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Analysis of House Price Determination in 13 G20 Countries: Random Effect Model

Ignatius Abasimi[1], Anisa Rupaningtyas Aulia[2], Uswatun Khasanah[3*]

Email : [1]abasimi.ignatius@gmail.com, [2]anisaraulia285@gmail.com, [3*]uswatun.khasanah@ep.uad.ac.id

[1]Shandong University, China; [2,3]Universitas Ahmad Dahlan, Indonesia
* *Corresponding Author*

Abstract
A house or a place to live is a primary need for all beings, but the lack of affordable housing to buy or rent can trigger a global housing crisis. After the collapse of the housing market in the US or the subprime crisis of 2008-2009 there was a revival of focus on the housing market. Empirical research has been conducted to look at the variables that affect house prices. However, it is still rare for researchers to examine the influence of macroeconomic variables in countries that have a strong role in the world economy. Therefore this study aims to determine the effect of the Consumer Price Index, Construction GDP, Unemployment Rate, Population Density, Exchange Rate and Power Purchasing Parity on the House Price Index as an indicator that reflects house prices. So, the contribution of this research is to provide novelty in the use of the house price index to determine the determinants that influence it. This research is a quantitative research using secondary data. The regression model used in this study is the Random Effects Model. The result of this study is the Consumer Price Index and Purchasing Power Parity have a significant positive impact on house prices. Therefore, the government needs to maintain the stability of these two indicators so that house prices remain stable. The Unemployment Rate and Exchange Rate show a significant negative effect on house prices. Therefore, the government needs to monitor and maintain the stability of the exchange rate and reduce the unemployment rate so that there is no significant decline in house prices. Meanwhile, construction GDP and population density show no effect on house prices. Additional studies are urgently needed to identify factors and housing price movements contributing to global and regional levels.

Introduction

Home or shelter is a primary need for all living things. In some countries the house is the largest single investment for households (Yao & Zhang, 2005). In Indonesia, the state is responsible for fulfilling residential areas stipulated in Law No. 1 of 2011 that the state is

responsible for organizing proper housing and residential areas for the community. In addition, the fulfillment of shelter is also regulated in Law No. 39 of 1999 concerning Human Rights (HAM), that every individual has the right to a comfortable residence and life.

A house or shelter is a basic human need, but the lack of affordable housing to buy or rent can trigger a global housing crisis. According to the World Bank, by 2025 the housing crisis could affect 1.6 billion people. The world needs to build around 96,000 new affordable homes every day to accommodate the estimated 3 billion people who need adequate housing by 2030 (Çalıyurt, 2022).

From the end of 2020 to the beginning of 2021 housing prices worldwide increased dramatically at the fastest rate in nearly 18 years (see Figure 1). According to Everett-Allen (2021) in the Knight Frank report, house prices around the world have an average increase of 11% in 2021 after the decline in house prices in 2020 due to the covid-19 pandemic. The increase in house prices has coincided with an increase in the number of homes demanded as a result of shifts in population growth and demographics.
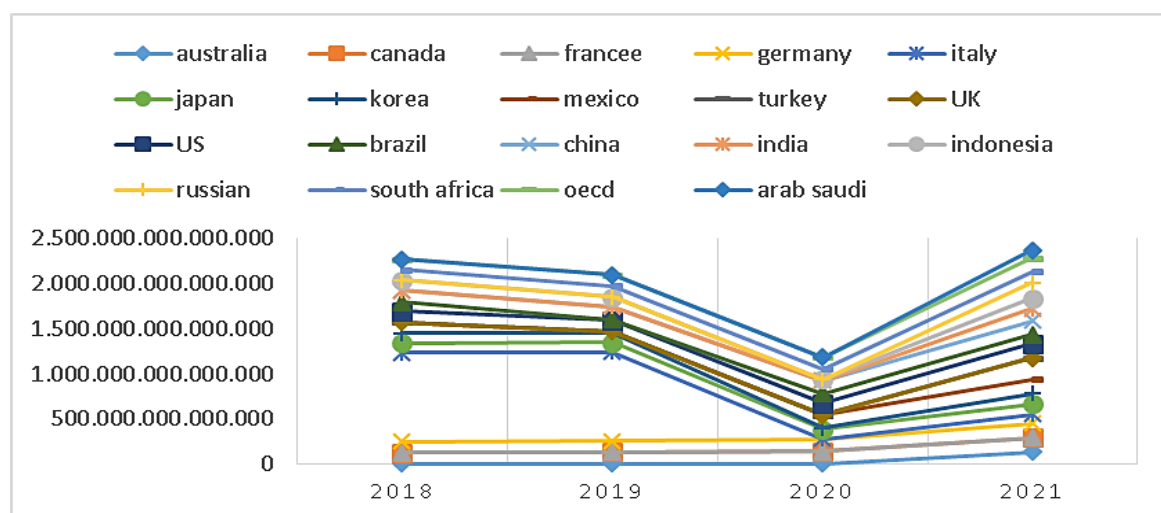
Source: Analytical House Price Indicators OECD, 2022
Figure 1. Nominal House Price, 2015=100, Q4

A variety of supply and demand side factors can determine housing prices in developing countries. And these factors can be both quantitative and qualitative. In previous studies, modeling forms have been carried out in analyzing the determination of house prices. According to Mahalik & Mallick (2011)the factors that influence house prices that are explained at the micro level may not apply at the macro level, due to differences in specific qualitative factors and data constraints at the macro level. Likewise, what applies in the context of developed countries may not apply in the context of developing countries.

Analyzing the factors that cause house prices to increase, it is shown by many overseas researchers that macroeconomic factors play a major role in determining the movement of

house prices (Tripathi, 2020). The world is at war with the country's economy whose prospects are significantly dimming. The various crises faced starting from the consequences of Covid-19, the increasingly severe humanitarian tragedies of the wars in Ukraine and Russia and the disturbances in natural gas supplies that occurred in Europe plunged the global economy into recession and triggered a crisis (Georgieva, 2022). In addition, to shocks to the commodity price sector which slowed down growth and exacerbating the cost of living crisis affecting hundreds of millions of people, especially the poor who are powerless to survive and support their families. Because of this, the world urgently needs decisive action and strong international cooperation, led by G20 member countries. The G20 international forum is a very important part that contributes to global economic recovery because it represents more than 2/3 of the world's population, 75% of global trade and 80% of world GDP (Kemenlu, 2022).

Balqis & Purwono (2021) and Rahman & Ridzuan (2020), mentioned that interest rates are always closely monitored so as not to have a wide impact when they rise as it will slow down the real sector. However, it should be noted that interest rates vary from bank to bank despite the threshold set by the central bank. This means that a lower interest rate will increase the purchasing power of individuals in buying a house as the interest to be paid is lower. Thus, it will increase the demand for housing loans and house prices (Isyanto, Zulkarnain, & Nawi, 2023). Economic growth represents a snapshot of changes in income and a person's ability to make demand for housing, thereby influencing real estate prices (Kabine, 2023).

Rising incomes and living standards affect the proportion of food consumption and shift to non-food consumption by improving housing and investment conditions. In addition, disposable income has a high correlation with house prices as it reflects the purchasing power of the people. Disposable income can reflect people's purchasing power for a house or apartment. Ramadhan, Setiawan, & Marwansyah (2022), This positive relationship suggests that an increase in an increase in the ratio of credit to economic growth leads to an increase in house prices. Hence, there is an increase in the availability of bank credit which is in line with the demand for housing loans, also along with the decline in interest rates (Taghizadeh-Hesary, Yoshino, & Chiu, 2019).

Nistor & Reianu (2018) dan Cohen & Karpavičiūtė (2017), The level of unemployment has an impact on disposable income and results in a more economical but more affluent housing choice behaviour. Other consequences of an increase in unemployment are lower wage growth expectations and increased future uncertainty, as well as lower ability to repay debt. This results in a decrease in the demand for housing loans. The unemployment rate also decreased the average price of houses in Toronto by 24.49 per cent and for young residents it is not possible to have their own house because of the high price even though there is an increase in the number of unemployed people, it is still not affordable for the middle and lower class.

Tripathi (2019) and Rohman & Zulaikha (2019), shows that in international trade when there is a shock that causes the home country's currency to appreciate, then less favourable terms of trade will lead to a decrease in local asset prices and vice versa. This suggests that there is a negative relationship between exchange rates and asset prices. Empirical evidence shows that the real effective exchange rate is positively related to house price growth in China, implying that currency appreciation has a positive effect on house price growth. A rising exchange rate allows for strong inflows of foreign capital in developed countries, which are commonly referred to as safe havens. However, a stronger exchange rate signals a decline in competitiveness and indicates the risk of housing default.

Li (2015) dan Zhang (2021) mentioned that empirical evidence in China shows that the country's large population affects the number of real estate buyers. Most buyers can only afford a down payment first, then the rest of the housing payment is obtained through bank credit loans. However, the effect on long-term accumulation is that mortgage loans expose China's banking industry to systematic financial risk. Furthermore, the existence of urban-centred population density will affect housing prices, which is divided into two, namely direct and indirect effects. The direct effect is that the demand for housing is higher when there are more people in urban areas. Meanwhile, the indirect effect is that regardless of the number of residents in urban areas, the demand for houses remains high, which results in an increase in house prices. This means that the direct and indirect effects still show that the increasing population, especially in urban centres, will increase the demand for housing and house prices.

Based on the studies that have been described previously, generally examining problems regarding the relationship between macroeconomic variables and residential property prices in various countries with interest rate variables, consumer price index, and stock prices, this study uses independent variables, namely Consumer Price Index, GDP Construction, Population Density, Unemployment Rate, Exchange Rate and Purchasing Power Parity with the dependent variable namely the House Price Index. There have been many studies using countries that are members of the G20. However, this still needs to be done regarding the determination of house prices with the house price index as the dependent variable. Therefore, the contribution of this study is to provide novelty in the use of the house price index to determine the determinants that influence it. This is interesting to study because it can help economists and researchers deepen their understanding of the housing market dynamics and the relationship between the property sector and other economic variables. Data limitations were an obstacle in this study, so only 13 G20 countries with complete variable data were used. The 13 countries are the United States, Australia, Brazil, India, Britain, Japan, Canada, Mexico, Korea, Russia, China, and Turkey. Due to the limited data, additional research is needed to complete the deficiencies in this study.

Literature Review

In the price policy, price is a value with an amount that has been determined between the buyer and seller through a negotiation process or a number of values that have been set by the seller. In market activities, price implementation plays a role in facilitating the interaction of demand and supply. Therefore an item has a price or value that is determined by the level of demand and supply of goods and services. And the price itself has a fluctuating nature. The pricing mechanism is a process in the activities of producers and consumers where the price itself plays a key role in the supply and demand for goods and services. Market prices will be formed as a result of the power of demand by consumers with the power of supply by producers.
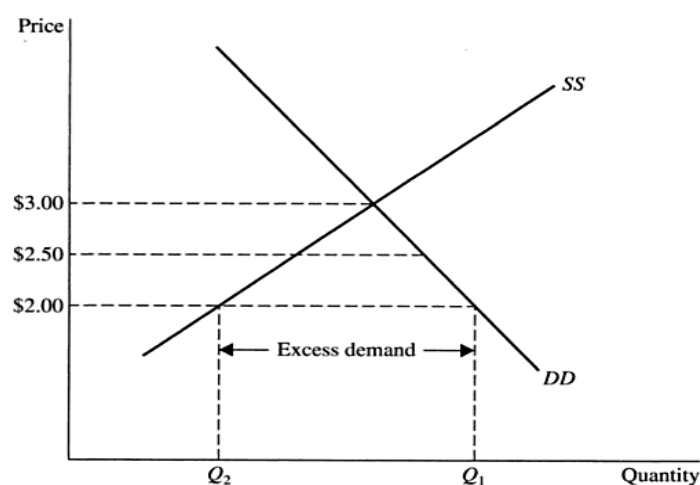
Source: Mankiw (2015)
Figure 2. Market Demand and Supply Curves

Figure 2 shows that the higher the price, the lower the demand for goods or services, and vice versa. Meanwhile, if the price decreases, the goods or services offered will also decrease, and vice versa. There are three conditions that will arise due to these interactions, namely, oversupply, excess demand, and equilibrium. oversupply occurs because the price of a good or service is above the point of intersection between the demand and supply curves. Excess demand occurs because the price of a good or service is below the point of intersection between the demand and supply curves. As a result, the price of the good or service will increase. Meanwhile, equilibrium is the point of intersection between the demand and supply curves. At the equilibrium intersection, the price does not change because the quantities demanded and offered are the same. This is called the market mechanism. At the equilibrium point there is no excess demand or supply, so the price of a good does not change because there is no pressure between supply and demand for goods or services.

The House Price Index is an index number to measure the level of price movements of residential property (flats, detached houses, terraced houses, etc.) purchased by households

from time to time. According to the literature Belke & Keil (2018) summarizes four approaches to variables that affect residential property prices, namely Firstly, an asset pricing approach that links real estate prices to future discounted income. Second, it focuses on the affordability and sustainability of housing prices or private household debt. This is analysed through income-to-income ratios, loan-to-value ratios, or affordability indices such as the ratio of actual monthly mortgage costs to income. Third, there is the hedonic pricing method. This means that hedonic price modelling takes into account the specific characteristics of individual objects or neighbourhoods, each of which contributes to the overall value of the real estate object. Fourth, there are econometric models that directly estimate the effect of real estate prices. Such models are based on some form of national, regional or local real estate price index combined in time series or panel form.

The Consumer Price Index is the most frequently scrutinized measure of inflation. In general, an increase in the CPI can cause an increase in the price of building materials, labor costs and other operational costs related to the construction and maintenance of houses. This can cause house prices to rise. Construction GDP is used to describe the percentage of construction output in a region or country. Construction GDP measures the contribution of the industrial sector including construction to a country's total GDP and provides economic value information which includes the production of goods and services in the manufacturing, mining and construction industries. Construction output is the production value of the construction sector in a region by measuring the amount of construction activity that occurs in a period of time. If construction output increases, it indicates an increase in housing demand for new homes, which will make house prices higher.

The level of population density of a region or country according to Maslow's theory states that a high level of population density can affect the price or value of an item or service, so that it will cause an increase in the cost of living. According to the Keynessian Consumption Theory in the book "The General Theory of Employment, Interest, and Money". John Maynard Keynes argued that a high unemployment rate will lead to a decrease in a person's income and consumption because the person does not have a job and income or income. This can reduce the demand for goods and services, slow down economic growth and prices of goods will tend to fall.

Exchange rates can affect international capital flows that enter the property market. If the domestic currency exchange rate declines, the price of domestic property market assets such as residential housing will become cheaper for foreign investors, and conditions like this can increase capital flows into the property sector and drive house prices up. In addition, the exchange rate can also affect the price of production of building materials because when the domestic currency exchange rate increases, it can result in an increase in the cost of imported building materials and ultimately house prices will also rise.

After the collapse of the housing market in the United States or the subprime crisis of 2008-2009 there was a revival of focus on the housing market. The housing market has a dual role in the housing market, namely as a consumer good and as an investment, which has been recognized in the literature (Leung, 2004). According to Nakajima (2011) it is possible that there are three groups of theories that try to explain the movement of house prices. The first group of literature focuses on the inflexible nature of the housing supply which is associated with longer times to build houses and scarcity of land, especially in urban areas.

Based on research conducted by Glaeser et al. (2005), investigating supply-side restrictions, it was identified that tightened housing supply regulations contributed to rising house prices. This is in line with findings Hilber & Vermeulen (2016), which found that the British planning system was an important determinant of housing affordability issues, particularly in urban areas. Another factor that can be linked to the supply side of housing is the role of limited land availability and this is in line with (Ho & Ganesan, 1998). Based on their findings, Ho & Ganesan (1998) identified that an increase in land supply will lead to a decrease in house prices.

The second theory of Nakajima (2011), investigates the demand side of housing with factors such as demographics and income or wealth identified as dominant factors. Adding to the theory, Ho & Ganesan (1998) noted that house prices in Hong Kong are mainly influenced by demographic factors, especially population growth and income. Nakajima (2011), believes that house prices increase when income is more volatile because households are encouraged to store their total wealth. Meanwhile, Glindro et al. (2011) outlines that there are two ways how demand can be influenced, namely based on the substitution effect and the wealth effect. The substitution effect causes the prices of the two substitute assets to move in opposite directions and eventually causes the prices of the assets to show a negative relationship. And the last theory Based on the Irrational Exuberance theory explained by Schiller (2000), it is the extreme enthusiasm of investors that pushes house prices up.

Analyzing the factors that cause house prices to increase, shown by many researchers abroad. Previous studies on the determinants of house prices have primarily been interested in disposable income, interest rates, unemployment rates, construction costs, credit and the money supply. They are shown to have an important impact on house prices, both positive and negative. The macroeconomic variables that have been modeled in previous studies have concluded that in the short term the CPI variable has no effect on overall house prices (Budi, 2021). Population, income affect housing demand (Chappell, 2014).

According to research Ma et al. (2017), the inter-market balance between housing construction output and related markets in terms of construction and property prices. Another macroeconomic variable used in the research variable, namely population density, shows results

that have a significant effect on the prices of all types of houses in Indonesia (Fauzia, 2019). Another study from Belke & Keil (2018), states that the unemployment rate has a positive effect on real estate prices. Higher unemployment rates are associated with lower real estate prices. In addition, other studies conducted by Pinjaman & Kogid (2020) and Hikam (2021) show that exchange rates have an effect or influence on house prices. Research Hikam (2021), shows that the variable Power Purchasing Parity or purchasing power has a positive effect on house prices in 5 Asian countries.

Method

This research uses explanatory research with quantitative data collection methods, namely research to explain one research variable with other variables in hypothesis testing. The type of data used in this study is a type of secondary data that is causal. Research data is sourced from the official website of the World Bank and the Organization for Economic Co-operation and Development (OECD). The data used is panel data from 13 G20 member countries, namely the United States, Australia, Brazil, India, Indonesia, England, Japan, Canada, Mexico, Korea, Russia, China and Turkey in 2015-2021.

The analytical method used in this research includes descriptive analysis, chow test, hausman test, lagrange multiplier test and panel regression test. Descriptive analysis aims to describe, present and summarize a set of existing data. The Chow test aims to select or compare the two regression models between the common effect model and the fixed effect model. The Hausmant test aims to provide an explanation of the model that is suitable for use, whether it is a random effect model or a fixed effect model. Furthermore, the lagrange multiplier test aims to compare econometric models and determine the best model between the random effect model and the common effect model.

From the stages of selecting the best model, it was found that the best model used in this study was the random effect model with the equation:

$$HPI_{it} = \beta_0 + \beta_1 CPI_{it} + \beta_2 CGDP_{it} + Ln\beta_3 PD_{it} + \beta_4 UR_{it} + Ln\beta_5 ER_{it} + Ln\beta_6 PPP_{it} + \varepsilon_{it} \qquad (1)$$

The dependent variable used is the house price index in per cent for each country and in the time period from 2015 to 2021. The independent variables used are the *Consumer Price Index* (CPI) with units of percent, construction *Gross Domestic Product* (GDP) with units of percentage of total GDP, *Population Density* (PD) with units of people per km2. There are also *Exchange Rate (ER)* variables with units of US$ and unemployment rate with units of percentage of total labour, and *Purchasing Power Parity* (PPP) with units of US$.

Result and Discussion

The number of observations from the descriptive analysis in table 1 is 91 of the 13 G20 member countries. Table 1 shows the average of each variable, namely the HPI variable has an average of 114.49% with the highest price index being in Turkey in 2021 which is 237.53% and the lowest value being in Russia in 2017 which is 91.27% and the standard deviation value of 19.60. On Consumer Price Index (CPI) obtained an average value of 138.80% with the highest value being in Turkey in 2021, namely 314.80% and the lowest value being in Japan in 2016, namely 103.46% and a standard deviation value of 35.90.

In construction GDP, it has an average value of 27.74% with the highest value in China in 2015, namely 40.84% and the lowest value in England in 2020, namely 17.10% and a standard deviation value of 7.02. On population density, the average value is 4.16 people/km2 and the highest population density is in Korea in 2020, namely 6.27 people/km2 and the lowest population density is in Australia in 2021, namely 1.09 people/ km2 and a standard deviation value of 1.68.

On *unemployment* or the unemployment rate obtained an average value of 5.82% and the highest unemployment rate is in Brazil in 2021 which is 14.40% and the lowest unemployment rate is in Japan in 2018 which is 2.40% and the standard deviation value is 2.95. Then, the exchange rate obtained an average of 2.90 US$ and the highest exchange rate was in Indonesia in 2020, namely 9.58 and the lowest exchange rate was in England in 2015, namely -0.42 and a standard deviation value of 2.86. Futhermore, an average of PPP is 2.37 US$ was obtained and the highest PPP rate was in Indonesia in 2018, namely 8.46 and the lowest PPP value was in the UK in 2017, namely -0.37 and a standard deviation value of 2.68.

Table 1. Descriptive Statistics

Var	Mean	Std.Dev	Min	Max
HPI	114.49	19.60	91.27	237.53
CPI	138.80	35.90	103.46	314.80
CGDP	27.74	7.02	17.10	40.84
LnPD	4.16	1.68	1.09	6.27
UR	5.82	2.95	2.40	14.40
LnER	2.90	2.86	-0.42	9.58
LnPPP	2.37	2.68	-0.37	8.46
Observation: 91				

Source: processed data, 2023

Table 2 is the summary of selection of the best model in data panel regression method. There are Chow Test, Hausman Test, and Lagrange Multiplier Test.

Table 2. Summary of Selection of the Best Model

Test	Prob	Conclusion
Chow	0.0000	With prob > F the best model to be applied in this test is*fixed effect*.
Hausman	0,3856	With prob>chi2, the best model to be applied in this test is*random effect*.
Lagrange Multiplier	0.0000	With a value of prob>chibar2, the best model used is*random effect*

Note: significance at alpha 0.05

Source: Processed data, 2023

Based on table 2, it can be concluded that the best research model is the Random Effect Model (REM). Because REM uses the Generalized Least Squared approach, the classical assumption test is not necessary.

Table 3 is the result of Random Effect Model. Table 3 shows that the values (R^2) obtained 0.6327, meaning that together the model explains the variation of 63.27% and the remaining 36.73% is explained by other variables outside the model. Furthermore, the F test at a significance level of 5% found that all independent variables in the simultaneous study had an effect on the variables *House Price Index* which is the benchmark for house prices (see table 3).

Table 3. Summary of Panel Data Regression Analysis Estimates

Variabel	Coef.	Uji t	Description
CPI	0.8826619*	0.000*	Significant
CGDP	0.1759847	0.748	No Significant
LnPD	3.299141	0.114	No Significant
UR	-3.552794*	0.000*	Signifinicant
LnER	-30.82367*	0.000*	Significant
LnPPP	28.54189*	0.001*	Significant
Statistic			
Prob F-Statistic		0.0000*	
The coefficient of determination (R²)		0.63727	
		*significance at alpha 0.05	

Source: Processed data, 2023

The equation formed from table 3 above is:

$$HPI_{it} = 15.71883\text{it} + 0.8826619CPI_{it} + 0.1759847CGDP_{it} + 3.299141LnPD_{it} - 3.552794UR_{it}$$
$$-30.82367LnER_{it} + 28.54189LnPPP_{it} + \varepsilon_{it} \qquad (2)$$

CPI is an independent variable that shows a significant positive effect on HPI which is indicated by a coefficient value of 0.8826619 and a probability value of 0.000 <alpha 5% or 0.05. This means that if the CPI increases by 1% then the HPI will increase by 0.8826619% assuming other variables are considered unchanged. The results of this study are supported by research conducted by Zamillaili & Qoyum (2021), Loan & Kogid (2020), Panagiotidis & Printzis (2016), Fanama & Pratikto (2019), Fauzia (2019) and Mohan et al. (2019) which shows that inflation has a significant positive effect on house prices. Theoretically, the relationship between CPI and

house prices in general means that an increase in CPI can cause an increase in the price of building materials, labor costs and other operational costs related to the construction and maintenance of houses. This can cause house prices to rise.

Construction GDP is an independent variable which shows research results that do not have a positive effect on the House Price Index. This is evidenced by a probability value of 0.748 > alpha 5% or 0.05 and a coefficient value of 0.1759847. Theoretically, construction GDP is an important indicator to show how the industrial sector, including construction, affects a country's economic growth. The high added value of the industry, including construction, shows that this sector makes a significant contribution to economic growth.

Theoretically, construction GDP has a significant effect on house prices and supports the initial hypothesis that construction GDP has a positive effect on HPI. However, the research results did not show results that support the initial hypothesis. Construction GDP has no effect on house prices in 2015-2021 due to the phenomenon of the property industry market. According to the Future of Construction report published by Oxford Economics (2019) which highlights China as the largest construction market in the world and will continue to be the largest contributor to the growth of the global construction market until 2030.

Followed by the United States and India as the second largest constructors -2nd and 3rd in the world. In 2015-2016 China experienced a slowdown in construction growth which resulted in a decrease in demand for building materials in its trading partner countries. Apart from China, the United States in 2016 also experienced problems in the construction sector. The United States, as the largest consumer in the global property market, lacks a skilled workforce in the construction sector. And India as a developing property market in 2016 has problems with global demand for building materials and property markets in other countries.

Government policies carried out by the Indian government led to a decrease in business activity and consumer spending in the property sector and affected the construction industry in its trading partner countries. These problems resulted in the poor quality of construction GDP. Conditions like this, if the demand for housing is low or fixed. So maybe construction GDP has no effect on house prices.

Population density is an independent variable which shows results that do not affect the House Price Index. It is proven that the probability value in the regression test results is 0.114 greater than 5% or 0.05 and the coefficient value is -3.552794. Theoretically, population density according to Maslow's theory states that a high level of population density can affect the price or value of an item or service, so that it will cause an increase in the cost of living. The higher the population density in a place or region, the more people need goods or services so that demand will increase. As a result, prices of goods and services tend to rise.

It is assumed that a region or country has a high population density, so that in tandem with high population growth, the need for housing or houses increases, this will increase the demand for housing (Graham & Makridis, 2023). The high demand for housing causes house prices to tend to rise. The theory and hypothesis which states that population density has an effect on house prices are not in line with the results of this study. Population density has no effect on house prices because each country has different characteristics.

For example, there may be a country or region with a high population density but relatively low house prices because it is located in a less desirable suburb, or an area with a low population density but high house prices because it is located in a city center. Research conducted by Fauzia (2019) shows that house prices are not affected by population density. However, in accordance with McKenzie et al. (2010) in Fauzia (2019), that one of the things that must be considered in housing demand is the number of housing units needed in the market . The housing units required by the market are constrained by the development of the population, especially those already in the labour force age category.

The unemployment rate is an independent variable that has a significant negative effect on the House Price Index. This is evidenced by the results of the study which showed a probability value of 0.000 and a coefficient value of -3.552794. This means that if the population density increases by 1% then the HPI will decrease by -3.552794% assuming other variables are considered unchanged. The results of this study are in line with the results of the study by Baharumshah et al. (2019) in Malaysia show that the unemployment rate has a significant negative effect on house prices in that country. Research by Yoon and Lee (2018) in South Korea shows that the unemployment rate has a significant negative effect on house prices in that country, especially in urban areas. Research by Calza et al. (2018) in Italy show that the unemployment rate has a significant negative effect on house prices in the country, and this effect is greater in urban areas.

According to Alfred Marshal's theory in the book "P*rinciples of Economics* (1890) introduced the theory of how the unemployment rate relates to the dynamics of the demand for and supply of work. Marshal said that there is an increase in unemployment if the demand for labor is lower than the supply of labor and vice versa. Marshal also mentioned that a high unemployment rate will cause a country's economic problems, it seems that people's purchasing power and investment will decrease which will ultimately affect the country's economic growth. The reduced purchasing power of houses coincides with the decrease in demand for houses, this condition causes lower house prices.

Exchange rate is an independent variable that has a significant negative effect on the House Price Index as evidenced by a probability value of 0.000 < alpha 5% or 0.05 and a coefficient value of -30.82367. This means that if the exchange rate increases by 1%, the HPI will decrease

by -30.82367% assuming other variables are considered unchanged. Theoretically, if the domestic currency exchange rate decreases, the price of domestic property market assets such as residential housing will become cheaper for foreign investors, and conditions like this can increase capital flows into the property sector and drive house prices up. In addition, the exchange rate can also affect the price of production of building materials because when the domestic currency exchange rate increases, it can result in an increase in the cost of imported building materials and ultimately house prices will also rise.

The initial hypothesis which states that the exchange rate has a positive effect on the House Price Index is not proven in this study. The results of the study show the reverse direction, namely a significant negative effect on the House Price Index. The results of this study are in line with the research by Johannes Strobel and Joseph Vavra entitled "*Exchange Rate and Housing Price: Evidence from OECD Countries*" published in 2015 in the Journal of International Economics used data from 18 OECD countries between 1970 and 2012. The research showed that an increase in the currency exchange rate relative to the currency of the country of origin can lead to a decrease in house prices in that country.

This condition can be explained that when the exchange rate of a country's currency strengthens relative to the currency of the country of origin, the goods and services produced in that country are more expensive for foreign consumers. This can reduce demand for exports from the country and increase imports. This condition can reduce economic growth and decrease house prices. In addition, an increase in the exchange rate also reduces the purchasing power of domestic consumers because the price of imported goods and services becomes cheaper, which is disproportionate to the increase in the price of domestic goods and services. This can also affect the demand for housing and lower housing prices in the country.

Magdalena (2015) states that the exchange rate is important in the purchase of a house because when the currency weakens, the amount of principal debt plus interest becomes more and more to be paid. So that the cost of capital increases due to the exchange rate and will increase property prices. Meanwhile, according to Sumer & Ozorhan (2020), exchange rates can influence investors' perceptions of considering housing as an investment tool. Thus, when the domestic exchange rate weakens, the more must be spent to own property and in the long run prefer to combine various other investment instruments.

Power Purchasing Parity or purchasing power is an independent variable that has a significant positive effect on the House Price Index. It is evident from the results of this study that it shows a probability value of 0.001 < alpha 5% or 0.05 and a coefficient value of 28.54189. This means that if PPP increases by 1% then HPI will increase by 28.54189% assuming other variables are considered unchanged. The results of this study are in line with the existing theory that PPP measures how many units of currency are needed to buy a certain unit of goods in a

certain country, and then compares it with the number of units of currency needed to buy the same goods in other countries. PPP measures the purchasing power of a currency for goods and services to be purchased with that currency in a particular country. If a country has a lower price of goods compared to other countries, then the purchasing power of the people in that country is higher. This can increase the demand for and price of housing in the country.

Hikam (2021) states that Power Purchasing Parity has a positive relationship with the property price index. This means that if PPP increases, it will encourage an increase in property demand through banking credit in the community. in principle, people can use credit to carry out economic activities according to the income they get. This shows that an increase in people's income will encourage people to be more courageous in borrowing credit in purchasing property. So that people believe that their increased income can be used to pay off bank loans. Furthermore, Posfai & Nagy (2017) state that the construction of suburban housing will reduce house prices in other neighbouring areas. But on the other hand, it increases the purchasing power of houses for people with low purchasing power, even though they are more vulnerable to crises and economically disadvantaged on a national scale.

Conclusion

This study examines the influence of several economic factors on house prices in 13 G20 member countries from 2015 to 2021. This study examines the effect of several economic factors on house prices in 13 G20 member countries from 2015 to 2021. The type of research used is explanatory with quantitative data and is included in the panel data type. The data processing method uses panel regression by conducting the Chow, Hausman, and Lagrange Multiplier tests. Meanwhile, data analysis uses quantitative descriptive. The analysis results show that the consumer price index and purchasing power parity significantly positively affect house prices in these countries. Therefore, it is suggested that the government maintain the stability of the consumer price index and purchasing power parity to maintain the stability of house prices. In addition, construction GDP and population density did not significantly affect house prices in the G20 countries during this period. However, the government needs to pay attention to the residential property sector and ensure the availability of housing at affordable prices to prevent a global housing crisis. Meanwhile, the exchange rate and unemployment rate are proven to have a negative effect on house prices in the 13 G20 member countries. Therefore, the contribution of this research could be a consideration for the government to monitor and maintain the stability of the exchange rate and reduce the unemployment rate so that there is no significant decline in house prices. This will have a positive impact on the interest of domestic and foreign investors as well as on economic growth. However, this research has some limitations. One of them is the limited data available, so only 13 G20 member countries can be

included in the analysis. In addition, the lack of previous research that focuses on the house price index is also an obstacle in comparing the results of this study. The limited relevant literature on this topic also limits the development of further research on the factors that influence house prices. Therefore, further research is needed to complement and develop an understanding of the determinants of house prices.

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