THE IMPACT OF MACROECONOMIC VARIABLES ON HOUSING PRICE IN DEVELOPING COUNTRIES

BY

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DECLARATION

We hereby declare that:

(1) This undergraduate research project is the end result of our own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

(3) Equal contribution has been made by each group member in completing the research project.

(4) The word count of this research report is 10,449 words.

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GDP	Gross Domestic Product
CPI	Consumer Price Index
POP	Population Growth
RRPPI	Real Residential Property Price Index
EXC	Exchange Rate
UNEMP	Unemployment Rate
POLS	Pooled Ordinary Least Squares
FEM	Fixed Effect Model
REM	Random Fixed Model
LM	Lagrange Multiplier

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PREFACE

Housing price act as an essential role in the economy of developing countries. The property price in developing countries nowadays is much higher compared to the past few decades. Therefore, this study tends to apply microeconomic variables in this research, including Gross Domestic Product (GDP), inflation rate, exchange rate, unemployment rate and population. The Real Residential Property Price Index measures the housing price trend. The selected developing countries are China, India, Malaysia, South Africa and Turkey.

Even though many factors can influence housing price, the researcher of this study strongly believes that macroeconomic determinants still play a crucial role in identifying housing prices and explaining their various fluctuations.

This research was done successfully due to researcher's curiosity and motivation from many parties. It has been conducted so that researcher can gain more knowledge about the housing market in developing countries.

ABSTRACT

This research project's objective is to examine the impact of macroeconomic variables on housing prices in developing countries from the year 2011 to the year 2021. This project studies the relationship between the gross domestic product, inflation rate, exchange rate, unemployment rate and population to the housing price. The Fixed Effect Model has been chosen as the most appropriate model in this research.

The findings of this research show that exchange rate has positive impact on the housing price Q. Besides, population and unemployment rate have negative impact on the housing price. Meanwhile, consumer price index and gross domestic product show an insignificant result towards housing price. These results contributed to government, policy makers, investors, and future researchers.

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

This study aims to examine macroeconomic determinants' influence on housing prices in developing countries such as China, India, Malaysia, South Africa, and Turkey from 2011 to 2021. Five macroeconomic determinants have been considered in this study: the gross domestic product (GDP), inflation rate, exchange rate, unemployment rate and population towards the housing prices in developing countries. The property market in developing countries will be discussed in this chapter, followed by the problem statement, research questions, objectives, and significance of the study.

1.1 Research Background

Housing is an essential requirement for all humans as it serves as a place for people to live and provide protection. Every human being appreciates their home, and most people strive to own their home. The fluctuations in house prices have become the most crucial factor in a family's decision to purchase a house. The young generation with low and medium income has issues owning a home. Le (2015) mentioned that house price fluctuations could significantly impact shifts in household wealth because households are the most critical investment group in most countries. Houses can also be utilized as long-term investment vehicles. The value of households will increase following the upgrade of public infrastructures nearby as it would bring convenience to the households. Therefore, lead to rising demand and subsequently increase house price. Besides, it can also stimulate the country's economic growth. The housing price and housing market activity can influence the economic development of a nation.

1.1.1 Property Market in China, India, Malaysia, South Africa, and Turkey

Based on the data shown in Figure 1.1 above, we can see that Malaysia and India have the most stable growth among the five countries. Malaysia and Indian properties were on a similar track between 2011 to 2018. The real residential property prices in Malaysia rose steadily from 2011 to 2020, then decreased. Relatively weak market sentiment was observed in the Malaysian property market in 2021 as consumers were more cautious and worried about the implementation of the Full Movement Control Order (FMCO) might bring unemployment issues, therefore, decreasing the purchasing power and lead a decrease in real residential property price (Foo, 2021).

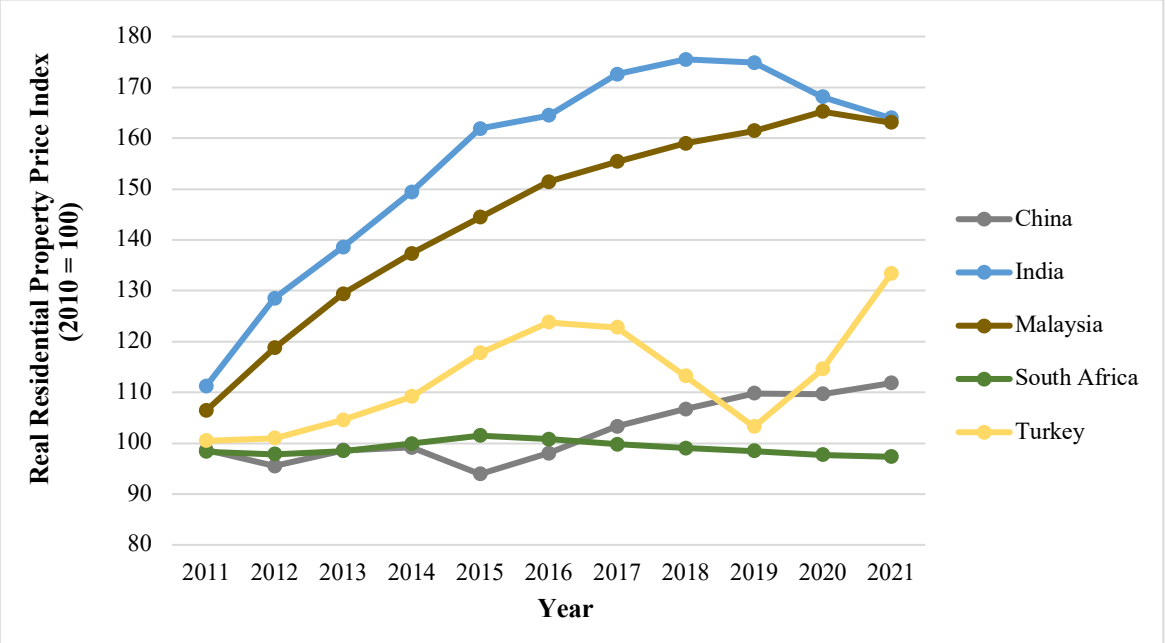
India property prices had a stable increase in growth until 2018 but started to decrease gradually in 2019. The Indian property market had high unsold stock in 2019, which led the developers to begin launching affordable and middle-range segments; however, the responses from the consumers are not encouraging as the property in city centres remain at high prices while the affordable projects are in far-flung peripheral areas which do not have the well-developed infrastructure or having small sizes city centres property that unable to fit a family with the size of 2 to 3 (Anuj Puri, 2019).

Turkey's property prices have increased since 2011 but started dropping dramatically and hit the lowest in 2019. However, the property prices then began to peak. The sudden increase in property prices resulted from declining housing loan interest rates. The Central Bank of India has slashed the key rate since the second half of 2019, leading to lower borrowing costs for homebuyers (Ankara, 2020).

The property price in South Africa has no massive changes by having an average index (98). South Africa's property market has been weak for a few years owing to low employment, poor household finances, and an underdeveloped mortgage market (Delmendo, 2021).

Lastly, China's property prices hit the lowest in 2015 and then increased. It is the first decline in China's property prices as the Chinese government has taken steps to limit property speculation by limiting bank loans, lowering mortgage quotas, and instituting a pilot property tax in selected cities after ages of deficit expansion (China: House Prices Fall, 2021).

Figure 1.1 Real Residential Property Price Index



Source: International Monetary Fund

1.2 Problem Statement

The property price in developing countries nowadays is much higher compared to the past few decades. The rising cost of housing puts households under stress and makes housing unaffordable. There is no denying that the high cost of housing in developing economies today will negatively impact those nations' economies. The economy's stability, equity, and growth are influenced by consumer purchasing power.

The elevated risk of a property bubble is one of the possible effects of high housing prices. This is referred to as a housing bubble when housing prices increase for no

discernible reason due to demand, speculation, or irrational investing until they can no longer be supported. Market speculators and investors who want a drastic increase in housing prices for their financial gain cause a housing bubble. The increase in housing costs has made it unaffordable for people to buy homes as they once could. Besides, there is also a high risk of a housing bubble due to low-interest rates and lax lending standards. When the credit sector grows, people are more likely to borrow and spend it on housing without considering housing costs. Many homeowners end up paying more than they borrowed due to their willingness to pay as much as possible for a home on the market.

Lack of housing affordability can also impact the economy by slowing economic growth. Humans are willing to purchase even if a home or a mortgage is expensive, as a home is one of their essential needs. When the mortgage is too expensive, borrowers are compelled to reduce their disposable income, which lowers their purchasing power and consumption. Additionally, the buyer must make a higher initial deposit for a mortgage, which will reduce consumption. Thus, the increase in housing prices may cause GDP to decline, slowing economic growth.

A house is deemed within an individual's means if it costs 30% of their gross income and has a price-to-income ratio no higher than 3.0. However, the selected developing countries have experienced record highs in house price-to-income ratio, which asserted that the houses are "seriously unaffordable". The price-to-income ratio for China (34.99), India (9.26), Malaysia (8.29), South Africa (3.38) and Turkey (12.65) shows that the housing costs have exceeded the affordability.

The selected developing countries face the same issue of the increasing living costs and insufficient income to sustain their families have prevented them from purchasing a property. According to Nur Hanani (2021), the estimated monthly average living cost in Kuala Lumpur was RM3,262, while the average monthly salary in Malaysia was RM6,590. However, the average housing price in Kuala Lumpur in 2021 was RM708,812. Housing costs have accounted for around a quarter of the discretionary income. Besides, only 70 % of Malaysian citizens own their house, as many first-time buyers face hefty costs when they buy a house since they must set aside a large sum of money for the down payment and monthly

mortgage payments. Thus, it leads many citizens to fear that they may be incapable of affording their own house.

Besides, the issue of affordable housing is threatening to become a crisis for Turkish citizens. Since February 2021, Turkey's housing cost has elevated by 96%. Turkish citizens are unlikely to find affordable housing due to the Turkish Lira's inability to recover after losing 40% of its worth in 2021 and international investors entering the market with a yearly inflation rate of 142%. As the pandemic spread, the economic crisis increased the cost of building supplies like cement, further slowing the development of new homes. Due to the increased demand and lack of supply, home prices have gone up, and private and public banks are now offering 120 to 240-month housing loans with interest rates between 1.2% and 1.8%. However, with an average monthly salary of 7,830 Turkish Lira, with around $530, Turks cannot even afford to pay their rent, relatively less obtain a mortgage. As a result, many decide to relocate outside of urban areas or are compelled to take on more debt (Cramer, 2020).

The high housing prices may contribute to a labour shortage and impact the labour market's effectiveness in local and national areas. The cost of housing is significantly higher in metropolitan areas than in rural ones. People often migrate to other areas when they can no longer afford the high cost of housing in one location. There would be a gap between workers and jobs due to labour mobility. It will also have trouble finding low-paid employees in expensive international cities. (Judith and Vivienne, 2007)

1.3 Research Questions

1.3.1 Main Research Question

How do the macroeconomic determinants influence housing prices in developing countries?

1.3.2 Specific Research Questions

i. How does the GDP influence housing prices in developing countries?
ii. How does the inflation rate influence housing prices in developing countries?
iii. How does the exchange rate influence housing prices in developing countries?
iv. How does the unemployment rate influence housing prices in developing countries?
v. How does the population influence housing prices in developing countries?

1.4 Research Objectives

1.4.1 General Objectives

This study aims to identify the macroeconomic factors that influence housing costs in developing nations.

1.4.2 Specific Objectives

i. To examine the relationship between GDP and housing prices in developing countries.
ii. To examine the relationship between inflation rate and housing prices in developing countries.
iii. To examine the relationship between exchange rate and housing prices in developing countries.
iv. To examine the relationship between the unemployment rate and housing prices in developing countries.

v. To examine the relationship between population and housing prices in developing countries.

1.5 Significance of the Study

The continuous house price fluctuation has generated numerous problems for the countries, particularly economic development. Investors, property purchasers, economists, and policymakers pay attention to the property market. Besides, low and medium-income households have suffered numerous negative consequences due to increasing property prices.

This study will look at the relationship between changes in property prices and the GDP, population, unemployment rate, inflation rate, and exchange rate. The significance of research to government agencies, policy experts, society, and investors is increased by this study. This study makes it possible for policymakers to implement monetary policy to support economic consistency, stability, and long-term viability.

1.6 Chapter Layout

Chapter 1 briefly discusses the property market's research background in developing countries and macroeconomic determinants. In addition, it included the study's significance, research questions, objectives, and problem statement.

Chapter 2 reviews the literature for each variable. The findings and outcomes from previous studies and the pertinent theoretical framework are included. Besides, this chapter presents the proposed theoretical or conceptual frameworks for property prices.

Chapter 3 will explain the study's methodology. This chapter will discuss the proposed study's empirical model, the data sources, the determinants' definitions, and the data analysis method.

Chapter 4 presents the data analysis using the methodology outlined in the previous chapter, along with empire findings, diagnostic testing and interpretation. Lastly, The main findings will be summarised and discussed in this chapter.

Chapter 5 summarises chapters 1 through 4 and their policy implications. It also points out their limitations and makes suggestions for further research.

1.7 Conclusion

This chapter includes a few research backgrounds, including details on property prices and factors that affect housing costs from a macroeconomic perspective in developing nations, including GDP, inflation, exchange rates, unemployment rates, and population. In summary, the study's findings will be able to identify the influence of macroeconomic determinants on housing prices and will serve as a guide for investors or homebuyers as they will be aware of the connection between housing prices and macroeconomic determinants.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

The research background for each determinant, the problem statement, the research questions, the research objectives, and the importance of the study regarding housing prices in developing nations were outlined in the earlier chapter. Before shifting to empirical analysis, various prior research studies on the factors influencing housing prices had been conducted in multiple countries. In the research, various factors were used.

This chapter examines the correlation between the independent determinants (GDP, inflation rate, exchange rate, unemployment rate and population) and the dependent determinant, the real residential property price index in developing countries. Besides, the theories used in the previous research will be discussed.

2.1 Review of Relevant Theoretical Models

2.1.1 Demand and Supply Theory

The demand and supply theory describes how the demand and supply of products and services are linked. Demand relates to the number of goods or services consumers desire, whereas supply refers to the quantity sellers can offer. For example, housing prices are strongly tied to income, so it is only affordable to own a home when people have a consistent fixed income (Aspen, 2012). But since their lower income cannot support them to own a home, citizens will be forced to rent rather than buy. Thus, as income falls, so does the demand for homes, resulting in decreased housing prices. This theory indicates that income and housing prices have a positive relationship.

2.1.2 Migration and Urbanization Theory

According to migration and urban theory, urbanization and migration may impact national housing costs. Population migration can influence urbanization by impeding land and infrastructure development for better living conditions, indirectly impacting housing costs (Lin, Ma, Zhao, Hu, and Wei, 2018). People choose to immigrate internationally after considering that it enables them to significantly raise their salary (Clemens, Montenegro & Pritchett, 2019). The size of the population is significant since more people emigrate to other countries due to population expansion in their home countries (Lewer and Van den Berg, 2008).

Contrarily, rural-urban migration entails transitioning from an economy predominantly focused on agriculture to one built on industry and services (Henderson, 2003). People relocate from rural to urban areas during urbanisation, coinciding with localised population expansion (Sivadas & Ismail, 2020). The demand for housing will rise as the urban population grows due to migration because there won't be enough housing in the cities to meet demand, leading to an increase in housing costs (Lin et al., 2018).

Additionally, a growing economy is accompanied by a low unemployment rate. It encourages people to move there due to the cities' higher job opportunities and high salaries (Todaro, 1969). Higher unemployment therefore suggests less job stability and has a negative impact on home prices (Holmes, Otero, & Panagiotidis, 2017). Therefore, the population and unemployment rates are suggested to determine home costs under the migration and urbanisation theory.

2.1.3 Purchasing Power Parity (PPP)

This theory clarifies how the exchange rate works in macroeconomics. The purchasing power and currencies of various countries can differ. The PPP

theory assumes that consumers can buy the same commodity in the same quantity and at the same price in different countries, known as the Law of One Price. This theory states that a balanced exchange rate within both countries will have equal purchasing power for domestic residents and visitors (Rudiger & Paul, 1976).

Additionally, it establishes the various price ranges. A country's currency gains value relative to other currencies when the cost of goods or services decreases because demand declines. Furthermore, this theory holds that a country's exports will increase as the exchange rate depreciates while import prices will remain relatively high. The domestic value of goods and services would be negatively impacted over time by the economy's high commodity prices, which would reduce the purchasing power of its citizens. (Ozor & Eze, 2016). Based to Mahalik and Mallick (2011), Relative prices are significantly impacted by the purchasing power of a country with a higher currency value and vice versa. When a country's currency depreciates, import prices rise relative to export prices, making it more competitive in the markets for goods and services. For instance, Malaysia attracts foreigners due to their higher purchasing power and currency exchange rate (Meidani et al., 2011).

2.2 Review of Literature

2.2.1 Real Residential Property Price Index

A household typically owns a house or other property, and home equity makes up most of that household's wealth. Many investors would buy real estate or a ho as a significant investment. The Real Residential Property Price Index is an index number used to calculate the rate of change in residential property prices over time, including those for flats, apartments, detached homes, and terraced homes. Only the market prices are taken into account when measuring.

According to Maryam Zabihi (2011), GDP positively correlates with housing prices. GDP growth indicates that personal consumption grows, which drives up housing costs. Duan, J., et al. (2021) mentioned that inflation has negatively influenced housing prices. Besides, there is an inverse correlation between the unemployment rate and the cost of housing. Unemployment rate declines will lead more people to obtain mortgage loans to purchase homes. As a result, housing demand increases housing costs (Li Gan, QingHua Zhang, 2013). In addition, the exchange rate positively influences housing prices. An increase in the exchange rate will lead the housing prices will rise (Joseph B. Lipscomb, John T. Harvey and Harold Hunt, 2003). The population significantly and positively impact housing demands and, consequently, the housing price (Trofimov, I. D., et al., 2018).

2.2.2 Gross Domestic Product (GDP)

The majority of studies found a strong correlation between GDP and housing prices. A higher GDP will result in faster economic expansion and higher levels of national wealth. The housing demand will increase as more people can buy their own homes. As a result, this has caused a rise in housing costs. Based on the study conducted by Li et al. (2018), Housing prices in China are significantly influenced by GDP, which has a strong positive correlation with housing prices. The rise in income levels raises the need for housing condition improvement and, as a result, increases investment. Studies from Li (2017), Li (2020) and Lei et al. (2010) also support the idea that China's housing prices are positively correlated with GDP. Besides, the findings that GDP positively and significantly influence housing prices in Malaysia were supported by Zulkifli et al. (2022), Tze San (2013) and Kok et al. (2018). Additionally, a significant number of earlier studies claimed that the GDP has a positive effect on housing prices in South Africa and India.

However, according to Wong & Sarma (2019) and Alpha Kabine (2022), GDP positively correlates with housing prices in Malaysia in the short run but

negatively in the long run. Furthermore, Akkay (2021) and Avramis (1970) argued that GDP shows no static relationship to housing prices in India and South Africa. GDP can only explain 15% of the price movement in South Africa's property sales.

2.2.3 Inflation Rate

There are conflicting opinions on how inflation affects the real estate market, and numerous studies support these opinions. According to Zhang et al. (2016), inflation positively impacts housing prices in China. Monetary authorities in China always pay attention to the macroeconomy operation. A tight monetary policy is usually adopted to counter the negative effect of interest rates. Li (2017) and Li (2020) pointed out inflation is positively correlated with housing prices in China. Inflation has the most significant impact on housing prices in China. Then, Wong & Sarma (2019) and Alpha Kabine (2022) found a positive relationship between inflation and house price in Malaysia. Similar results were also found by Prabhu Parrikar (2019) and Habanabakize & Dickason (2022), mentioning inflation will increase the housing price in India and South Africa.

However, Duan et al. (2021) argued that inflation negatively impacts China's housing prices. The massive price of housing results in declining demand for homes, particularly for those who lack a significant amount of money to afford a house. When housing demand declines, it is challenging for the real estate developer to sell properties at higher prices. Therefore, the prudent course of action is to sell the house for less money to keep the business funded (Li, 2015). A similar result is also supported by Mallick & Mahalik (2014), Trofimov et al. (2018) and Pinjamin & Kogid (2020).

2.2.4 Exchange Rate

The depreciation of the domestic currency reduces domestic residents' purchasing power in the housing market due to the economic downturn. Foreigners' house demand will increase while the house in a certain country is cheaper as the currency in that country is depreciating. Thus, it led to a rise in housing prices.

Based on Zhang et al. (2012), the exchange rate has significant effects on China's housing prices and is determined as the most important factor in China's house prices. Most researchers examined that the exchange rate positively relates to the house price in developing countries. In nations where foreign investment plays a significant role in the economy, an increase in housing prices is typically correlated with an appreciation of the exchange rate (Pinjamin & Kogid, 2020). Apart from this, Akça (2022) mentioned that the rising exchange rate in Turkey has a particular impact on the construction industry through costs and increased housing costs. A similar result of the adverse correlation between exchange rate and housing price was also found by Gebesolu (2019), Prabhu Parrikar (2019), Lekhuleni (2022), and Kwangware (2009).

However, Wong & Sarma (2019) argued that Malaysia's exchange rate and house prices have a negative relationship. The decrease in the exchange rate will significantly impact the increasing house demand due to the development of the construction sector (Colak, 2021). In addition, Mallick & Mahalik (2014) mentioned that the exchange rate does not influence India’s housing price.

2.2.5 Unemployment Rate

Most previous studies mentioned that the unemployment rate significantly impacts house prices. Based on Chitra Ganeson & Illias Masri (2015), the

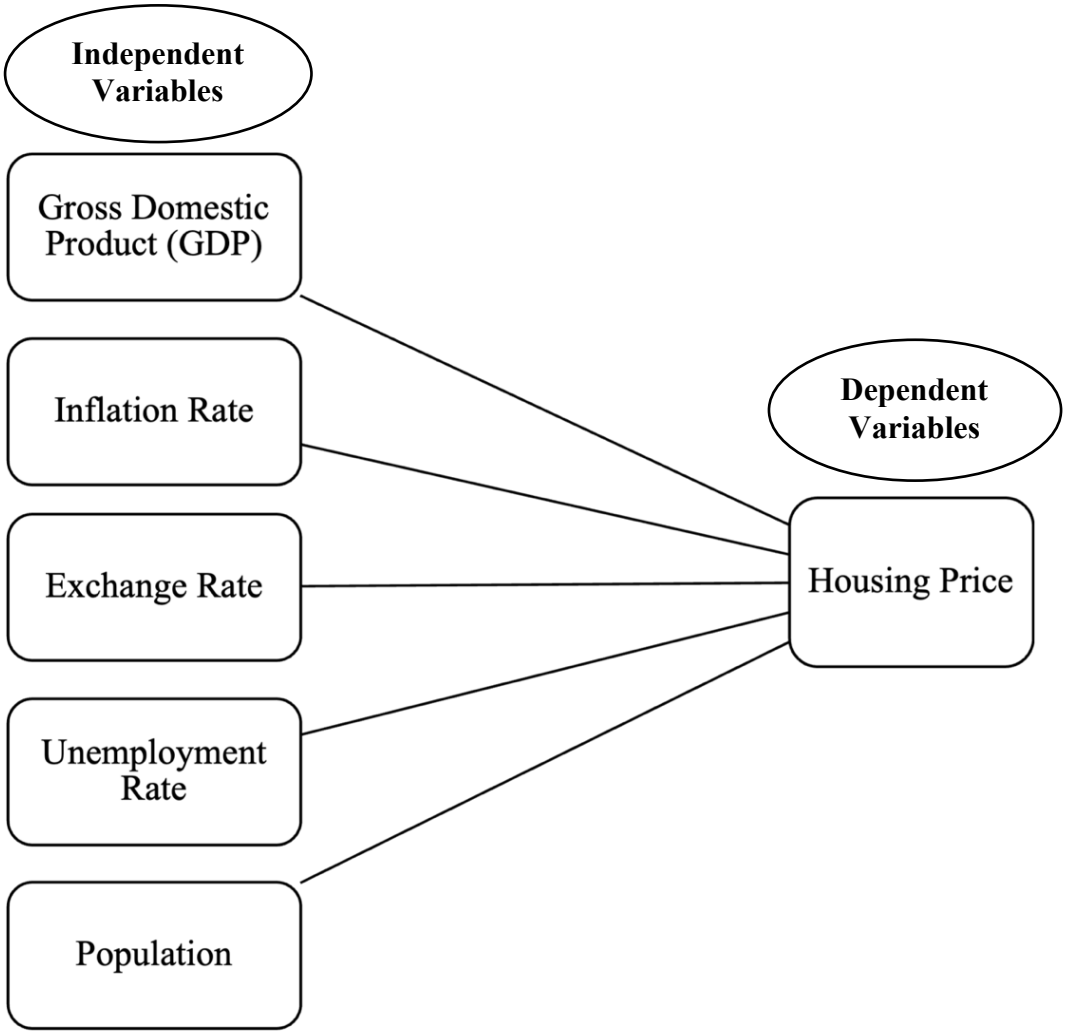
unemployment rate has a negative impact on house prices in Malaysia. The outcome is consistent with the research done by Liu & Shen (2005), which mentioned that increasing the unemployment rate will lead the house price in China to drop. However, Lekhuleni (2022) argued that the unemployment rate had a positive and persistent effect on South Africa's housing prices.

2.2.6 Population

All previous studies had a consistent result which is the population positively and significantly impacts housing prices. This result is supported by Wong & Sarma (2019) and Trofimov et al. (2018). The increase in population increases the housing demand and, thus, the housing price. The house price will be affected when the demand exceeds the housing supply. People are willing to spend more to own a home when there are only a few available homes on the real estate market.

2.3 Proposed Theoretical/ Conceptual Framework

Figure 2.1 Macroeconomic determinants of housing prices



Adapted from:

Chitra Ganeson, & Illias Masri, A. M. (2015). An analysis of the factors affecting house prices in Malaysia – An Econometric Approach

Figure 2.1 above states the five independent variables influencing the housing price. The macroeconomic determinants included GDP, inflation rate, unemployment rate, exchange rate and population.

2.4 Conclusion

To conclude this chapter, the connection between the real residential price index and macroeconomic determinants has been clarified using previous research literature. However, inconsistent results were obtained by the researchers as the studies were carried out in different nations and had different data. The theoretical framework between the real residential price index and its factors was also covered in this chapter.

CHAPTER 3: METHODOLOGY

3.0 Introduction

This chapter includes model specification, research design, data collection, panel data analysis, and diagnostic testing. In the following chapter, the research model is examined using each procedure. The five factors used in this study to determine the real residential property index in developing nations are the gross domestic product (GDP), the inflation rate, the exchange rate, the unemployment rate, and the population. The sample period of this study is from 2011 to 2021. There are 55 total observations in the yearly form of all the data.

3.1 Model Specification

3.1.1 Multiple Regression Analysis

Multiple regression analysis expands the two-variable model when there are more than two explanatory variables and a dependent variable. Five independent determinants explain the dependent determinant in this study. A multiple regression model is used to investigate the correlation between the regress and regressors. In this study, a comprehensive model will be developed.

The general model takes only the independent variable into account. The following is the equation:

$$Y_{it}= \beta_0+\beta_1 X_{1it}+\beta_2 X_{2it}+\beta_3 X_{3it}+\beta_4 X_{4it}+\beta_5 X_{5it}+\mu_{it}$$

$$RRPPI_{it}= \beta_0+\beta_1 GDP_{1it}+\beta_2 CPI_{2it}+\beta_3 EXC_{3it}+\beta_4 UNEMP_{4it}+\beta_5 POP_{5it}+\mu_{it}$$

Where,

$RRPPI_{it}$	= Real Residential Property Price Index
GDP_{it}	= Gross Domestic Product
CPI_{it}	= Inflation rate, proxy by consumer price index
EXC_{it}	= Exchange rate
$UNEMP_{it}$	= Unemployment rate
POP_{it}	= Population, proxy by population growth rate
β_0	= Intercept
$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$	= Partial regression coefficients
μ_{it}	= Error term

3.1.2 Panel Data

Panel data are time series observations-based data sets that combine cross-sectional and time series dimensions. Panel data, which have more degrees of freedom and sample variability than cross-sectional data, allow for more precise inference of model parameters. As panel data test more complex and intricate behavioural hypotheses, they also have a greater capacity to capture the complexity of human behaviour than single cross-section or time series data.

3.1.2.1 Pooled Ordinary Least Squares Model

Regression using pooled OLS enables analysis of n units of observations throughout t times. It examines panel data, which combines cross-sectional and time series data (Baltagi, 2008). The letters i and t serve as a double subscript for the variables in a pooled OLS model. The subscript i represents the individual observation and the cross-sectional dimension, whereas the subscript t specifies the time and represents the time series dimension. According to Killingsworth (1990), pooled OLS can generate accurate estimates for each parameter in a model.

It should be noted that it still has some drawbacks, such as when the error term of individual units tends to remain constant over time. As a result, Killingsworth (1990) advises against using simple pooled OLS unless this unit effect is absent. Instead of using the pooled OLS, one could use the fixed-effects estimation, which enables the error term to be specified as an individual-specific time-invariant component. The pooled OLS model will investigate the relationship between macroeconomic determinants and the real property price index in this study. The equation is represented as follows:

$$Y_{it} = \alpha + \beta X_{it} + \varepsilon_{it}, \; i = 1, 2, \ldots, n \; ; \; t = 1, 2, \ldots, t$$

Where:

Y_{it} = Real Residential Property Price Index (dependent variable)

α = Intercept

β = Coefficient of X

X_{it} = Macroeconomic determinants (independent variable)

ε_{it} = Error term

The equation above shows how Y and X are related to one another. The intercept, α, reflects the value of the dependent variable Y when the independent variable X is zero. The dependent variable Y has changed in reaction to a unit change in the independent variable X, as shown by the coefficient of X.

3.1.2.2 Fixed Effect Model (FEM)

For each cross-sectional unit, dummy variables are added to the fixed effects regression model, resembling OLS regression. It's crucial to make sure the n isn't too big. (n-1) dummies in the regression must be considered to utilize the fixed effect utilizing square. A specific time-invariant error term and a random error term that varies across individual observations and over time

make up estimation through fixed effects (Killingsworth, 1990). The following is a representation of the equation:

$$Y_{it} = \alpha + \beta X_{it} + \mu_i + \varepsilon_i \, , \, i = 1, 2, \ldots , n \; ; \; t = 1, 2, \ldots , t$$

Where:

Y_{it} = Real Residential Property Price Index (dependent variable)

α = Intercept

β = Coefficient of X

X_{it} = Macroeconomic determinants (independent variable)

μ_i = Company fixed effect

ε_i = Error term

Baltagi (2008) asserts that FEM becomes a suitable model if there is a particular set of n number of observations. The subjects of our analysis must also be the same, and all exhibit the same size effect, as our inference must only be based on these specific observations (Borenstein, Hedges, Higgins & Rothstein, 2010).

3.1.2.3 Random Effect Model (REM)

In contrast to the fixed effect model, which does so by using dummy variables, the random effect model represents its ignorance of the actual model through the disturbance term. A composite error term and an intercept β_1 representing the average value shared by all the independent variables make up the random effect model (Gujarati & Porter, 2009). This model can be illustrated as follows:

$Y_{it} = \beta_1 + \beta_2 X_{it} + \varepsilon i + u_{it}$

$Y_{it} = \beta_1 + \beta_2 X_{it} + w_{it} \, , \, i = 1, 2, \ldots , n \; ; \; t = 1, 2, \ldots , t$

where

Y_{it} = Real Residential Property Price Index (dependent variable)

β_1 = Common mean value for the intercept, assumed to be random

β_2 = Coefficient for X

X_{it} = Macroeconomic determinants (independent variable)

μ_{it} = Combined time series and cross-section error components

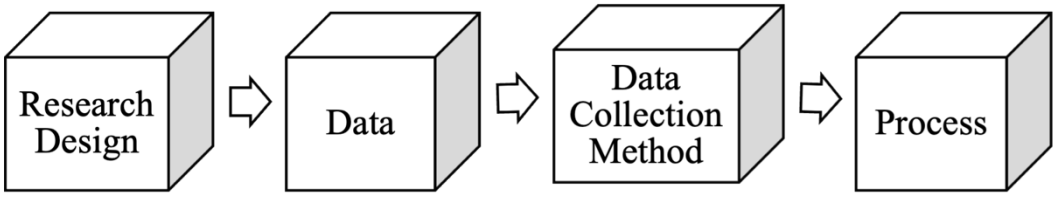
ε_{it} = Cross-section or individual-specific error component

w_{it} = Composite error term

The random effect model presupposes several things, namely that there is no association between the various error components. Furthermore, there is no autocorrelation between the error components and the cross-sectional and time-series units. In addition, there is no relationship between w_i and the independent factors. There is a correlation between the error terms linked to two different referent points in time inside a given cross-sectional unit. The OLS estimators would be useless in this case. Hence it is advisable to utilise the generalised least squares method. (Gujarati and Porter, 2009).

3.2 Research Design

Figure 3.1 Research Flow



This study aims to investigate the relationship between the real residential property price index (dependent determinants) and macroeconomic determinants, including GDP, inflation rate, exchange rate, unemployment rate and population (independent determinants).

The data of this study is quantitative as it is more suitable and appropriate due to carrying out hypothesis testing using numerical data.

3.3 Data Collection Methods

Data collection is necessary to investigate the connection between the real residential property price index and macroeconomic determinants. Every piece of information is derived in annual form from secondary sources. Each dependent and independent determinant data is numerical, with 11 observations. The independent determinants are GDP, inflation rate, exchange rate, unemployment rate, and population, which are used to examine the significant correlation toward real residential property price index in developing countries (China, India, Malaysia, Turkey and South Africa). Besides, the data are collected from the World Bank and Federal Reserve Bank of St. Louis (FRED) database from 2011 to 2021. Secondary data resources are chosen as they are easier to access, cost-saving, and less time-consuming than primary data.

3.3.1 Real Residential Property Price Index

The Real Residential Property Price Index's data source is the Federal Reserve Bank of St. Louis (FRED) database, and its time range is from 2011 to 2021. For this study, there are 11 observations, and the measurement unit is an index. The Residential Property Price Index is an index number that tracks the rate of change in the cost of residential properties (apartments, single-family homes, and terraced homes) purchased by households. It can demonstrate property price trends in the selected developing countries.

3.3.2 Gross Domestic Product (GDP)

GDP data is collected from the World Bank database. All information is annually from 2011 to 2021, and the measurement unit is percentage (%). GDP reflects the economic situation. More people will purchase a house if the economy grows and thus causing the housing price to rise. The GDP growth rate is the annual average change of GDP at a market price based on constant local currency for a given national economy at a specific period.

3.3.3 Inflation Rate

The inflation rate data of this study are collected from the World Bank database annually from 2011 to 2021. Consumer Price Index (CPI) is a tool for measuring inflation. CPI is a weighted average price evaluation of a basket of consumer goods and services based on an index. The following formula of the consumer price index is:

$$\text{Consumer Price Index (CPI)} = \sum_{i=0}^{n} \text{CPI} \times \text{Weight}$$

3.3.4 Exchange Rate

Exchange rate data is collected annually from the World Bank database from 2011 to 2021. The official exchange rate is included in the study as it is announced by a country's foreign exchange administration.

3.3.5 Unemployment Rate

The primary indicator for assessing the state of a nation's labour market is its unemployment rate. The unemployment rate is the unemployment rate of working-age adults over 16 in a country who can both find employment and

actively look for work. The data is collected in percentage (%) from the World Bank database. The following formula is the unemployment rate calculation:

$$\text{Unemployment Rate} = \frac{\text{Number of Unemployed}}{\text{Total Labour Force}}$$

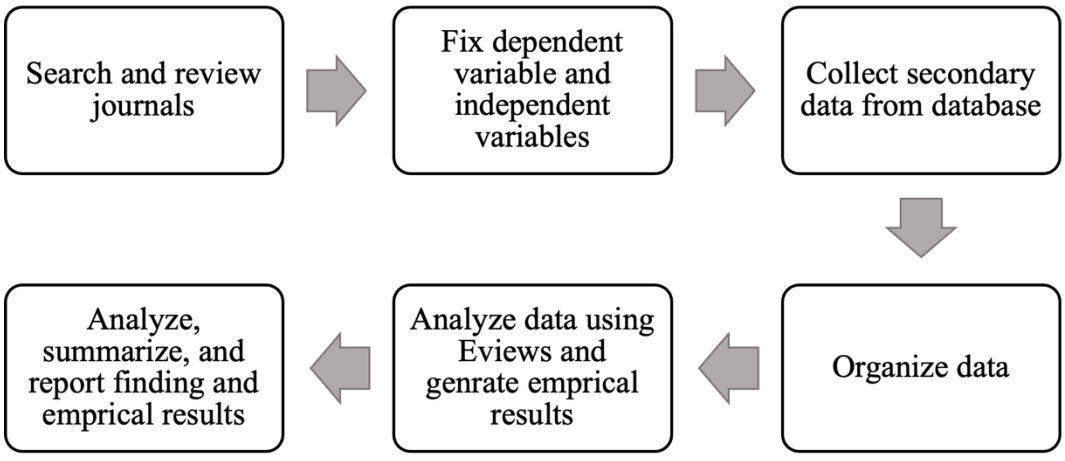
3.3.6 Population

The population data, expressed as an annual percentage of the population growth rate, is taken from the World Bank database. The term "population" refers to the actual population, which includes all residents regardless of nationality or legal status. The following is the calculation of the population growth rate:

$$\text{Population Growth Rate} = \frac{\text{New Population-Original Population}}{\text{Original Population}} \times 100$$

3.4 Data Processing

Figure 3.2: Diagram of Data Processing



Data processing involves six steps which are shown in figure 3.2.

Step 1: Search and Review Journals

Google Scholar, Science Direct, and other databases were used to find several journals related to the research on the factors influencing housing prices in a few selected developing nations. The journals come from various countries, including China, India, Turkey, Malaysia, and South Africa, to aid in selecting appropriate independent variables for this study.

Step 2: Fix Dependent Variable and Independent Variables

Real Residential Property Price was fixed as the dependent variable after reviewing the summary of journals and the availability of data. Additionally, GDP, inflation rate, exchange rate, unemployment rate, and population were selected as the independent variable for this study as they significantly impacted previous studies. Besides, the study only uses data that is collected annually.

Step 3: Collect Data from the Database

The World Bank and Federal Reserve Bank of St. Louis (FRED) databases gather all the dependent and independent variables information. The data collected is annual data and a total of 66 observations.

Step 4: Organize Data

All data are organized in excel after the data collection. The data are repeatedly checked after download to ensure they are accurate and in the proper order. The incorrect data is then modified and fixed.

Step 5: Analyze the data using EViews to generate the Empirical Results

To run the OLS and obtain the empirical findings, Eviews is used. R-squared and Adjusted R-squared are also shown, and T- and F-tests are derived from the observed results.

Step 6: Analyze and Summarize Empirical Results

Verify the outcomes of each variable and the entire model, then analyze the findings and the correlations between the independent and dependent variables. Additionally, compare those findings with those of earlier researchers to see if they support the hypotheses in chapters 1 and 2.

3.5 Panel Regression Analysis

3.5.1 Poolability Test

A poolability test was performed to identify which empirical model between Pooled OLS or FEMis better suited for estimating the equation. This test is the first step in identifying which model is more appropriate for estimating the data set.

H_0: There is a common intercept.
H_1: There is no common intercept.

Decision Rule: Reject if the probability of F-statistic is less than a 5% significant level; otherwise, do not reject.

Reject H_0 means that pooled OLS model is invalid and FEM is more appropriate.

3.5.2 Breusch and Pagan Lagrange Multiplier Test

The Breusch-Pagan Lagrange Multiplier (BPLM) Test determines whether the regression contains any random effects. The Lagrange Multiplier (LM) statistic has one degree of freedom and follows the chi-square distribution. If the results reject the null hypothesis, it can be concluded that REM is preferable.

H_0: There is no random effect, $\sigma_i^2 = 0$, where i=1,2,3,...
H_1: There is a random effect, $\sigma_i^2 \neq 0$, where i=1,2,3,...

Decision Rule: Reject if the p-value is less than 5%; otherwise, do not reject.

Reject H_0 means that REM is more appropriate.

3.5.3 Hausman Test

Torres-Reyna (2007) states that the Hausman test can be conducted to distinguish between FEM and REM. This test primarily examines the correlation between the disturbance and other explanatory factors.

H_0: Correlation does not exist between country individual effect and X_{it}.
H_1: Correlation exists between country individual effect and X_{it}.

Decision Rule: Reject H_0 if the p-value of the test statistic (H) is less than a 5% significant level; otherwise, do not reject H_0.

Reject H_0 means that FEM is more appropriate than REM.

3.6 Diagnostic Checking

3.6.1 Multicollinearity

The link between two or more independent variables is referred to as multicollinearity. When multicollinearity develops, it is impossible to determine which explanatory variables affect the dependent variable since they are strongly correlated and reliant on one another.

A multicollinearity can be assumed in a model when high R^2 in the model but few significant t ratios are shown in the model's result. Only minor independent variables can clarify the model if the R^2 is more significant than 0.8. High pairwise association between two independent variables is the second way to identify multicollinearity.

3.6.2 Normality

The normality test determines a data set's conformance with a normal distribution (Ghasemi & Zahediasi, 2012). The research findings' validity will be tested if the data set is not regularly distributed. The Jarque-Bera test will be used to examine whether the sample data has skewness and kurtosis consistent with a normal distribution to determine the normality of our research data. Skewness is a metric that expresses the imbalance in the frequency distribution. On the other hand, kurtosis measures how much the frequency distribution is tailing off.

Hypothesis:
H_0: The error term is normally distributed.
H_1: The error term is not normally distributed.

Decision Rule: Reject H_0 if the p-value is lower than 0.05; otherwise, do not reject H_0.

3.6.3 Autocorrelation

The error term for any observation related to the error term of other observations ordered in time or space is known as autocorrelation. The autocorrelation causes the OLS method to overestimate the variances as there are higher values of t-statistics and F-statistics in the specification (Gujarati & Porter, 2009). Cross-sectional data does not have an autocorrelation issue because the individual units are unrelated. However, the time-dependent relationship between inertia in the economic data typically causes the autocorrelation issue in time series data.

The frequently used test to identify the first-order autocorrelation issue in the regression analysis is the Durbin-Watson test. This test can be applied to the normal distribution if the sample size is large. The sample size and number

of independent variables are key factors in determining its critical value. The hypothesis testing of the Durbin-Watson test is as below:

H_0: $\rho = 0$
H_1: $\rho \neq 0$

If the Durbin-Watson value is between 1.5 and 2.5, then there is no autocorrelation, according to the decision criteria for the Durbin-Watson test for autocorrelation (Ayyangar, 2007).

3.7 Hypotheses Development

3.7.1 Gross Domestic Product (GDP)

H_0: The real residential property price index and GDP have no significant relationship.
H_1: The real residential property price index and GDP have a significant relationship.

The value of the final goods and services produced by a nation over a given period, excluding the value of imports, is typically measured by its GDP.
Li et al. (2018) found that GDP positively correlates with China's housing prices. Furthermore, Lekhuleni (2022) mentioned that GDP has significantly positively correlated with housing prices in South Africa. Besides, the results of GDP positively and substantially influence housing prices in Malaysia were supported by Zulkifli et al. (2022), Tze San (2013) and Kok et al. (2018). Based on the study conducted by Prabhu Parrikar (2019) in India, GDP shows a strong positive correlation with housing prices. However, Wong & Sarma (2019) and Alpha Kabine (2022) indicated that GDP negatively affects house prices in the long run. This study expects the real residential property price index and GDP have a significant relationship. Therefore, the null hypothesis is rejected.

3.7.2 Inflation rate

H_0: The real residential property price index and inflation rate have no significant relationship.
H_1: The real residential property price index and inflation rate have a significant relationship.

Consumer price index (CPI) inflation is defined as an increase in the price of several goods and services that specific household types regularly purchase. The study by Zhang et al. (2016) mentioned that the inflation rate positively impacts housing prices in China. This is supported by Wong & Sarma (2019) and Alpha Kabine (2022), the housing price in Malaysia were found to have a positive relationship with inflation. The studies conducted by Prabhu Parrikar (2019) and Habanabakize & Dickason (2022) in India and South Africa mentioned that inflation would increase the housing price. However, a study by Duan et al. (2021) argued that inflation has a negative impact on China's housing prices. This study expects the real residential property price index and inflation rate have a significant positive relationship in developing countries. Therefore, it will reject the null hypothesis.

3.7.3 Exchange rate

H_0: The real residential property price index and exchange rate have no significant relationship.
H_1: The real residential property price index and exchange rate have a significant relationship.

The exchange rate is the value of a nation's currency in terms of another country's currency or economic zone. Based on the study by Gebesolu (2019), Prabhu Parrikar (2019), Lekhuleni (2022), and Kwangware (2009) mentioned that the exchange rate has an adverse relationship with the housing price. However, Wong & Sarma (2019) indicated that the exchange rate negatively

influences house prices in Malaysia. Furthermore, Mallick & Mahalik (2014) mentioned that the exchange rate does not impact the housing price in India. This study expects the real residential property price index and exchange rate have a significant positive relationship in developing countries. Therefore, it will reject the null hypothesis.

3.7.4 Unemployment rate

H_0: The real residential property price index and unemployment rate have no significant relationship.
H_1: The real residential property price index and unemployment rate have a significant relationship.

The unemployment rate is the proportion of the labour force that is unemployed. In addition, those who report being unemployed, being available for work, and actively seeking employment in the previous four weeks are considered unemployed. Based on the studies conducted by Chitra Ganeson & Illias Masri (2015) in Malaysia, they figured out that the unemployment rate negatively influences house prices. Besides, it is supported by Liu & Shen (2005) mention that increasing the unemployment rate will lead the house price in China to drop. However, Lekhuleni (2022) indicated that the unemployment rate positively influences South Africa's housing prices. This study expects the real residential property price index and unemployment rate have a significant negative relationship in developing countries. Therefore, it will reject the null hypothesis.

3.7.5 Population

H_0: The real residential property price index and population have no significant relationship.

H_1: The real residential property price index and population have a significant relationship.

The population is based on the actual population, which tallies all residents regardless of nationality or legal status. According to the studies conducted by Wong & Sarma (2019) and Trofimov et al. (2018) affirmed, the population influence housing price. The increase in population increases the housing demand and, thus, the housing price. The house price will be affected when the demand exceeds the housing supply. When the property market has only a few houses, people are willing to spend more to own their homes. This study expects the real residential property price index and population have a significant positive relationship in developing countries. Therefore, it will reject the null hypothesis.

3.8 Conclusion

In summary, this chapter covered the proposed empirical model, data sources, variables descriptions, and methods used in this study for analyses and testing. This chapter has distinctly stated and expanded upon the concepts for each methodology. The E-views software's data analysis results and findings for each method will be presented and explained in detail in the following chapter.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

This chapter concentrates on presenting and analysing the empirical findings obtained through the hypothesis testing used in the methods described in Chapter 3. The chapter's main highlights are the results of panel regression analysis tests like the Poolability Test, Breusch-Pagan LM Test, and Hausman Test. EViews 12 is used to generate all of the outcomes. A discussion of further clarification will follow each test result.

4.1 Descriptive Analysis

Table 4.1: Descriptive Summary Statistic of All Variables

	RRPPI	CPI	EXC	GDP	POP	UNEMP
Mean	122.8905	140.3905	18.0928	4.6515	1.17563	10.2740
Median	111.2466	124.6298	6.6445	5.2400	1.2943	5.4240
Maximum	175.5103	314.8061	74.0996	11.2000	1.7026	33.5590
Minimum	93.9233	103.1745	1.6750	- 6.6000	0.0893	2.8800
Std. Dev	26.7566	40.6957	23.6737	3.7123	0.4047	8.8814
Skewness	0.7072	2.2247	1.5025	- 1.1640	- 0.8840	1.2731
Kurtosis	1.9585	8.80226	3.4933	4.9129	2.9190	3.10065
Jarque-Bera	7.0699	122.5183	21.25030	20.80540	7.1791	14.8811
Probability	0.02916	0.0000	0.000024	0.000030	0.027611	0.000587
Sum	6758.9760	7721.4760	995.1043	255.8300	64.6597	565.0660
Observation	55	55	55	55	55	55

Table 4.1's outcome is based on 55 annual observations from 2011 to 2021. Table 4.1 displays the findings for all the variables that are relevant to descriptive statistics, such as the Real Residential Property Price Index (RRPPI), Consumer Price Index

(CPI), Exchange Rate (EXC), Gross Domestic Product Growth (GDP), Population Growth (POP), and Unemployment Rate (UNEMP).

Based on the table above, the maximum real residential property price index reaches 175.5103, and the minimum is 93.9233. The standard deviation is 26.7566, and the median of housing price is 26.7566. The real residential property price index data is relatively stable as the kurtosis is less than 3, which is 1.9585.

The highest consumer price index is 314.8061, while the lowest is 103.1745. The standard deviation of the consumer price index is 40.6957, whereas the median is 124.6298. The consumer price index data is more volatile than others as it results in high kurtosis (8.802226), which is more than 3.

Besides, the maximum of exchange rate reached 74.0996%, and the minimum fell to 1.675%. The result leads to 23.6737 of the standard deviation and 6.6445 of the median of the exchange rate. The exchange rate in developing countries is volatile since the kurtosis exceeds 3, which is 3.4933.

Moreover, the highest reading of GDP growth reached 11.2%, and the lowest reading reached -6.6%. The GDP's median is 5.24, and the standard deviation is 3.7123. Additionally, the data of this variable is volatile due to its kurtosis of more than 3, which is 4.9129.

The maximum population growth rate peaked at 1.7026%, and the minimum fell to 0.0893%. The standard deviation results in 0.4047, and the median results in 1.2943. The population growth rate is not volatile since kurtosis does not exceed 3, which is only 2.9190.

Last but not least, the highest unemployment rate peaked at 33.559%, and the lowest reached 2.88%. The standard deviation result is 8.8814, and the median is 5.4240. The kurtosis is 3.10065, which exceeds 3; therefore, the data is volatile.

4.2 Panel Regression Analysis

4.2.1 Poolability Test

Table 4.2: Result of Redundant Fixed Effect

Effect Tests	Statistic	Degree of freedom (d.f.)	Probability
Cross-section F	17.098677	(4,45)	0.0000
Cross-section Chi-square	50.831673	4	0.0000

The test is used in conjunction with the poolability test to select either the Pooled OLS model or the Fixed Effect Model as the regression model. Table 4.2 indicates that the probability has a zero value, less than the 5% significance level. The null hypothesis that the panel data follows the Pooled OLS model is thus rejected. So, the FEM is selected.

4.2.2 Breusch-Pagan LM Test

Table 4.3: Result of Lagrange Multiplier Test

Method	Cross-section One-sided	Period One-sided	Panel Both
Breusch-Pagan	16.10225 (0.0001)	2.707178 (0.0999)	18.80943 (0.0000)

Breusch-Pagan LM (BPLM) test is conducted to determine whether the Pooled OLS or REM is more suitable (Gujarati & Porter, 2009). Table 4.3's "Panel" results show that the probability (0.000) is below the 5% significance level. REM is preferable to the Pooled OLS model because the null hypothesis used to support it is also rejected.

4.2.3 Hausman Test

Table 4.4: Result of Hausman Test

Test Summary	Chi-square statistic	Chi-square. d.f.	Probability
Period random	45.682233	5	0.0000

The Hausman test is used to determine whether the REM or FEM is preferable because both previous tests rejected the use of the Pooled OLS model. The alternative hypothesis suggests that the panel data does not follow the random effect model, contrary to the null hypothesis. The outcome in Table 4.4 indicates that the null hypothesis should be rejected because the probability is less than the 5% level of significance. Therefore, when compared to Pooled OLS and REM, FEM is the best option.

4.2.4 R-square

Table 4.5: Summary of R-squared Result

No. of countries: 5 No. of observation: 55	
R-squared	0.870179
Adjusted R-squared	0.844215

According to the results in Table 4.5, the value of R square is 0.870179, which indicates that the macroeconomic determinants can account for 87.02% of the variation in the real residential property price index. On the other hand, the adjusted R square value of 0.844215 indicates that, when the degree of freedom is taken into account, 84.42% of the total variation in the real property price index can be attributed to macroeconomic determinants in developing countries.

4.2.5 F-statistic

Table 4.6: Summary of F-statistic

No. of countries: 5 No. of observation: 55	
Hypothesis	H_0: $\beta_1=\beta_2=\beta_3=\beta_4=\beta_5= 0$ H_1: At least one of the coefficients is different from 0.
Decision Rule	Reject H_0: If the p-value is smaller than 0.05. Otherwise, do not reject H_0.
P-value	0.0000
Conclusion	Reject H_0

Note: β_1 represent consumer price index, β_2 represent exchange rate, β_3 represent gross domestic product, β_4 represent population, β_5 represent unemployment rate.

Table 4.10 demonstrates that the model as a whole is significant because the p-value of 0.0000 is less than the 1% significance level. As a result, there is enough data to conclude that the model is significant at the 1% level.

4.2.6 T-statistic

Table 4.7: Result of T-statistic

Independent Variable	Hypothesis	Decision Rule	P-value	Decision	Conclusion
Gross Domestic Product	H_0: $\beta_1 = 0$ H_1: $\beta_1 \neq 0$	Reject H_0 if p-value is smaller than 0.05. Otherwise, do not reject H_0.	0.05732	Do not reject H_0	Gross domestic product insignificantly affects the real residential property index.
Consumer Price Index	H_0: $\beta_1 = 0$ H_1: $\beta_1 \neq 0$	Reject H_0 if p-value is smaller than 0.05. Otherwise, do not reject H_0.	0.9476	Do not reject H_0	Consumer price index insignificantly affects the real residential property index.
Exchange rate	H_0: $\beta_1 = 0$ H_1: $\beta_1 \neq 0$	Reject H_0 if p-value is smaller than 0.05. Otherwise, do not reject H_0.	0.0001	Reject H_0	Exchange rate significantly affects the real residential property index.
Unemployment rate	H_0: $\beta_1 = 0$ H_1: $\beta_1 \neq 0$	Reject H_0 if p-value is smaller than 0.05. Otherwise, do not reject H_0.	0.0769	Reject H_0	Unemployment rate significantly affects the real residential property index.
Population	H_0: $\beta_1 = 0$ H_1: $\beta_1 \neq 0$	Reject H_0 if the p-value is smaller than 0.05. Otherwise, do not reject H_0.	0.0819	Reject H_0	Population significantly affects the real residential property index.

The significance of one independent variable's influence on the dependent variable was examined using the T-statistic. According to Table 4.7, exchange rate, population and unemployment rate significantly affect the real residential property price index. In contrast, the consumer price index and gross domestic product insignificantly affect the real residential property price index.

4.3 Diagnostic Checking

4.3.1 Multicollinearity

4.3.1.1 High pairwise correlation coefficient

Table 4.8: Correlation Analysis

	RRPPI	**CPI**	**EXC**	**GDP**	**POP**	**UNEMP**
RRPPI	1.0000	0.1709	0.5990	0.0077	0.0248	-0.4847
CPI	0.1709	1.0000	0.2161	-0.0963	-0.0190	0.2291
EXC	0.5990	0.2161	1.0000	0.0263	-0.1191	-0.1332
GDP	0.0077	-0.0963	0.0263	1.0000	-0.2742	-0.4715
POP	0.0248	-0.0190	-0.1191	-0.2742	1.0000	0.3840
UNEMP	-0.4847	0.2291	-0.1332	-0.4715	0.3840	1.0000
Notes: Correlation > 0.8, indicating that the two variables are highly correlated.						

Hypothesis:

H_0: There is no multicollinearity exists among explanatory variables.

H_1: There is multicollinearity exists among explanatory variables.

If the pairwise or zero-order correlation coefficient between the two independent variables surpasses 0.8, there is a significant multicollinearity issue. According to Table 4.8's findings, there is no significant

multicollinearity issue among the independent variables because their pairwise correlation coefficients are not greater than 0.8.

4.3.2 Normality

Table 4.9: Jarque-Bera Test

No. of countries: 5 No. of observation: 55	
Hypothesis	H_0: The error term is normally distributed. H_1: The error term is not normally distributed.
Decision Rule	Reject H_0: If the p-value is lower than 0.05. Otherwise, do not reject H_0.
Jarque-Bera	0.601726
P-value	0.740179
Result	Normally distributed

Based on Table 4.9, the p-value is higher than the significance level of 5%; therefore, the alternative hypothesis is rejected as it indicates the error term is normally distributed.

4.3.3 Autocorrelation

Table 4.10: Durbin-Watson Test

No. of countries: 5 No. of observation: 55	
Hypothesis	H_0: $\rho = 0$ H_1: $\rho \neq 0$
Durbin-Watson Statistic	0.393550
Result	Autocorrelation exist

According to the Durbin-Watson Test's decision rules, autocorrelation does not exist if the Durbin-Watson value is between 1.5 and 2.5. However, the result of the Durbin-Watson test shown in Table 4.10 is 0.393550; therefore, this result concludes that the null hypothesis is being rejected and that the autocorrelation problem exists in the model. The autocorrelation problem might exist due to the short period of data which only consists of 10 years of data and the slight variation of data.

4.4 Discussion of Major Findings

Table 4.11: Findings of Developing Countries

Independent Variable	Expected Sign	Regression Result
Gross Domestic Product	Positive	Insignificant
Consumer Price Index	Positive	Insignificant
Exchange Rate	Positive	Positive
Unemployment rate	Negative	Negative
Population	Positive	Negative

4.4.1 Gross Domestic Product

The regression analysis's findings indicate that GDP has an insignificant impact on RRPPI. It is inconsistent with the Law of Supply and Demand and past studies such as Li et al. (2018) and Tze San (2013). However, the insignificant study of Akkay (2021) and Avramis (1970) stated that GDP does not influence housing prices. Fundamental macroeconomic indicators do not solely influence housing prices. Housing prices can also be impacted by other factors, such as social, civil, environmental, and demographical factors, to conduct a more comprehensive study of the effects of various categories of issues on the level of housing prices.

4.4.2 Consumer Price Index

According to the regression analysis, RRPIs are not significantly impacted by the consumer price index. It is incompatible with prior research and theory. However, the studies by Ong (2013) and Saudin et al. (2020) can support the comparable inconsequential results. Property value and the inflation rate have an adversarial relationship. Thus even though they are moving in the same direction, the inflation rate does not influence housing prices (Manaf, Said, Al & Adenan, 2019). The relationship between the inflation rate and housing prices may be weaker due to the variable CPI composition in each emerging economy (Tang, Ye & Qian, 2019).

4.4.3 Exchange Rate

The exchange rate significantly influences the RRPI. It is consistent with earlier research by Pinjamin & Kogid (2020) and Zhang et al. (2012). As the exchange rate rises, exports become more expensive while imports become less expensive, which drives up the price of housing. Since the appreciation of the local currency can be translated to the growth in wealth owing to foreign trade, this supports the wealth effect based on the demand side of the theory of housing prices. Housing demand will increase as wealth or income rises, resulting in a home price rise.

4.4.4 Unemployment Rate

According to the regression analysis, the unemployment rate in the selected developing nations negatively and significantly impacts the RRPI. It is compatible with the Migration and Urbanization Theory and earlier research by Liu and Shen (2005) and Chitra Ganeson (2015). The demand for property will decline when unemployment rates increase since most people cannot afford a home. As a result, house prices will decrease.

4.4.5 Population

According to the regression results, the RRPI in the chosen developing nations is significantly and negatively impacted by the population, which is not supported by the Migration and Urbanization Theory. The decline in population growth will also increase the housing price by looking at the number of households. The decline in population growth does not mean that the number of households has declined. The number of households can influence the housing demand. Although the population growth is falling, the number of households is increasing due to the number of people living alone and the number of divorces.

4.5 Conclusion

The most appropriate model is FEM, according to the panel data analysis of five developing nations from the years 2011 to 2021. The outcome demonstrates that the population, unemployment rate, and exchange rate significantly impact the real residential property price index. On the other hand, it is discovered that the real residential property price index is insignificant to the consumer price index and the gross domestic product.

CHAPTER 5: DISCUSSION, CONCLUSION, AND IMPLICATIONS

5.0 Introduction

This topic includes a summary of the last chapter's independent variables and hypothesis testing. Further discussion of the research's key findings, implications, implications, and suggestions will also be covered in this topic. As a result, the research will be assessed as the study's conclusion.

5.1 Summary of Statistical Analysis

Table 5.1: Summary of Statistical Analysis

Test	Hypothesis	Results	Decision
POLS vs FEM	H_0: There is a common intercept. H_1: There is no common intercept.	0.0000	Reject H_0. FEM is appropriate.
POLS vs REM	H_0: There is no random effect, $\sigma_i^2 = 0$, where i=1,2,3,... H_1: There is a random effect, $\sigma_i^2 \neq 0$, where i=1,2,3,...	0.0000	Reject H_0. REM is appropriate.
FEM vs REM	H_0: No correlation exists between country individual effect and $X_{it.}$ H_1: Correlation exists between country individual effect and X_{it}.	0.0000	Reject H_0. FEM is appropriate.

The Poolability test, Breucsh-Pagan test and Hausman test were conducted to find the most appropriate model. All test results illustrate that the probability (0.0000)

is lower than the 5% significant level. Therefore, FEM was chosen as the most suitable model compared to POLS and REM.

5.2 Summary of Major Findings

Table 5.2: Summary of Regression Results

Dependent Variable	Independent Variable	Expected Sign	Regression Result
Real Residential Property Price Index	Gross Domestic Product	Positive	Insignificant
	Consumer Price Index	Positive	Insignificant
	Exchange Rate	Positive	Positive and significant
	Unemployment rate	Negative	Negative and significant
	Population	Positive	Negative and significant

Based on Table 5.2, GDP and CPI are insignificantly influencing the real residential property price index. The unemployment rate and population positively and significantly influence the real property price index, while the exchange rate negatively influences the real property price index.

5.2 Implications of the Study

5.2.1 Government

This study can be used as a guide for governments to understand better the dynamics of the real estate market and design efficient policies that manage

the stability of housing prices in both groups of the chosen nations as the housing sector is essential to every economy.

Although governments in developing countries have implemented several programmes to reduce housing expenses, most of their residents, especially those in the low and middle-income categories, still struggle to pay the current housing costs. The government must therefore work harder to implement its housing strategy, with a particular emphasis on the younger population. The government might give increasing the real estate market's efficiency top priority. Increasing market transparency can help achieve this. Transparency may be increased by providing the most up-to-date and accurate information on real estate market transactions. The public is confused by the real residential property index that is now being supplied because it is based on an annual basis. If the government could update the data monthly or more regularly, the connected stakeholders could obtain more accurate data and react to the market more precisely.

Additionally, there is an adverse relationship between unemployment rates and housing costs because higher unemployment affects home affordability, which drives down housing costs. To lower the unemployment rate through changing aggregate demand and the pace of economic development, the government should utilise expansionary fiscal and monetary policy to stabilise housing prices in developed economies. This will promote housing market developments and prevent a rapid decrease in property prices.

5.3 Limitations of the Study

Data discrepancy, or the lack of compatibility or similarity among the data collected, is the first study limitation identified. This is because some nations are grouped under the same region, making it impossible to use the selected developing economies in this study to represent all nations worldwide.

Another drawback is that only 10 years of the data's range, from 2011 to 2021, were covered in the sample periods. This is because the data for the dependent and independent variables were gathered annually from the World Bank. The study has fewer observations, resulting in lower precision and power.

In developing nations, housing prices are also influenced by macroeconomic factors. Still, in the real market, housing prices are also influenced by microeconomic factors, such as household spending and supply and demand. Since this study may not be thorough in its analysis of housing prices, future researchers are advised to compare housing prices with macroeconomic and microeconomic elements to provide reliable information.

5.4 Recommendations for Future Researchers

More independent variables are advised to include in future research, such as real interest rates or variables based on supply or demand in the housing markets, which were unavailable in this study. A better fit model can be produced by increasing the flexibility and reducing the bias of the regression by adding additional independent variables, but this must be justified within a theoretical framework to avoid producing an over-fit model.

Besides, more nations are urged to include in the research as this will enable them to conduct a more thorough review and analysis of housing costs and develop more accurate estimates of how well the housing markets in those nations will perform.

Additionally, future researchers are advised to use various data frequencies, such as weekly, monthly, or quarterly, as some determinants may fluctuate more than others. This may lead to improved test reliability and make it simpler to measure changes between variables.

To conduct a more thorough analysis, future researchers should examine housing prices in light of macroeconomic and microeconomic issues. For instance, people

in urban and rural areas earn different monthly salaries and lifestyles. The data studied, which represents the average housing costs in developing nations, cannot be applied to specific geographic areas, particularly rural ones.

5.5 Conclusion

First, the study primarily examines the factors that influence housing prices on a macroeconomic level in a few developing nations, namely China, India, Malaysia, South Africa, and Turkey. Additionally, the Fixed Effect Model was used in this study to produce the results using data from 2010 to 2021.

The empirical findings showed that the exchange rate positively and significantly impacts housing prices. Additionally, the findings indicated that the population and unemployment rate negatively and significantly impact housing prices. The GDP and consumer price index, however, significantly influence housing prices.

The results of this study can shed some light on how macroeconomic factors like GDP affect housing prices in the real estate market for the government, homebuilders, and investors. In addition, regardless of the chosen developing economies, this study offers guidelines for the authority or policymakers to follow to control housing prices. Finally, several limitations and suggestions are offered for upcoming researchers to follow to prevent issues and enhance future research on the pertinent subject.

REFERENCES

Akça, T. (2022). House Price Dynamics and relations with the macroeconomic indicators in Turkey. International Journal of Housing Markets and Analysis. https://doi.org/10.1108/ijhma-04-2022-0059

AKKAY, R. C. (2021, April 30). The Macroeconomic Determinants of The Housing Prices in Turkey. Erciyes Üniversitesi İktisadi Ve İdari Bilimler Fakültesi Dergisi, 58, 241–264. https://doi.org/10.18070/erciyesiibd.801319

Alpha Kabine, C. (2022, January 25). Determinants of house prices in Malaysia. International Journal of Housing Markets and Analysis. https://doi.org/10.1108/ijhma-09-2021-0105

Ankara. (2020, February 18). House prices increase nearly 10 percent. Hürriyet Daily News. Retrieved September 12, 2022, from https://www.hurriyetdailynews.com/house-prices-increase-nearly-10-percent-152179

Anuj Puri. (2019, August 27). Will Property Prices Fall in 2019? Roofandfloor. Retrieved September 1, 2022, from https://roofandfloor.thehindu.com/real-estate-blog/will-property-prices-fall-in-2019/

Anyalewechi, C. (2021, November 26). South African currency suffers decline over fears of new Covid variant with many mutations. Nairametrics. https://nairametrics.com/2021/11/26/south-african-currency-suffers-decline-over-fears-of-new-covid-variant-with-many-mutations/

Aspden, A. (2012) House prices and unemployment for UK regions - research papers in Economics. Retrieved September 6, 2022, from https://plagiarism.repec.org/qingyu/qingyu2.pdf

Avramis, N. (2016, December). Investigating the macroeconomic determinants of RDP house prices in South Africa. OpenUCT Home. Retrieved September 2, 2022, from https://open.uct.ac.za/handle/11427/25094

Ayyangar, L. (2007) Skewness, Multicollinearity, Heteroskedasticity—You Name It, Cost Data Have It! Solutions to Violations of Assumptions of Ordinary Least Regression Models Using SAS. SAS Global Forum, Orlando, 16-19 April 2007.

Baltagi, B. (2008). Econometric Analysis of Panel Data. John Wiley & Sons, Hoboken.

Barakova, I., Bostic, R. W., Calem, P. S., & Wachter, S. M. (2003). Does credit quality matter for homeownership? Journal of Housing Economics, 12(4), 318–336. https://doi.org/10.1016/j.jhe.2003.09.002

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2010). A basic introduction to fixed-effect and random-effects models for meta-analysis. Research Synthesis Methods, 1(2), 97–111.doi:10.1002/jrsm.12

Butler, D., & Sevgili, C. (2022, September 5). Turkey's inflation hits new 24-year high beyond 80%. Reuters. https://www.reuters.com/world/middle-east/turkeys-inflation-touches-new-24-year-high-802-2022-09-05/

China: House prices fall for first time since 2015 amid wider property slump. (2021, November 15). Global Construction Review. Retrieved September 1, 2022, from https://www.globalconstructionreview.com/china-house-prices-fall-for-first-time-since-2015-amid-wider-property-slump/

Chitra Ganeson, & Illias Masri, A. M. (2015). An analysis of the factors affecting house prices in Malaysia – An Econometric Approach..Retrieved September 5, 2022, from http://eprints.usm.my/37601/1/sspis_2015_ms224_-_235.pdf

Clemens, M. A., Montenegro, C. E., & Pritchett, L. (2019). The place premium: Bounding the price equivalent of migration barriers. Review of Economics and Statistics, 101(2), 201-213.

Colak, Z. (2021). A causality on factors affecting housing prices: Case of Turkey. Pressacademia, 10(2), 58–71. https://doi.org/10.17261/pressacademia.2021.1405

Cramer. (2020, May). A tragedy for Ukraine, a housing crisis for Turkey The Arab Weekly. https://thearabweekly.com/tragedy-ukraine-housing-crisis-turkey

Delmendo, L. C. (2021, July 5). South Africa's housing market is improving. Global Property Guide. Retrieved September 1, 2022, from https://www.globalpropertyguide.com/Africa/South-Africa/Price-History

Dhillon, D. (2018, May 16). The Indian rupee is at its weakest since January 2017, and will probably keep falling. Business Insider. https://www.businessinsider.in/the-indian-rupee-is-at-its-weakest-since-january-2017-and-will-probably-keep-falling/articleshow/64190730.cms

Duan, J., Tian, G., Yang, L., & Zhou, T. (2021). Addressing the macroeconomic and hedonic determinants of housing prices in Beijing metropolitan area, China. Habitat International, 113, 102374. https://doi.org/10.1016/j.habitatint.2021.102374

Foo, C. H. (2021, June 4). Will Malaysia's house price increase in 2021 amid covid-19? I.Property.com.my. Retrieved September 1, 2022, from https://www.iproperty.com.my/guides/house-price-malaysia-covid-19-65397

Gebesoglu, P. F. (2019, March 27). Housing price index dynamics in Turkey. Yaşar Üniversitesi E-Dergisi. Retrieved September 4, 2022, from https://dergipark.org.tr/en/pub/jyasar/issue/44178/520991

Ghasemi, A., & Zahediasl, S. (2012). Normality Tests for Statistical Analysis: A Guide for Non-Statisticians. International Journal of Endocrinology and Metabolism, 10, 486-489. https://doi.org/10.5812/ijem.3505

Glindro, E.T., Subhanij, T., Szeto, J. & Zhu, H. (2011). Determinants of house prices in nine Asia pacific economies. International Journal of Central Banking 7: 163-204

Global Real House Price Index. (n.d.). [Dataset]. International Monetary Fund. https://www.imf.org/external/research/housing/images/globalhousepriceindex_lg.png

Growing at a slower pace, world population is expected to reach 9.7 billion in 2050 and could peak at nearly 11 billion around 2100. (2019, June 17). United Nations. Retrieved from https://www.un.org/development/desa/en/news/population/world-population-prospects-2019.html.

Gujarati, D.N. and Porter, D.C. (2009). Basic Econometrics. 5th Edition, McGraw Hill Inc., New York.

Habanabakize, T., & Dickason, Z. (2022, March 31). Political risk and macroeconomic effect of housing prices in South Africa. Cogent Economics &Amp; Finance, 10(1). https://doi.org/10.1080/23322039.2022.2054525

Henderson, V. (2003). The urbanization process and economic growth: The so-what question. Journal of Economic growth, 8(1), 47-71.

Holmes, M. J., Otero, J., & Panagiotidis, T. (2017). A pair-wise analysis of intra- city price convergence within the Paris housing market. The Journal of Real Estate Finance and Economics, 54(1), 1-16.

Judith, Y., Vivienne, M. (2007) Housing affordability: a 21st century problem National Research Venture 3: Housing affordability for lower income Australians.

Killingsworth, Mark R. (1990). The Economics of Comparable Worth. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research. https://doi.org/10.17848/9780880995528

Kok, S. H., Ismail, N. W., & Lee, C. (2018b, February 8). The sources of house price changes in Malaysia. International Journal of Housing Markets and Analysis, 11(2), 335–355. https://doi.org/10.1108/ijhma-04-2017-0039

Kwangware, D. (2009). THE IMPACT OF MACROECONOMIC AND FINANCIAL FACTORS ON THE PERFORMANCE OF THE HOUSING PROPERTY MARKET IN SOUTH AFRICA. Home. Retrieved September 4, 2022, from http://vital.seals.ac.za:8080/vital/access/manager/Repository/vital:1042?site_name=GlobalView&view=null&f0=sm_subject%3A%22Housing%2B--%2BSouth%2BAfrica%22&f1=sm_subject%3A%22Microeconomics%22&sort=null

Le, T. (2015). Do soaring global oil prices heat up the housing market? Evidence from Malaysia. Economics: The Open-Access, Open-Assessment E-Journal, 9, 1-30

Lei, F., Lu, W., Hu, W., & Liu, K. (2010). Macroeconomic Factors and Housing Market Cycle: An empirical analysis using national and city level data in China. Scientific Research . Retrieved September 2, 2022, from https://file.scirp.org/pdf/18-2.5.16.pdf

Lekhuleni, T. I. (2022, March 2). The dynamic effect of macroeconomic factors on housing prices: Evidence from South Africa. OpenUCT Home. Retrieved September 4, 2022, from https://open.uct.ac.za/handle/11427/35892

Lewer, J. J., & Van den Berg, H. (2008). A gravity model of immigration. Economics letters, 99(1), 164-167.

Li, J. (2020). The effects of macroeconomic factors on housing prices in China: Empirical research and linear regression analysis. Proceedings of the 2020 2nd International Conference on Economic Management and Cultural Industry (ICEMCI 2020). https://doi.org/10.2991/aebmr.k.201128.090

Li, L. (2015, June). Prices and bubbles: Factors affecting the Chinese real estate market. Prices and Bubbles: Factors Affecting the Chinese Real Estate Market. Retrieved September 3, 2022, from https://lup.lub.lu.se/student-papers/search/publication/7373769

Li, P. (2017). Macroeconomic determinants of China's housing prices. Proceedings of the 8th International Conference on E-Business, Management and Economics - ICEME 2017. https://doi.org/10.1145/3157754.3157780

Li, Z., Razali, M. N., Gholipour Fereidouni, H., & Mohd. Adnan, Y. (2018). Macro-economic index effect on house prices in China. International Journal of Housing Markets and Analysis, 11(3), 453–475. https://doi.org/10.1108/ijhma-03-2017-0025

Lin, Y., Ma, Z., Zhao, K., Hu, W., & Wei, J. (2018). The impact of population migration on urban housing prices: Evidence from China's major cities. Sustainability, 10(9), 3169.

Liu, H., & Shen, Y. (2005). Housing prices and General Economic Conditions: An Analysis of Chinese New Dwelling Market. Tsinghua Science and Technologi 334-343 Volume 10 Retrieved September 5, 2022, from https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6076043

Mahalik, M. K., & Mallick, H. (2011). What causes asset price bubble in an emerging economy? Some empirical evidence in the housing sector of India. International Economic Journal, 25(2), 215-237.

Mallick, H., & Mahalik, M. K. (2014). Factors determining regional housing prices: Evidence from major cities in India. Journal of Property Research, 32(2), 123–146. https://doi.org/10.1080/09599916.2014.963642

Manaf, S. M. A., Said, N. S. M., Al, S. R. O., & Adenan, N. D. (2019). Housing price variation analysis in Malaysian scenario. E–Academia Special Issue GraCe Journal, 240-245.

Meidani, A. A. N., Zahibi, M., & Ashena, M. (2011). House prices, economic output, and inflation interactions in Iran. Research in Applied Economics, 3(1).

Nur Hanani, A. (2021, April 26). Data shows average cost of living in Kl is RM3,300 monthly. The Malaysian Reserve. Retrieved from https://themalaysianreserve.com/2021/04/26/data-shows-average-cost-of-living-in-kl-is-rm3300-monthly/.

Ong, T. S. (2013). Factors affecting the price of housing in Malaysia. Journal of Emerging Issues in Economics, Finance and Banking (JEIEFB), 1, 414-429.

Ozor, J. O., & Eze, M. O. (2016). An econometric analysis of the relationship between exchange rate depreciation and inflation in Nigeria. International Journal of Economics, Commerce and Management, 9.

Pinjaman, S., & Kogid, M. (2020). Macroeconomic determinants of house prices in Malaysia. Jurnal Ekonomi Malaysia, 54(1), 153–165. https://doi.org/10.17576/jem-2020-5401-11

Prabhu Parrikar, J. G. (2019, March). The influence of macroeconomic factors on housing prices in India: an empirical study. Indian Journal of Economics and Development, March 2019, Vol 7 (3) Retrieved September 3, 2022, from https://www.researchgate.net/profile/Jaya-Prabhu-Parrikar/publication/332110668_The_influence_of_macroeconomic_factors_on_housing_prices_in_India_an_empirical_study/links/5ca1ad5892851cf0

aea57134/The-influence-of-macroeconomic-factors-on-housing-prices-in-India-an-empirical-study.pdf?origin=publication_detail

Rudiger, D., & Paul, K. (1976). Flexible exchange rates in the short run. Brookings Papers on Economic Activity, 3. Retrieved from https://www.brookings.edu/wpcontent/uploads/1976/12/1976c_bpea_dornbus ch_krugman_cooper_whitman.pdf

Saudin, S. B., Jehani, N. A., Mastani, N. A., & Ab Malek, I. (2020). A study on the relationship between house price index and its determinants in Malaysia. Malaysian Journal of Computing, 5(2), 515-522.

Sivadas, S., & Ismail, N. W. (2020). Increasing Urban Vulnerability in Malaysia: A Myth or Reality? Journal of Islamic, 5(28), 130-140.

South Africa's unemployment rate is one of the highest in the world – but companies struggle to hire for these jobs. (2022, May 6). BUSINESSTECH. Retrieved September 1, 2020, from https://businesstech.co.za/news/business/583766/south-africas-unemployment-rate-is-one-of-the-highest-in-the-world-but-companies-struggle-to-hire-for-these-jobs/

Tang, J., Ye, K., & Qian, Y. (2019). Rethinking the relationship between housing prices and inflation: new evidence from 29 large cities in China. International Journal of Strategic Property Management, 23(3), 142-155.

Todaro, M. P. (1969). A model of labor migration and urban unemployment in less developed countries. The American economic review, 59(1), 138-148.

Torres-Reyna, O. (2007). Panel Data Analysis Fixed and Random Effects Using Stata (v. 4.2). Data & Statistical Services, Priceton University.

Trofimov, I. D., Aris, N. M., & Xuan, D. C. (2018). Macroeconomic and demographic determinants of residential property prices in Malaysia. Zagreb

International Review of Economics and Business, 21(2), 71–96. https://doi.org/10.2478/zireb-2018-0015

Turak, N. (2022, February 3). Turkey's inflation hits nearly 50%, highest in two decades. CNBC. https://www.cnbc.com/2022/02/03/turkeys-inflation-hits-nearly-50percent-highest-in-two-decades-.html

Tze San, O. (2013). Factors affecting the price of housing in Malaysia. Journal of Emerging Issues in Economics, Finance and Banking (JEIEFB) An Online International Monthly Journal (ISSN: 2306 367X) Volume:1 No.5 May 2013

Washington, DC: World Bank. (2019, October 1). Turkey Economic Monitor, October 2019. Open Knowledge Repository. Retrieved September 1, 2022, from https://openknowledge.worldbank.org/handle/10986/32634

Wong, & Sarma, Binti (Eds.). (2019). MACROECONOMIC VARIABLES AND HOUSING PRICE IN MALAYSIA(Proceedings of the International Conference on Economics 2019 (ICE 2019) 23-34). https://www.ums.edu.my/fpep/files/paper32019.pdf

Zhang, H., Li, L., Hui, E. C. M., & Li, V. (2016, October). Comparisons of the relations between housing prices and the macroeconomy in China's first-, second- and third-tier cities. Habitat International, 57, 24–42. https://doi.org/10.1016/j.habitatint.2016.06.008

Zhang, Y., Hua, X., & Zhao, L. (2012). Exploring determinants of housing prices: A case study of chinese experience in 1999–2010. Economic Modelling, 29(6), 2349–2361. https://doi.org/10.1016/j.econmod.2012.06.025

Zulkifli, A. B., Kogid, M., Pinjaman, S., & M.Alin, J. (2022, February 7). Macroeconomic Variables and Malaysia House Price Index. International Journal of Academic Research in Economics and Management Sciences, 11(1). https://doi.org/10.6007/ijarems/v11-i1/12214

Appendices

Appendix 1: Descriptive Statistic

	RRPPI	CPI	EXC	GDP	POP	UNEMP
Mean	122.8905	140.3905	18.09281	4.651455	1.175631	10.27393
Median	111.2466	124.6298	6.644478	5.240000	1.294285	5.424000
Maximum	175.5103	314.8061	74.09957	11.20000	1.702644	33.55900
Minimum	93.92330	103.1745	1.674955	-6.600000	0.089252	2.880000
Std. Dev.	26.75664	40.69574	23.67374	3.712254	0.404653	8.881374
Skewness	0.707161	2.224652	1.502455	-1.164013	-0.884044	1.273131
Kurtosis	1.958489	8.802261	3.493334	4.912854	2.919041	3.100648
Jarque-Bera	7.069905	122.5183	21.25030	20.80540	7.179079	14.88112
Probability	0.029160	0.000000	0.000024	0.000030	0.027611	0.000587
Sum	6758.976	7721.476	995.1043	255.8300	64.65969	565.0660

Appendix 2: Poolability Test

Redundant Fixed Effects Tests
Equation: EQ02
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	17.098677	(4,45)	0.0000
Cross-section Chi-square	50.831673	4	0.0000

Cross-section fixed effects test equation:
Dependent Variable: RRPPI
Method: Panel Least Squares
Date: 12/07/22 Time: 02:01
Sample: 2011 2021
Periods included: 11
Cross-sections included: 5
Total panel (balanced) observations: 55

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	0.132452	0.057402	2.307462	0.0253
EXC	0.570695	0.096616	5.906806	0.0000
GDP	-1.649610	0.673169	-2.450516	0.0179
POP	19.03710	5.939361	3.205244	0.0024
UNEMP	-2.054769	0.305337	-6.729516	0.0000
C	100.3731	11.60686	8.647738	0.0000

R-squared	0.672867	Mean dependent var	122.8905
Adjusted R-squared	0.639486	S.D. dependent var	26.75664
S.E. of regression	16.06543	Akaike info criterion	8.493886
Sum squared resid	12646.81	Schwarz criterion	8.712868
Log likelihood	-227.5819	Hannan-Quinn criter.	8.578568
F-statistic	20.15725	Durbin-Watson stat	0.460317
Prob(F-statistic)	0.000000		

Appendix 3: Breusch-Pagan LM Test

Lagrange Multiplier Tests for Random Effects
Null hypotheses: No effects
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	16.10225 (0.0001)	2.707178 (0.0999)	18.80943 (0.0000)
Honda	4.012762 (0.0000)	1.645350 (0.0499)	4.000889 (0.0000)
King-Wu	4.012762 (0.0000)	1.645350 (0.0499)	4.270879 (0.0000)
Standardized Honda	15.58948 (0.0000)	1.956436 (0.0252)	2.923524 (0.0017)
Standardized King-Wu	15.58948 (0.0000)	1.956436 (0.0252)	4.657962 (0.0000)
Gourieroux, et al.	--	--	18.80943 (0.0000)

Appendix 4: Hausman Test

Correlated Random Effects - Hausman Test
Equation: EQ03
Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	45.682233	5	0.0000

** WARNING: estimated period random effects variance is zero.

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
CPI	-0.112182	0.132452	0.002114	0.0000
EXC	0.612714	0.570695	0.000123	0.0002
GDP	0.045941	-1.649610	0.815595	0.0605
POP	35.770937	19.037098	14.269174	0.0000
UNEMP	-1.956053	-2.054769	0.017341	0.4535

Period random effects test equation:
Dependent Variable: RRPPI
Method: Panel Least Squares
Date: 12/07/22 Time: 02:04
Sample: 2011 2021
Periods included: 11
Cross-sections included: 5
Total panel (balanced) observations: 55

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	105.3834	10.06991	10.46518	0.0000
CPI	-0.112182	0.063324	-1.771576	0.0843
EXC	0.612714	0.074117	8.266888	0.0000
GDP	0.045941	1.037435	0.044284	0.9649
POP	35.77094	5.878914	6.084617	0.0000
UNEMP	-1.956053	0.266406	-7.342390	0.0000

Effects Specification

Period fixed (dummy variables)

R-squared	0.850222	Mean dependent var	122.8905
Adjusted R-squared	0.792615	S.D. dependent var	26.75664
S.E. of regression	12.18485	Akaike info criterion	8.076310
Sum squared resid	5790.348	Schwarz criterion	8.660261
Log likelihood	-206.0985	Hannan-Quinn criter.	8.302128
F-statistic	14.75903	Durbin-Watson stat	0.421664
Prob(F-statistic)	0.000000		

Appendix 5: Correlation Analysis

	RRPPI	CPI	EXC	GDP	POP	UNEMP
RRPPI	1	0.170911850	0.599034405	0.007691020	0.024789059	-0.484696110
CPI	0.170911850	1	0.216137776	-0.096344115	-0.018968141	0.229116833
EXC	0.599034405	0.216137776	1	0.026330058	-0.119143338	-0.133249028
GDP	0.007691020	-0.096344115	0.026330058	1	-0.274190574	-0.471547281
POP	0.024789059	-0.018968141	-0.119143338	-0.274190574	1	0.383979406
UNEMP	-0.484696110	0.229116833	-0.133249028	-0.471547281	0.383979406	1

Appendix 6: The Fixed Effect Model

Dependent Variable: RRPPI
Method: Panel Least Squares
Date: 12/02/22 Time: 15:28
Sample: 2011 2021
Periods included: 11
Cross-sections included: 5
Total panel (balanced) observations: 55

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-0.006343	0.095903	-0.066140	0.9476
EXC	1.936692	0.463620	4.177323	0.0001
GDP	-0.277114	0.488287	-0.567523	0.5732
POP	-28.04142	15.75595	-1.779735	0.0819
UNEMP	-2.526044	1.395441	-1.810212	0.0769
C	148.9485	31.54423	4.721895	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.870179	Mean dependent var	122.8905
Adjusted R-squared	0.844215	S.D. dependent var	26.75664
S.E. of regression	10.56073	Akaike info criterion	7.715128
Sum squared resid	5018.809	Schwarz criterion	8.080098
Log likelihood	-202.1660	Hannan-Quinn criter.	7.856265
F-statistic	33.51467	Durbin-Watson stat	0.393550
Prob(F-statistic)	0.000000		