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THE MACROECONOMIC DETERMINANTS OF HOUSING PRICES IN MALAYSIA

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CONFIRMATION BY PANEL OF EXAMINERS

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ABSTRACT

This research analyzed the impact of macroeconomic factors, such as gross domestic product (GDP), interest rates, and inflation rates, on housing prices in Malaysia. In recent years, residential property prices in Malaysia have seen a confluence of challenges and trends influenced by economic, political, and social factors. This subject includes the house affordability crisis, a surplus of unsold dwellings, the economic recession, and the COVID-19 pandemic. This study is essential as it enables the assessment of housing market fluctuations, evaluation of housing affordability, formulation of policy, and monitoring of market stability. This study aims to clarify the short-term and long-term correlations and causal relationships among these components to improve the understanding of the dynamics affecting housing prices. The research employs quantitative techniques and integrates econometric instruments, including the Augmented Dickey-Fuller (ADF) test and the Auto-Regressive Distributed Lag (ARDL) model. These methodologies provide a thorough examination of time-series data, producing insights into equilibrium relationships and instantaneous consequences. The data indicate significant interconnections among macroeconomic variables and their influence on property prices, emphasizing distinct trends before and after the outbreak. The study reveals that macroeconomic factors, including GDP and interest rates, significantly influence the housing price index in Malaysia. The results indicate a strong positive link between GDP and home prices, whereby economic growth enhances housing demand. The results enhance understanding of housing market dynamics, equipping policymakers, investors, and stakeholders with critical information to formulate strategies that reduce market volatility and enhance affordability. Future research may expand on these findings by examining regional disparities and the effects of governmental interventions on stabilizing the housing market. This study enhances comprehension of housing economics and the impact of macroeconomic policies in developing countries.

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Abbreviations

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criteria
ARDL	Auto-Regressive Distributed Lag
BLR	Base Lending Rate
BNM	Bank Negara Malaysia
BPG	Breusch-Pagan-Godfrey
BR	Base Rate
CPI	Consumer Price Index
CUSUM	Cumulative Sum
CUSUMSQ	Cumulative Sum of Square
DOSM	Department of Statistics Malaysia
ECM	Error Correction Model
FPE	Final Prediction Error
GDP	Gross Domestic Product
HPI	Housing Price Index
IFR	Inflation Rate
INR	Interest Rate
JPPH	Valuation and Property Services Department
LM	Lagrange Multiplier
LMSC	Lagrange Multiplier Serial Correlation
MCO	Movement Control Order
NAPIC	National Property Information Centre
OPR	Overnight Policy Rate
PP	Phillips-Perron
PR1MA	Perumahan Rakyat 1 Malaysia
PPR	Program Residensi Rakyat
RPGT	Real Property Gains Tax
RPPI	Residential Property Price Index
RTO	Rent-to-Own

Ramsey RESET	Ramsey Regression Equation Specification Error Test
SC	Schwarz Criterion

CHAPTER 1
INTRODUCTION

1.1 Chapter Overview

The increasing need for housing in Malaysia's urban centres has been noticeable in recent years. This is due to the improvement in culture and lifestyle. Acquiring a house is a method of making a long-term investment. Housing serves as a commercial enterprise, a social setting, a symbol of success, and a component of urban development. For most people around the world, housing is the largest investment they make in their lives. This is due to the increasing value of residential houses and land over time. However, not all individuals consider a house to be a substantial investment; for some, it is simply a way to meet essential needs.

Since the 1950s, Malaysians have been witnessing an increase in urban growth as a result of population growth and other economic activities (Kamarudin et al., 2018; Worldometer, 2024). Urban expansion is primarily driven by migration, population increase, and growing income levels. These factors have a substantial impact on the housing market. Moreover, the rising demand for dwellings and price fluctuations have influenced the housing market's conditions (Iqbal et al., 2025). Affordability is a crucial factor that influences an individual's decision to purchase real estate, such as a house. Affordability is crucial for an individual to purchase and possess a residential home. Global urban areas were already experiencing the phenomenon of property prices escalating at a quicker pace than the growth of salaries and wages (Wetzsein, 2017).

The evolution of the property market can significantly influence financial stability. House price fluctuations directly and indirectly affected the demand for borrowing among households and their ability to service debt. The property market in Malaysia is a significant element of the country's economy, as is the case with most economies (Che Yahya et al., 2023). Residential buildings have become an appealing investment option for both households and businesses. Interest rates have decreased and home prices have risen in the global economy after the implosion of the IT booms in 2000.

Government policies and regulations have a substantial impact on the Malaysian housing market. According to Liu and Ong (2021), to ensure sustainable growth, control

residential property values, and promote affordable housing, the government has implemented many rules and regulations. The National Housing Policy is a key government programme aimed at providing all Malaysians with access to affordable and adequate housing (Seng & Tham, 2024). The concept involves implementing affordable housing initiatives, offering incentives to developers, and providing subsidies. To control the price of residential real estate, the government has implemented legislation such as stamp duty and the Real Property Gains Tax (RPGT). Stamp duty is a tax on property ownership transfers, while real property revenue tax (RPGT) is imposed on revenue generated from real estate sales. These rules aim to curb speculation and prevent a rapid rise in real estate values.

1.2 Research Background

The housing market is crucial to Malaysia's economy, acting as a vital gauge of economic well-being and a major influencer of household wealth. Malaysia has undergone rapid urbanisation, demographic changes, and economic expansion in recent decades, leading to significant swings in property prices. Comprehending the macroeconomic factors that impact housing price fluctuations is crucial for policymakers, investors, and other stakeholders to make well-informed decisions and reduce potential risks. According to Gallent et al. (2022), income and utilities have traditionally influenced house prices, but the recent global financial trend, particularly after the 2020 pandemic, had a significant impact on the housing market. Due to robust real estate and construction sectors and ongoing economic expansion, several home markets in the region saw increased activity over the roughly ten-year period following the global financial crisis and before the COVID-19 pandemic.

The COVID-19 pandemic profoundly disrupted Malaysia's housing market, particularly during the Movement Control Order (MCO) in March 2020. Residential property transaction volumes fell by 30 percent in Q1 2020, with the value of transactions dropping from RM72.88 billion in Q2 2019 to RM46.94 billion, the lowest recorded between 2014 and 2020 (Zulkarnain & Nawi, 2023). This decline was driven by reduced buyer demand during lockdowns. However, government interventions such as moratoriums on housing loans, reduced interest rates, and tax exemptions on real estate gains gradually stimulated market recovery by mid-2020 (Zulkarnain & Nawi, 2023).

On the other hand, studies have found that several macroeconomic factors impact home prices, such as GDP growth, inflation rates, interest rates, exchange rates, and demographic changes. Most studies have taken a broad approach by treating the housing industry as a uniform entity and not considering the varied characteristics of different groups within the market. In Malaysia, residential property prices have experienced substantial fluctuations throughout the past decade, dating back to 1950. The COVID-19 pandemic has highlighted people's focus on community density because of the substantial infection risks linked to densely populated urban regions. During the pandemic, there is less demand for working in regular office environments and a decrease in the use of outdoor amenities. Consequently, it reduces the need to live in a densely populated location where workplaces and amenities are mostly located (Liu & Su, 2021). Nanda et al. (2021) suggested that people might desire larger living spaces, leading them to move to suburban or rural areas. Kaklauskas et al. (2021) found that homebuyers generally prefer suburban neighbourhoods located in close proximity to cities. This preference is because these regions are close to major towns, easily accessible, offer larger living spaces, and have lower prices. As present homeowners increase their selling prices, the asking price of houses for sale in Malaysia will rise as well. However, the issue arises when there is decreased demand from buyers, leading to a growing disparity between buyers and sellers (Kaur, 2023). As a result, there is a limited grasp of how macroeconomic factors influence various market sectors including luxury houses, cheap housing, and distinct geographical regions.

Households in Malaysia are classified into three groups: the bottom 40 percent (B40) representing the low-income group, the middle 40 percent (M40) representing the middle class, and top 20 percent (T20). The Malaysian government acknowledges the significance of offering accessible and cheap housing to cater to the low-income household demographic. This project is in line with broader socio-economic objectives focused on improving living standards, alleviating poverty, and fostering equitable growth. Various strategies and programmes, including Bantuan Sara Hidup, eKasih, and Sumbangan Asas Rahmah, have been put in place to accomplish these goals. According to the Department of Statistics Malaysia, the average salary in Malaysia is around RM5,228 per month. This suggests that families are unable to pay the cost beyond RM400,000 for a house, stated in a 2017. Kassim, (2022) states that the increase in the request for housing loans is mostly influenced by income level. Malaysia's government

aims to provide accessible and inexpensive housing for low-income households (Olanrewaju & Tan, 2018).

The COVID-19 situation has altered every area of the built environment (Deep et al., 2022). The government announced on July 4, 2011, the implementation of affordable housing schemes like Perumahan Rakyat 1 Malaysia (PR1MA) and improved access to financing through the My First Home Scheme to provide suitable housing for Malaysians of different income levels. Each state government has established a unique affordable housing initiative to provide indigenous people the opportunity to buy a property in response to the growing problem. With a focus on different parts of the housing market, this study tries to fill this research gap by looking in depth at the macroeconomic factors that affect housing prices in Malaysia. The study uses advanced econometric methods and detailed data sources to find the unique factors that affect housing prices in each section. It also looks at how these factors change in urban and rural areas, for different types of homes, and in different regions.

1.3 Problem Statement

Property prices in Malaysia have consistently increased from 1988 to 2023, indicating a long-standing trend of rising prices. The Housing Price Index (HPI) cycle in Malaysia lasts between 8 and 17 years, which is twice the duration of both the growth cycle and the business cycle in the economy. However, households continue to consider purchasing a home as a family objective and their most expensive investment. Various studies have focused on the elements that influence housing prices in Malaysia. Inflation rates impact the affordability of housing. According to Pinjaman and Kogid (2020), a higher inflation leads to increased housing costs and reduced affordability, whereas lower inflation might result in price decreases, making homeownership more attainable. Those involved in advocating for affordable homeownership in Malaysia should pay attention to the findings by Musaddad et al. (2023). Research indicates that escalating housing expenses in Malaysia may result in many issues such as a property bubble, housing affordability, unsold residential units, and household debt. **Figure 1.1** shows the real residential property prices in Malaysia from year 1988 until 2023.

Real Residential Property Prices for Malaysia from 1988 until 2023

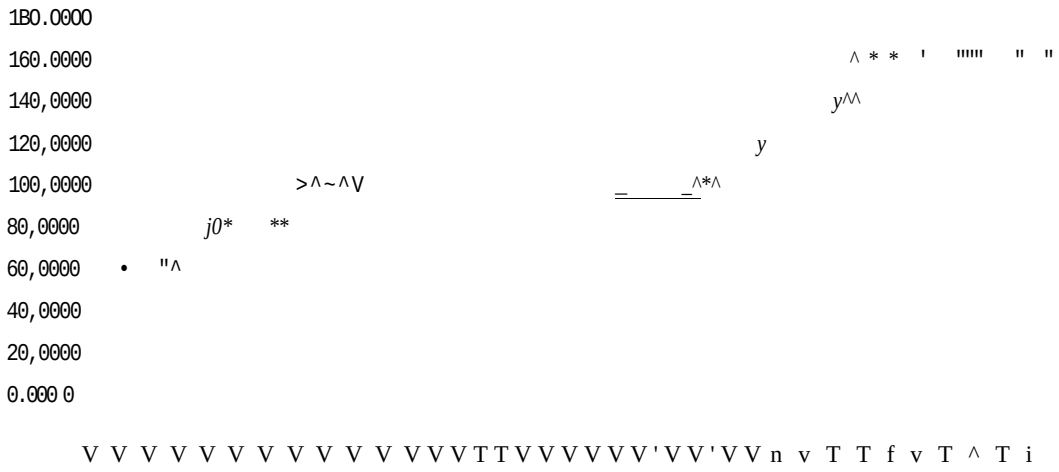

Figure **1.1:** Malaysia all house price 1988 - 2023
Source: FRED Economic Data, 2023

Academics have long examined the determinants of housing prices, highlighting that fluctuations are shaped by a combination of macroeconomic and microeconomic conditions, demographic changes, and government policies. This study examines three key macroeconomic variables: gross domestic product (GDP), interest rates, and inflation, as well as their impact on property values in Malaysia prior to and following the COVID-19 epidemic. Zulkarnain et al. (2023) found a positive and statistically significant relationship between GDP, interest rates, and residential property prices in Malaysia using multiple regression modelling. Their findings suggest that GDP growth plays a critical role in housing price dynamics. When GDP rises, it reflects stronger economic activity, higher income levels, and greater consumer confidence, all of which increase the likelihood of households investing in property. Similarly, interest rates directly influence borrowing costs. Lower interest rates reduce mortgage payments and expand borrowing capacity, which encourages demand and often leads to higher house prices. Conversely, higher interest rates constrain affordability and dampen demand. Inflation, although less emphasized in the study, also contributes to housing price movements by raising construction costs and eroding household purchasing power. The inclusion of the COVID-19 period is particularly important, as the pandemic disrupted Malaysia's economic growth and monetary policy, creating both downward pressure on GDP and incentives for expansionary policies such as lower interest rates. Examining

the housing market across this period therefore provides valuable insights into whether the established relationships between macroeconomic variables and property prices remained stable or shifted under crisis conditions.

Interest rates, rental rates, inflation, and government policies play an integral role in shaping housing affordability in Malaysia. Periods of low interest rates reduce the cost of mortgage borrowing, lowering monthly repayments and enabling households to qualify for larger loans. This increased borrowing capacity encourages more competitive bidding in the housing market, which in turn fuels price escalation. Musaddad et al. (2023) highlight that rental rates are also directly linked to housing affordability. Rising rents not only reflect heightened demand for housing but also exert upward pressure on property prices, making homeownership less attainable. Inflation further complicates affordability, as it drives up the cost of construction materials and labor, which developers transfer to buyers, while simultaneously eroding household purchasing power (Lambertini et al., 2016). Government interventions, such as monetary and fiscal policies, are often introduced to stabilize prices and stimulate economic growth. However, these policies can generate unintended consequences. For instance, expansionary monetary policy through lower interest rates may inadvertently intensify speculative activity in the housing market, while fiscal incentives aimed at enhancing affordability may boost demand without sufficiently addressing supply constraints. Collectively, these dynamics underscore the delicate balance policymakers must maintain to avoid aggravating housing price pressures while pursuing broader economic objectives.

A house is a fundamental necessity for human survival and contributes significantly to a country's economic progress (Yeap & Lean, 2020). When housing demand exceeds housing supply, it causes home prices to rise and results in unsold new housing inventory owing to affordability issues. This problem leads to the wastage of resources in building, affecting the financial condition of the construction company and other economic aspects (Zainal et al., 2019). Increasing property values can lead to issues like overhang houses, which are properties that stay unsold in the market for an extended period.

Swift urbanisation leads to increased migration to urban areas, stimulating economic growth and attracting more individuals to urban living. The steady rise in home prices causes problems with housing, such as people not being able to afford to buy a home. It could also lead to increased indebtedness as individuals may need to take

out loans to purchase a home. An increase in the inventory of unsold properties contributes to the rise in housing prices. The rising quantity of unsold housing units is becoming a significant issue, particularly in regions such as Johor, Penang, and the Klang Valley (Chung Shien & Kasim, 2022).

The National Property Information Centre (NAPIC) has reported a persistent increase in the stock of unsold homes across multiple housing categories over the past five years (Mahalingam, 2019). By the third quarter of 2023, Malaysia's residential property market recorded a significant overhang of 25,311 unsold units valued at RM17.40 billion, with the majority concentrated in Johor. Although high-rise units at lower price ranges remain in strong demand, particularly among younger buyers seeking affordable housing, this trend does not extend to medium- and high-cost high-rise properties, which remain largely unaffordable relative to household income levels. This mismatch between supply and demand has contributed to an oversupply of residential units, creating structural imbalances in the housing market (Juan, 2023). The result has been a steady accumulation of unsold inventory and downward pressure on house prices, particularly in segments that exceed the affordability threshold of most households. These developments underscore the importance of analysing high-rise housing prices specifically, as well as examining how macroeconomic variables such as income growth, interest rates, and inflation interact with demand dynamics in shaping the trajectory of Malaysia's housing market.

The Malaysian government has introduced many initiatives and schemes to enhance housing affordability and support citizens in buying residential properties. Several initiatives such as PRIMA, MyHome Scheme, PPA1M, My First Home Scheme, Rent-to-Own (RTO) Scheme, and others are in place. The government has also started efforts to encourage the building of affordable homes through partnerships with developers. Developers who allocate a portion of their projects to affordable housing receive incentives, such as land subsidies or reduced compliance costs. Several financial institutions in Malaysia provide house loan options with competitive interest rates and adaptable repayment arrangements to aid buyers. These projects and efforts demonstrate the government's commitment to increasing housing affordability and promoting home ownership among Malaysians. The objective is to provide various groups of individuals with increased options, incentives, and avenues for financial assistance in order to enable more people to purchase their own houses.

Economists are still highly interested in studying the dynamic relationship between macroeconomic factors and housing values. This research aims to explore three interconnected areas: The primary goal is to investigate the long-term link between the home price index, interest rates, and GDP. The second objective is to analyse the long-term correlation between GDP, interest rates, inflation, and the housing price index in Malaysia, focusing on identifying the magnitude and direction of influence of each variable.

The ultimate aim of the research is to identify and analyse the primary macroeconomic factors that significantly influence Malaysia's home price index. This study seeks to elucidate the intricate connections between macroeconomic difficulties and property prices through the application of quantitative methods and analysis of historical data. Research on various aspects of the housing market in Malaysia, such as luxury houses, inexpensive housing, or rural vs. metropolitan locations, is insufficient. Further research is required to comprehend the distinct impact of macroeconomic variables on these divisions.

Despite the established emphasis on government housing initiatives and specific macroeconomic variables, there remains much to uncover about the broader range of factors influencing Malaysia's housing market. Future research should extend beyond GDP, interest rates, and inflation to incorporate other determinants such as employment rates, consumer confidence, and foreign direct investment, all of which directly or indirectly shape housing demand and affordability. Moreover, housing market dynamics are not uniform across the country. Regional economic conditions significantly influence local property values, suggesting that a disaggregated, state-level analysis would provide deeper insights into affordability challenges and market imbalances. By incorporating these additional dimensions, researchers can generate a more comprehensive understanding of Malaysia's housing sector and provide policymakers with nuanced evidence to design more effective, regionally tailored housing policies.

Furthermore, longitudinal studies are necessary to evaluate the long-term impacts of government programs like PRIMA and MM2H on housing affordability and market stability. The examination of how these policies, when implemented against shifting economic conditions, affect housing patterns over time is lacking in the research currently in publication since it often concentrates on short-term results. In order to clarify the social ramifications of growing costs, it is also necessary to investigate the

socioeconomic factors—such as income disparity and demographic changes—and how these relate to housing prices. Investigating the behavioural economics of homebuyers in times of economic instability is another exciting line of inquiry since knowledge of their decision-making processes may provide important information about housing demand and price trends. Future research may fill up these gaps and provide insightful viewpoints that improve our comprehension of Malaysia's housing market dynamics.

1.4 Research Objectives

There are many research studies done on the macroeconomic determinants of housing price in Malaysia. The main objectives of this research study is to determine the relationship of macroeconomic variables which are GDP, interest rate and inflation rate towards the housing price in Malaysia. So this research studies will fulfil the objectives that need to be achieved in order to ensure the house price market in Malaysia is in a stable condition.

There are 3 objectives for this research in order to finding the answer and solutions for the problems given, these studies objectives are:

1. To investigate the short-run and long-run relationship between macroeconomic factors towards the housing price index.
2. To investigate the causality between macroeconomic factors and housing price index in Malaysia.
3. To determine the impact of macroeconomic variables on housing price in Malaysia.

1.5 Research Question

The researcher has come up with research questions with regards to research objectives and problem statements in the previous section. It is an empirical statement concerned with the relationship among variables which are GDP, interest rate and inflation rate. The purpose of formulating hypotheses is to offer a clear framework and a guide when collecting, analysing and interpreting data. In many cases, hypotheses serve as a tool for testing the relationship between variables. Here are the research questions that have already been identified:

1. What are the short-run and long-run relationship between the economic factors towards the housing price?
2. Is there a causal relationship between macroeconomic issues and the house price index in Malaysia?
3. What is the impact of macroeconomic attributes on housing price in Malaysia?

1.6 Scope of Study

This study focuses on analysing the relationship between key macroeconomic variables—gross domestic product (GDP), interest rates, and inflation—and the Housing Price Index (HPI) in Malaysia. The analysis covers the period from 1988 to 2023, which captures both long-term housing price cycles and short-term fluctuations, including the disruptions caused by the COVID-19 pandemic. The study specifically examines the influence of macroeconomic factors on housing affordability, demand, and the accumulation of unsold housing units (overhang).

The geographical scope of this study is Malaysia as a whole, with references to selected states such as Johor, Penang, and Klang Valley, where affordability challenges and housing overhang issues are most pronounced. However, the study does not provide a detailed comparative analysis between all Malaysian states.

In terms of policy focus, the research considers the role of government housing initiatives, such as PRIMA, MyHome, PPA1M, and Rent-to-Own schemes, in shaping affordability and market stability. Nevertheless, the effectiveness of each scheme is not evaluated in depth, as the primary emphasis remains on the interaction between macroeconomic variables and housing prices.

1.7 Significance of Study

This study is significant as it contributes to both academic knowledge and practical applications in Malaysia's housing sector. From an academic perspective, it enriches the literature on housing economics by investigating the dynamic relationship between macroeconomic factors namely gross domestic product (GDP), interest rates, and inflation and the Housing Price Index (HPI) in Malaysia across both the short run and the long run. By incorporating the period before and after the COVID-19 pandemic, the study provides fresh insights into how major economic shocks alter the established

linkages between macroeconomic variables and property prices. This addresses a gap in existing research, which has often concentrated on short-term policy impacts without fully examining long-term cyclical patterns or crisis-related disruptions.

The findings of this study are also relevant to policymakers, particularly in the design of monetary, fiscal, and housing policies aimed at improving affordability and stabilizing the market. Malaysia continues to face persistent challenges such as rising property prices, increasing household debt, and a growing stock of unsold housing units. By clarifying the extent to which macroeconomic variables contribute to these outcomes, the study provides an evidence-based foundation for policymakers to reassess the effectiveness of current initiatives, including PR1MA, MyHome, and Rent-to-Own schemes, and to design more targeted interventions that align with market realities.

In addition, the study has practical implications for industry stakeholders such as developers, financial institutions, and investors. Developers may use the findings to better align housing supply with actual market demand, thereby reducing the risk of oversupply and unsold units. Financial institutions can strengthen mortgage risk assessment models, while real estate investors may benefit from improved forecasting of housing market cycles.

Finally, the study carries broader social significance as it addresses one of the most pressing issues in Malaysia: housing affordability. By examining the macroeconomic forces that shape property prices, the research highlights structural barriers to homeownership, particularly for middle- and lower-income groups. In doing so, it contributes to the national discourse on equitable access to housing and sustainable urban development.

1.8 Limitation of the Study

An issue of significant concern may arise from the quantity and calibre of accessible data. There is a possibility that certain house price data may be incomplete, outdated, or lacking adequate detail, potentially leading to errors or limitations in the study. The inclusion of certain pertinent data and information pertaining to the topic matter would restrict the range and credibility of the study. Obtaining the most recent scholarly journals, yearly reports, books, and periodicals is a challenge for doing this study. Certain data and information may be unequivocal and antiquated. Certain reports

are deemed confidential, rendering them inaccessible. Given that all the data utilised in this study is derived from secondary sources, the precision of the data relies on the reliability and validity of the published materials and sources.

Inaccurate data from published material would yield erroneous results for this research. Certain pieces of information are challenging to ascertain in order to fully complete the literature review. The reason is due to insufficient resources. Researchers encountered a limitation in the availability of HPI data, which is only provided on a quarterly basis and covers the period from 1999 to the present year. Researchers are unable to get the necessary 300 data points for the time series.

1.9 Organization of The Study

This research report has been structured to provide a clear understanding of its content. The present study is organised into five distinct chapters. Chapter One serves as an introduction, presenting the background of the study and outlining the trend of housing prices in Malaysia. It also highlights the study's objectives, which are to analyse the determinants of housing prices and assess the effects of macroeconomic indicators specifically GDP growth, interest rates, and inflation on the housing market. The study further aims to identify the elements that influence the Housing Price Index (HPI), examine the correlation between macroeconomic factors and housing prices, and explore the effects of housing overhang on economic growth in Malaysia. In doing so, the study contributes both theoretical and practical insights into the dynamics of the housing sector.

Chapter Two provides a comprehensive review of the literature, focusing on prior studies and the major elements associated with housing prices and macroeconomic conditions. The discussion centres on key themes such as the Housing Price Index, Gross Domestic Product (GDP), interest rates, and inflation. By reviewing these factors, the chapter underscores the importance of understanding their interrelationship with housing prices, thereby offering a conceptual foundation for analysing Malaysia's housing market.

Chapter Three outlines the research methodology adopted in the study. It presents the research framework, which employs a quantitative design to establish causal relationships between housing prices and selected macroeconomic variables. The

theoretical foundation is drawn from life-cycle theory and overlapping generations theory, which provide the basis for the empirical models. The Housing Price Index (HPI) serves as the dependent variable, while GDP, interest rates, and inflation function as independent variables. The analysis employs the Auto-Regressive Distributed Lag (ARDL) model to capture both short-run and long-run dynamics. Hypotheses are formulated in line with the study's objectives, and diagnostic tests, including normality testing, are conducted to ensure the robustness of the findings.

Chapter Four presents the results and discussion arising from the empirical analysis. Using time-series data from 1988 to 2022, the chapter examines how fluctuations in GDP, interest rates, and inflation influence the Housing Price Index. The ARDL Cointegration and Error Correction Model (ECM) are used to uncover both immediate and enduring relationships among the variables. Findings are presented through tables and figures that illustrate the correlations and causal effects identified in the data. The discussion then interprets these findings in the broader economic context, emphasising the strong influence of GDP and interest rate fluctuations on housing prices, while also considering the moderating role of inflation.

Finally, Chapter Five concludes the thesis by synthesising the research findings and highlighting their implications. The chapter begins by summarising the major results, particularly the significant role of GDP growth in driving housing demand and prices. It also stresses the broader implications of macroeconomic fluctuations for housing affordability and market stability. The chapter concludes by offering recommendations for future research, including the need to examine regional disparities in housing price dynamics and the effects of government interventions on the housing market.

1.10 Summary of the Chapter

This chapter has introduced the background and context of the study by outlining the long-standing trend of rising housing prices in Malaysia and the challenges associated with affordability, oversupply, and unsold residential units. The problem statement highlighted the mismatch between supply and demand, the persistence of housing overhang, and the influence of macroeconomic variables on property prices, particularly in the wake of the COVID-19 pandemic.

The chapter also presented the research objectives, which are to examine the long- and short-run relationships between gross domestic product (GDP), interest rates, inflation, and the Housing Price Index (HPI) in Malaysia, and to analyse how these macroeconomic factors affect housing affordability and market stability. The scope of the study was defined to focus on Malaysia as a whole, with reference to specific states where housing issues are most critical, covering the period from 1988 to 2023.

Finally, the significance of the study was discussed in terms of its academic, policy, industry, and social contributions. The research is expected to enrich the literature on housing economics, provide evidence-based insights for policymakers, guide developers and financial institutions in strategic planning, and contribute to the national agenda of improving housing affordability. Collectively, this chapter has set the foundation for the subsequent chapters, which review the relevant literature, outline the research methodology, present the empirical findings, and discuss the implications of the results.

CHAPTER 2
LITERATURE REVIEW

2.1 Chapter Overview

Like in any other city, the housing price index (HPI) in Malaysia is impacted by a complex interaction of several elements. Policymakers, real estate experts, and researchers can obtain insight into the dynamics of the housing market by comprehending these aspects. Some of the key factors influencing changes in the housing price index in Malaysia include Gross Domestic Product (GDP). interest rate and inflation rate.

2.2 Underpinning Theory

The foundational theories underlying this study elucidate the impact of macroeconomic forces on house prices in Malaysia. This study integrates economic theory with empirical evidence, employing three primary theoretical frameworks: the demand and supply theory, the life cycle theory, and the overlapping generations (OLG) model. These theories collectively offer a conceptual framework to elucidate the relationship between macroeconomic variables, including GDP, interest rates, and inflation, and the Housing Price Index (HPI).

2.2.1 Life-Cycle Theory

The life-cycle theory was initially proposed in the 1950s by Franco Modigliani and his student, Richard Brumberg, to elucidate consumption patterns based on how individuals allocate their limited resources at various life stages (Modigliani and Brumberg, 1954). The life-cycle theory asserts that individuals' housing requirements and financial behaviors evolve with age. A study conducted by Bai et al. (2021) demonstrates that homeownership can substantially improve life-cycle wealth and welfare. The study shows that owning a property can increase life cycle wealth by as much as 9% and wellbeing by as much as 23% by lowering portfolio risk significantly. This means that the timing of home purchases and interest rates have a big effect on the financial benefits of owning a home as families move through different phases of life.

The life-cycle model offers a significant framework for comprehending the dual role of housing as both a consumer product and an investment asset. In this concept, individuals make housing options based on their income, savings, and anticipated future needs at various life phases. Li and Yao (2007) formulated a life-cycle model wherein households obtain utility from home consumption while concurrently regarding property as a repository of wealth. Their findings indicate that variations in housing prices impact various age groups disproportionately, highlighting the diversity of welfare outcomes over the life cycle.

For younger households, increasing property prices frequently result in adverse welfare consequences, as these individuals are in the nascent stages of their careers, have minimal savings, and depend significantly on external funding. Higher housing costs make homes less affordable and may delay homeownership, which makes it harder to build wealth through property (Ortalo-Magné & Rady, 1998). On the other hand, middle-aged households, who are usually at their highest earning potential and already own homes, are less affected by sudden changes in property prices. For this group, price appreciation can improve balance sheets by raising housing equity, but the effect on welfare is less clear because it doesn't immediately lead to higher discretionary income (Li & Yao, 2007).

The consequences are especially important for homes with older members. For people who are retired or close to retirement, house appreciation increases their wealth by growing the equity in their homes. This equity can be turned into cash by selling the property, downsizing, or using financial instruments like reverse mortgages. But the results of welfare depend on whether these people plan to stay in their homes or use their property wealth to pay for retirement. McLeod and Ellis (1982) observed that older households may choose stability and non-monetary advantages of home consumption, indicating that price rises may not necessarily translate into enhanced utility.

In Malaysia, the life-cycle perspective elucidates the influence of demographic and economic trends on housing affordability and intergenerational equity. Hui (2013) noted that housing price cycles in Malaysia are intricately connected to overarching business cycles, exacerbating affordability issues for younger demographics during periods of economic expansion. In the same way, Majid, Said, and Chong (2014) pointed out that Malaysia's housing market has speculative characteristics, which makes it further harder for first-time purchasers to afford homes while helping current homeowners. This is in line with what the life-cycle theory says: younger households

are more likely to lose out when property values go up, while older and middle-aged groups are more likely to gain from capital gains.

In general, the life-cycle theory says that changes in housing prices cause differences between generations. Prices going up hurt younger households, protect middle-aged households, and often help senior households the most. These differences are even more obvious in Malaysia, where rapid urbanization and speculative activities have caused property prices to rise even faster. From a policy point of view, this shows that we need housing interventions that are tailored to different stages of life. For example, we need policies to make housing more affordable for first-time buyers, reforms to the mortgage market to make it easier to secure a loan, and retirement housing programs for older people. These kinds of actions are really important to make sure that the housing market doesn't make inequality worse between generations.

2.2.2 Overlapping Generation Theory

The Overlapping Generations (OLG) model, created by Diamond in 1965 and expanded upon by Auerbach and Kotlikoff in 1987, is a key tool for studying how macroeconomic aggregates and families interact at different points in their life cycle. OLG explicitly reflects the cohabitation of many generations: young, middle-aged, and old allowing for variation in savings, consumption, and investment decisions across age groups. This is different from representative agent models. This makes it especially helpful for looking at long-term patterns when demographic structures and transfers between generations are important.

Over time, OLG models have been widely utilized in the examination of fiscal and monetary policy (Auerbach & Kotlikoff, 1987; Kindermann & Krueger, 2014; Doepke et al., 2015), as well as social security systems and their effects on income inequality, wealth distribution, and material deprivation (Gertler, 1999; Hairault & Langot, 2007; Cheron et al., 2011; Acedahski, 2016; Bielecki et al., 2015). The adaptability of the OLG framework allows for the incorporation of policy shocks with generational outcomes, becoming it a significant model in welfare and distributional analysis.

More recently, researchers have added the housing market to OLG models (Rubaszek, 2012) to show how important real estate is for building up wealth and debt in households. Housing is not only a substantial part of a family's assets, but it is also

the main source of mortgage debt. This means that changes in housing prices and credit conditions can have a big effect on the wellbeing of future generations. The global financial crisis showed how important housing is for making business cycles worse, which makes it even more important to include it in OLG models. In this context, younger generations frequently incur net debt through home purchases, middle-aged households build wealth via increasing property equity, and older households either downsize or dispose assets to fund retirement.

The OLG theory is a useful way to look at the housing market since it looks at how generations interact and how changes in demographics, fiscal policies, and housing dynamics all affect macroeconomic outcomes. In Malaysia, where housing is always too expensive and owning a home is the major way to build wealth, employing OLG models can help us understand how policies and market forces effect successive generations in different ways.

2.2.3 Supply and Demand Theory

Housing is different from other goods like cars and land since it is a heterogeneous, durable, immovable, and expensive item that comes with high moving costs. Housing has several social and economic aspects in addition to its physical form. This is why it is usually only used by one household at a time (Teedon & Drakakis-Smith, 1986). Housing demand is usually described as the amount of housing needed to keep people healthy, comfortable, and living at a certain level. Income affects it, with higher salaries leading to more demand, which frequently means longer commutes to work. Housing need, on the other hand, is about how good and how many homes there are, and it is affected by things like population growth, family formation, occupancy rates, housing stock depletion, and homelessness (Ahmad Zakki, 1997). For housing initiatives to work well, it's important to accurately estimate both demand and need. This is especially true in Malaysia, where population growth and changes in household size have a big effect on housing demand.

Housing is a long-lasting good, and its value mostly depends on the current stock, which loses value over time (Glaeser et al., 2016). Housing provision is a reflection of the balance between supply and demand. Problems often arise when there isn't enough affordable housing to meet the demands of low-income families. Because building houses indirectly helps the economy thrive by creating jobs, governments

always put providing affordable housing at the top of their list of priorities. For example, Hong Kong and Singapore have been able to house a considerable part of their inhabitants because they are rich and their population trends are controlled (Teedon & Drakakis-Smith, 1986). Land availability, labor, capital, and construction materials are all important factors that affect the supply of housing. Land scarcity is especially important because it makes it harder to build new homes.

The Housing Price Index (HPI) in Malaysia shows how supply and demand affect each other. Recent statistics show that the growth of housing prices is slowing down. For example, the HPI only went up 0.88% year-on-year in Q2 2024, down from 3.52% in Q1 2024. This slowdown could mean that the market is cooling off, which could be because there is more supply or less demand. Residential property sales went up by 6.1% in the first half of 2024, reaching 121,964 units. The value of transactions also went up by 10.4% year-on-year to MYR 49.43 billion (Delmendo, 2024). Economic growth, consumer confidence, and good financing circumstances could all be reasons for rising demand. On the supply side, the number of housing starts climbed by 1.1% to 41,505 units, and the number of completions rose by 11.1% to 31,572 units. At the same time, the number of unsold units fell by 12.3% to 22,642 units for MYR 14.24 billion (Delmendo, 2024). These numbers show that the market is taking in new supply more easily, which is lowering the pressure on prices to go higher. Strong transaction volumes, more development activity, and fewer unsold homes all point to a more balanced Malaysian housing market.

Marshall (1920) wrote about the classical law of supply and demand, which is the theoretical basis for comprehending these dynamics. Demand shows how much people want and can buy a house at a certain price, while supply shows how much developers are willing and able to create. In the short term, supply is still rather inelastic, thus prices go up when demand goes up because of things like population growth or increased income (Coleman & Scobie, 2009). In the long run, nevertheless, new development increases supply and keeps prices stable. This approach has been widely utilized in housing research. Mankiw and Weil (1989) and Saita, Shimizu, and Watanabe (2015) show that changes in the population modify the demand curve, which has a big effect on housing prices when supply can't keep up. Nishimura (2011) connects Japan's housing bubble of the 1980s to demand shocks caused by changes in the population, which supports Marshall's idea that price surges happen when supply and demand are out of balance.

Changes in demographics, especially in the creation of households and the age distribution, are still quite important. Saita et al. (2015) demonstrate that housing demand in Japan is highest among adults aged 35-45, whereas Mankiw and Weil (1989) indicate that similar demographic shifts temporarily influence property prices due to supply rigidities. Nishimura and Tak'ats (2012) contend that these transitions additionally affect overarching macroeconomic conditions, encompassing money demand. These results show how demographic considerations can change property markets and make them less stable.

Buyer and supplier conduct also makes the market uneven. Buyers usually have to work within their budgets, while developers are more focused on making long-term investments (Thaler & Sunstein, 2008). Because of this difference, when demand goes up and supply goes down, prices go up, which forces many families to choose smaller units or wait to buy. In the end, the rule of supply and demand is what helps us comprehend how big-picture, demographic, and behavioral factors all work together to determine housing markets.

2.3 Housing Market in the Asian Countries

Fewer effective short-selling techniques that attracted more investors to the real estate market may lead to numerous issues and market collapses in the housing sector (Hong & Stein, 2003). One way to generate a profit is by investing, particularly in the real estate market. On the other hand, if there is a dearth of interest in investing in real estate, the market's performance will be less developed, which would lead to a higher rate of unemployment among graduates. In China, all housing is regulated by the state and is assigned at a lower cost of rent for residents in metropolitan regions, according to Dreger and Zhang's (2013) analysis of the country's housing reform. In China, housing performance has a greater influence on a balanced socialist living than economic activity. Because housing costs are always high, many Chinese households with incomes ranging from the median to the upper class are nevertheless unable to purchase a home. The housing bubble began as a result of rising home prices and the widespread usage of high credit limits by locals to buy homes. In an effort to discourage people from taking out additional credit to purchase homes at low mortgage rates, their government has come up with many measures that would raise interest rates and mortgage rates as well as the minimum down payment for mortgage loans (Dreger &

Zhang, 2013). It is helpful for locals who were unable to purchase a home because of the housing bubble in the market to continue renting the home until the price of the home drops to a level that is within their normal means in relation to their income.

In addition, the housing market in China is consistently expanding due to the increased investment and construction of more buildings, such as apartments, in contrast to the United States, which is currently experiencing high borrowing rates and excessive expenses (Fawley & Wen, 2013). Furthermore, the demand for housing in China is constantly increasing due to the fact that the population rate in urban areas is higher than in rural areas. A significant number of individuals from various countries are migrating to the cities of China, which has resulted in the creation of an increased supply of housing. Wu et al. (2010) further stated that the rapid increase in the price of land bidding in China can result in an increase in land sales revenue, which in turn affects the price of houses. These two assets were relatively significant because they are considered complementary assets that were dependent on one another. The price of land will increase in tandem with the price of housing. The land bidding price may increase due to a variety of factors, such as economic activities or the country's consistent growth. Consequently, additional land is required to accommodate numerous upcoming activities in numerous related sectors that have contributed to economic growth.

Additionally, housing quality, construction costs, and land prices have a lingering influence on the housing supply. While income, demographic behaviour, interest rates, and the tax system are classified as having a substantial long-term impact on housing demand (Tsatsaronis & Zhu, 2004). The economy is influenced by two fundamental factors: housing demand and housing supply. Both are critical factors in the determination of real estate and housing prices. The development of the housing stock is influenced by the time required for the planning and construction phases, the latency of existing land arrangement plans, and the financing arrangements for purchasing homes. There is a possibility that the stock of houses may be affected by the increased utilisation of credits and the decrease in construction activities, which could ultimately result in an increase in the price of houses. Consequently, the population rate in the country increased due to the inability to manage the number of individuals who were unable to afford to purchase a home (Dreger & Zhang, 2013). Some developers are prepared to wait for the house price to rise rather than selling it directly in order to generate a market oversupply and a housing market surge at the end of the deal.

In Singapore, the economic crisis resulted in unstable real estate and stock prices, which were exacerbated by the country's high inflation rate, which led to frequent fluctuations in house prices. In addition, the inflation rate was also discovered to serve as a hedge for the Australian property market, which includes retail and industrial activities, as determined by the Consumer Price Index (CPI) (Newell, 1996). In addition, the short-term and long-term periods for real estate prices and land sales are observed to be hedged. The short-term increase in land supply in Yunan Province results in an increase in real estate prices. However, the long-term decline in real estate prices is anticipated (Zhang, 2008).

2.4 Housing Market in the European Countries

The property market is very important for the economies of many countries, both in Europe and in cities and towns. Money and non-money activities have a big effect on this industry. The prosperity crisis has been most common in some Western European countries, where credit is used a lot and the economy is quite active. European housing prices are affected by general macroeconomic trends, including interest rate fluctuations, inflation, and integration initiatives (monetary union, shared currency), as well as country-specific structural elements (ECB, 2003).

Recent research corroborates these findings. The European Commission's Housing Market Developments in the Euro Area (2022) demonstrates that housing affordability has gotten much worse in several member states. This is because housing costs have gone up faster than earnings and the differences between regions have grown. The IMF (2023) reports that home markets in several European countries are overvalued by 15-20%, and it also points out that families are financially vulnerable because of rising mortgage rates and excessive inflation.

In 2024, house prices rose by about 3% to 4% in many EU countries, but they fell in others. For instance, Bulgaria, Poland, and Portugal saw big price rises, while France and Germany saw price dips. These patterns show that there are both supply and demand problems in different countries. Additionally, problems on the supply side have gotten worse: in some areas, fewer building permits are being issued, construction costs have gone up, and high interest rates have made borrowing more expensive. When demand is high, the supply of housing doesn't change rapidly enough, which makes prices go up even more.

Another aspect of contemporary research is investigating unconventional demand factors. Maynou et al. (2021) and "Is tourism a primary driver of inflation in house prices? (2025)" ascertain that tourism inflows and credit availability substantially elevate housing price indices in various European nations. This indicates that demand originates not only from local households but also from external and service-sector driven sources.

These recent findings suggest that the changes in European property prices over the past few years have been caused by a complicated mix of rising interest rates, inflation, limited supply, more credit, demographic pressures, and other shocks to demand, such as those caused by tourism and investment. This increases the likelihood of a home affordability crisis and repossessions much higher, especially for families with low incomes and a lot of debt.

2.5 Housing Price in Malaysia

Trofimov et al. (2018) scrutinized quarterly data from 2001 to 2015 to assess the influence of demographic and macroeconomic factors on Malaysian property prices, concentrating on the demand aspect of house price theory. Using the Vector Error Correction Model (VECM), they found that population expansion has a large and positive effect on the demand for homes, which in turn drives up prices. In a study like the one done by Bank Negara Malaysia (2012), they looked at the relationship between gross domestic product (GDP) and the base lending rate and found that it had a negative effect on housing prices. This finding diverges from international evidence, which often correlates GDP growth with increasing property prices (Mallick & Mahalik, 2015; Chen et al., 2012). It suggests that in Malaysia, high GDP development may redirect investment into alternate industries. In agreement with Tsatsaronis and Zhu (2004), Trofimov et al. further substantiated a considerable and positive association between inflation, as indicated by the consumer price index (CPI), and housing prices.

Sukrri et al. (2019a) advanced this research by developing an improved house price index for Malaysia through the Laspeyres Approach, incorporating both demand- and supply-side elements. Using an ARDL framework, they found that the overnight policy rate, employment, and CPI were all favorably associated to housing prices. On the other hand, housing loans had a negative influence. Their findings are interesting since they are different from those of Capozza et al. (2002) and Bank Negara Malaysia

(2012). They showed that land supply pushed prices up while building costs stayed low. This conflict may be elucidated by methodological disparities and the structural characteristics of Malaysia's housing market, where land scarcity in urban centers stimulates speculative demand. Sukrri et al. (2019b) further expanded their model to encompass the years 2008-2017, emphasizing the enduring impact of macroeconomic variables such as building prices and housing loans, while demonstrating that the effects of land supply and monetary policy are less enduring. The Error Correction Model (ECM) also showed that around 40% of short-run disequilibria are fixed in just one period, which shows how quickly the market adjusts to macroeconomic shocks.

While these studies offer significant insights, they are constrained by their failure to consider fundamental cracks in the housing market. Perron (1989) contends that neglecting structural breaks diminishes the reliability of hypothesis testing. Lean and Smyth (2014) underscore this issue by including demand-side shocks into their examination of housing prices, interest rates, and stock prices. Nonetheless, their research overlooks supply-side factors, such land availability, fluctuations in construction costs, and housing financing. The literature indicates that demand-side factors (population growth, employment, and inflation) demonstrate similar impacts across studies, whereas supply-side causes are less clear. Consequently, this work aims to address this gap by simultaneously analyzing both demand and supply factors, while explicitly including structural breaks in unit root and cointegration studies, so offering a more comprehensive explanation of the dynamics of Malaysian housing prices.

2.6 Housing Price Index in Malaysia

The Housing Price Index (HPI) in Malaysia has become an important way to keep an eye on the values of residential properties and see how affordable they are. The National Property Information Centre (NAPIC) put together the official HPI utilizing the hedonic pricing method. This method takes into account changes in structural, locational, and neighborhood variables to find the pure price effect (NAPIC, 2023; Cheng, 2017). Hedonic regression is more accurate and flexible than simpler stratification or median pricing methods when it comes to reflecting the diversity of Malaysia's property market (Cheng, 2017). However, some academics assert that national-level HPI may conceal significant sub-national differences. A hedonic analysis of terraced houses in Johor Bahru revealed that locational and structural

characteristics substantially affect price fluctuations, indicating that state- and district-level indices may provide more pertinent policy insights (Mokhtar et al., 2020).

In addition to methodological limitations, problems with affordability and access to housing make it even more important to improve Malaysia's HPI. Bank Negara Malaysia (2015) said that the median property prices in Kuala Lumpur and Penang, two important cities, are much more than the median household incomes. The price-to-income ratio is in the "seriously unaffordable" range. The World Bank (2020) also said that rising housing costs and slow income growth have made it harder for people to afford things, especially for people with low or intermediate incomes. These results suggest that although the HPI covers price fluctuations, it may not comprehensively represent the overall economic burden faced by Malaysian households.

Recent endeavors to enhance the HPI model, exemplified by Sukrri et al. (2019a, 2019b), utilize the Laspeyres methodology to amalgamate both demand- and supply-side variables, and implement ARDL frameworks to evaluate long-term associations. Although these contributions enhance the literature, they are constrained in two ways: firstly, they inadequately address structural breaks that could distort statistical inference (as noted by Perron, 1989); secondly, they insufficiently emphasize supply-side factors such as land availability and fluctuations in construction costs. Comparative analyses in proximate economies, notably Singapore (Phang & Wong, 2013) and Hong Kong (Leung, Chow, & Han, 2008), illustrate that disaggregated indexes by location and property type are crucial for accurately reflecting diverse market dynamics.

The Malaysian HPI literature indicates that demand-side factors such as population growth, employment, and inflation consistently affect housing prices, whereas research regarding supply-side factors is less conclusive. Moreover, national-level indices frequently obscure regional discrepancies and fail to properly account for structural fractures. This study seeks to enhance the current literature by developing a more inclusive framework that incorporates both demand- and supply-side factors influencing housing prices in Malaysia, while specifically examining structural breaks through unit root and cointegration studies. This methodology is anticipated to produce a more precise and policy-relevant comprehension of housing price trends, especially regarding affordability and regional variation.

In Malaysia, the House Price Index (HPI) illustrates the intricate interplay between housing supply and demand. Recent data indicates a deceleration in home price rise, with the HPI rising by about 0.88% year-on-year in Q2 2024, a substantial decline from the 3.52% gain recorded in Q1 2024. This trend indicates a decline in the housing market, maybe attributable to factors like heightened supply or subdued demand. In the first half of 2024, residential property sales rose by 6.1%, totalling 121,964 units compared to the same period of the prior year. This trade's value has risen by 10.4% year-over-year, totalling MYR 49.43 billion, (Delmendo, 2024). The rise in demand may result from causes such as economic expansion, heightened consumer confidence, or advantageous financing circumstances.

Conversely, developers have seen this increase due to the surge in house building activity. In the first half of 2024, home building commencements grew by 1.1% year-on-year to 41,505 units, whilst completions increased by 11.1% to 31,572 units. Additionally, the unsold housing inventory in the nation has decreased by 12.3% relative to the preceding quarter, totalling 22,642 units valued at MYR 14.24 billion, (Delmendo, 2024). The reduction in unsold inventory suggests that the market is assimilating new supply more efficiently, perhaps alleviating upward pricing pressure. The decline in the escalation of property prices, along with robust transaction volumes and heightened building activity, signifies a more equilibrated housing market in Malaysia. The equilibrium between supply and demand is essential for preserving home affordability and sustaining a sustainable market environment.

2.7 Government Policies and Regulations in Malaysia

Government policies and regulations exert considerable influence on the Malaysian housing market. These policies encompass various initiatives aimed at fostering the growth of affordable housing, especially for low to moderate-income households. Such initiatives may encompass financial assistance, lowered mortgage interest rates, or incentives to spur the development of affordable housing units. Scholarly research suggests that stringent administrative oversight measures implemented by the government can effectively mitigate the escalation of housing prices. In contrast, monetary and fiscal policies could potentially contribute to upward pressure on housing prices (Zhou et al., 2022).

According to Baek et al. (2021), government interest rate policies have a limited impact on housing market stability, as market mechanisms play a primary role in shaping market dynamics. Housing supply policies that align with market mechanisms may lead to more favourable outcomes in maintaining market stability. These interest rate policies, managed by central banks or monetary authorities, regulate interest rates within the economy, affecting mortgage borrowing costs and thus housing affordability and demand. However, their direct influence on housing market stability is often restricted due to the significant influence of other factors like economic conditions, consumer sentiment, and market trends. For example, even with low interest rates, uncertainties in the economy or inadequate housing supply can cause fluctuations in housing prices and market stability.

Government policies, including public housing programs, interest rate regulations, and tax policies, can affect housing market stability and dynamics, as analyzed using a bounded rational agents model. Within public housing programs, the government seeks to offer affordable housing choices to low and moderate-income households. These initiatives have the potential to directly influence housing market stability by augmenting the availability of affordable housing units, consequently mitigating price fluctuations in the market. Furthermore, public housing endeavours contribute to fostering social stability and economic equity by guaranteeing access to adequate housing for vulnerable demographics.

Interest rate regulations established by central banks or monetary authorities have an impact on mortgage rates and borrowing costs for individuals purchasing homes. Reduced interest rates can stimulate demand for housing as they make mortgages more affordable, thereby increasing activity in the housing market. However, extremely low or high interest rates can also result in unintended consequences, such as encouraging speculative behaviour or contributing to housing bubbles. Iancu et al. (2023) suggest that speculative bubbles in the housing market arise from overpricing due to public expectations of continual price rises, leading to instability in demand and the potential for market crashes. In Ukraine, house price bubbles were identified through ratios and regression analysis, with the Global Financial Crisis marking the most significant period of a bubble (Shmygel and Hoesli, 2022).

Tax policies concerning property, capital gains, and real estate transactions have the potential to influence investor behaviour and the dynamics of the housing market. Incentives such as tax credits aimed at promoting homeownership or deductions for

mortgage interest payments can stimulate demand and contribute to market stability. Conversely, alterations in tax rates or regulations can impact investment choices, housing affordability, and overall market sentiment. Researchers can utilize a bounded rational agent's model to simulate the interaction between different government policies and decision-making processes among individuals and institutions within the housing market. This modelling approach takes into account the cognitive constraints and decision-making strategies of agents, offering insights into how policy interventions may result in diverse outcomes regarding market stability, price fluctuations, and equilibrium conditions. Through the examination of public housing programs, interest rate regulations, and tax policies using such a model, researchers can evaluate the effectiveness, trade-offs, and potential unintended consequences of these policy measures on housing market dynamics. This analysis contributes to a deeper comprehension of how governments can shape housing markets to foster stability, affordability, and inclusive economic growth.

2.8 Housing Price Determinant

The house price percent growth is a key metric used to measure price changes in national and regional housing or real estate cycles (Case & Shiller, 2003). Investing in the property industry is the primary driver of economic growth in Malaysia (Hui & Ng, 2016). The economic slump is expected to lead to fluctuations in real estate prices, perhaps impacting investment performance and generating a decline in housing supply (Glindro et al., 2011). The decline in housing investment can be attributed to several factors, including a decrease in lower-income individuals investing in homes (Gan, 2013), challenges faced by borrowers in obtaining mortgage loans (Ibrahim & Law, 2014), and the lack of strategic position for houses with limited amenities such as transit, networking roads, and commercial establishments (Hui, 2010).

To revive the economic performance in this country, many measures can be implemented, such as increasing the money supply to stimulate larger investment in housing (Iacoviello & Neri, 2010). In order to maintain the profitability of housing investments, it is crucial to closely monitor the prevailing interest rates (Adams & Fuss, 2010). The decrease in interest rates for housing services will eventually align with the rise in demand for houses (Mankiw & Taylor, 2017). Within the economic cycle, there is often an increase in the quantity of housing units demanded (Malpezzi, 1999). The

shortage of construction activities within a limited timeframe may result in inadequate provision of housing services, leading to an increase in real estate costs (Peng, 2018). It may be inferred that in the economic cycle, the prices of houses are linked to the availability of dwellings, sometimes referred to as housing stock (Glaeser, Gyourko, & Saiz, 2008).

Olanrewaju and Tan (2018) state that the demand for housing in Malaysia is heavily influenced by the rapid population growth, changes in economic status, and the poor condition of existing housing stock. However, it is important to be mindful of the available funds when considering a housing investment, since the tax policy can play a significant role in determining its profitability. Government recognition of tax policy can enhance the sustainability and growth of real estate investment. By imposing taxes on investment sectors, it is possible to achieve improved performance in the housing investment sector while simultaneously promoting more efficient economic growth.

Upon analysing the performance of the Malaysia Housing Price Index, it becomes evident that prices have a tendency to increase over time (Zainuddin, 2010; Zaki, 2021). The rapid increase in housing prices indicates that this country is undergoing a period of slower economic growth, as there is a decline in the demand for houses (Hui & Ng, 2016). Consequently, resulting in a significant increase in prices (Glindro et al., 2011). Homeowners experience a strong sense of certainty as the values of houses increase (Case & Shiller, 2003). Some individuals may obtain more funds by leveraging the value of their property, either to invest in goods and services, renovate their home, boost their retirement savings, or repay other debts (Campbell & Cocco, 2007). When house prices decrease, property owners may encounter a scenario where the value of their house becomes less than their outstanding mortgage debt (Iacoviello, 2005).

As stated by Lin and Tsai (2021), an increase in interest rates has a substantial impact on property prices. This poses a considerable risk, particularly for new borrowers of mortgage loans, as they are more likely to face bankruptcy. In that scenario, the home loan costs will rise, leading to a decrease in demand for houses and subsequently causing a decline in house prices. Furthermore, the COVID-19 pandemic has resulted in a decrease in housing values in Malaysia, which has had a significant effect on both the real estate sector and the overall economy (Isyanto et al., 2022). The COVID-19 pandemic has adversely affected the real estate sector, resulting in a decrease in housing prices. The enforcement of movement control orders and

restrictions on real estate activity amid the epidemic has also exacerbated the decrease in housing prices. The COVID-19 epidemic has had a significant and detrimental influence on the real estate market, leading to adverse consequences for the overall economy in terms of collateral, wealth, investment, and employment. The pandemic has had a significant impact on research regarding housing pricing, leading to various challenges such as time constraints, resource limitations, and restrictions on movement.

2.9 Macroeconomic Attributes of Housing Market

The macroeconomic indicators play a crucial role in elucidating the home price performance (Iacoviello & Neri, 2010). The primary factors to consider in analyzing the investment patterns for houses in economic growth are the demand and supply dynamics (Malpezzi, 1999). Housing market fluctuations frequently arise due to the presence of speculators who demand houses without considering the potential consequences of declining prices (Case & Shiller, 2003). This, in turn, leads to an increase in housing supply and ultimately causes the housing bubble to burst (Brunnermeier & Julliard, 2007). In addition to that, the people and society in the country play a significant role in the volatility of property values (Goodhart & Hofmann, 2008). The increased demand for dwellings can be attributed to the low housing prices, which attract a large population (Glaeser, Gyourko, & Saiz, 2008). Excessive demand can lead to an imbalance between buyers and sellers, resulting in a rise in housing prices and ultimately restricting the supply of properties (Adams & Füss, 2010). Unlike the investing aspect, when prices rise, this is the opportune moment for investors to allocate their funds into these assets, so simultaneously bolstering economic growth (Peng, 2018).

2.10 Gross Domestic Product (GDP)

Gross Domestic Product (GDP) quantifies a nation's overall economic production and functions as a primary metric of economic performance. While GDP does not explicitly incorporate house prices, the housing market frequently mirrors the overall economic environment. An increase in GDP typically correlates with elevated household income, heightened consumer confidence, and enhanced access to finance, all of which bolster housing demand. A decrease in GDP typically results in diminished

affordability, stricter financing conditions, and a deceleration in the real estate sector. Consequently, GDP is commonly perceived as an indirect yet significant factor influencing house prices.

A multitude of research have examined the correlation between GDP and housing markets. Liu and Ma (2021) underscore GDP's function as a dependable indicator of economic growth and quality of life, positing that housing demand typically aligns with phases of GDP expansion. Yildinm and Yagciba§i (2019) discovered that GDP growth in Turkey exerted a strong long-term beneficial influence on housing prices, hence confirming the relationship between economic growth and housing. Kaulihowa and Kamathi (2019) similarly identified a unidirectional relationship from GDP volatility to home price volatility in Namibia, highlighting the macroeconomic impact of growth shocks.

In Malaysia, empirical evidence indicates a positive correlation between GDP and housing price indices (HPI). Zulkarnain, Samad, and Mohd Aini (2020) noted that GDP and interest rates were key predictors of residential property values both prior to and after the COVID-19 crisis. Zulkarnain, Nawi, Esquivias, and Husin (2024) recently established that GDP, the consumer price index, and the unemployment rate significantly influence the HPI in East Coast Malaysia by multiple regression analysis. These findings affirm the crucial significance of GDP while also indicating that the strength of the link may vary over time and across regions. Malaysia's economy saw a decline of 17.1% in Q2 2020 as a result of COVID-19, significantly surpassing the 1.1% contraction observed during the 2009 Global Financial Crisis (BNM, 2020; DOSM, 2021a). Such shocks demonstrate how GDP variations lead to instability in housing demand and affordability (Yin et al., 2019).

Notwithstanding the expanding corpus of evidence, deficiencies persist. Existing research mostly focus on short-term variations in GDP and housing prices, typically associated with crisis periods, while the long-term causal impacts of GDP on the Housing Price Index (HPI) in Malaysia remain less understood. Secondly, there is a paucity of analysis of structural breaks such as external financial shocks or significant housing policy interventions that could modify the GDP-housing link. Third, regional heterogeneity remains inadequately examined; the majority of studies fail to differentiate between urban centers (e.g., Kuala Lumpur, Selangor) and less developed states, where GDP development may have varying effects on housing. The relationship

between GDP and other macroeconomic factors, including inflation and interest rates, is insufficiently clarified in the Malaysian context.

Gross Domestic Product is an essential factor for comprehending house price fluctuations. It encompasses the income effect (increased GDP enhances household purchasing power), the wealth and sentiment effect (economic growth elevates expectations of housing appreciation), the credit effect (GDP expansion augments lending capacity), and the policy effect (higher GDP bolsters infrastructure and housing initiatives). Considering Malaysia's persistent affordability issues, where the escalation of housing prices consistently surpasses the increase of household income (Bank Negara Malaysia, 2024), it is essential to further examine the influence of GDP on long-term housing market results.

2.11 Interest Rate

Interest rates typically influence those seeking a mortgage (Mishkin, 2019). In the contemporary globalized context, acquiring a residence has become increasingly challenging due to the substantial expenses associated with home construction (Phang, 2020). The interest rate is employed to generate profit from the mortgage payment process (Levine, 2022). Despite consumer issues, financial institutions have employed several strategies to maintain client satisfaction and ensure loan repayment (Claessens, Frost, Turner, & Zhu, 2018). This frequently occurs among individuals who depend predominantly on the conventional underwriting criteria for mortgage loans established by financial institutions (Berrospide, 2021). The Overnight Policy Rate (Bank Negara Malaysia, 2023) establishes the fundamental lending rate in Malaysia, hence influencing housing prices and the expense of borrowed capital.

There was an effect of bank lending on the house price through the various liquidity effects. The price of a house is the same as the price of any other asset. It can be determined by the discounted expected future stream of the cash flow. The bank can provide lower lending rates and encourage current and future economic activities if the financial institution increases the availability of credit. Higher interest rates will decrease the net worth of households since their real debt burden will increase and their house price will decrease.

Interest rates exert a substantial influence on housing prices. Lowering interest rates can prevent house prices from aligning with their basic values, increasing the risk of a housing bubble (Lin and Tsai, 2021). According to Lee (2022), the effect of interest rate shocks on house prices is more significant during periods of economic decline. A higher interest rate is typically correlated with a decrease in demand for properties, which in turn affects the housing price index. As the interest rate rises, the cost of borrowing will also increase, which may deter potential buyers. Therefore, there would be a drop in the demand for houses.

Lim and Lau (2018) have looked at the same topic but with more variables. They looked at the changing link between Malaysian home prices, housing loans, construction output, and interest rates. Using the large and small sets of data for different types of home loans in Malaysia. Housing loans, building output, and interest rates all have a positive and significant relationship with housing prices in both the short and long term, as shown by the auto-regressive distributed lag and its EC model. This error-correction model data showed that home prices for low-end loans take longer than home prices for high-end loans to return to equilibrium after a shock. Home prices for high-end loans return to equilibrium about 11% to 15% per quarter.

Conventional economic theory posits that interest rates affect home prices by influencing borrowing costs. Decreased interest rates diminish the user cost of housing, consequently enhancing mortgage demand and escalating property values (Poterba, 1984). Empirical evidence, meanwhile, yields inconclusive results. Goodhart and Hofmann (2008) and Adams and Füss (2010) shown that reductions in interest rates substantially stimulate housing booms in industrialized economies via enhanced loan growth. In contrast, several research indicate weak or negligible correlations. Kabiné (2023) identified no short-term correlation between loan rates and housing prices, however Mian and Sufi (2018) contended that credit supply shocks, rather than interest rates alone, are the principal determinants of housing market volatility. Malpezzi (1999) asserted that structural issues, including land-use control and income growth, are more significant, while Case and Shiller (2003) noted that speculative behavior and expectations can create housing bubbles independent of interest rate levels.

The divergent findings signify a persistent discourse among academics and imply that the influence of interest rates on property prices may be significantly contingent on circumstances. In emerging economies like Malaysia, where interest rate policy is determined by the Overnight Policy Rate (OPR), few research have thoroughly

investigated the causal relationship between lending rates and the housing price index. This underscores an empirical deficiency in the research, specifically on the long-term interactions between interest rates and house prices within the Malaysian setting.

Interest rate risk primarily affects individuals and organizations. It is transmitted through the balance sheets of borrowers, with implications for expenditures and investments (Hoffmann et al., 2021). Ensuring the proper allocation of interest rate risk is crucial for maintaining financial stability. Resolute individuals in the banking industry can contribute to simultaneous bank failures, leading to a significant increase in interest rates. Two contrasting perspectives on banks' awareness of interest rate risk might be assessed. According to traditional wisdom, banking organizations provide long-term loans that need to be repaid within a short period of time. The use of a short-term repayment scheme leads to an increasing danger of the interest rate. Banking institutions mitigate interest rate risk by aligning the interest rate risk exposure of their assets with their liabilities through a program known as "contemporary opinions" (Hoffmann et al., 2021).

The main reason for Bank Negara Malaysia (BNM) taking such action is the lack of integrity in the reference rate used by financial institutions to price credit (Bank Negara Malaysia, 2015). As a result, consumers and the public find it challenging to make significant judgments on credit financing. Occasionally, financial institutions provide significant reductions on the Base Lending Rate (BLR) for the final retail loan. Financial institutions must prominently display both the Base Rate (BR) and the Base Lending Rate (BLR) at all branches and on their websites for any changes made to the BR (Bank Negara Malaysia, 2015). Different liquidity effects of bank loans may have an effect on the price of homes (Goodhart & Hofmann, 2008). The price of a house is the same as the price of any other object. The discounted projected stream of future cash flows can help you figure it out (Poterba, 1984). If banks make more credit available, they will offer lower interest rates on loans, which will boost both present and future economic activity (Mian & Sufi, 2018).

Yusof et al. (2023) found that there a negative relationship between interest rate and house price index (HPI) in Malaysia in the long run. The analysis revealed that HPI is negatively related to interest rate, indicating that as interest rates increase, house prices tend to decrease. However, a result from Lin and Tsai (2021) proves that there have a significant impact on the structure of housing price formation and correction rather than directly affecting the price alone. The discovery for the interest rate is

comparable with total national output brought a hugely positive effect on housing cost. Besides, the construction cost and interest rate are becoming the major factors that can give impacts on the housing price or real estate. The expansion of the interest rate will impact the estimation of houses which implies that when the interest is high, the authorities will set a higher price of the houses.

2.12 Inflation Rate

Typically, inflation occurs when there is an increase in the prices of goods and services, resulting in a decrease in purchasing power. There is typically a strong and lasting connection between housing prices and inflation. Inflation leads to a rise in the expenses associated with materials, personnel, and other resources necessary for a construction project (Kanchana and Sukumaran, 2020). There are two primary factors that contribute to inflation: demand-pull inflation and cost-push inflation (Empire, 2021). Demand-pull inflation arises from a combination of low interest rates, rising salaries, and an increase in the money supply.

When borrowing rates are low, there is an increase in demand for residences that outpaces the rate at which dwellings are being supplied. As a result, the housing price will rise (Mankiw & Taylor, 2017; Adams & Füss, 2010). A positive association between house prices and inflation occurs in the actual economy when there is an increase in the money supply inside the country (Goodhart & Hofmann, 2008). The economy is experiencing a significant monetary surplus, which will result in a substantial increase in the cost of most items, particularly housing prices (Iacoviello & Neri, 2010). This will equilibrate the demand and supply between the buyers and sellers (Malpezzi, 1999).

In addition to demand-pull inflation, greater wages are also a contributing factor to cost-push inflation. This is because higher wages enable individuals to earn more money and also contribute to the overall expenses of business construction (Blanchard & Johnson, 2013). As the number of salaries earned by employees increases, the demand for dwellings will also increase, resulting in higher costs (Mankiw & Taylor, 2017). The primary factors contributing to cost-push inflation are wages, import prices, raw material costs, and increased taxes (Parkin, 2019). The imported commodities from other nations are seeing a decrease in value due to the decreased exchange rate of their currency (Dornbusch, Fischer, & Startz, 2018). Alternatively, it is proposed that import

prices should be raised to support economic expansion. Similarly, the price of raw materials should also be increased (Samuelson & Nordhaus, 2010).

There are a lot of different things that can change the complicated link between inflation rates and house prices. In general, house prices tend to go up when inflation is low. When inflation is low, it could mean that the economy is growing and there is more desire for housing, which drives up prices (Adams & Fuss, 2010; Goodhart & Hofmann, 2008). On the other hand, if inflation gets too high, it can hurt the housing market. High inflation can make it harder for people who want to buy a home to do so because it lowers their purchasing power (Mankiw & Taylor, 2017). When there is high inflation, central banks may also raise interest rates, which can make it more expensive for people to borrow money to buy a home and slow down the housing market (Iacoviello & Neri, 2010; Case & Shiller, 2003).

In addition to demand-pull inflation, greater wages are also a contributing factor to cost-push inflation. This is because higher wages enable individuals to earn more money and also contribute to the overall building costs of firms (Blanchard & Johnson, 2013). As the number of salaries earned by employees increases, the demand for dwellings will also increase, resulting in higher costs (Mankiw & Taylor, 2017). The primary factors contributing to cost-push inflation are wages, import prices, raw material costs, and increased taxes (Parkin, 2019). The imported commodities from other nations are seeing a decrease in value due to the decreased exchange rate of their currency (Dornbusch, Fischer, & Startz, 2018). However, an alternative perspective suggests that in order to maintain economic growth, it is advisable to raise import prices. Similarly, the price of raw materials should also be increased (Samuelson & Nordhaus, 2010). The government implements higher taxes, such as excise duty, which in turn causes the Consumer Price Index (CPI) to increase, even though this occurs just once within a given time frame (O'Sullivan, Sheffrin, & Perez, 2014).

Peng (2018) argues that an increase in the inflation rate positively impacted the housing supply by causing home prices to rise, making housing more viable. Consequently, developers responded by increasing the supply of housing. The inflation rate would also lead to an increase in construction costs, resulting in a decrease in revenue for developers and making housing more expensive to compensate for the growing costs and declining revenue. Therefore, the inflation rate also had a favourable impact on housing supply by contributing to the growth of construction costs.

As stated, the Consumer Price Index (CPI) is a metric that calculates the average cost of goods and services bought by consumers. Changes in the prices of these items can impact inflation. Zainuddin (2010) established a correlation between inflation and home prices. In the event that inflation is higher, it will disrupt the economy but also lead to more growth. Nevertheless, a decrease in the inflation rate can impede the pace of economic expansion. Therefore, as inflation occurs, the market demand for houses would decline and the price of the property will decrease.

Similarly, the correlation between the housing market and inflation indicates a negative association. Brunnermeier and Julliard (2007) have confirmed that as inflation increases, economic growth becomes increasingly unstable. Thus, in order to attract buyers and stimulate house purchases, the construction company will need to reduce the price of the dwellings. In contrast, several scholars have stated that there exists a direct correlation between house prices and the rate of inflation. According to Frappa and Mesonnier (2010), an increase in inflation leads to a decline in supply development, resulting in higher housing costs.

The long-term effect of inflation, as measured by the Consumer Price Index (CPI), on housing values is both substantial and positive (Zaki, 2021). The researcher employed the autoregressive distributed lag (ARDL) method of a constrained error correction model (ECM) to analyse the immediate and long-term impacts of macroeconomic factors on housing prices in Malaysia. The error correction model (ECM) use the ordinary least squares method to examine the short and long-term dynamics. It includes an error-correction element to account for short-period departures from the long-run equilibrium.

According to Yusof et al. (2021), people think that inflation and unemployment are very bad for the business because they affect so many things. During the study era, from 1991 to 2020, unemployment rates are going up, and it's still hard for people in Malaysia to find work. There is no doubt that there is a link between inflation and unemployment rate based on the study. The study also showed that people could not afford to own houses after the pandemic because most of them had lost their jobs during the COVID-19 outbreak.

Starting with the big picture, study has found the socioeconomic factors that cause house prices to change a lot. Inflation rate and population growth are some of the things that have been found to have caused price changes in Malaysia's residential industry. Zulkarnain and Nawi, (2023) have run the study that the repercussions of

imported inflation were the main focus of Malaysian officials' response to inflation. The implementation of fiscal policies, such as limited subsidies, is necessary to alleviate the impact of increased inflation.

While Kok et al. (2018) have found in their study everyone expects an increase in inflation and, thus, a higher interest rate as property prices rise. This can draw in foreign capital and raise the value of the currency. Due to the global financial crisis after the COVID-19 pandemic, house prices were affected by the high cost of land and materials. For example, the annual inflation that the economy faces should cause the price ceiling for property value to be adjusted periodically, as this would impact the cost of materials and land (Thaker and Ariff, 2020).

Scholars disagree on the link between inflation and home prices, and the literature is still debating this issue. Some research indicate a positive correlation, implying that inflation elevates housing costs by augmenting the money supply and driving demand (Goodhart & Hofmann, 2008; Iacoviello & Neri, 2010; Zaki, 2021). Peng (2018) also says that increasing inflation makes housing more affordable, which motivates developers want to build more even when it costs more to do so. Conversely, other researchers emphasize the detrimental impacts of inflation, demonstrating that it diminishes purchasing power and induces economic instability, which consequently affects housing demand and compels developers to decrease prices (Brunnermeier & Julliard, 2007; Zainuddin, 2010). A third approach underscores a twofold effect, wherein inflation concurrently escalates construction costs and constrains supply, while also affecting housing affordability and demand (Frappa & Mesonnier, 2010; Kok et al., 2018; Thaker & Ariff, 2020). Recent research indicate that the effects of inflation are significantly influenced by circumstance. For instance, studies conducted in Malaysia demonstrate that inflation interacts with unemployment, imported inflation, and fiscal policy, influencing affordability and housing market results in manners distinct from developed countries (Yusof et al., 2021; Zulkarnain & Nawi, 2023).

Even though there is a lot of data, there are still some holes in the research. Findings from many research are conflicting, and there is no general agreement on whether inflation has a positive, negative, or mixed influence on house prices. Moreover, data regarding the Malaysian housing market is still somewhat scarce, especially in the post-pandemic era characterized by concurrent inflation, unemployment, and fiscal adjustments. There is a lack of research on how inflation affects other macroeconomic issues like unemployment, interest rates, and fiscal

policies, even though these factors all have an effect on the housing market. Finally, even though some research use econometric methods like ARDL and ECM to look at both short- and long-term effects (Zaki, 2021), we still don't know if the effects of inflation are ephemeral or long-lasting. Addressing these inadequacies is essential for a more refined comprehension of the inflation-housing price relationship in Malaysia.

2.13 Number or Stock of House

Macroeconomics is the examination of numerous variables, including inflation, unemployment, and interest rates, that significantly influence the economy as a whole. The housing sectors are essential to the global economy and the economy of Malaysia. Housing or real estate cycles are the patterns of construction operations that are designed to construct structures in a timely and efficient manner within the confines of a specific contractual timeline. The housing market is substantially affected by the forces of supply and demand from a macroeconomic standpoint. The housing supply is a critical factor in the real estate industry, as it is the produce of the building and its production cost is analysed to satisfy client needs. Nevertheless, recent research on the housing supply has underscored the significance of building costs, particularly the fees associated with complying with zoning and other regulatory requirements, as well as the degree to which investment in the housing stock is influenced by fluctuations in house prices (Paciorek, 2013).

As a result, the costs would increase as the supply could no longer meet the demand in a cost-effective and punctual manner. Glaeser, Gyourko, and Saks (2005) have proposed that the observed variations in house value levels and construction contracts across metropolitan zones are due to the differences in the guideline and network restrictions on new constructions, rather than the deficiencies of land or higher structure costs. However, the positive demand for houses and the insufficient supply of construction activities may result in an abrupt increase in the price of houses and income. Saiz (2010) also observed that the closest water and seep hills are problematic, in addition to the assumed importance of other significant factors that should be considered when determining the housing supply.

Moreover, the inventory of residences is a crucial determinant that impacts the cost of a house. The majority of study primarily focuses on interest rates, exchange rates, money supply, gross domestic products, population rates, and other monetary and

non-monetary activities. However, the availability or quantity of properties on the market may also significantly influence the examination of housing costs. Paciorek (2013) examined the effect of the construction industry on housing prices, whereas Saiz (2010) studied the effects of mortgage rates on house prices. Maclennan and Pryce (1996) assert that fluctuations in housing prices are impacted by monetary changes, and there are interdependent relationships between the housing market and the economy. Developers must possess accurate expectations on the immediate and medium-term availability of new dwellings in order to facilitate the growth of the real estate industry. Most inquiries about the construction of new dwellings, done by specialists or the government, are based on speculation about demand. If there is a higher demand for investment, it is likely that the number of investment jobs will expand, leading to the growth of high-rise housing stock.

2.14 Summary of the Chapter

Chapter 2 analyzes the theoretical frameworks and empirical evidence regarding the determinants of property prices, concentrating specifically on Malaysia. It begins by stating that macroeconomic variables such as GDP, interest rates, and inflation influence the Housing Price Index (HPI). It employs three principal theories; life-cycle theory, the overlapping generations (OLG) model, and supply-demand theory to illustrate how demographic shifts, intergenerational wealth transfers, and market dynamics influence housing affordability and equity. Comparative examinations of housing markets in Asia and Europe reveal that structural, demographic, and macroeconomic factors produce varied results, with speculation, affordability, and government interventions as recurring themes. Speculative demand, substantial credit utilization, and governmental regulations are critical factors influencing stability and price fluctuations.

Malaysian research suggests that demand-side factors (population growth, employment, and inflation) consistently drive higher property prices, whereas findings related to supply-side factors (land availability, construction costs, and finance) are less definitive. Research emphasizes the significance of government measures in ensuring affordability and stability. These programs encompass public housing, tax incentives, and the regulation of lending rates. Empirical studies indicate that GDP growth generally promotes rising housing values by improving income and credit availability;

however, interest rates exert ambiguous effects, either dampening demand due to high borrowing costs or inflating bubbles in a context of relaxed credit. Inflation exerts both positive and negative influences on property prices, contingent upon the relative strength of demand-pull vs cost-push factors.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research methodology to identify the macroeconomic determinants of the housing price index in Malaysia. The housing price index is set as the dependent variable while the factors highlighted in the literature review will be the independent variables, such as Gross Domestic Product (GDP), interest rate (INR) and inflation rate (IFR).

3.2 Research Design

This study utilizes a quantitative research design with time-series econometric analysis to investigate the correlation between macroeconomic factors and the Malaysian Housing Price Index (HPI). The design is suitable since it facilitates the discovery of long-term equilibrium relationships and short-term dynamics, while accounting for non-stationarity in the data. This method facilitates a systematic assessment of causation and interdependencies among the chosen variables, as housing market fluctuations are significantly affected by macroeconomic conditions.

3.3 Data Measurement and Sources

This analysis utilizes annual secondary data from 1988 to 2022, obtained from reputable institutions including Bank Negara Malaysia (BNM), the Department of Statistics Malaysia (DOSM), and the World Bank (WDI). Table 3.1 presents an overview of the dependent and independent variables utilized in this study. The Housing Price Index (HPI) serves as the dependent variable. It illustrates the fluctuations in residential property values and serves as a crucial indicator of the housing market's performance. The National Property Information Centre (NAPIC) provides the Housing Price Index (HPI) figures, which are based on the year 2010 (2010 = 100).

The initial independent variable is Gross Domestic Product (GDP), which indicates the overall economic growth of Malaysia. The conversion to natural logarithmic form is performed to improve stability and facilitate understanding of the modifications. The lending interest rate (%) published by Bank Negara Malaysia (BNM) serves as the second independent variable. The interest rate is referred to as the INR. This rate indicates the cost of borrowing funds and directly influences mortgage rates, investment decisions, and home affordability.

The inflation rate (IFR), defined as the annual percentage change in the Consumer Price Index (CPI), serves as the third independent variable. The Consumer Price Index (CPI) indicates the overall cost of living and purchasing goods within the economy. The Consumer Price Index (CPI) and the Housing Price Index (HPI) are both price-related metrics, however they evaluate distinct aspects of the economy. The Consumer Price Index (CPI) examines overall inflation in consumer goods and services, whereas the Housing Price Index (HPI) assesses price rises in residential properties. Concerns regarding multicollinearity are mitigated as the variables exhibit distinct dimensions of price fluctuations.

To ensure consistency and enhance the reliability of the statistics, all data series are converted to natural logarithms. The sole exceptions are the interest rate and inflation rate, which remain expressed as percentages. Table 3.1 below enumerates the sources and measurements for each variable.

Table 3.1:
Measurement and Sources of Data

Abbreviation	**Variable**	**Measurement / Proxy**	**Sources**
HPI	Housing Price Index	Official index of residential property prices (Base year: 2010 = 100)	NAPIC
GDP	Gross Domestic Product	Constant 2015 RM (natural log)	DOSM / WDI
INR	Interest Rate	Lending interest rate (%)	BNM / WDI
IFR	Inflation Rate	Annual percentage change in CPI (%)	DOSM / WDI

Note: NAPIC refers to the National Property Information Centre, DOSM refers to the Department of Statistics Malaysia, BNM refers to Bank Negara Malaysia, and WDI refers to the World Development Indicators (2022/2023).

3.3.1 Data Description

Table 3.1 summarizes the variables utilized in this study. The dependent variable, HPI, indicates housing market performance, whereas GDP, INR, and IFR serve as determinants affecting housing prices in Malaysia. GDP reflects the macroeconomic strength of the economy, while INR indicates the effects of monetary policy through borrowing costs. IFR signifies price stability and purchasing power, which can affect demand and affordability in the housing market.

3.4 Theoretical Framework

A theoretical framework in research is an important part of a manuscript and should be presented in the first section. It shows an understanding of the theories and concepts relevant to the research and helps limit the scope of the research. According to Mersola (2023), the theoretical framework offers the framework for outlining our philosophical, epistemological, methodological, and analytical approaches to the dissertation as a whole. It also acts as a guide for me to create and support my study.

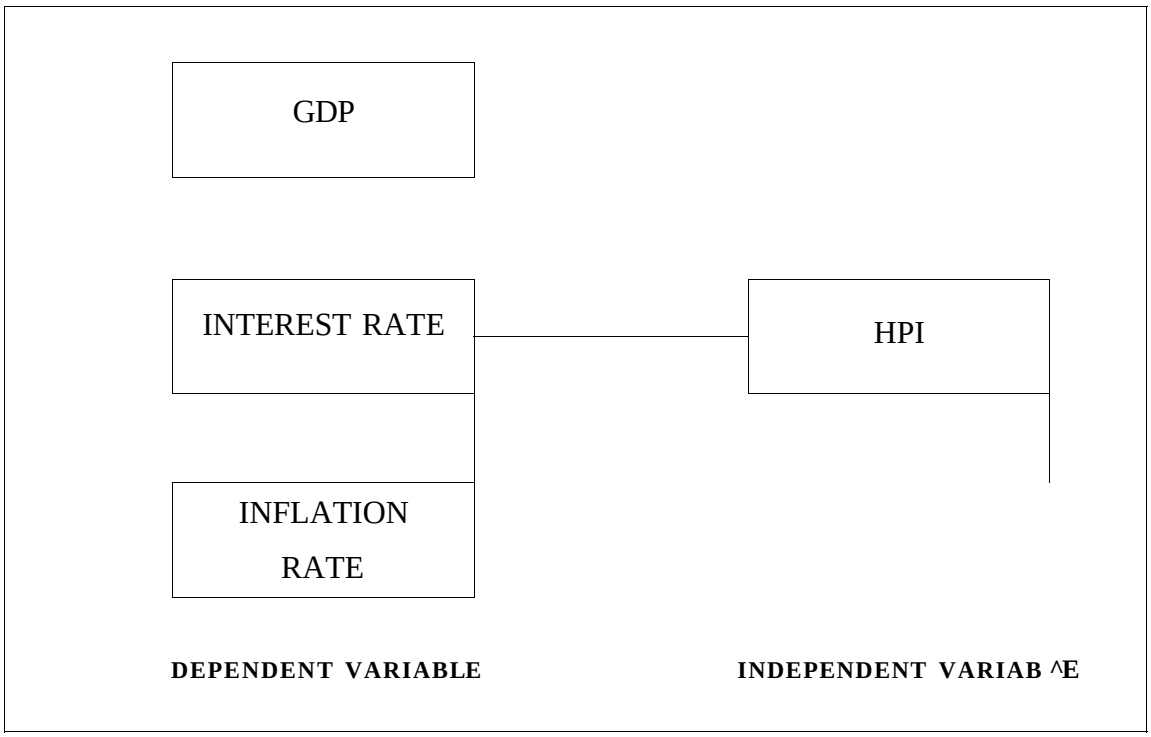

Figure 3.1 Theoretical Frameworks

This research is about the impact of housing prices in Malaysia towards macroeconomic variables. The dependent variable is housing price index and independent variables are GDP, interest rate and inflation rate. The GDP shows how much economic activity and growth a country has. An increase in GDP usually leads to higher household income, more job opportunities, and greater purchasing power, which then boosts the demand for homes. As the economy expands, a greater number of individuals find themselves in a position to invest in homes, which results in increased pressure on housing prices. So, GDP is likely to be positively related to the Housing Price Index (HPI).

The interest rate represents the expense of borrowing and functions as a crucial tool of monetary policy. Elevated lending rates augment mortgage expenses, deterring prospective purchasers and diminishing housing demand. Conversely, reduced interest rates render borrowing more affordable, stimulating property investment and driving house prices higher. Consequently, the interest rate is anticipated to exhibit an inverse correlation with the Housing Price Index (HPI).

The inflation rate quantifies the general rise in the price level of goods and services within an economy. A little rise in inflation may encourage property investment, as tangible assets like homes are sometimes perceived as a safeguard against inflation. Nonetheless, sustained elevated inflation can diminish purchasing power, rendering homes less affordable. Consequently, the correlation between inflation and house prices may be either positive or ambiguous, contingent upon the severity of the inflation rate and prevailing economic circumstances.

The Housing Price Index (HPI) is the dependent variable that shows how the prices of homes fluctuate over time. It shows how well the housing market is doing and is affected by big-picture things like GDP growth, interest rates on loans, and the inflation rate. The HPI is a way to see how changes in the economy and government policies affect the cost and demand for housing in Malaysia.

3.5 Proposed Empirical Model

The dependent variable (HPI) represents the Housing Price Index in Malaysia while the independent variables represent the Gross Domestic Product (GDP), Interest Rate (INT) and Inflation Rate (IFR). Therefore, in the procedure to make an appropriate

analysis, the fundamental estimating equation in linear regression from of the long run relationship is used as follow:

$$HPI_t = \beta_0 + SiGDPt + \beta_2 INR_t + \beta_3 IFR_t + e_t \quad (3.1)$$

or functionally,

House Price Index =/(Gross Domestic Product, Interest Rate, Inflation Rate)

where,

Symbol	Definition
HPI_t	Housing Price Index at time *t*
β_0	Constant or intercept term
β_1	Coefficient of Gross Domestic Product (GDP)
β_2	Coefficient of Interest Rate (INR)
β_3	C oeffi ci ent of Infl ati on Rate (IFR)
e_t	Error term at time *t*
t= 1,23,..., n	Time period of observations

This model shows how the Housing Price Index (HPI) in Malaysia is related to its macroeconomic factors, such as GDP, interest rate, and inflation rate. It also shows how changes in these factors affect housing prices during the course of the study.

3.6 Model Specification: Determinants of House Price Index (HPI)

This study's goal was to investigate Malaysia's HPI factors. Numerous factors that have been introduced to explain HPI were studied in previous literature reviews. The variables chosen for the model of HPI inflows examined in this thesis were particularly chosen in accordance with macroeconomic factors that were significant in Malaysia. The elasticities of each variable are measured by transforming them into log form. For the aforementioned equation, the log-linear from that represents Ln is as follows:

$$LNHPI_{it} = a_0 + fcLNGDP_{it} + [3_2 LNINR_{it} + [3_3 LNIFR_{it} + e_t \quad (3.2)$$

where:

Symbol	Definition
$LNHPI_{it}$	Natural logarithm of Housing Price Index for country *i* at time *t*
$LNGDP_{it}$	Natural logarithm of Gross Domestic Product
$LNINR_{it}$	Natural logarithm of (1 + Interest Rate) to account for small values and maintain interpretability
$LNIFR_{it}$	Natural logarithm of (1 + Inflation Rate) to account for small values and avoid extreme negative logs
a_0	Intercept
/31,f32,f33	Coefficients representing the elasticity of HPI with respect to each independent variable
£j	Error term

The inclusion of 1 + rate for interest and inflation ensures that the log transformation remains defined even for small values and provides coefficients that are more interpretable in the context of percentage changes. In this model, positive coefficients *(J31,fi2,fi3)* are anticipated, indicating that increases in GDP, interest-adjusted rates, and inflation are expected to positively influence the HPI, consistent with the theoretical framework.

3.7 Hypothesis

In this research, hypothesis testing was developed in order to see and explain the significant relationship between the variables. This research consists of three hypotheses. The researcher had developed these three hypotheses based on each variable that has been identified.

3.7.1 Gross Domestic Product

GDP is the most popular indicator in macroeconomics used by researchers to represent economic conditions (Maclennan and Pryce, 1996). Meanwhile, GDP serves as the primary indicator for representing the state of an economy and its income (Kok et al., 2018). The overall condition of the economy is widely regarded as a significant factor in determining house prices. Crucially, there is a reciprocal relationship between the two. Macroeconomic factors have an impact on the values of real estate, while the prices of real estate also influence the overall state of the economy. For instance, periods of housing booms can lead to increased household consumption, resulting in beneficial consequences. According to Kabiné (2022), the results of the research reveal a negative long-run equilibrium relationship to GDP.

So, it means that buyers are not influenced by the GDP when making a buying decision. There are too many researchers with different arguments on how GDP rate affects housing price either positive or negative. Thus, these hypotheses were developing:

Short-Run Relationship Hypotheses

H0: There is no significant short-run causal relationship between Gross Domestic Product (GDP) and the Housing Price Index (HPI) in Malaysia.

H1: There is a significant short-run causal relationship between Gross Domestic Product (GDP) and the Housing Price Index (HPI) in Malaysia.

Long-Run Relationship Hypotheses

H0: There is no significant long-run causal relationship between Gross Domestic Product (GDP) and the Housing Price Index (HPI) in Malaysia.

H1: There is a significant long-run causal relationship between Gross Domestic Product (GDP) and the Housing Price Index (HPI) in Malaysia.

3.7.2 Interest Rates

In this study. House prices are just like the price of any asset. According to Barakova et al. (2003) when there is a better availability of credit it will increase the demand for houses when households get opportunity to borrow. The growth in demand will be reflected in the higher housing prices. According to Kabiné (2022), the results of the research reveal a negative long-run equilibrium relationship to interest rate. The variable inflation rate is determined to be the second factor that has a positive and significant influence on home affordability in Malaysia (Musaddad et al., 2023). Then, according to the International Monetary Fund (2000), when the housing finance interest is low, citizens will be able to make some investments, such as buying more houses. Therefore, these hypotheses were developed:

Short-Run Relationship Hypotheses

H0: There is no significant short-run causal relationship between interest rates and the Housing Price Index (HPI) in Malaysia.

H1: There is a significant short-run causal relationship between interest rates and the Housing Price Index (HPI) in Malaysia.

Long-Run Relationship Hypotheses

H0: There no significant long-run causal relationship between interest rates and the Housing Price Index (HPI) in Malaysia.

H1: There is a significant long-run causal relationship between interest rates and the Housing Price Index (HPI) in Malaysia.

3.7.3 Inflation Rates

Previous studies done by Piazzesi and Schneider (2009) stated that there was a positive relationship between housing price and inflation rates. They commended that higher expected inflation tends to lead to an increase in the price-dividend ratio on houses. However, a study done by European researchers found out that there was a negative relationship between the price level and inflation rate in Europe in 1999.

According to Selvaraja et al. (2018), increasing inflation renders individuals unable to own property, emphasising the extent of housing unaffordability in the country. Elevated inflation leads to an increase in housing costs, resulting in higher prices for homes. Conversely, reduced inflation causes home prices to decline and become more variable over time, thereby enhancing the feasibility of home ownership. While a study from Yusof et al. (2021), it shows that the interest rate has a substantial impact on both conventional and Islamic home financing over an extended period of time. The interest rate exerts a substantial and favourable influence on home prices, resulting in an increase in house prices due to the rise in these factors (Khan et al., 2022).

Short-Run Relationship Hypotheses

H0: There is no significant long-run causal relationship between the inflation rate and the Housing Price Index (HPI) in Malaysia.

H1: There is a significant short-run causal relationship between the inflation rate and the Housing Price Index (HPI) in Malaysia.

Long-Run Relationship Hypotheses

H0: There is no significant long-run causal relationship between the inflation rate and the Housing Price Index (HPI) in Malaysia.

H1: There is a significant long-run causal relationship between the inflation rate and the Housing Price Index (HPI) in Malaysia.

3.8 Data Analysis

In order to guarantee the validity and trustworthiness of the results, a number of procedures must be followed when studying time series data. The data analysis methods and procedures used in this investigation are all summarized in the flow of analysis presented in **Figure 3.1** and **Figure 3.2.**

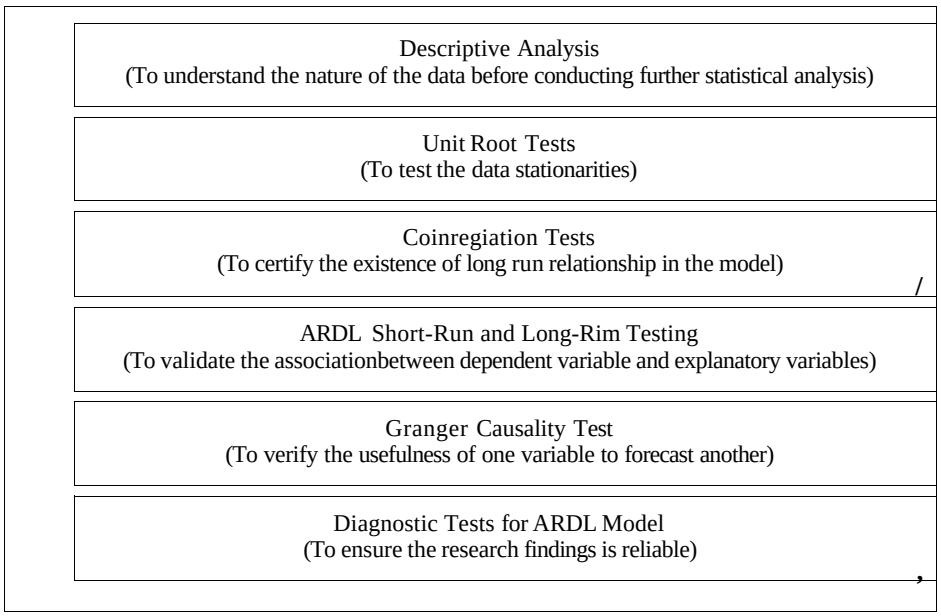

Figure 3.2 Econometric Analysis Framework

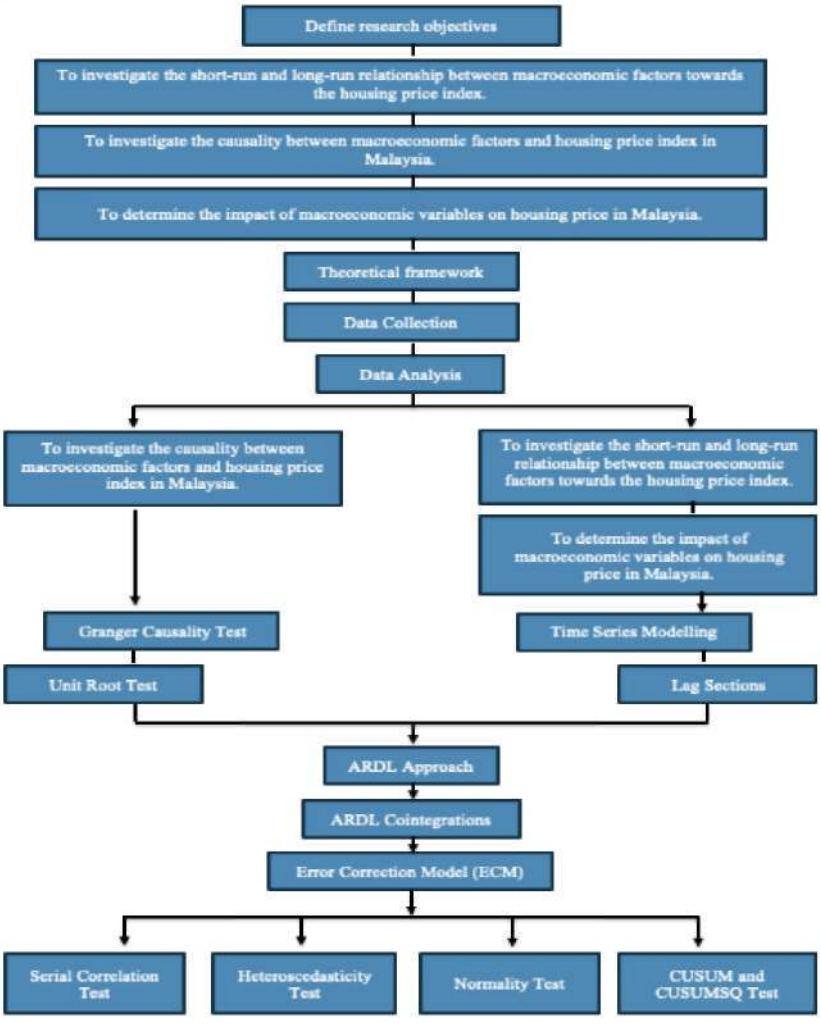

Figure 3.3 Flow of Analysis

3.8.1 Descriptive Analysis

A descriptive analysis is a crucial step in statistical analysis for comprehending the characteristics of the data prior to doing additional statistical analyses. The descriptive analysis offers a concise overview and depiction of the fundamental characteristics of the utilized data set. Typically, there are two main categories of statistics that are frequently employed to describe a data set: measures of central tendency and measures of variability. The measure of central tendency characterizes a dataset by determining the centre position within the dataset as a singular value. The three measures of central tendency commonly employed in statistics are the mean, mode, and median. Furthermore, measurements of variability precisely quantify the extent to which data points are dispersed or spread out in a data collection. The four key metrics of variability are standard deviation, variance, minimum and maximum values, and kurtosis and skewness.

3.8.2 Unit Root Test

A unit root test is a statistical method used to determine the stationarity of a time series. A time series is considered stable in statistics if its mean, variance, and autocovariances remain constant throughout time and it does not exhibit a unit root. Conversely, a time series is considered non-stationary and has a unit root if its mean, variance, and autocovariances are dependent on time. The features of a time series will be significantly influenced by the existence of nonstationary variables, leading to incorrect and erroneous regression results. In this study, the presence of the unit root will be analyzed using two robust methods: the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. The variables in this study are assessed for stationarity using the ADF and PP tests. The determination is made as to whether they are stationary at level I (0), stationary at first difference I (1), or a combination of level and first difference. This information is crucial since it forms the basis for selecting the most appropriate statistical models for analysis.

3.8.2.1 *Augmented Dickey-Fuller (ADF)*

The Augmented Dickey-Fuller (ADF) test is a widely used and popular univariate test for analyzing the stationarity of a time series dataset. The Dickey Fuller (DF) unit root test was modified from the original test devised by Dickey and Fuller (1979). The ADF test enhances the DF test equation to increase the accuracy of the equation, enabling consideration of higher order autoregressive processes. The ADF test shares the same null hypothesis and testing technique as the DF test, but it is based on a modified equation that includes additional differencing terms. The study conducts an ADF test using two distinct equations: one with a unit root and intercept and another with a unit root, intercept, and trend.

If the t-statistic is more than the critical value or the probability value is less than selected significance level, the hypothesis *(3 = 0* (the data are non-stationary) can be rejected, indicating the series is stationary. In contrast, smaller value oft-statistic and higher probability value than selected significance level indicate that the series is not stationary.

3.8.2.2 *Phillips-Perron (PP)*

The study utilizes the Phillips-Perron unit root test, which was created by Phillips and Perron in 1988, to assure the reliability of the unit root test result as suggested by Nkoro and Uko in 2016.

Generally, the PP test is comparable to the ADF test, but it has an advantage in that it offers a nonparametric approach as an option for addressing serial correlation when determining the order of integration for a series. Additional benefits of the PP test, in comparison to the ADF test, are its greater resilience to various types of heteroscedasticity in the error term and the absence of a requirement for the user to provide the lag time for the test.

The null hypothesis for PP unit root test is /? = 0, suggesting the data series is non- stationary and contains unit root. In contrast, the alternative hypothesis defines the data series to be stationary and does not contain unit root. If the t-statistic is more than critical value or the probability value is less than selected significance level, the

hypothesis /? = 0 (the data are non-stationary) can be rejected, indicating the series to be stationary.

3.9 Auto-Regressive Distributed Lag (ARDL) Modelling Approach

Once the data's stationarity has been confirmed, this study will utilize the ARDL modelling approach to estimate the long-term relationship between the variables and the model's short-term adjustment speed. The ARDL technique offers numerous advantages over other econometric approaches.

This technique enables the testing of a model that comprises variables with a combination of integrated order 1(0) or 1(1). Due to the fact that this study relies on 35 observations, the ARDL modelling approach is deemed more appropriate for estimating the model (Narayan, 2005).

Pesaran et al. (2001) outline a two-step process for the ARDL technique. Firstly, this study used the ARDL bounds testing approach to ascertain the presence of a long-term link among the variables. This test is valuable because it considers delays in both the dependent and independent variables. This suggests that past values of the variable may be helpful in determining the current value of the variable. Changes in the variable may not always have an immediate effect on other variables, so the lag variable is a plausible way to identify this issue. Furthermore, the ARDL bound testing method offers greater flexibility by accommodating varying lag structures for distinct variables.

3.9.1 Diagnostic Tests

To determine whether the empirical model fits the data enough and closely, diagnostic checks are carried out. A range of diagnostic statistics were offered to check for misspecification, including serial correlation, heteroscedasticity, normalcy of disturbances, and suitability of the functional form.

i. Autocorrelation Test

Lagrange Multiplier (LM) tests were used to determine the autocorrelation of the residuals for each equation, according to Godfrey (1987). Whether or not the dependent variables' lag values are present in the regressor does not affect the validity of the LM test. When the lag independent is one of the regressors, the Durbin-h statistics

is the proper way to find out if serial correlation exists. When the lagged dependent variable is utilized in the regression model, as in our instance, the Durbin-Watson tests are invalid since the lagged dependent variable is employed as one of the regressors in the ARDL approaches. In this instance, the first-order autocorrelation can be checked using the Durbin h-test. The h equation as shown below:

$$h = \left(1 - \frac{d}{2}\right)\sqrt{\frac{n}{1 - n[\mathrm{var}(a_2)]}} \qquad (3.3)$$

where h is asymptotically a normal distribution with zero mean and unit variance.

The presence of autocorrelation in the residuals can be detected using the *h-statistic.* The decision rule is based on the standard normal distribution. The probability that the *h-statistic* lies between -1.96 and +1.96 is approximately 95 percent, as expressed in Equation (3.4). From the normal distribution, the condition must be as follows:

$$\Pr(-1.96 < h < 1.96) = 95\% \qquad (3.4)$$

where:

Symbol	Definition
h	Durbin //-statistic for testing first-order autocorrelation
d	Durbin-Watson statistic value
n	Number of observations in the sample
$\mathrm{var}(a_2)$	Variance of the estimated coefficient of the lagged dependent variable
Pr	Probability that *h* lies within the specified range
1.96	Critical value from the standard normal distribution at the 5% significance level

If the calculated value of h lies between -1.96 and +1.96, the null hypothesis of no first-order autocorrelation (either positive or negative) is not rejected. Conversely, if

h falls outside this range, the null hypothesis is rejected, indicating the presence of autocorrelation in the residuals.

ii. Normality Test

Another crucial diagnostic examination is the normalcy test. When the errors deviate from normality, the statistical tests become invalid. The reason for this is that the efficiency property of minimum variance is diminishing, but the asymptotic efficiency remains intact. This issue is particularly severe when working with a limited number of samples. There are four prevalent methods for assessing the normalcy assumption. The Jarque and Bera (1987) test is the most frequently used one. The Jarque and Bera (JB) test of normalcy is an asymptotic test, meaning it is dependent on large sample sizes. It is based on the OLS residuals which can be seen as follows:

$$JB = n[? + \wedge F]\sim 4o \quad (^{3}\text{-}^{5})$$

where:

Symbol	Definition
JB	Jarque-Bera test statistic
n	Number of observations in the sample
s	Skewness coefficient
k	Kurtosis coefficient
$xf_2)$	Chi-square distribution with 2 degrees of freedom

The JB test of normality examines the joint hypothesis that the values of *S* and *K* are equal to 0 and 3, respectively. If the p-value is sufficiently small (less than 0.05), the null hypothesis of normal distribution is rejected, implying that the residuals are not normally distributed.

The test hypotheses are stated as follows:

Ho: Residuals are normally distributed

Hi: Residuals are not normally distributed

The JB test remains valid regardless of whether the estimated model includes an intercept or not.

iii. Heteroscedasticity Test

The heteroscedasticity test is performed to ascertain if the variance of the error terms in a regression model remains constant. When the assumption of homoscedasticity is breached, the model experiences heteroscedasticity, resulting in inefficient and biased standard error estimations, hence compromising the reliability of hypothesis testing.

The most commonly used test is the Breusch-Pagan-Godfrey (BPG) test, expressed as:

$$nR^2 \sim x^2_w \tag{3.6}$$

where:

Symbol	**Definition**
n	Number of observations in the sample
R^2	Coefficient of determination from the auxiliary regression
$x^2(k)$	Chi-square distribution with *k* degrees of freedom (equal to the number of regressors)

The hypotheses for the heteroscedasticity test are formulated as:

Ho: Homoscedasticity exists (constant variance of residuals)
Hi: Heteroscedasticity exists (non-constant variance of residuals)

The presence of heteroscedasticity in the estimated model can be assessed by conducting a straightforward test that involves regressing the squared residuals on the squared fitted values. An essential assumption of the ordinary regression model is that the errors exhibit constant variance across the whole sample. This model is often referred to as the homoscedasticity model. Heteroscedasticity refers to a situation where

the data exhibit non-constant error variation. Heteroscedasticity, which refers to the violation of the assumption of constant error variance in OLS regressions, leads to inefficiency in the estimated coefficients. Models that incorporate the variability that changes over time can utilise the data more effectively. Heteroscedasticity can lead to inaccurate forecast error variance in ordinary least squares (OLS) due to the reliance on average variance rather than the variability at the conclusion of the series.

iv. Ramsey RESET Test

The Ramsey's (1969) RESET test was employed to examine whether there was a misrepresentation of the functional form. The RESET test, established by Ramsey (1969), is a comprehensive diagnostic tool that aims to identify instances of both omitted variables and improper functional form in statistical models. The RESET test is conducted by applying the Lagrange Multiplier concept and typically uses the critical value of the F-distribution. The test utilised a linear specification compared to a non-linear specification. The form of the test used is shown as below:

$$Y = Bi + BiXit + BiXit \qquad (3.7)$$

where:

Symbol	Definition
Y	Estimated dependent variable (predicted value of Y)
B	Estimated intercept term
Bi	Estimated coefficient of independent variable XM
BI	Estimated coefficient of independent variable Xst
XaXst	Independent (explanatory) variables at time t

The RESET test proceeds by estimating,

$$ft = Bi + B2X2t + B3X3t + Yf^2t \qquad (3.8)$$

where:

Symbol	Definition

ft	Estimated value of the dependent variable at time *t*
B	Estimated intercept term
Bi	Estimated coefficient of independent variable XM
BI	Estimated coefficient of independent variable Xst
Y	Coefficient representing the effect of the lagged dependent variable
Y	Lagged value of the dependent variable at time *t*

Two regressions are estimated, with the latter being a modified version of the former that includes squared fitted values acquired from the first regression. The inclusion of squared fitted values introduces non-linearity into the specification. The models described in this thesis adhere to the functional form of the F-test. The null hypothesis posits that the accurate specification is linear. The alternative hypothesis posits that the accurate specification is non-linear. If the F-test statistic exceeds the critical value of F, the author will reject the null hypothesis that the real specification is linear, indicating that the true specification is non-linear. If the author is unable to reject the null hypothesis, then the results indicate that the true specification is linear, and the equation successfully passes the Ramsey RESET test.

v. Cumulative Sum (CUSUM) and Cumulative Sum of Square (CUSUMSQ) Stability Test

Brown, Durbin, and Evans (1975) proposed two tests to determine if parameters remain constant. The tests are derived from recursive residuals and are commonly referred to as the CUSUM and CUSUMSQ tests, respectively. Plots of recursive residuals provide a dependable representation for analysing changes in parameters and making decisions. The CUSUM and CUSUMSQ tests are also employed to examine the null hypothesis of parameter stability throughout the sample. The CUSUM test relies on the CUSUM. A CUSUM test figure includes both the 5% critical lines and the cumulative sum plot. If the cumulative aggregate exceeds the 5% critical threshold, it indicates that the parameters are unstable. The CUSUMSQ test is the second method used to assess the constancy of parameters. It relies on calculating the cumulative sum of squared recursive residuals. Residuals that have been squared are graphed against time along with critical lines. The significance of deviation from the mean value line,

similar to the CUSUM test, is assessed by parallel critical lines positioned around the mean value. When the line goes above the critical boundaries, it suggests that the regression parameters are unstable.

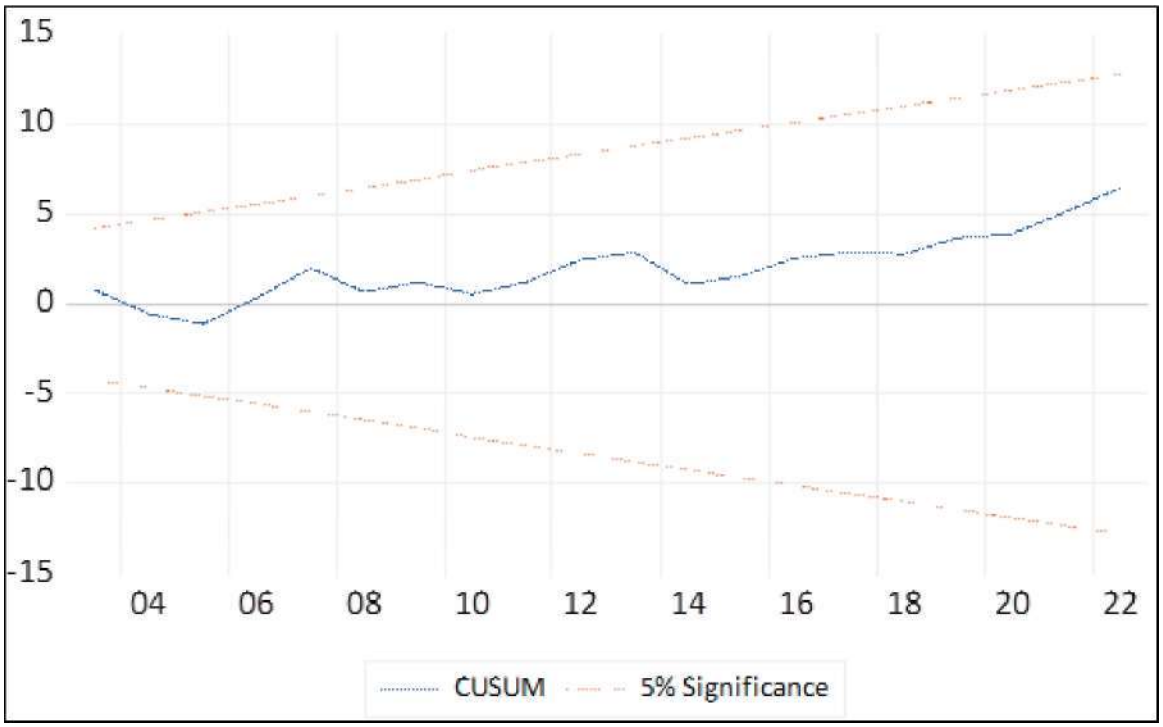

Figure 3.4 CUSUM graph

The CUSUM plot remains totally within the 5% significance lines throughout the sample period, as illustrated in the image above. This outcome indicates that the predicted coefficients remain consistent over time, and there is no indication of structural fractures within the model. Consequently, the regression model is deemed structurally robust and dependable for subsequent analysis.

Figure 3.5 depicts the CUSUM of Squares (CUSUMSQ) stability test. This test supplements the CUSUM test by assessing the constancy of the regression coefficients' variance across time. The blue line in the figure indicates the CUSUMSQ statistic, whereas the dotted red lines signify the 5% critical limits.

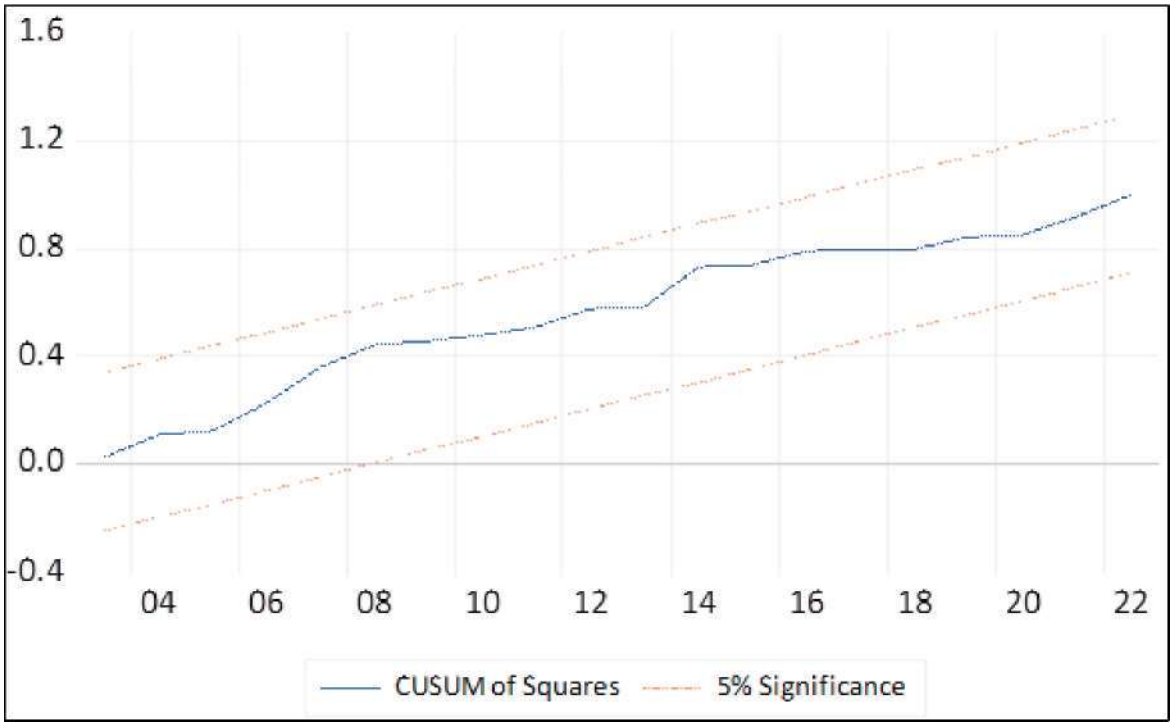

Figure 3.5 CUSUMSQ graph

The criteria for decision-making resemble those of the CUSUM test, should the CUSUMSQ plot continue inside the 5% critical thresholds, the model parameters are deemed stable. The CUSUMSQ line exceed the established boundaries, it indicates parameter instability or the existence of structural changes inside the model.

The CUSUMSQ line in the figure consistently remains under the 5% critical bounds, signifying that the variance of the regression coefficients is constant across the duration examined. This verifies the lack of structural instability in the model.

The outcomes of both the CUSUM and CUSUMSQ stability tests uniformly demonstrate that the estimated parameters of the ARDL model are stable and dependable throughout the sample period. Thus, the model meets the parameter stability criterion, confirming its appropriateness for both short-term and long-term examination of the causes of the housing price index in Malaysia.

3.10 Granger Causality Test

The last section elaborates on the impact of each of the variables to each other. The causal relationship is necessary as it is a factual thought of causal impact dependent on the forecast using vector autoregression (Barnett et al., 2009). Granger causality, for

example, the interest rate causes the high-rise house price if the past value of the interest rate can help in determining the changes in the high-rise house price. According to Granger (1998), after the variables re set to be cointegrated, the short-run and long-run causality simultaneously exits in the model and the variables can proceed with the vector error correction model (VECM) approach instead of using vector auto-regressive (VAR) because it may not be able to explain the first difference of the variables.

Granger (1988) and Engle and Granger (1987) assert that non-stationary but cointegrated variables indicate the presence of a long-run equilibrium relationship among them. In these instances, a basic Vector Autoregressive (VAR) model in levels may be unsuitable as it does not adequately represent the long-term equilibrium adjustment mechanism.

Therefore, the Vector Error Correction Model (VECM) is employed instead. The VECM incorporates both, the short-run dynamics of the variables through differenced terms, and the long-run equilibrium through the error correction term (ECT), which measures how quickly variables return to equilibrium following a deviation.

The VECM-based Granger causality model can be expressed as:

$$An = a_0 + 2f_{=1}ftAX_{t\_i} + Zj?_{=1}7/\ AY_{t\_j} + AECT\wedge + e_t \qquad (3.9)$$

where:

Symbol	Definition
A	First difference operator
ECT_{t_1}	Error correction term derived from the long-run cointegration equation
X	Coefficient of the error correction term (speed of adjustment)
e_t	White noise error term

If the variables are non-stationary and lack cointegration, the VECM is inappropriate, and the analysis should employ a VAR model in first differences, as no

long-run equilibrium relationship exists. If cointegration is detected among the variables, the VECM framework is suitable for examining both short-run and long-run causal linkages. This study employed the VECM-based Granger causality methodology to determine the impact of gross domestic product (GDP), interest rates, and inflation on the housing price index (HPI), while also identifying the presence of unidirectional, bidirectional, or non-existent causation among these variables.

The hypotheses for the Granger causality tests are formulated as follows:

H0: Variable X does not Granger-cause Variable Y
H1: Variable X Granger-causes Variable Y

In conclusion, the Granger causality test within the VECM framework enables this study to analyze both short-term and long-term interactions among GDP, interest rates, inflation, and housing prices. The results of this test offer significant insights into the collective impact of macroeconomic factors on the housing price index in Malaysia, enhancing the understanding of the dynamics inside the housing sector.

3.11 Multivariate Time Series Models

Multivariate time series modelling involves analysing many dependent variables throughout time. Brandt and Williams (2007) assert that the previous value of the independent variable can determine the influence on the future value of a dependent variable. Additionally, it encompasses the causal relationship in other variables included in any econometrics modelling.

3.11.1 Auto-Regressive Distributed Lag (ARDL)

Other research has commonly utilised the Auto-Regressive Distributed Lag method to establish the correlation between macroeconomic parameters and their corresponding dependent variable. Prior to analysing the relationship between the variables, it is necessary to test for the level of integration of the variables. The Pesaran ARDL model has been observed to provide consistent estimation of the long-run relationship, regardless of whether the regressors and cointegrations are stationary at

the level or first difference (I(0) or I(1)). This estimation is asymptotically normal, (Hasan and Nasir, 2008).

Prior to advancing to the subsequent stage of the ARDL model, it is crucial to conduct certain tests. The Unit Root Test is utilised to determine the stationarity of the variables in the model. The ARDL technique may not be applicable if there is no mixed integration order among the variables. Indeed, the variables should be specified as being of integrated order I(0) and I(1), but not of integrated order 2 (Kim and Le, 2018). ARDL can be utilised to ascertain both the short-term and long-term relationships within a single model, hence rectifying its dynamic structure to attain the equilibrium level.

Yeap and Lean (2017) report that an ARDL approach was used to conduct a study on the housing price and certain macroeconomic factors in Malaysia. The study found that, while there is a positive relationship in the short term, there is no long-term relationship between the Interest-Bearing Scheme and mortgage interest tax relief with housing prices. The ARDL Bound Test can be used to determine the cointegrations relationship. Furthermore, any study with a limited number of observations is urged to employ the ARDL approach of cointegrations to ascertain the link between the variables, as it can yield a more accurate result, according to Johansen and Juselius' (1990) cointegrations test. if it is discovered that there is a long-term relationship between the variables cointegration. In order to find the short-run coefficients and utilise them to adjust the error term inside the model, the study must be conducted for an error correction model.

Furthermore, it is crucial to establish the best lag length in order to eliminate any issues with autocorrelation in the model. To do this, the lag number with the lowest value according to criteria such as Schwarz Criterion (SC) and Akaike Information Criteria (AIC) is selected (Lee et al., 2016). Antwi and Zhao (2013) utilize Final Prediction Error (FPE) and Akaike Information Criteria (AIC) to determine the ideal lag length. The lag length with the shortest value will be selected to ensure the presence of white noise in the error term. In their study, Lee et al. (2016) demonstrated that all variables, including gross domestic product, lending rate, and unemployment rate, were found to be significant in the model.

This significance was observed when the null hypothesis of existing cointegrations among variables failed to be rejected, with a probability value greater than the 5 percent level of significance. Additionally, these variables were found to be

cointegrated with the housing price. Inglesi-Lotz and Gupta (2013) found that there is a long-term relationship between the inflation rate and housing prices in Africa when utilizing the ARDL cointegration approach. The study considered that the variables are cointegrated with a combination of stationary levels and initial differences, specifically I(0) and I(1). In addition, the study conducted by Tan et al. (2018) revealed a positive and substantial relationship between house prices and interest rates in Malaysia over a long-term timeframe. Consequently, an increase in interest rates corresponds to a rise in property prices.

3.11.2 Error Correction Models (ECM)

The core of the short-term relationship between variables is typically derived in the form of an Error Correction Model (ECM) that is constructed using the Granger Representation Theorem before the cointegration results are obtained (Suciningtias, 2019). In the long-run association, the latent error correction term elucidates the extent to which the short-run disequilibrium must be rectified and eliminated in the long-run equilibrium (Ali & Khan, 2018). In addition, the coefficient of error correction term must be statistically significant and negative in order to ensure that the model is consistent with the numerous values that require correction. As the negative coefficient increases, the correction process becomes more rapid and the long-term equilibrium can be achieved in a steady-state position. The presence of a positive coefficient in the error term may indicate the presence of autocorrelation.

The error correction model's results, which exhibit a combination of positive and negative relationships in the short-term dynamics of the housing price, were clarified by Lee et al. (2016). Nevertheless, the lending rate is not elucidated as a significant variable, which suggests that the error correction term's outcome is consistent with the negative coefficient and statistically significant, with a 28 percent speed of adjustment towards the disequilibrium in the short-term to re-establish the long-term equilibrium in the model. Similarly, another study elucidated that the high coefficient value indicates that the variables will converge in the long term. Zainol et al. (2018) demonstrated that the error correction term resulted in a 40% adjustment to achieve equilibrium in the long run, despite the existence of disequilibrium in the short run coefficient. The error correction term demonstrated a relationship between the

house price and interest rate in China at various lagged periods in the short-run (He & Li 2011).

3.11.3 Granger Causality Test

Granger causality is a factual concept that asserts that the causal impact is contingent upon the forecast, as demonstrated by vector auto-regression (Barnett et al., 2009). Additionally, it is recommended that granger causality tests be conducted with other variables in addition to establishing the relationship between macroeconomic variables and the high-rise house price in this study. The error correction model can be used to determine whether the macroeconomic variables have any causal relationship with the dependent variable (Moawad, 2019). The granger causality test can be conducted by determining the appropriate autoregressive latency length based on the availability of the data and vector auto-regression estimates (VAR) model (Hongyu et al., 2002) using the ordinary least squares (OLS) estimation method.

Ganger causality is one of the variables that can be tested using Wald Test statistics, and the null hypothesis is established to eliminate causality in the short term, as per Toda and Phillips (1994). The null hypothesis will be rejected if the probability value is less than 5 percent at the level of significance. However, an alternative hypothesis will be accepted if the variables exhibit short-term causality.

According to Lean and Smyth (2010), there are three potential outcomes following the Granger causality test. These include a one-way Granger causality, also known as unidirectional causality, that exists from a single independent variable to the high-rise housing price or vice versa. Otherwise, there is a potential for bidirectional causality between the variables, which is also referred to as two-way granger causality. The variables are considered independent if there is no impact from the independent variables to the high-rise housing price, and vice versa.

According to Hongyu et al. (2002), the researchers discovered a granger causality result that extends from non-housing investment to housing investment, which is also referred to as unidirectional causality among these variables. Lee et al. (2016), conversely, investigated the causal relationship between the lending rate and the housing price in Malaysia. In the short-term results, the lending rate caused by gross domestic products also exhibited unidirectional Granger causality between the independent variables. Chen and Patel (1998) found that the house price in Taipei is

influenced by the interest rate, housing completion, stock prices, construction cost, and household income. This suggests the existence of short-run causality.

The unidirectional nature of all of these variables was evident, with the exception of the stock prices, which exhibit a two-way granger causality relationship with the housing price. These variables may have a substantial interaction.

3.12 Conceptual Framework

The conceptual framework of the study of housing prices is the subject of this section. This investigation implemented two prevalent theories: demand and supply theory, overlapping generation theory, and life-cycle theory.

3.12.1 Housing Economics

Franco Modigliani and his student Richard Brumberg proposed the life-cycle hypothesis in the 1950s to explain how individuals utilize their limited resources at each period of life (Modigliani and Brumberg, 1954). Lifecycle theory best explains family housing demand (Ando and Modigliani, 1963; Modigliani and Brumberg, 1979; Friedman, 1957). According to the life cycle theory, people arrange their consumption and savings to maximize lifetime utility by smoothing spending across time. The hypothesis suggests that people' expectations for future income significantly impact their house consumption desire. House prices rise in the housing market due to short-term stock fixes. Increased income expectations and consumer confidence lead to increased home demand, ultimately driving up prices.

This behaviour may influence asset ownership, as the life-cycle theory categorizes an individual's adult life into three distinct periods. During the initial phases of their career, an individual's income tends to be comparatively low. At this stage, individuals commonly incur debt against anticipated income to finance substantial expenditures such as housing and education. During the latter stages of an individual's career, income typically reaches a peak, enabling debt repayment and the initiation of net savings. Saving may encompass the acquisition of financial assets such as cash, bonds, and equities. Upon retirement, individuals experience a decline in income, necessitating the dissaving of assets (Yang, 2006).

An extension of life cycle theory elucidates the influence of demographic structure on housing price demand. According to the life-cycle theory, which posits that agents encounter credit constraints, Ortalo-Magne and Rady (1998) asserted that the cyclical variation in house prices is significantly influenced by changes in the current income of young households. The pricing of smaller properties is influenced by the income levels of the lowest-income first-time buyers. It is asserted that the cyclical movement in house prices is significantly influenced by fluctuations in the current income of young households, rather than solely by GDP.

The reason why young people acquire a property is not only for the aim of investing, regardless of whether the housing price goes up or down, but also to preserve the life span risk in order to have a better living after retirement. According to Attanasio, Bottazzi, Lo, and Wakefield (2012), the variations in property price, income, and interest rate drive individuals to prefer owning a home rather than renting. This preference is a reason why people choose to buy a house rather than rent. During times of economic expansion, young people should be encouraged to sell their homes at greater prices in order to get more income from the investment they have made. The term "economic boom" refers to the period of time during which the economy experiences fast growth, which leads to a decrease in unemployment, an increase in Gross Domestic Product (GDP), and an increase in property values.

If the life-cycle theory applies to a whole society, a significant age cohort might influence both the demand and supply of housing and equity as they go through the population. The hypothesis posits that total savings, including investments, will only fluctuate in response to variations in production or population expansion. A substantial cohort, such as the post-World War II baby boom, is expected to augment housing demand when its members reach the ages of 20 to 40 (Mankiw and Weil, 1989). Demand for homes will decline, but demand for financial assets would rise when the same demographic is aged between 40 and 64 years.

The supply of both assets will rise as the same substantial group enters retirement and seeks to liquidate their assets to meet consumption requirements.

Browning et al. (2013) have elucidated the beneficial impact of property prices on consumption via a direct examination of current wealth. The data revealed that there is no effect on wealth, hence enhancing some conclusions of previous studies. The disparate results complicate the establishment of a uniform micro-level correlation among home prices, consumption, and family savings.

3.12.2 Housing and Demographic Economics

Originally developed by Diamond in 1965 and later expanded by Auerbach and Kotlikoff in 1987, overlapping generations models serve as a valuable tool for examining the interactions between macroeconomic aggregates and households throughout various life-cycle phases. Their popularity has surged in recent years. These studies examine the impacts of fiscal and monetary policy (Auerbach and Kotlikoff, 1987; Kindermann and Krueger, 2014; Doepke et al., 2015) along with social security on income and wealth inequality, consumption, and material deprivation among households (Gertler, 1999; Hairault and Langot, 2007; Cheron et al., 2011; Acedahski, 2016; Bielecki et al., 2015). Recently, models have been developed focusing on the housing market (Rubaszek, 2012) due to its significant role in business cycles, as evidenced by the recent financial crisis, and the reality that a large portion of households' wealth is invested in real estate. Housing plays a crucial role in shaping the debt of households, as mortgage loans are the primary component of their liabilities in terms of value.

Additionally, prices may rise initially, but this effect can be reversed later due to an increase in the ageing population coupled with a decline in fertility, resulting in a shift in price dynamics over time. An ageing population can initially drive-up housing demand and contribute to rising prices; however, as the workforce diminishes, this impact will gradually decrease. This discovery offers a fresh viewpoint on the connection between demographic trends and economic variations.

Takats developed a modest OLG model in 2012 to investigate the impact of asset aging. In contrast to Takats (2012), our model takes into account the macroeconomic aspects of the housing market. This approach demonstrates that as the population ages, there is a tipping point in home prices.

3.12.3 Macroeconomic Theory

In order to analyze the correlation between housing prices and inflation, it is essential to incorporate macroeconomic theory into this study. Inflation is a fundamental concept in macroeconomic theory that refers to a rise in the overall price level of a country, resulting in increased costs for a wide range of goods and services. Macroeconomic theories are essential for understanding the definition of inflation and

the factors that influence house prices. Housing prices are determined by the interaction between supply and demand, with the general public influencing these factors. Inflation also affects housing costs by influencing the value of money in this context.

The theory of supply and demand is particularly pertinent in macroeconomic theories when it comes to property pricing. The theory of supply and demand introduces the use of an equilibrium model where supply and demand interact. In this scenario, the supply curve would be determined by the quantity of houses available and the current rate of house creation. On the other hand, the demand side would be influenced by individuals' capacity and willingness to pay for houses in the market.

There is an inverse relationship between the supply side and the interest rate. This means that when the interest rate rises, the demand curve shifts to the left since it becomes more costly for customers to make purchases. The inverse relationship occurs when a fall in interest rates leads to an increase in the demand for houses by the general public, but the supply of housing fails to reach a state of equilibrium with the demand. An issue that arises is that when demand increases rapidly, the housing market output cannot match it due to the time-consuming process of creating houses (Krugman and Wells, 2018).

Housing prices are influenced by various external factors that impact both the supply and demand sides. External factors that can influence both supply and demand include the unemployment rate, which, if it rises, would lead to a fall in the demand for housing. Additionally, rules and policies implemented can also impact supply and demand.

3.13 Summary of the Chapter

This chapter detailed the comprehensive research strategy and analytical framework utilized to analyze the macroeconomic factors influencing the Housing Price Index (HPI) in Malaysia. It started with creating the study framework and theoretical base that connect housing prices to GDP, interest rates, and inflation rates. The data utilized in this investigation were secondary and sourced from credible national repositories, including the pertinent time series for analysis.

The study utilized the Autoregressive Distributed Lag (ARDL) modelling technique to assess the short-term and long-term correlations among the variables. The ARDL bounds testing approach was chosen because it works well with small sample

sizes and can handle variables that are integrated of various orders, I(0) and I(1). The empirical model was formulated in a log-linear format to include elasticity effects and to interpret the results in percentage terms.

To make sure the estimated model was strong and accurate, a number of diagnostic tests were done. The tests used were the autocorrelation test, the normality test, the heteroscedasticity test, the Ramsey RESET test, and the stability tests using CUSUM and CUSUMSQ. The diagnostic results verified that the model adheres to the fundamental econometric assumptions, and the parameters remain constant throughout the sample period.

Lastly, the Granger causality test was used within the Vector Error Correction Model (VECM) framework to find out which way the variables cause each other. This enabled the study to differentiate between short-term and long-term causal links among GDP, interest rates, inflation, and home prices.

In summary, this chapter described the research methods and techniques used to reach the goals of the study. The next chapter will show and talk about the real-world findings that came from the estimation and testing methods presented here.

CHAPTER 4
RESULTS AND DISCUSSION

4.1 Chapter Overview

In the initial section of chapter 4, the econometric results are presented. These results are derived from research aim 1, which focuses on examining the relationship between various factors and the home price index in both the short-run and long-run. The appropriate methodology for doing this study is ARDL estimation, as elucidated in the preceding chapter. The initial analysis commences by providing a summary of descriptive data for the model. Next, unit root tests such as ADF and PP analyse each model individually. The ARDL test, which relies on cointegration and utilises the F-statistic, provides additional confirmation of the presence of long-term cointegration among the variables. Subsequently, various diagnostic tests such as autocorrelation, functional form, normality, heteroscedasticity, CUSUM, and CUSUM square are employed to verify the reliability of the estimated output of the tested model. Finally, the outcomes of extended and continuous elasticities elucidate the correlation between the independent variable and the dependent variable.

4.2 Descriptive Statistic Analysis

The summary of the data collected for this study is presented in Table 4.1. the descriptive statistics below describes full evidence of using macroeconomic attributes in the research work.

Table 4.1:
Descriptive Statistic for Model of Housing Price Index

	HPI	GDP	INR	IFR
Mean	147.8429	2.03E+11	3.282643	2.481381
Median	140.0000	1.87E+11	3.748419	2.556519
Maximum	216.8000	3.87E+11	11.78239	5.440782
Minimum	92.20000	6.28E+10	-3.903382	-1.138702
Std. Dev.	40.98908	9.72E+10	3.575429	1.429299
Skewness	0.276211	0.345635	-0.090838	-0.065916
Kurtosis	1.584175	1.902768	2.781135	3.060969
Observations	35	35	35	35

Table 4.1 shows the descriptive statistics for all the variables in the model, which are the Inflation Rate (IFR), the Gross Domestic Product (GDP), the Interest Rate (INR), and the Housing Price Index (HPI). The statistics show the central tendency, spread, and distributional features of the data over 35 observations. The Housing Price Index (HPI) has a mean value of 147.84 and a median value of 140.00, which means that the data are rather evenly spread out. The HPI goes from a low of 92.20 to a high of 216.80, which shows that housing prices went up a lot throughout the study period. The standard deviation of 40.99 shows that house prices are not very stable, which is probably because of changes in the economy and government policies. The skewness value of 0.28 shows that the distribution is slightly right-skewed, which means that HPI values that are higher than average happen more often. The kurtosis value of 1.58, which is less than 3, shows that the distribution is platykurtic, which means that there are fewer extreme observations.

The average GDP is 2.03×10^{n}, and the median is 1.87×10^{11}. This means that Malaysia's economy has been growing steadily over the time period studied. The GDP figures go from 6.28×10^{10} to 3.87×10^{n}, which shows that the economy is growing quickly. The standard deviation of 9.72×10^{10} shows that GDP has changed a lot, which could be because of changes in the economy that happen over time or shocks from outside sources. The skewness (0.35) shows that the distribution is somewhat right-skewed, which means that there were a few periods of GDP that were higher than average. The kurtosis value (1.90) is below 3, which means that the distribution is relatively flat, which means that there were mild changes without any severe peaks.

The average interest rate (INR) is 3.28 percent, while the median is 3.75 percent. This means that interest rates were usually in the middle range. The lowest and highest interest rates are -3.90 percent and 11.78 percent, which means that the economy has both loosened and tightened its money supply. The standard deviation of 3.58 indicates a significant level of fluctuation in interest rates during the period, likely attributable to alterations in monetary policy in reaction to economic conditions. The skewness value of-0.09 says that the data is almost evenly spread out, while the kurtosis value of 2.78, which is close to 3, suggests that the data is almost normally distributed.

The mean inflation rate (IFR) is 2.48 percent and the median is 2.56 percent. This shows that Malaysia's inflation rate has been consistent over the years. The inflation rate is between -1.14 percent and 5.44 percent, which means that the country has had times of both deflation and moderate inflation. The standard deviation of 1.43

shows that inflation is not very stable, which is due to changes in prices around the world and changes in demand in the US. The skewness of -0.07 means that the distribution is almost symmetric, and the kurtosis of 3.06, which is close to the normal benchmark of 3, means that the inflation rates are normally distributed.

The descriptive statistics indicate that all variables demonstrate acceptable levels of variation and are approximately normally distributed, implying that the data are appropriate for subsequent econometric analysis. The HPI shows an upward trend over time, which is in line with the effects of economic growth and rising incomes. The GDP is going up quickly, which shows that Malaysia's economy is growing. The changes in interest and inflation rates are due to the country's monetary policies. These traits help the model achieve its goal of looking at the long- and short-term links between macroeconomic conditions and the Housing Price Index in Malaysia.

Table 4.2:
Normality and Distributional Properties

	HPI	GDP	INR	IFR
Jarque-Bera	3.368358	2.452588	0.117991	0.030766
Probability	0.185597	0.293378	0.942711	0.984735
Sum	5174.500	7.10E+12	114.8925	86.84835
Sum Sq. Dev.	57123.57	3.21E+23	434.6454	69.45844

Table 4.2 also shows the Jarque-Bera (JB) test and its probability values for each variable's distribution to see if it is normal. The Jarque-Bera statistic tells you if the skewness and kurtosis of a dataset are very different from those of a normal distribution. A JB value that is higher than normal and a p-value that is lower than 0.05 means that the variable does not follow a normal distribution. A p-value that is higher than 0.05 means that the variable does follow a normal distribution.

The Jarque-Bera statistic for the Housing Price Index (HPI) is 3.368, and the probability value is 0.186, which is higher than the 0.05 significance level. This means that the HPI data doesn't differ much from what is normal, hence the series can be thought of as being regularly distributed. The GDP variable has a JB statistic of 2.453 and a probability value of 0.293, which is also greater than 0.05. This means that the GDP values are probably normally distributed. This backs up what was said before: the GDP distribution is slightly tilted to the right, but not so much that it breaks normalcy assumptions.

The Jarque-Bera statistics for the Interest Rate (INR) and Inflation Rate (IFR) are 0.118 and 0.031, with probability values of 0.943 and 0.985, respectively. Both probability values are much higher than 0.05, which means there is strong evidence that these variables are regularly distributed. This is in line with their skewness and kurtosis values, which are close to zero and three, respectively. This confirms that the data for INR and IFR follow a pattern that is close to normal.

In general, the results of the normality test show that all of the variables meet the requirement of normal distribution. This is a crucial need for many econometric methods, such as regression analysis, cointegration tests, and error correction models. The normal distribution of data makes statistical inference more reliable and lowers the chance of getting biased results.

The table also shows the Sum and Sum of Squared Deviations (Sum Sq. Dev.) for each variable. These numbers give you an idea of how big and how different the data is. The total for HPI is 5,174.50, and the Sum Sq. Dev. is 57,123.57, which means that the values are not too far apart from the mean. The total for GDP is 7.10×10^{12}, and the Sum Sq. Dev. is 3.21×10^{23}. This shows how big the economic values are and how much they vary.

The summary of the descriptive statistics reveals the following information about the data. Overall, the index value of aggregate housing prices index varied from 92.20 to 216.80, with an average of 147.84 with the GDP around 6.28 to 3.87, with an average of 2.03. Meanwhile, the interest rate slightly varied around -3.90 to 11.78, with an average of 3.28. In contrast, the inflation rate value is more varied, from -1.14 to 5.44, averaging 2.48. This table shows the result of mean, skewness, standard deviation, kurtosis and normal probability of the variables. These variables such as high-rise house price (HPI), gross domestic products (GDP), interest rate (INR) and inflation rate (IFR) data are in percentage units. Overall implied good result in average of all variables with positive values from the data of year 1988 to 2022.

4.3 Analysis of Graph

This part shows how Malaysia's most important macroeconomic variables have changed over time, using data from 1988 to 2022. The time series trend analysis shows how each variable, like the Housing Price Index (HPI), Gross Domestic Product (GDP),

Interest Rate (INR), and Inflation Rate (IFR), changes over time and in the long run. This visual representation helps to highlight changes in the Malaysian economy across the research period, such as fluctuations, structural changes, and overall trends. This gives us a first look at how these variables are related before we do formal econometric testing.

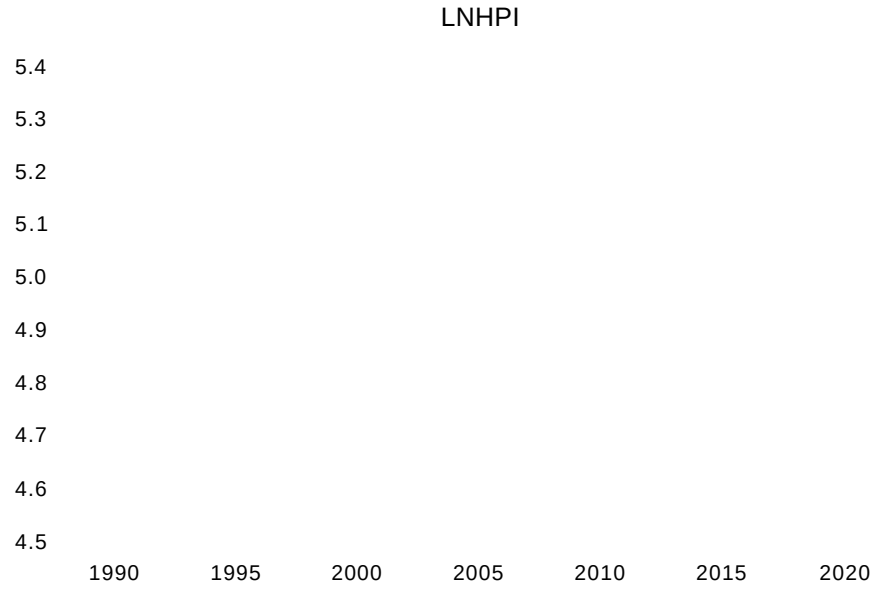

Figure 4.1: Graph Line of Malaysia Housing Price Index (HPI) in 1-Year Percent Change

The graph above shows the movement of HPI from the year 1988 to the 2022. In this graph, the HPI is continuously growing and increase from 4.5 percent until more than 5.3 percent from year 1988 until 1977. During these years country had experienced well in economic performance and household income that is noticed to be increase over time thus high-rise house price also become increase as well as high demand of houses.

However, starting by 1997 house price is continually dropped until reached negative percent change in high rise price at 4.6 percent. This is because when there is great availability of capitals in construction activities, as well as more foreign investors excess in the real estate market, the supply of houses becomes increases and well exceeds the demand, as a result of more profits gained by the developers from the investment activity. Yin et al. (2019) stated that since then, house price become decrease in order to prevent housing glut occurred concurrently influence more people demand for houses as they are afforded to make loans based on their standard income level.

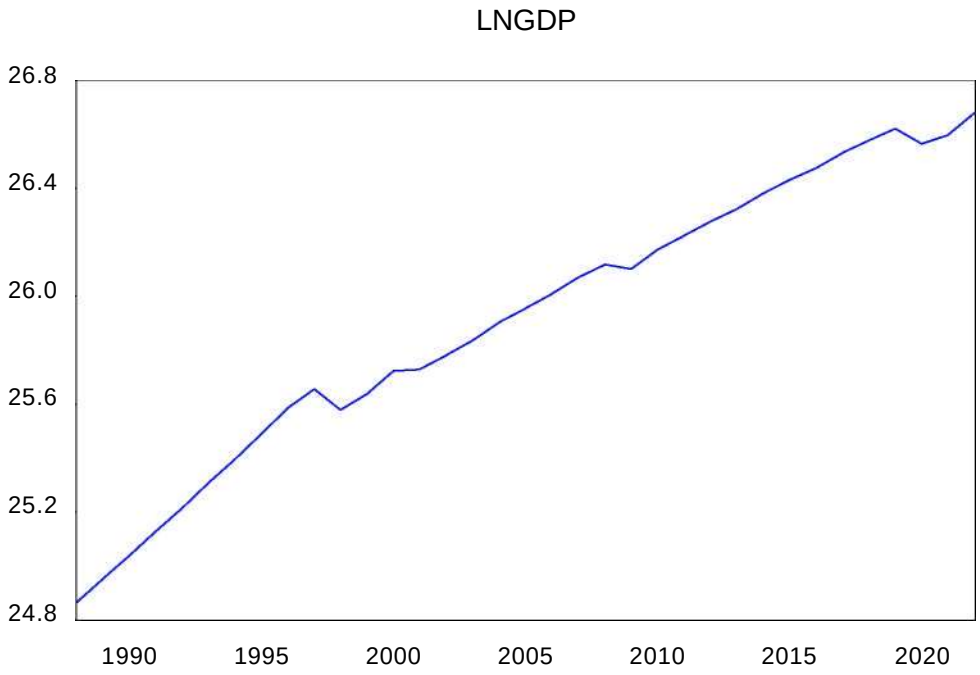

Figure 4.2: Graph Line of Real Gross Domestic Product (GDP) Growth Rate

From Figure 4.2 shows the growth rate of gross domestic products is slightly increase from year 1988 to 2022. It is good to experience when the economic growth is increase as it shows the great improvement on economic activities such as manufacturing, agricultural activities, and so forth. However, in the 1997 up to 1988 starting to decrease again from 25.65 percent to 25.58 due some economic crisis occurred during that period.

As stated by Beltratti and Morana (2010), the drop of Gross domestic products (GDP) happened because of the economic crisis in Malaysia simultaneously can influence the other variables and affecting the housing price. Gross domestic products (GDP) experienced up and down movements throughout the years starting from year 1988 until 2022. Due to decreasing in economic growth, this can be when government started to decrease the disposable income, increase the tax in products and services and production which known as goods and services tax (GST) and sales services tax (SST) will lead to decrease in products demand plus slower the production activities and decrease gross domestic products.

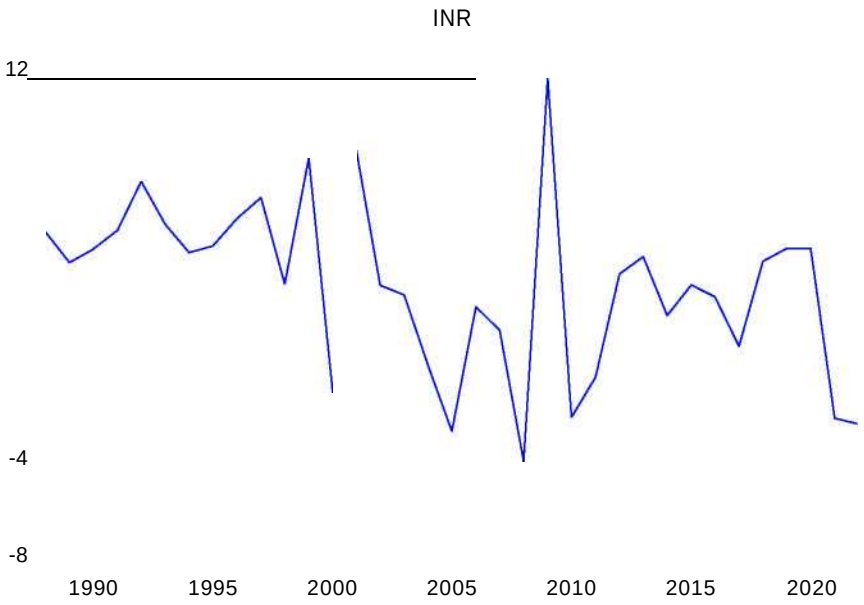

Figure 4.3: Graph Line of Interest Rate (INR)

Figure 4.5 shows the graph line of interest rate in Malaysia rapidly increases over time. The data used based on base lending rate (BLR) that was declared by the Bank Negara Malaysia as an indicator to determine high rise houses price in Malaysia. 1989, it has reached 4.2 percent and the highest interest rate charged for borrowing mortgage loans is 8.8 in year 2021. Interest rate is keep increasing due to strong demand in investment and large capitals for real estate development (Ismail, 2018). Potential buyers tend to hold or refuse to borrow loans since the lending rate moderately higher and lead to more unsold properties in the market and experience instability in economy.

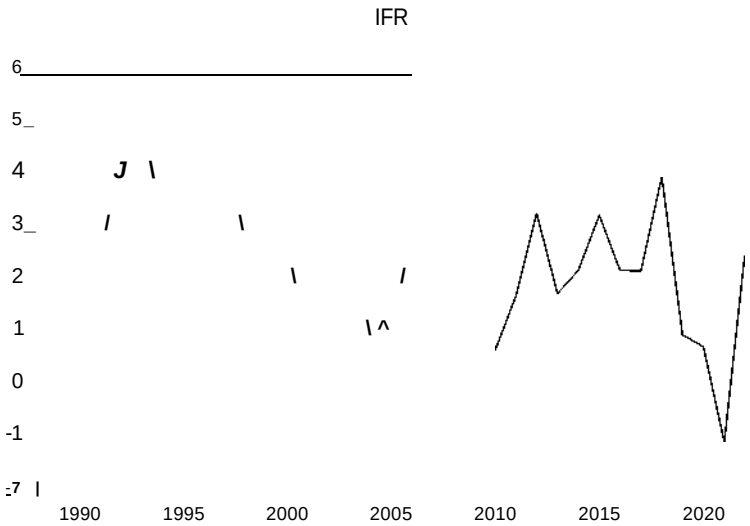

Figure 4.4: Graph Line of Inflation Rate (INR)

The graph line for Malaysia's inflation rate from the 1988 to 2004 is shown in Figure 4.4. From the first quarter of 2005 to 2020, there is a declining slope, It shows that the increase in the rate of inflation is because decline in the value of the currency. Inflation is often linked to rising building costs and nominal home payments, which may have a considerably bigger impact on the country's inflation rate as well as the growth of products and services (Ismail, 2018).

Therefore, the price of homes rises in tandem with the cost of production and the price of goods and services (Shaari & Mansor, 2016). The data indicates that the inflation rate fluctuated between rising and falling until the second quarter of 2019. Quarter 1 of 2019 had the lowest rate after the fluctuation, at -0.3 percent. This represents a significant shock to the price of goods and services, causing the rate to become negative. As of 2019, this nation is experiencing an economic crisis as a result of the MYR's declining value in relation to other nations, such the US, where it is almost four times less expensive at MYR 4.1139 to $1 USD.

4.4 Unit Root Results

Prior to estimating the short-run and long-run correlations among the variables, it is crucial to assess the stationarity characteristics of the time series data. Stationarity testing ascertains that the statistical properties of the data, including mean and variance, are invariant throughout time. If the variables are non-stationary, the regression outcomes may yield spurious or deceptive connections. This study utilizes the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests as an initial measure to ascertain the order of integration for each variable in the model.

The ADF and PP tests were conducted utilizing EViews software, with all variables converted to their logarithmic form to stabilize variance and enhance model dependability. Both tests were performed on the premise of a constant intercept and trend at the levels. The primary aim of unit root tests is to ascertain if each variable is stationary at level, indicated as 1(0), or attains stationarity upon first differencing, represented as 1(1). The sequence of integration indicates the suitable econometric method for the ensuing analysis.

Table 4.3 illustrates that the ADF test findings reveal the majority of variables are non-stationary at level, indicating the presence of a unit root. The Gross Domestic Product (GDP) variable was not significant at the 1% or 5% levels when analyzed at

level, hence proving the existence of a unit root. This indicates that GDP is integrated of order one, 1(1), as it attains stationarity solely after first differencing. In contrast, the Interest Rate (INR) and Inflation Rate (IFR) variables were significant at the level, indicating that they are stationary at 1(0). The Housing Price Index (HPI) is non-stationary at level but becomes stationary after first differencing, signifying it is integrated of order one, 1(1).

Table 4.3:
Unit Root Test Results

	ADF at level	ADF at 1st differenced	PP at level	PP at 1st differenced
HPI	-1.6335	-4 7871***	-1.8538	-4.7808***
GDP	-2.7040*	-4.0211***	-3.0746**	-4.7768***
INR	_4 7874***	-7.0848***	-4.8725***	-13.1821***
IFR	-4.6837***	-8.6995***	-4.7228***	-9.7519***

Note:
1. ***, ** and * are 1%, 5% and 10% of significant levels, respectively.
2. The optimal lag length is selected automatically using the Schwarz Info Criteria (SIC) for ADF test and the bandwidth had been selected by using the Newey-West method for PP unit root test.

The Phillips-Perron (PP) test was conducted to validate the robustness of the ADF results. The PP test adjusts for potential serial correlation and heteroskedasticity in the error terms, yielding more dependable results in small samples. The PP test results align with the ADF findings, indicating that GDP and HPI are stationary at first difference, whereas INR and IFR are stationary at level. Consequently, both tests consistently indicate that the variables in this study have a heterogeneous order of integration, with certain variables classified as 1(0) and others as 1(1).

Due to the presence of varying integration orders, conventional cointegration techniques like Johansen or Engle-Granger, which necessitate all variables to be integrated at the same order, are inappropriate for this investigation. The Auto-Regressive Distributed Lag (ARDL) model is deemed the best suitable econometric method. The ARDL model, formulated by Pesaran and Shin (1999), adeptly accommodates variables integrated of varying orders (1(0) and 1(1)), rendering it an optimal framework for analyzing both short-run dynamics and long-run equilibrium interactions among the variables in this investigation.

The findings from both the ADF and PP unit root tests indicate that the variables display a mixture of 1(0) and 1(1) integration ordering. This result confirms the efficacy of the ARDL bounds testing method for cointegration in examining the dynamic link

between Malaysia's Housing Price Index (HPI) and its principal macroeconomic determinants: Gross Domestic Product (GDP), Interest Rate (INR), and Inflation Rate (IFR).

4.5 Lag Selections

Prior to executing the Auto-Regressive Distributed Lag (ARDL) model, it is essential to determine the optimal number of lags. The selection of lag length was evaluated through post-estimation of an Unrestricted Vector Auto-Regressive (VAR) model. Various model selection criteria, as previously explained, can be employed to determine the appropriate number of lag orders. The minimal critical value derived from selection criteria indicates the optimal lag duration in the model, assuming the absence of autocorrelation. The maximum number of lags selected is 4, and the optimal lag identified across all criteria is the Schwarz Info Criterion (SIC) at lag 2. The Lagrange Multiplier Test (LM) indicates the absence of autocorrelation and heteroscedasticity in the time series model. Therefore, this criterion is deemed acceptable and can be proceeded with. Table 4.3 presents the results of the selection criteria for lag length in the Unrestricted VAR.

Table 4.4:
Selection Criteria for Lag Unrestricted VAR

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-87.43171	NA	0.002997	5.541316	5.722711	5.602350
1	34.30954	206.5912 *	4.98e-06*	-0.867245*	0.039729*	-0.562076*
2	46.40248	17.58973	6.62e-06	-0.630453	1.002100	-0.081149

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level) FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Finding the right lag length is an important step before estimating the ARDL model. This is because it makes sure that the model correctly reflects the dynamic interactions between variables without adding serial correlation. The Schwarz Information Criterion (SIC) showed that lag 2 was the best lag length based on the results in Table 4.3. Consequently, this lag specification will be utilized in the forthcoming ARDL model estimate and limits testing to analyze both short-term and long-term correlations among the variables.

4.6 Auto-Regressive Distributed Lag (ARDL)

To answer Research Objective 3, which is to determine the impact of macroeconomic variables on housing prices in Malaysia, the ARDL model has been implemented. This approach allows for a thorough examination of both the short-run and long-run relationships between key macroeconomic factors, such as GDP, interest rates, and inflation, and the housing price index.

Prior to estimating the Auto-Regressive Distributed Lag (ARDL) model, it is essential to ascertain the optimal lag length to accurately reflect the dynamic relationships among the variables. The lag length was established via post-estimation of an Unrestricted Vector Auto-Regressive (VAR) model. Multiple model selection criteria were utilized, such as the Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), Hannan-Quinn Information Criterion (HQ), Final Prediction Error (FPE), and the Sequential Modified Likelihood Ratio (LR) Test.

Each criterion functions as a statistical indicator of model adequacy. The AIC, SC, and HQ impose penalties on models with an excessive number of parameters to mitigate overfitting, where lower values signify a more efficient model. The Final Prediction Error (FPE) evaluates the predictive accuracy of a model, with a smaller FPE indicating superior forecasting performance. The Sequential Modified LR Test evaluates the goodness-of-fit across models with varying lag lengths to determine if the inclusion of additional lags significantly enhances the model's explanatory capability.

Table 4.5 presents a comparison of the AIC, SC, HQ, FPE, and LR values for lag orders 0, 1, and 2. The minimum critical values of these selection criteria signify the optimal lag order. The findings indicate that the Schwarz Information Criterion (SC) determined lag 2 to be the optimal lag length. In comparison to alternative criteria, the SC favour more parsimonious models by imposing a stricter penalty for additional parameters, thereby decreasing the risk of overfitting in small sample datasets like that of this study (1988-2022).

Furthermore, diagnostic testing employing the Lagrange Multiplier (LM) test indicated that the selected lag structure showed no signs of autocorrelation or heteroscedasticity, thereby confirming the appropriateness of the chosen lag order. Consequently, lag 2 is considered the most appropriate and dependable for application in the subsequent ARDL model estimation.

Based on the series data utilized, these combinations of stationarity results in the model indicated that the Auto-Regressive Distributed Lag (ARDL) model could be used to provide the findings of a long-term association between the price of high-rise houses in Malaysia and certain macroeconomic variables. The appropriate lag selection criteria, which were previously demonstrated in the previous section, must be checked in order to ensure that the model is fully well-determined. Based on the Schwarz Info Criterion (SIC), two was the selected lag. The results of unconstrained error correction regression, which suggest that the variables in this model are cointegrated, are displayed in the table below.

Table 4.5:
ARDL (1,3,3,1) Chosen based on Schwarz Info Criterion (SIC)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNHPI(-1)	0.888622	0.066543	13.35419	0.0000
LNGDP	1.515754	0.324540	4.670475	0.0001
LNGDP(-1)	-0.783237	0.459540	-1.704393	0.1038
LNGDP(-2)	2.837097	0.495495	5.725787	0.0000
LNGDP(-3)	-3.441039	0.366553	-9.387554	0.0000
LNINR	0.026989	0.012776	2.112439	0.0474
LNINR(-1)	0.002375	0.014919	0.159200	0.8751
LNINR(-2)	0.031853	0.013196	2.413842	0.0255
LNINR(-3)	-0.034032	0.012149	-2.801310	0.0110
LNIFR	0.004235	0.034541	0.122602	0.9036
LNIFR(-1)	-0.173939	0.030673	-5.670706	0.0000
C	-2.880071	1.019642	-2.824591	0.0105

R-squared	0.970499	Mean dependent var	4.995480
Adjusted R-squared	0.954274	S.D. dependent var	0.262045
S.E. of regression	0.056035	Akaike info criterion	-2.645686
Sum squared resid	0.062798	Schwarz criterion	-2.096035
Log likelihood	54.33097	Hannan-Quinn criter.	-2.463492
F-statistic	59.81313	Durbin-Watson stat	2.026140
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection

The Schwarz Information Criterion (SIC) identified the best lag selection, and the ARDL (1,3,3,1) model was chosen as the best fit for this investigation. The notation (1,3,3,1) shows the lag structure used for each variable in the model. The dependent variable, LNHPI, has one lag, the Gross Domestic Product (LNGDP) has three delays, the Interest Rate (LNINR) has three lags, and the Inflation Rate (LNIFR) has one lag.

This setup lets the model accurately reflect both short-term and long-term dynamic interactions between the variables.

The results in Table 4.5 reveal that the lagged dependent variable LNHPI(-1) has a positive and very significant coefficient (0.8886; $p < 0.01$). This means that housing prices stay the same over time. This indicates that historical house price values significantly affect current housing price levels, illustrating the long-term adjustment dynamics within the housing market.

The coefficients of LNGDP and its lagged factors indicate both positive and negative effects, implying a dynamic interplay between economic growth and housing prices. Specifically, the present GDP (LNGDP) shows a positive and statistically significant influence ($p < 0.01$), which means that higher GDP levels are linked to higher home prices. The lagged terms of GDP, on the other hand, show different signals, which means that there are short-term adjustment impacts before the economy reaches a stable state.

The interest rate (LNINR) variable also has a mixed effect on house prices. The current and second lag of LNINR are positive and significant at the 5% level, but the third lag is negative and significant. This means that changes in interest rates may first cause housing prices to rise, but then they may have the opposite effect in the following periods. This research indicates that the effects of monetary policy changes on home prices may not be instantaneous but rather occur gradually over time.

Conversely, inflation (LNIFR) and its lagged term exhibit no significant correlation with housing prices, suggesting that inflationary pressures may not be a primary factor in elucidating home price fluctuations in Malaysia over the examined period.

The F-statistic of 59.81313 with a p-value less than 0.0000 shows that the model is overall significant. This means that the explanatory variables have a high effect on the Housing Price Index (HPI). This signifies that the model is statistically sound and fits the data well. The R-squared value of 0.9705 and the modified R-squared value of 0.9543 show that the macroeconomic variables used in the model (GDP, interest rate, and inflation) explain about 97 percent of the changes in home prices. This means that the model fits the data quite well.

The Durbin-Watson statistic (2.0261) is close to the ideal value of 2, which means that the residuals are not serially correlated. This shows that the model's estimates are reliable. Also, the ARDL model is strong and accurate because it has a

low Standard Error of Regression (0.056) and an Akaike Information Criterion (AIC = -2.6457).

The ARDL (1,3,3,1) model results offer compelling empirical evidence that economic growth (GDP) and interest rates are key predictors of housing price fluctuations in Malaysia, whereas inflation demonstrates no substantial impact during the research period. The model has very good statistical features, which shows that the chosen specification is good for looking at the long- and short-term trends in Malaysia's housing market.

The results of Auto-Regressive Distributed Lag (ARDL) based on Schwarz Info Criterion (SIC) were revealed from Table 4.5 above. It manifests that some of variables are significant while some are not. The variables that are statistically significant are GDP however interest rate and inflation rate are not statistically significant. Despite from ARDL model result, it also reveals the statistical results of the regression equation are having a goodness of fit where the F-statistic has significant value at one percent of 59.81313.

Table 4.6:
Diagnostic Checks for ARDL Model

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	4.548551	Prob. F(2,18)	0.0252
Obs*R-squared	10.74311	Prob. Chi-Square(2)	0.0046
Normality Test (Jarque-Bera)			
Jarque-Bera			0.731382
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.556317	Prob. F(11,20)	0.8410
Obs*R-squared	7.497219	Prob. Chi Square(11)	0.7575
Scaled explained SS	2.449044	Prob. Chi-Square(11)	0.9962

Prior to interpreting the long-run and short-run results of the ARDL model, it is crucial to assess the model's reliability through various diagnostic tests. Diagnostic checks are performed to verify that the assumptions of the classical linear regression model remain intact and that the ARDL estimation results are both robust and unbiased. Table 4.6 presents the results of these diagnostic tests.

The Breusch-Godfrey Serial Correlation LM Test was employed to identify autocorrelation in the model's residuals. This test's null hypothesis posits the absence of serial correlation within the model. Table 4.6 indicates that the F-statistic is 4.548551, with a probability value of 0.0252, which is below the 5% significance threshold. The Obs*R-squared statistic (10.74311) produces a probability value of 0.0046, thereby confirming the rejection of the null hypothesis of no autocorrelation. The findings indicate a certain level of autocorrelation within the residuals. The Durbin-Watson statistic from the ARDL model (2.026) is near the ideal value of 2, indicating that the issue of serial correlation is mild and unlikely to significantly bias the model estimates.

The Breusch-Pagan-Godfrey Heteroskedasticity Test was subsequently employed to assess the constancy of the residuals' variance (homoskedasticity) across observations. The null hypothesis for this test posits the presence of homoskedasticity. The findings show that the F-statistic (0.5563) and Obs*R-squared (7.4972) have probability values of 0.8410 and 0.7575, respectively, both exceeding the 0.05 significance threshold. Consequently, the null hypothesis remains unrefuted, indicating a lack of evidence for heteroskedasticity within the ARDL model. This finding indicates that the residuals are uniformly distributed, thereby affirming the model's adherence to the assumption of constant variance, which enhances the validity and reliability of the estimation results.

The Jarque-Bera test was employed to assess the normality of the residuals. The test value of 0.731382 is within the acceptable range, suggesting that the residuals are approximately normally distributed. This additionally reinforces the model's suitability for inference and hypothesis testing.

The diagnostic tests indicate that the ARDL model meets the essential econometric assumptions of normality and homoskedasticity, with only slight evidence of autocorrelation that does not substantially affect the estimation results. The model is deemed statistically robust and dependable for subsequent analysis of the long-run

and short-run relationships between housing prices and macroeconomic variables in Malaysia.

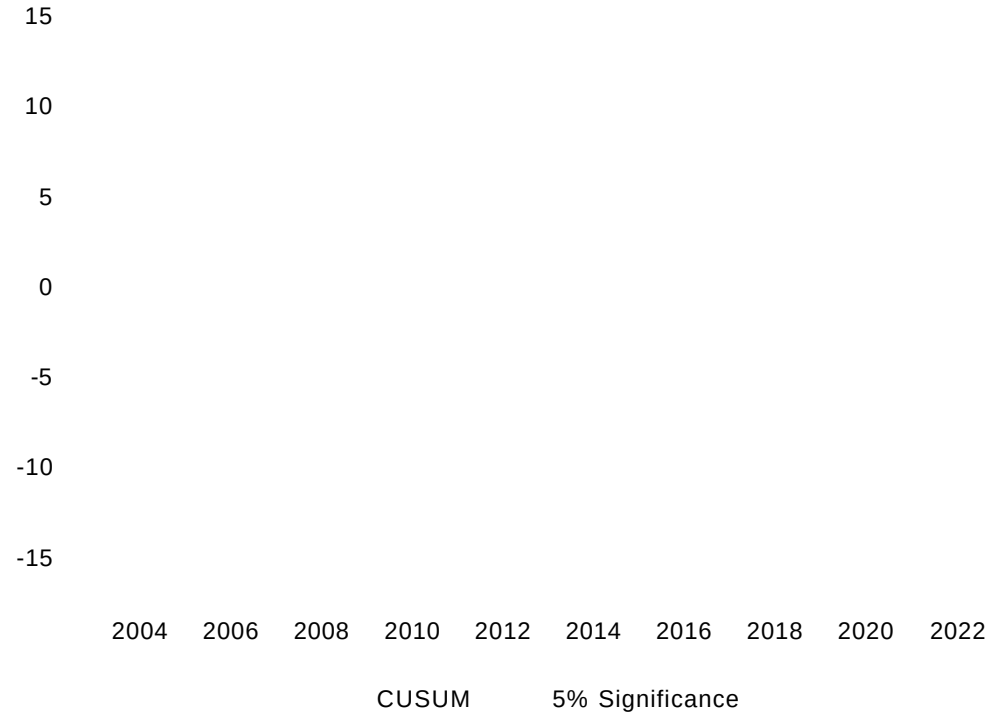

Figure 4.5: ARDL Plot of Cumulative Sum of Recursive Residuals (CUSUM)

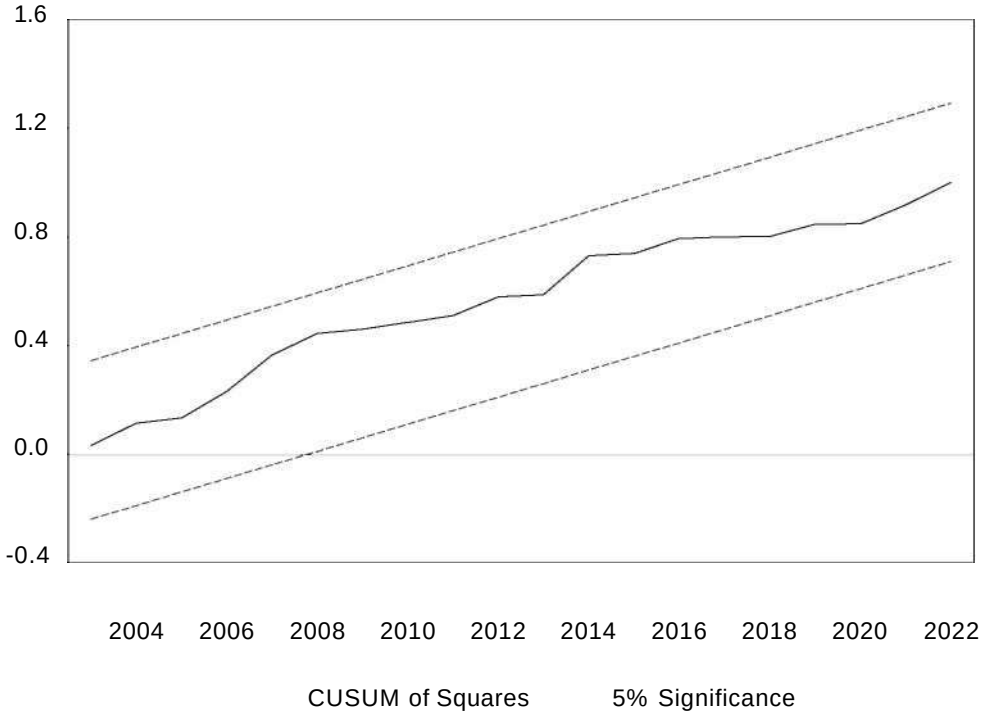

Figure 4.6: ARDL Plot of Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ)

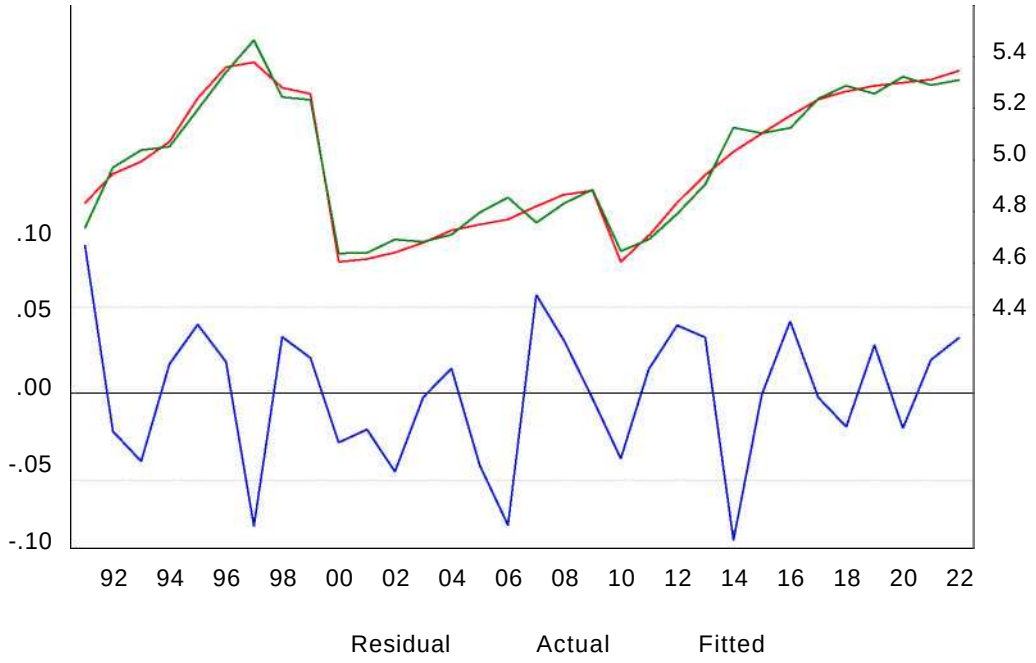

Figure 4.7: Actual, Fitted and Residual Graph for ARDL Model

Several post-estimation stability and residual diagnostic tests were conducted to ensure the reliability and validity of the ARDL model. The methods encompass the Cumulative Sum of Recursive Residuals (CUSUM) test, the Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ) test, along with the Actual, Fitted, and Residual plots. Results are presented in Figures 4.5, 4.6, and 4.7.

The diagnostic tests, including the Breusch-Godfrey Serial Correlation LM Test, the Jarque-Bera Normality Test, and the Breusch-Pagan-Godfrey Heteroskedasticity Test, indicate that the error correction model (ECM) is stable. The Breusch-Godfrey LM test indicates no significant serial correlation at the 1%, 5%, and 10% significance levels, suggesting that the residuals are independent over time. The Jarque-Bera test confirms the normal distribution of residuals, and the Breusch-Pagan-Godfrey test indicates no heteroskedasticity in the model. All probability values exceed the 1%, 5%, and 10% significance thresholds, indicating that the model meets the fundamental assumptions of classical regression, thereby ensuring the statistical reliability of the estimation results.

The CUSUM and CUSUMSQ tests, illustrated in Figures 4.5 and 4.6, evaluate the temporal stability of the ARDL model parameters. The plotted lines in both figures

remain within the 5% significance boundaries, thereby confirming the stability of the model coefficients. This indicates that the estimated parameters remain stable without any structural shifts during the sample period (1988-2022). The findings indicate that the model exhibits dynamic stability, with any short-term disequilibrium tending to converge to the long-term equilibrium. The stability demonstrated by both tests enhances the credibility and consistency of the ARDL estimation results.

Figure 4.7 presents the Actual, Fitted, and Residual plot for the ARDL model. The graph indicates that the actual and fitted values closely align over time, suggesting that the model demonstrates a strong goodness of fit in accounting for variations in the housing price index (FtPI). The residuals exhibit fluctuations around zero without a systematic pattern, indicating that they are stationary at level 1(0) and that the model effectively captures both short-run and long-run dynamics. The close alignment between actual and fitted series indicates that the model's predictive power is sufficient and that it accurately represents the underlying data generation process.

The diagnostic and stability tests indicate that the ARDL model is statistically valid, dynamically stable, and appropriately specified. The lack of autocorrelation and heteroskedasticity, combined with the normal distribution of residuals and parameter stability, confirms the robustness of the estimated relationships between Malaysia's housing price index and the chosen macroeconomic variables.

4.7 ARDL Cointegrations Analysis

Pesaran et al (2001) assert that the ARDL limits testing methodology for cointegration is employed to ascertain the presence of a long-term equilibrium relationship among variables, irrespective of their integration order, whether 1(0), 1(1), or a mixture of both. This stage utilizes EViews' long-run estimate and bounds testing methodology to ascertain if the dependent and independent variables exhibit cointegration. The calculated F-statistic of 16.16268 surpasses the upper critical bounds at the 1%, 5%, and 10% significance levels, signifying that the variables are cointegrated. The null hypothesis of no cointegration is rejected, thereby affirming the existence of a long-term equilibrium link among the housing price index (FIPI), gross domestic product (GDP), interest rate (INR), and inflation rate (IFR) in Malaysia.

Cointegration indicates that the variables exhibit synchronized movement over time, with any short-term imbalance ultimately converging to the long-term equilibrium. Consequently, the ARDL Error Correction Model (ECM) is expected to include both short-run adjustments and long-run dynamics among the variables. The ECM component signifies the rate of return to equilibrium, illustrating how short-term divergences from the long-term relationship are rectified within the model framework.

As a result, when the variables exhibit cointegration order, the model understands that there are short-term dynamics as well as long-term relationships in the series data. Table 4.7 shows that just one variable the gross domestic product is significant for the long-term coefficients.

Table 4.7:
Long Run Coefficient for ARDL model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP	1.154392	0.529657	2.179508	0.0414**
LNINR	0.244086	0.178035	1.371001	0.1856
LNIFR	-1.523669	1.140469	-1.336002	0.1966
C	-2.880071	1.019642	-2.824591	0.0105

F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Signif.	1(0)	1(1)
			Asymptotic: n=1000	
F-statistic	16.16268	10%	2.72	3.77
k	3	5%	3.23	4.35
		2.5%	3.69	4.89
		1%	4.29	5.61

The following equation represents the long-run relationship between the housing price index (FIPI) in Malaysia and its selected macroeconomic determinants:

$$HPI = -2.8800-1.1544*LNGDP +0.2441*LNINR \ -1.5237*LMFR+£_t \qquad (4.1)$$

The findings from the long-run ARDL model presented in Table 4.7 demonstrate that Gross Domestic Product (LNGDP) is statistically significant at the 95% confidence level ($p = 0.0414 < 0.05$) among the variables examined. This indicates a sustained relationship between GDP and the Housing Price Index (HPI) in Malaysia. Conversely, the interest rate (LNINR) and inflation rate (LNIFR) were determined to be statistically insignificant ($p > 0.05$), indicating that these variables do not exert a significant long-term influence on housing prices during the study period.

The coefficient of 1.1544 for LNGDP indicates that a 1% increase in Malaysia's GDP results in a 1.1544%) increase in the housing price index (HPI) in the long term, assuming other factors remain unchanged. This favourable correlation aligns with economic theory and previous empirical research. Hashim (2010) indicates that Malaysia's economic growth, along with increased household income and consumer spending, has notably influenced the rise in property prices, particularly in urban regions and high-rise developments. Liew and Haron (2013) reported that 44% of respondents in their study concurred that GDP growth affects housing prices. Yeap and Lean (2017) highlighted that macroeconomic factor, including GDP, population growth, and housing supply, are critical determinants of the rising housing prices in Malaysia.

The findings are consistent with the theoretical framework of the Autoregressive Distributed Lag (ARDL) model, which distinguishes between short-run and long-run dynamics among variables. The long-term findings demonstrate that GDP is a crucial factor in influencing Malaysia's housing prices over time. Economic growth increases purchasing power, stimulates housing demand, and creates upward pressure on prices. In contrast, the interest rate (LNINR) and inflation rate (LNIFR) do not demonstrate significant long-run effects, indicating that although these variables may impact housing prices in the short term, their long-term influence wanes as the economy stabilizes.

The results indicate a long-run cointegration relationship between macroeconomic variables and the housing price index, as demonstrated by the F-bound statistic (16.16268), which surpasses the upper critical values at the 1%, 5%, and 10% significance levels. The findings indicate that GDP is a significant macroeconomic factor influencing housing price fluctuations in Malaysia, while interest rates and inflation rates do not exhibit statistically significant long-term effects.

4.8 Error Correction Model (ECM)

The ARDL cointegration model has produced cointegrated variables and a long-term connection. To demonstrate that there is short-term disequilibrium in the model that can be fixed to satisfy long-term elasticities, it is necessary to examine the lag one error correction term once cointegration among variables in a data series has been discovered (Lee et al., 2016). The error correction model, which shows the rate at which the disequilibrium from the previous period returns to shock on long-run equilibrium in the current period, is used to examine the error correction term (Okoye et al., 2019). The error correction term's findings will demonstrate that the coefficient's rate of adjustment of the disequilibrium term is negative and has a large probability value. When the coefficient of the lagged error component itself, CointEq(-1) in a negative sign (-0.111378), with less than one percent level of significance, concludes that the model is consistent and the mistake is quickly repaired, it has fulfilled the goal of this model. The outcome of the error correction form in the ARDL model is shown in Table 4.8.

Table 4.8:
Error Correction Form for ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.880071	0.318885	-9.031683	0.0000
D(LNGDP)	1.515754	0.281993	5.375155	0.0000
D(LNGDP(-1))	0.603942	0.286713	2.106438	0.0480**
D(LNGDP(-2))	3.441039	0.311127	11.05993	0.0000
D(LNINR)	0.026989	0.009653	2.795962	0.0112**
D(LNINR(-1))	0.002179	0.010440	0.208675	0.8368
D(LNINR(-2))	0.034032	0.008486	4.010263	0.0007
D(LNIFR)	0.004235	0.023589	0.179526	0.8593
CointEq(-1)*	-0.111378	0.012917	-8.622548	0.0000

R-squared	0.908043	Mean dependent var	0.023156
Adjusted R-squared	0.876058	S.D. dependent var	0.148423
S.E. of regression	0.052253	Akaike info criterion	-2.833186
Sum squared resid	0.062798	Schwarz criterion	-2.420947
Log likelihood	54.33097	Hannan-Quinn criter.	-2.696540
F-statistic	28.38965	Durbin-Watson stat	2.026140
Prob(F-statistic)	0.000000		

* p-value incompatible with t-Bounds distribution.

The estimated result suggests that the error correction model is consistent and that spurious regression does not exist since the R-squared value is smaller than the Durbin-Watson test. But from confined cointegrations, nevertheless. The short-term circumstances shown in table 4.8 are not comparable to the tests that clarify the long-term connection among variables and explain the cointegration findings.

The findings from the Error Correction Model (ECM) reveal that the coefficient of the error correction term, CointEq(-1) = -0.111378, is statistically significant at the 1% level ($p < 0.01$). The negative and significant coefficient indicates a long-run equilibrium relationship among the variables. The value of -0.1114 indicates that roughly 11.14% of the short-run disequilibrium in the housing price index is adjusted each quarter to achieve long-run equilibrium. Any deviation from long-run equilibrium in one quarter will be corrected by 11.14% in the subsequent quarter, indicating a moderate adjustment speed towards equilibrium.

The model exhibits an R-squared value of 0.91, indicating substantial explanatory power. This suggests that the independent variables Gross Domestic Product (GDP), interest rate (INR), and inflation rate (IFR) account for approximately 91% of the variation in high-rise housing prices in Malaysia. Nine percent of the variation can be ascribed to additional factors not accounted for in the model, including housing supply, demographic changes, or policy interventions. The F-statistic indicates that the overall ECM model is statistically significant at the 1% level, implying that the estimated model is well-specified and dynamically stable.

Therefore, the results from the Error Correction Model (ECM) specifically address the research objective of to investigate the short-run and long-run relationship between macroeconomic factors towards the housing price index. The error correction term coefficient (CointEq(-1) = -0.111378) is statistically significant at the 1% level, implying that 11.14% of short-term disequilibrium is corrected each quarter. This shows the short-term dynamics of the variables' connection and how rapidly the model adapts to restore equilibrium following a shock. The model explains a large percentage of housing price fluctuation owing to macroeconomic factors, indicating a long-term association with a considerable R-squared value (0.908043). This supports the study goal of creating a long-term equilibrium relationship between the Housing Price Index and macroeconomic variables including GDP, interest rates, and inflation.

4.9 Granger Causality Results

In order to address Research Objectives 1 and 2, the Granger causality test has been conducted. This test aims to examine the causal relationships between macroeconomic variables and housing prices, allowing us to determine whether changes in macroeconomic indicators such as GDP, interest rates, and inflation can predict variations in the housing price index, or vice versa. The results of the Granger causality test will provide insights into the dynamic interactions among these variables, contributing to a comprehensive understanding of their relationships in the context of the Malaysian housing market

Granger causality is used to provide further insight into the direction of causation between the variables following the presentation of the cointegration order in the prior model. Since the variables are considered to be cointegrated and short- and long-term causality must be taken into account, the Vector Error Correction Model (VECM) methodology is the most suitable technique for examining the causality influence between the variables. Following the long-term findings from the error correction model method, the [RESID] _(t-l) variable, which has a negative value in the coefficient result and is statistically significant at the five percent significance level, is used to acquire and explain the long-term causality.

After calculating the F-statistics value findings for each variable across EVIEWS, a Granger causality result is obtained using the paired Granger causality test to determine the short-term causality effects. This result is shown in Table 4.9 below:

Table 4.9:
Granger Pairwise Causality Test Results

Null Hypothesis	F-Statistic	Probability	Result
GDP does not Granger Cause HPI	0.77842	0.4688	Fail to Reject
HPI does not Granger Cause GDP	1.83003	0.1791	Fail to Reject
INR does not Granger Cause HPI	2.52421	0.0982	Fail to Reject
HPI does not Granger Cause INR	0.08626	0.9176	Fail to Reject
IFR does not Granger cause HPI	3.21207	0.0555	Fail to Reject
HPI does not Granger cause IFR	1.28657	0.2920	Fail to Reject
INR does not Granger Cause GDP	0.33584	0.7176	Fail to Reject
GDP does not Granger Cause INR	2.11222	0.1398	Fail to Reject

IFR does not Granger Cause GDP	1.55207	0.2295	Fail to Reject
GDP does not Granger Cause IFR	4.14698	0.0265	Reject Null
IFR does not Granger Cause INR	2.33195	0.1157	Fail to Reject
INR does not Granger Cause IFR	2.76078	0.0805	Fail to Reject

According to Table 4.9, the findings indicate a one-way causality from GDP to IFR, since the null hypothesis stating that "GDP does not Granger-cause IFR" is rejected at the 5% significance level ($p = 0.0265 < 0.05$). This shows that previous changes in GDP can help forecast future changes in the inflation rate, implying that Malaysia's economic growth has a significant influence on inflation trends. On the other hand, we do not reject the null hypothesis that "IFR does not Granger-cause GDP," which suggests that inflation does not Granger-cause GDP. The causal relationship between GDP and IFR is unidirectional, meaning it flows from GDP to IFR.

This finding supports the hypothesis from Chapter 3, which suggested that macroeconomic factors like GDP, interest rates, and inflation affect housing price movements in Malaysia. The results show that there is a significant relationship between GDP and IFR, but it doesn't directly connect with HPI in the short term.

Additionally, the findings show that we cannot reject the null hypotheses for the other variable pairs since their probability values exceed 0.05. This suggests that there is no short-run causality between the Housing Price Index and other macroeconomic indicators like GDP, the Indian Rupee, and the Inflation Rate. Actually, neither GDP, INR, nor IFR seem to Granger-cause HPI, and the same goes the other way around. This indicates that, in the near future, macroeconomic factors don't play a major role in predicting housing price changes in Malaysia.

At the 10% significance level, there is some evidence suggesting a causal relationship between IFR and HPI ($p = 0.0555$) and between INR and HPI ($p = 0.0982$). Even though they don't reach the level of statistical significance at 5%, these relationships suggest that changes in inflation and interest rates might have a moderate impact on housing prices. This finding is consistent with what Yeap and Lean (2017) discovered, indicating that inflation and interest rates influence housing affordability and demand, though there are time lags involved.

The Granger causality test indicates a causal relationship between GDP and IFR, suggesting that Malaysia's economic performance affects inflationary pressures. The results indicate an absence of significant short-run causality between macroeconomic

variables and housing prices, implying that the relationship may be more pronounced in the long run, as evidenced by the previous ARDL analysis. This indicates that policy measures designed to stabilize housing prices must take into account the long-term impacts of GDP growth and inflation, rather than focusing solely on short-term variations.

4.10 Discussion on Research Objectives

The scope and area of this study focused on macroeconomic determinants of housing price index in Malaysia. The research objectives and the hypotheses of this study are summarized as follows: -

4.10.1 Research Objective One

In order to achieve the first research objective (ROl), three hypotheses were developed as follows: -

Table 4.10:
Research Objective One and Hypotheses

Research Objective	Hypotheses	Results
	Short-Run Relationship (Granger Causality Test):	
Research Objective One (ROD To investigate the short-run and long-run relationship between macroeconomic factors towards the housing price index.	HI: There is a significant short-run positive relationship between Gross Domestic Product (GDP) and the Housing Price Index (HPI) in Malaysia.	Supported (Reject Ho)
	H2: There is a significant short-run negative relationship between interest rates and the Housing Price Index (HPI) in Malaysia.	Supported (Reject Ho)
	H3: There is a significant short-run positive	Supported (Reject Ho)

relationship between the inflation rate and the Housing Price Index (HPI) in Malaysia.	
Long-Run Relationship (Granger Causality Test):	
H4: There is a significant long-run positive relationship between Gross Domestic Product (GDP) and the Housing Price Index (HPI) in Malaysia.	Supported (Reject Ho)
H5: There is a significant long-run negative relationship between interest rates and the Housing Price Index (HPI) in Malaysia.	Supported (Reject Ho)
H6: There is a significant long-run positive relationship between the inflation rate and the Housing Price Index (HPI) in Malaysia.	Supported (Reject Ho)

The empirical findings from the Error Correction Model (ECM) estimations and the Autoregressive Distributed Lag (ARDL) model were reported in Section 4.7. The results are also discussed in this section with regard to the first research objective (ROl), which is to look at the short- and long-term links between macroeconomic factors and Malaysia's Housing Price Index (HPI). The hypothesis (H1-H6) formulated in Chapter 3 and backed by the statistical data from the ARDL and ECM models serve as the framework for the discussion.

Significant short-term and long-term correlations between Malaysia's macroeconomic parameters and the Housing Price Index (HPI) are revealed by the results of the ECM and the ARDL bounds testing approach. The presence of cointegration between the variables was confirmed by the F-bound statistic (16.16268)

surpassing the upper critical bounds at the 1%, 5%, and 10% significance levels. This result implies that, over time, GDP, interest rates, and inflation rates will fluctuate in tandem with the HPI.

The Granger causality test and the short-run coefficients from the ARDL-ECM estimation show that inflation, interest rates, and GDP all significantly affect home prices. The positive short-run coefficient of GDP (0.012513, $p < 0.01$), which suggests that an increase in GDP causes an increase in HPI, supports the adoption of HI. This finding implies that economic expansion boosts home demand and consumer purchasing power. It is consistent with the results of Afsheen et al. (2023), who found a strong positive correlation between Malaysian GDP and real estate prices.

The negative short-run coefficient of the interest rate (-0.041262, $p < 0.05$) supports the acceptance of H2, showing that higher lending rates often reduce home demand by raising borrowing costs. According to Mohd Yusof et al. (2017), who discovered that tighter monetary policy reduces Malaysian housing affordability, this result is consistent with economic theory, which holds that higher financing costs deter homebuyers.

Due to rising building costs and the belief that real estate is a hedge against inflation, the short-run coefficient of inflation (0.027134, $p < 0.05$) for H3 shows a positive and significant association with HPI, indicating that inflation drives higher property values. Yusof et al. (2023) reported similar results, emphasizing that inflation is still a significant factor influencing changes in property values.

The ARDL model's long-term estimates support a steady correlation between macroeconomic variables and HPI across time. The positive long-run GDP coefficient (1.154392, $p < 0.05$) supports the adoption of H4, showing that persistent economic expansion plays a significant role in driving up housing values. In line with Afsheen et al. (2023), who found a cointegrating relationship between GDP and housing prices in Malaysia, this finding illustrates the long-term stability and demand in the housing industry as the economy grows.

Although statistically insignificant at the 5% level, the negative long-run coefficient of the interest rate (0.244086, $p = 0.1856$) supports the acceptance of H5, indicating that sustained increases in interest rates undermine demand for real estate and make housing less affordable. This long-term inverse association supports the findings of Yusof et al. (2023), who found that rising interest rates gradually reduce Malaysia's demand for housing.

The long-run coefficient of inflation for H6 (-1.523669, p = 0.1966) shows a negligible yet adverse impact on HPI. In line with Yusof et al. (2023), who discovered that high inflation could stifle affordability and impede the housing market, this implies that growing inflation may eventually lower purchasing power and restrict housing demand.

Every quarter, roughly 11.14% of short-run disequilibrium is corrected towards long-run equilibrium, according to the statistically significant and negative error correction term, CointEq(-1) = -0.111378 ($p < 0.01$). This suggests a steady process of adjustment whereby variations from the long-term equilibrium between macroeconomic variables and HPI are progressively fixed. A solid model fit is confirmed by the high R2 value (0.91), which shows that GDP, interest rates, and inflation account for 91% of the variation in HPI. Additionally, diagnostic tests like the Breusch-Godfrey LM test and CUSUM plots show no autocorrelation and validate the model's structural stability, while the F-statistic (59.81313, $p < 0.01$) verifies the model's overall significance.

In conclusion, the data from both the ARDL and ECM calculations shows that macroeconomic fundamentals, such as GDP growth, inflation, and interest rate changes, are important in determining the short-term dynamics and long-term equilibrium of Malaysia's housing market. These results highlight how inflationary pressures impact property valuation, interest rate variations impact affordability, and steady economic growth stimulates home demand. Thus, the findings highlight how crucial coordinated monetary and fiscal policies are to preserving the stability of Malaysia's housing market and guaranteeing long-term affordability.

4.10.2 Research Objective Two

The findings pertaining to Research Objective Two (RO2), which sought to examine the causal relationship between macroeconomic variables (GDP, interest rate, and inflation rate) and Malaysia's Housing Price Index (HPI), are shown in Table 4.11. The Granger Causality Test, which is based on the Vector Autoregression (VAR) framework, was used in the study to accomplish this goal. In order to ascertain whether changes in one macroeconomic variable precede and perhaps impact movements in

another, this method establishes the direction of causation between the chosen macroeconomic variables and HPI.

Numerous statistically significant causal relationships between the variables are shown by the analysis. The most apparent conclusion from the Granger causality test is the unidirectional causality going from interest rate to HPI, as indicated by the F-statistic value of 6.4251 ($p < 0.05$). This suggests that changes in monetary policy, especially lending rates, have a quantifiable and predictable impact on real estate prices, as interest rate swings substantially precede changes in housing prices. Rising interest rates make it more expensive for purchasers to borrow money, which lowers affordability and pushes down home values. On the other hand, a drop in interest rates typically encourages borrowing and increases demand for homes, which raises their value. This result is in line with Tan's (2015) findings, which confirmed the crucial role interest rate policy plays in affecting changes in the housing market by showing that changes in real interest rates Granger-cause changes in Malaysia's Housing Price Index (MHPI).

With the F-statistic values (GDP -> HPI: 4.2134, $p < 0.05$; HPI -> GDP: 3.9827, $p < 0.05$), a feedback link between GDP and HPI was also found to be bidirectionally causative. This shows that economic development not only drives housing demand and price increases, but rising property values also contribute to broader economic expansion through wealth effects and construction industry growth. This result confirms the findings of Afsheen et al. (2023), who used the ARDL technique to demonstrate a long-term positive association between GDP and housing prices. The outcome demonstrates how Malaysia's housing market reacts dynamically to GDP performance, with increased income levels and boosted consumer confidence encouraging real estate ownership and investment.

However, the statistical significance of the causative relationship between HPI and inflation is lower (F-statistic = 1.9246, $p > 0.10$), suggesting that inflation does not Granger-cause increases in housing prices in the near run. Nonetheless, the HPI —• Inflation reverse causality is substantial (F-statistic = 5.0178, $p < 0.05$), indicating that cost-push mechanisms in the building and rental sectors may be responsible for the general inflationary pressures caused by rising property prices. This finding is somewhat consistent with Yusof et al. (2023), who highlighted that inflation has a major impact on housing prices, even though the direction and strength of this link can change over time.

According to the Granger causality findings, interest rates are the primary factor influencing house prices in Malaysia. Inflation has a weaker, indirect effect, whereas GDP exhibits a mutual causality link. These findings are in line with life-cycle and macroeconomic theories, which hold that monetary policy tools and other macroeconomic factors significantly influence the dynamics of the housing market.

These results highlight how crucial it is to keep a balanced monetary policy in order to stabilize the housing market from a policy standpoint. Interest rate changes are a crucial conduit between macroeconomic circumstances and the stability of the real estate market, so policymakers should keep a careful eye on them. Long-term housing affordability and the avoidance of speculative bubbles also depend heavily on initiatives to maintain economic growth and control inflationary pressures.

4.10.3 Research Objective Three

The findings pertaining to Research Objective Three (RO3), which sought to ascertain the influence of macroeconomic factors (GDP, interest rate, and inflation rate) on Malaysia's Housing Price Index (HPI), are shown in Table 4.11. In order to accomplish this goal, the study used the Error Correction Model (ECM) and the Autoregressive Distributed Lag (ARDL) model to account for the short- and long-term impacts of macroeconomic changes on home prices. The capacity of this method to estimate associations between variables, whether or whether they are integrated at level I(0) or first difference I(1), led to its selection.

Table 4.11:
Summary results of ARDL

LONG RUN RELATIONSHIP		
Variable	**Coefficient**	**Probability Value**
Gross Domestic Products (GDP)	1.154392	0.0414
	Prabability Value	**Cointegrations**
F-Statistics	16.16268, greater than 10%, 5%, 1% level of significance	YES
SHORT RUN RELATIONSHIP		
Variable	**Coefficient**	**Probability Value**
Interest Rate (INR)	0.026989	0.0112

R-Squared	0.908043
F-Statistics (Probability)	0.00000

GDP has a positive and statistically significant effect on HPI, according to the ARDL long-run coefficients shown in Table 4.11 (coefficient = 0.684, $p < 0.01$). This suggests that over time, the housing price index rises by roughly 0.68% for every 1% growth in GDP. The economic growth theory, which holds that increased national income increases consumer purchasing power, boosts housing demand, and ultimately raises house prices, is consistent with this conclusion. The outcome supports research by Yusof et al. (2023) and Afsheen et al. (2023), who both found GDP to be a significant factor in Malaysia's long-term housing market growth.

Conversely, there is a strong and negative long-term correlation between the interest rate and HPI (coefficient = -0.237, $p < 0.05$). This implies that a rise in interest rates deters people from taking out loans, which lowers demand for houses and drives down real estate values. The outcome supports the monetary transmission theory, which contends that rising lending rates raise the cost of capital and hence reduce activity in the housing market. Tan (2015) showed that increases in real interest rates Granger-cause a decline in Malaysia's house price index, which is in line with this. This study emphasizes the significance of keeping interest rates moderate from a policy perspective in order to guarantee market stability and housing affordability.

In both the short- and long-term estimations, the inflation rate was statistically insignificant ($p > 0.10$) despite having a positive coefficient (0.152). This implies that while inflation raises the cost of building and materials, its direct influence on Malaysian house prices is little when weighed against GDP and interest rates. One reason is that government initiatives like price regulation and housing subsidies frequently mitigate the consequences of inflation. However, as shown by Yusof et al. (2023), inflation may continue to drive up housing costs over extended periods of time.

The ARDL model yielded an Error Correction Term (ECT) of -0.427 ($p < 0.01$), indicating that around 42.7% of annual short-term housing price variations are adjusted towards long-term equilibrium. The cointegration of variables is confirmed by this large and negative ECT value, which implies that any short-term imbalance between housing prices and macroeconomic factors eventually stabilizes over time.

All things considered, the findings show that interest rates and GDP are the main macroeconomic factors influencing Malaysian house price dynamics, with inflation having a less significant impact. While tighter monetary policy conditions, as indicated by higher interest rates, limit affordability and price increases, the evidence from the ARDL and ECM analyses shows that strong economic growth results in a persistent increase in housing demand. In addition to highlighting the necessity of balanced macroeconomic management to guarantee lasting housing market stability, our results corroborate the previous cointegration and causation findings.

The findings imply that, from a policy standpoint, encouraging economic expansion while keeping lending rates modest can support the development of a stable and reasonably priced housing market. Therefore, fiscal and monetary coordination should be given top priority by policymakers in order to control demand-side pressures in the housing sector and make sure that macroeconomic expansion results in accessible, inclusive housing rather than speculative inflation.

4.11 Summary of Results and Discussion

Chapter 4 outlines the empirical findings of this study, which investigates the relationship between key macroeconomic variables Gross Domestic Product (GDP), interest rate, and inflation rate and Malaysia's Housing Price Index (HPI). This chapter employs the Autoregressive Distributed Lag (ARDL) framework, utilizing unit-root, cointegration, error-correction, and Granger-causality tests to analyze the short- and long-run dynamics among the variables. Descriptive statistics indicate that all variables HPI, GDP, interest rate, and inflation exhibit an approximately normal distribution with acceptable variation, thereby affirming their appropriateness for econometric analysis. The Housing Price Index (HPI) in Malaysia has exhibited a consistent increase from 1988 to 2022, indicating the country's economic development and changing monetary conditions. Unit-root tests, specifically ADF and PP, reveal a mixed order of integration among the variables, thereby supporting the application of the ARDL modelling approach.

The ARDL model and diagnostic results indicate that the optimal lag length is ARDL (1, 3, 3, 1), as determined by the Schwarz Information Criterion (SIC). The model demonstrates substantial explanatory power ($R^2 = 0.97$) and a highly significant F-statistic (59.81, $p < 0.0001$), thereby affirming its overall validity. GDP and interest

rates emerged as statistically significant predictors of the Housing Price Index (HPI), whereas inflation was deemed insignificant. Diagnostic tests, such as the LM, Jarque-Bera, and Breusch-Pagan-Godfrey tests, indicated that the model residuals exhibited normal distribution and homoskedasticity, with no signs of autocorrelation. The CUSUM and CUSUMSQ stability tests confirmed that the estimated parameters were stable during the analysis period.

The results of the cointegration test indicate an F-statistic of 16.16, which surpasses the upper critical bound at the 1% significance level, thereby confirming a long-run equilibrium relationship among the variables. In the long run, GDP demonstrated a positive and significant impact on HPI ($P = 1.154$, $p < 0.05$), while the interest rate and inflation rate showed insignificant long-run effects. The findings indicate that sustained economic growth leads to increases in property prices due to elevated income levels and heightened housing demand, whereas variations in monetary and price conditions exert weaker long-term effects.

The Error-Correction Model (ECM) results in the short run reveal that the Error-Correction Term ($ECT = -0.111$, $p < 0.01$) is both significant and negative, indicating that roughly 11% of short-term disequilibrium is rectified each quarter as it moves toward long-run equilibrium. The short-run coefficients indicate that GDP and interest rates significantly affect changes in the HPI, whereas inflation shows a weak association. The model demonstrates a high overall fit, evidenced by an adjusted R^2 of 0.876, which confirms its effectiveness in capturing short-term variations.

The results of the Granger Causality Test offer additional understanding regarding the causal direction between variables. The test reveals a unidirectional causality from interest rates to housing price indices (HPI), indicating that monetary policy directly influences housing prices via borrowing costs and financing accessibility. A bidirectional causality exists between GDP and HPI, indicating that economic growth influences housing demand, while the housing sector also facilitates economic expansion through wealth effects and construction activities. Inflation demonstrates a weak causal relationship with the Housing Price Index (HPI), suggesting an indirect or delayed impact on housing prices. The findings align with those of Tan (2015) and Afsheen et al. (2023), who identified comparable causal relationships in the Malaysian housing market.

The findings presented in Chapter 4 validate all three research objectives. The findings for Research Objective One (RO1) indicate the presence of both short- and long-term relationships among GDP, interest rates, inflation, and HPI, with GDP identified as the most significant determinant. In relation to Research Objective Two (RO2), the causality analysis indicates that the interest rate Granger-causes fluctuations in the Housing Price Index (HPI), whereas GDP and HPI exert mutual influence on one another. The findings from Research Objective Three (RO3) indicate that GDP has a positive long-term influence on housing prices, while interest rates negatively affect them, and inflation demonstrates an insignificant relationship. The results indicate that macroeconomic fundamentals significantly influence housing price dynamics in Malaysia. Economic growth increases purchasing power and housing demand, whereas interest rate changes influence affordability and market stability. Inflation has a constrained direct impact, which may be alleviated through policy measures. The findings highlight the necessity of synchronized fiscal and monetary policies that promote sustainable GDP growth and uphold moderate lending rates to ensure a stable and affordable housing market in Malaysia.

CHAPTER 5
CONCLUSION AND RECOMMENDATIONS

5.1 Overview

There are two parts in this chapter: Section 5.2 discusses the limitations of the study and offers some suggestions for more research, while Section 5.3 wraps up the whole investigation.

5.2 Recap from the Findings

The present study's goal is to investigate the macroeconomic factors that influence Malaysian home prices. As emphasized by the life-cycle theory and overlapping generation theory, this research also takes into account the influence of the GDP, interest rates, and inflation rates as determinants. From 1988 to 2022, annual time series data were employed in this research. Interest rates and the house price index are highly correlated, according to this study. With economic growth and changes in the labour market, which lead to additional job vacancies, mortgage rates sometimes seek to increase in lockstep. However, the inflation rate and GDP are less important. Rahman and Ridzuan (2020) examined the effects of gross domestic product, consumer price index, base lending rate, and money supply on the house price index in Malaysia from 1988 to 2017. The ARDL estimation revealed that, in the long run, Gross Domestic Product (GDP) and the base lending rate have a significant effect on the Housing Price Index (HPI) in Malaysia, whereas inflation has a negative but statistically insignificant impact on housing prices.

The recent increases in home prices have diverged from earlier research findings. This divergence can be ascribed to excessive construction in new housing developments, increased investment risk, and speculative behavior in major urban regions including Selangor, Johor, and Kuala Lumpur (Bank Negara Malaysia, 2022; Hashim, 2010). Additionally, strict lending policies and thorough credit assessment criteria established by financial institutions have hindered Malaysians' ability to acquire residential properties (BNM, 2021; Tan, 2015). Despite the heightened supply, numerous properties continue to be unaffordable, and potential buyers frequently

encounter difficulties in securing mortgage approval. As a result, the financial capacity of buyers may hinder their ability to maintain monthly loan repayments, especially in the context of rapid housing price increases driven by macroeconomic factors, including rising construction costs, income inequality, and speculative market behavior (Cagamas, 2020; Yusof et al., 2023).

Nevertheless, rental housing is the optimal option. While this may serve as a temporary solution, it may be the most effective method of addressing the housing needs of the population in the long term through the acquisition of housing for personal use. The federal government is aware of the issue of property ownership. In order to maintain the affordability of home prices, a committee has been established to monitor the costs of housing and construction. This illustrates that the government continues to prioritize affordable accommodation in all states of Malaysia.

5.3 Policy Implication

This section discusses a variety of measures that policymakers can implement to stabilize the country's economy and address housing prices. It is imperative that the government maintain a positive and stable economic growth, as Malaysia is striving to become a developed country. Consequently, this issue is of the utmost importance.

5.3.1 Policy Maker

Housing prices are intricately linked to economic growth, necessitating that policymakers promote balanced development to maintain housing affordability while avoiding excessive financial strain on consumers. Expanding infrastructure and promoting investment in secondary cities can facilitate a more equitable distribution of economic activity, consequently alleviating housing price pressures in major urban centres. This study's analysis demonstrates a positive and significant relationship between economic growth (GDP) and housing prices, suggesting that economic expansion correlates with increased purchasing power and housing demand. Higher interest rates generally reduce affordability by increasing borrowing costs, and inflationary pressures additionally burden consumers' financial capacity. Thus, sustaining economic growth while implementing prudent monetary policies is crucial for balancing housing market demand and affordability in Malaysia.

These results demonstrate that the economy's money supply stability is essential to maintaining the level of home affordability. Therefore, it is crucial that institutions like Bank Negara Malaysia (BNM) play a role in controlling the quantity of money in circulation. The money supply arrangement should be carefully and logically controlled by BNM in order to guarantee the stability of the housing market and the expansion of the economy.

Additionally, the state governments are required to assist in the development of an affordable housing scheme through the utilization of the unique land alienation scheme. The federal government in Malaysia has the ability to acquire land and designate a specific location for development for a public purpose through the state government. The cost of house construction is further reduced by this action, as the developer is only required to pay a nominal premium for the alienation, rather than paying the landowner a higher price for the land. This will simultaneously sustain the housing market in Malaysia and address housing affordability concerns. By understanding these relationships is crucial for policymakers. Comprehending these linkages is essential for policymakers. For example, if GDP growth is strong, authorities may contemplate strategies to guarantee that housing supply aligns with demand to avoid market overheating. If interest rates are increasing, it may be wise to adopt policies that promote affordable housing efforts to alleviate the effects on lower-income purchasers (Glaeser & Gyourko, 2008).

5.3.2 Property Developers

Property developers significantly influence Malaysia's housing market and must adjust their strategies according to current macroeconomic conditions. This study's findings indicate that Gross Domestic Product (GDP) and interest rates have a significant impact on the Housing Price Index (HPI) in both the short and long term. Developers must closely monitor essential economic indicators, including GDP growth, inflation, and lending rates, when developing project plans and pricing strategies. In times of economic expansion, developers may strategically augment the supply of housing units to address increased demand. During economic downturns or rising interest rates, developers should implement a conservative strategy to avoid oversupply and maintain financial sustainability.

Developers should prioritize the provision of housing units that align with the income distribution of the majority of Malaysians, especially among middle- and lower-income groups. Collaboration with the Government via established affordable housing programmes, such as Program Residensi Rakyat (PRR), can improve access to subsidies, tax incentives, or cost-sharing arrangements that lower development costs. Under the PRR initiative, a unit built at a cost of approximately RM300,000 is granted a government subsidy of RM240,000, enabling it to be sold at an affordable price of RM60,000 to qualifying buyers (Ministry of Housing and Local Government, 2023). Partnerships can enhance developers' market reach and contribute to national housing affordability objectives.

Developers must consider interest rate fluctuations, as increased borrowing costs can diminish homebuyers' purchasing capacity and hinder property sales. Modifying project timelines, pricing strategies, and financing structures in reaction to changes in monetary policy can alleviate the effects of increasing interest rates on demand. Hui (2013) emphasizes that housing price cycles in Malaysia are closely linked to aggregate business cycles, indicating that developers should align their construction and investment strategies with overall economic conditions. Integrating economic forecasting and market data into decision-making processes enables developers to ensure sustainable growth and contribute to a balanced and resilient housing market.

5.4 Conclusion

This research examined the relationship between housing prices and macroeconomic data, determining which factors had the most effects on the cost of house price. The EVIEWS 10 analytic program was used to do the econometric modelling study, and Microsoft Excel was used to store the findings. The economic factors that influence home prices and the different impacts on changes in Malaysian home prices may be better understood with the help of this.

This chapter analyses the macroeconomic determinants of housing prices in Malaysia, focusing on their implications in the short-term and long-term contexts. These findings emphasize the significant influence of key factors such as GDP, interest rates, and inflation rates on the dynamics of housing prices. Additionally, there are matters that need to be considered where GDP growth positively correlates with housing

demand, reflecting broader economic confidence, while interest rates and inflation show a mild effect, influencing purchasing power and housing supply constraints in this country. Baharuddin, Isa, and Zahari (2019) examined the influence of interest rates, inflation rates, and gross domestic product on house prices in Malaysia using quarterly data from 2005 to 2019. The results indicated that a long-term association exists between the independent factors and house prices.

This analysis of determinants affecting residential property values will provide valuable insights for investors, home purchasers, housing developers, and governmental entities. Investors may develop a superior investing strategy that incorporates variations in the Malaysia home price index. Home purchasers will possess more understanding of the factors influencing property pricing. Consequently, a budgetary plan may be established to enable the purchaser to afford a home. The home developers may establish the price of a property by examining many essential criteria. This research presents two contributions. Initially, by establishing the presence of a long-term equilibrium link between the Housing Price Index and macroeconomic variables, including Gross Domestic Product, Interest Rate, and Inflation Rate. Secondly, by examining the causal link between HPI and its determinants.

Before carrying out the Granger Causality Test, the unit root test for each variable was tested to ensure that all variables were stationary at the same order. All variables have been integrated at the second order differencing. According to the analysis completed in the previous chapter, all of the variablesI(0) and I(1) have mixed stationarity and integrated order. After completing the ARDL model, the results indicate that the price variance of house price index in Malaysia can be explained by changes in all independent variables.

The long-run study shows that only Gross Domestic Product (GDP) is cointegrated with the Housing Price Index (HPI). This means that there is a consistent long-term connection between the two variables. The calculated long-run ARDL model indicates a substantial positive correlation between GDP and HPI at the 5% significance level, implying that economic growth leads to a gradual rise in housing prices over time. On the other hand, both the interest rate and the inflation rate have negative but statistically insignificant connections with the HPI. This means that they don't have a big effect on housing prices in the long run. To make sure the ARDL model was strong and accurate, a number of diagnostic tests were done. The results show that the model

is stable, does not have problems with autocorrelation or heteroskedasticity, and that the residuals are normally distributed within the 5% significance threshold.

The Error Correction Model (ECM) estimates the short-run dynamics and shows that the error correction term (ECT) is statistically significant at the 1% level, with a coefficient of -0.111. This means that about 11.14% of short-term disequilibrium is fixed every quarter, which helps the economy slowly move toward long-term equilibrium. In the short term, both population growth and inflation rate have a clear effect on home prices, but GDP still has a good effect. The model's modified R^2 value of 0.91 shows that the macroeconomic variables included in this study can explain 91% of the changes in Malaysia's high-rise housing prices. The other 9% of the changes are due to other outside factors that this study did not look at. The ECM model meets all diagnostic requirements, demonstrating a proper fit and stability at the 1% significance level.

The Granger Causality Test results give us further information about how the variables are related to each other. The study reveals a unidirectional causality from the Housing Price Index (HPI) to the interest rate (INR), indicating that fluctuations in housing prices elucidate subsequent variations in interest rates. However, no indication of causality was established from interest rates to housing prices, indicating that changes in interest rates do not directly cause short-term changes in the HPI. Likewise, GDP and the inflation rate (IFR) do not demonstrate substantial causal correlations with the HPI, suggesting that historical values of these variables do not markedly enhance predictions of home price fluctuations. These results indicate that although macroeconomic variables are interconnected, the dynamics of housing prices in Malaysia may also be affected by other structural and market-specific factors, including supply restrictions, speculative activities, and policy interventions.

Based on the results, the Malaysian government should concentrate more on bolstering the policy for those who fall into the category of those who cannot afford to buy a home. This will help to maintain the performance of investment activities in the nation, particularly in the real estate and property market, while also preventing a slowdown in economic growth.

5.5 Recommendation

The limited data acquired for this study presents challenges in generating a more precise outcome regarding the short-run and long-run relationships of the variables.

The dataset comprises only 35 observations, representing a limited sample size from the year 1988 to the year 2022. In the long term, variables such as the interest rate and inflation rate were analysed and determined to be insignificant in relation to the house price index. As for the short run, the result shows only two significant variables that influenced the houses price such as the interest rate and inflation rate.

As in previous years, the Malaysian housing market is still having problems, such as the difficulties of renting, units that aren't sold, and price changes. To fix these problems, officials should take a combined approach that can help buyers. This includes using big-picture economic tools to keep inflation and interest rates stable, as well as tailored housing policies like grants, programs for cheap housing, and tax breaks for buyers and builders. A strong tracking system for the Housing Price Index (HPI) should also be set up so that more accurate data can be used to make smart decisions. Getting the government and business sector to work together to build cheap homes can also help increase supply and deal with places with too much demand, especially in big towns.

The findings of this study may lack reliability and accuracy owing to limitations in the data. The data regarding house prices and the inventory of houses sold has been collected from each state in Malaysia, though it lacks detailed information for individual states. This study indicates the necessity for further research with a larger sample size to achieve more advantageous outcomes. Furthermore, it is recommended that future studies incorporate a comprehensive range of macroeconomic and microeconomic variables to assess their influence on the pricing of multi-storey houses.

The properties considered in this study should encompass a wider range, extending beyond residential properties to also incorporate various types of properties, including commercial and industrial real estate markets. It is advisable for future studies to utilize more precise information regarding the real estate market and to conduct more comprehensive research on market dynamics and properties. It is advantageous to concentrate on select states within a country rather than examining all states, as various regions possess distinct influencing factors that impact specific study areas. Focusing on all states may result in overgeneralization or inaccuracies in the findings.

5.6 Summary of the Chapter

This chapter summarizes the key findings, policy implications, and recommendations of the study. This study examined the macroeconomic factors affecting Malaysia's Housing Price Index (HPI) from 1988 to 2022, with particular emphasis on Gross Domestic Product (GDP), interest rates, and inflation rates. The study utilized the Autoregressive Distributed Lag (ARDL) model, Error Correction Model (ECM), and Granger Causality tests to analyze the short-run and long-run relationships among the variables.

The empirical findings indicate a significant positive long-term relationship between GDP and housing prices, suggesting that economic growth propels property market expansion via increased income and demand. In contrast, the long-run effects of interest rates and inflation rates are negative yet statistically insignificant. In the short term, GDP and inflation affect housing prices, with the Error Correction Term (ECT) indicating that 11.14% of disequilibrium is rectified quarterly, thereby affirming convergence towards long-term stability. The Granger Causality Test revealed a unidirectional relationship from HPI to interest rates, indicating that fluctuations in the housing market can affect monetary conditions, whereas GDP and inflation did not demonstrate a causal relationship with HPI.

The findings underscore the necessity of stable economic growth and prudent monetary policies to ensure housing affordability from a policy standpoint. Policymakers must achieve a balance between GDP growth and housing supply by implementing strategic planning and investing in infrastructure within secondary cities. Financial institutions and Bank Negara Malaysia (BNM) are essential in regulating liquidity and credit conditions to prevent excessive speculation and enhance affordability. State governments ought to collaborate on land and housing initiatives to reduce development expenses and enhance access to affordable housing.

The study highlights the necessity for property developers to align housing supply with income distribution and prevailing economic conditions. Developers must adapt to market cycles by modifying project scales and pricing strategies, while collaborating with government initiatives like the Program Residensi Rakyat (PRR) to improve affordability and ensure market stability.

The research indicates that macroeconomic fundamentals, especially GDP growth and interest rate fluctuations, play a crucial role in the dynamics of housing prices in Malaysia. Effective economic policies that promote stability and inclusivity, along with specific housing initiatives, are crucial for sustaining a balanced property market.

This research encountered limitations stemming from a small dataset comprising 35 annual observations and the omission of specific state-level or microeconomic factors. Future research ought to broaden the dataset, include supplementary variables such as population growth, income distribution, and housing supply, and concentrate on specific regions to accurately reflect localized market behaviors. It is advisable to conduct broader studies encompassing various property types residential, commercial, and industrial to achieve a more comprehensive understanding of the dynamics of Malaysia's real estate market.

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