | 299 | 0.56 | -0.89 | -2.26 | 1.91 |
| Developing countries | | | | | |
| <i>House Price</i> | 402 | 105.87 | 20.07 | 67.26 | 209.43 |
| RIR | 403 | 2.94 | 2.73 | -6.62 | 19.88 |
| <i>Credit Growth</i> | 403 | -1.25 | 4.92 | -11.26 | 54.09 |
| GDP | 403 | 22.73 | 2.60 | 17.91 | 30.40 |
| Population | 403 | 0.69 | -0.81 | -2.08 | 5.32 |

Table 3 and Table 4 show dynamic panel regression identification results using the Generalized Method of Moments method. In tables 3 and 4, the estimation results are using the GMM-SYS (Generalized Method of Moment - System) in estimating variables that affect house prices such as real interest rates, credit growth, GDP, and population growth. In interpreting the estimation results using GMM-SYS, it must be ascertained beforehand that the value of the model's parameters can be estimated statistically.

The overidentifying restriction identification test is used in the validity of the instrument used. This test is performed using the Hansen test, which is distributed with chi-square statistics. The estimation results show that the Hansen test scores for developed, developing countries, and overall are 0.525, 0.692, and 0.892, respectively. The scores for each of these subgroups of countries are not significant at the 1%, 5%, or 10% levels. This shows that H_0 is accepted, which means that overidentifying is accepted, and the model is valid.

The GMM-SYS estimates in tables 3, and 4 in the AR column (2) are used to test the autocorrelation between variables. Arrelano-Bond for AR (2) distributed z-statistics. Table 3 shows the AR (2) results in the GMM -SYS

estimation of 0.136 and 0.245 for the developed and developing countries subgroups, respectively, which means that these values are not significant at the 1%, 5%, and 10% levels. The whole country's results show AR (2) 0.077 so that H_0 is accepted, which indicates that there is no autocorrelation between variables in the three models.

A partial test is used to see the effect of the independent variable on the dependent variable. Then to see the level of significance of the independent variable in influencing the dependent variable. In Tables 3 and 4 in both the developed and developing countries subgroups, the estimation results of the GMM in this study show a probability value of 0.000. The overall country estimation results indicate a probability value of 0.000 from the lag of the dependent variable. The probability value of each GMM estimation result shows that house prices still correlate between times, so that in this analysis, there is a dynamic relationship.

The real interest rate variable has a p-value of 0.000 for the sub-group of developed, developing countries, and the whole countries, which is significant at the 1% level with coefficient values of -1.165, -0.069, and -0.259, respectively. The significant result shows that H_0 is rejected so that the real interest rate variable has a significant effect on house prices. The negative value of the real interest rate coefficient indicates that when there is an increase in the real interest rate by 1%, it will decrease the house price index by the coefficient value, assuming other independent variables are considered constant.

The credit growth variable has a p-value of 0.000 for the sub-group of developed countries. It is significant overall at the 1% level with a coefficient value of 0.729 and 0.656, while in the developing country sub-group, the p-value is 0.038 and significant at the 5% level with a coefficient value of 0.159. The positive value of the credit growth coefficient indicates that when there is an increase in credit growth of 1% in the developed country sub-group and as a whole and 5% in the developing country sub-group, it will increase the house price index by the unit coefficient, *ceteris paribus* assumption.

The real GDP variable for developed countries, developing countries, and as a whole has a p-value of 0.000, which is significant at the 1% level with coefficient values of 0.780, 0.591, and 0.973, respectively, meaning that H_0 is rejected so that the GDP variable significantly affects house prices. The GDP coefficient's positive value shows that when there is an increase in GDP by 1%, it will increase the house price index by the coefficient, assuming other independent variables are considered constant.

The population growth variable in developed, developing countries, and whole countries have a p-value of 0.000, significant at the 1% level with a coefficient value of 3.264, 2.595, and 2.265. These results indicate that population growth has a positive effect on the house price index in developed, developing countries, and as a whole. The population growth coefficient's positive value indicates that a population increase of 1% will increase the house price by the respective coefficient, assuming that the other independent variables are held constant.

A simultaneous test is a test used to see the effect of independent variables together in influencing the dependent variable and in looking at the significance of the independent variable on the dependent variable, jointly used prob> F whether it is less than the significant level of 1%, 5% or 10%. Tables 3 and 4 show the GMM-SYS estimate results with a prob> F value of 0.000 for the subgroups of developed countries, developing countries, and all countries. The probability value> F means that the probability value is significant at the 1% level, and H0 is rejected so that the real interest rate variables, credit growth, economic growth, and population growth have a significant effect on house prices.

Table 3. Results of the GMM System Estimator for Developed Countries and Developing Countries

| Variable | Developed countries | | Developing country | |
|------------------------|---------------------|---------|--------------------|----------|
| | Coef. | P-value | Coef. | P-value |
| <i>L.House Price</i> | 0863 | 0.000 * | 0868 | 0.000 * |
| RIR | -1,165 | 0.000 * | -0.069 | 0.000 * |
| <i>Credit Growth</i> | 0.729 | 0.000 * | 0.159 | 0.038 ** |
| GDP | 0780 | 0.000 * | 0.591 | 0.000 * |
| Population | 3,264 | 0.000 * | 2,595 | 0.000 * |
| Cons. | - | - | - | - |
| Prob> F | 0.000 | 0.000 | 0.000 | 0.000 |
| AR (1) | | 0.017 | | 0.064 |
| AR (2) | | 0.136 | | 0.245 |
| Sargan Test | | 0.000 | | 0.000 |
| Hansen Test | | 0.525 | | 0.692 |
| Hansen Test GMM | | 0.113 | | 0.233 |
| Hansen Test (Diff GMM) | | 0.998 | | 0.943 |
| Hansen IV | | 0.358 | | 0.513 |
| Hansen (Diff IV) | | 0.939 | | 0.896 |

Source: STATA 13, 2019 output results

Information: * significant at the 1% level

** significant at 5% level

Table 4. Overall Country GMM System Estimator Results

| Variable | Entire Country | |
|----------------------|----------------|---------|
| | Coef. | P-value |
| <i>L.House Price</i> | 0.803 | 0.000 * |
| RIR | -0.259 | 0.000 * |
| <i>Credit Growth</i> | 0.656 | 0.000 * |
| GDP | 0.973 | 0.000 * |

| | | |
|------------------------|-------|---------|
| Population | 2,265 | 0.000 * |
| Cons. | - | - |
| Prob> F | 0.000 | 0.000 |
| AR (1) | | 0.008 |
| AR (2) | | 0.077 |
| Sargan Test | | 0.000 |
| Hansen Test | | 0.892 |
| Hansen Test GMM | | 0.425 |
| Hansen Test (Diff GMM) | | 0.998 |
| Hansen IV | | 0848 |
| Hansen (Diff IV) | | 0820 |

Source: STATA 13, 2019 output results

Information: * significant at the 1% level
 ** significant at 5% level

The results of the analysis using the GMM-SYS method previously described provide evidence of the hypothesis that the real interest rate variable has a negative and significant effect on the house price index in the sub-groups of developed countries, developing countries, and the whole country. This is following the hypothesis. The variables of credit growth, economic growth, and population growth have a positive and significant effect on the house price index in the sub-groups of developed countries, developing countries, and all countries. This is following the hypothesis.

The price of housing assets is the most crucial factor in financial and macroeconomic stability. Housing asset prices can also be one of the most critical channels in monetary policy control because the volatility of housing asset prices is very vulnerable to financial stability risks. Housing is also difficult to trade; a difficult sector is often the subject of an economic crisis. In addition, house prices as a wealth asset make housing prices fluctuations the main pathway for shocks in the economy (Cesa-Bianchi et al., 2013). The boom in the non-tradable sector triggered by excessive credit expansion was at the heart of many banking and currency crises experienced by emerging market economies in the 1990s and early 2000s (Claessens, Kose, Laeven, dan Valencia, 2013).

The estimation results using the GMM-SYS (Generalized Method of Moments - System) method show that credit growth, economic growth, and population growth have a significant effect on house prices in the subgroups of developed, developing countries and for the whole country by having a positive coefficient on house prices (Cesa-bianchi, Céspedes, &Rebucci, 2015; Tong, 2017). Real interest rates have a negative and significant effect on house prices for subgroups of developed countries, developing countries, and the entire country (Cesa-bianchi et al., 2015; Glindro, Subhanij, Szeto, & Zhu, 2008a; Singh & Nadkarni, 2018; Tong, 2017).

The real interest rate variable is intended to reflect the monetary policy stance. A stable monetary policy response should manifest itself by changes in the real interest rate(Cesa-bianchi et al., 2015). Interest rates can also play a dual role in determining the cost of financing and serving as an indicator of the

opportunity cost of owning a home. Financing is a vital factor in the housing market (Ciarlone, 2015).

Real interest rates have a negative and significant coefficient value, implying that real interest rates are negatively related to housing prices in the sub-group of developed countries, developing countries, and all countries. This is because housing is the primary need of individuals or households. The purchase of a house is closely related to the household's ability to finance the whole house price. The inability of households to finance the house's overall cost makes the household finance with loan funds, so it is closely related to interest rates. When there is an increase in interest rates, the cost of borrowing will increase. This encourages households not to make purchases of housing so that the demand for housing adjusts with a reduction, which then causes a decline in house prices. The exposure is consistent with the results of Cesa-bianchi et al. (2015), Glindro et al. (2008b), and Singh & Nadkarni (2018).

Housing finance is an essential factor in developing the housing market, as most housing transactions are financed through bank credit. Fluctuations in credit growth were identified as an essential factor that causes significant deviations in asset prices and amplifies the business cycle. The link between bank credit and asset prices can work through the prosperity and guarantee channels. Greater access to credit can increase demand for housing assets (Singh & Nadkarni, 2018).

The GMM-SYS estimation results show that in the two subgroups of countries, the variable credit growth has a significant directional effect on the house price index. However, the two subgroups of countries have quite a considerable difference in coefficients where every 1% increase in credit growth in developed countries will increase the house price index by 0.729, while for developing countries by 0.159. This occurs due to differences in the availability of credit for developed and developing countries. Then the effect that arises after the existence of higher credit growth for developed countries. This is because households or individuals will respond more to the expectations of a higher future income increase in developed countries. The results of the overall estimate correspond to Cesa-bianchi et al. (2015), Constantinescu & Lastauskas (2018), Glindro et al. (2008a), Hedlund (2018), and Singh & Nadkarni (2018).

Economic growth is a projection of an increase in a country's productivity. When there is an increase in productivity in a country, there will be a change in its population's wealth and economic capacity so that this increase will cause a shift in the demand curve. This shift creates a new equilibrium in the economy, which increases prices for real output, including an increase in prices for houses. This increase in demand for housing can take the form of housing as an investment and consumption.

This is consistent with Glindro et al. (2008), which states that an increase in a country's income can be projected through real GDP when economic growth develops rapidly with an increase in the business cycle. The condition of economic growth can be seen through a combination of the income level and the price level. At the price level, household wealth can influence the price level and cause the AD curve to shift. Household wealth involves the value of financial

assets and real assets (housing). High real asset prices will increase wealth assets and increase consumption and investment, increasing housing demand (Piros and Pito, 2013).

Burda (2013) asserts that house prices are significantly influenced by population growth. This is because population growth will affect housing demand (Karantonis, 2008). For example, if population growth increases, housing demand will also increase, leading to an increase in house prices and vice versa. Therefore, there is a direct (positive) relationship between housing prices and population density growth (Miles, 2012).

A place to live is an individual's immediate need so that a growing population will increase the desire to fulfill their needs in having a place to live. Therefore, every time the population grows, there will be a unidirectional growth in housing demand, which causes the housing demand curve to shift. Then there will be an increase in house prices. The sub-group of developed and developing countries has the same estimation result, which has a positive relationship between house prices and population growth. However, the influence coefficient's magnitude is different from developed countries to have a more significant influence than developing countries. This happens because, again, in the statement that the demand for housing is closely related to the ability of individuals to finance housing demand. Judging from the economic growth of developed countries, the power of individuals in developed countries is higher than individuals in developing countries so that when there is population growth, the response to developed countries to own a house will be greater than in developing countries. This is supported by Taltavull de La Paz (2003), Lee (2009), and Rosli (2011), who found that population growth is a significant factor in house prices.

5. Conclusions and recommendations

Based on the estimation results and discussion in the previous chapter, it can be concluded that the variables used in the study, namely real interest rates, economic growth, credit growth, and population growth, have a lower effect on house prices than developed countries due to the character of price changes—housing in a developing country that is volatile but has a low increase in house prices. Besides, house prices in developed countries have a higher increase. Loans have a more significant impact on developed countries than in developing countries.

This study provides suggestions for policymakers to control house prices so that there are no house price bubbles that cause a financial crisis. The government needs to work with financial institutions to increase prudence in the housing finance system. More research is also needed on the factors that influence house prices so that consistent results can be found. This research covers 54 developed and developing countries. It is hoped that further research can cover all countries in the world. This study uses macroeconomic variables and monetary policy variables. In this research, many variables can affect house prices both from the demand and supply side.

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