MSc Dissertation Submission Cover Page

Student Name: Rayan Albakri

Programme: MSc Venture Capital & Private Equity with Financial Technology

Supervisor: Jose De Leon Guillamon

Dissertation Title: Macroeconomic, Demographic and Financial Determinants of House Prices in Saudi Arabia

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Macroeconomic, Demographic and Financial Determinants of House Prices in Saudi Arabia

Name: Rayan Albakri

Institution: UCL

Supervisor Name: Jose De Leon Guillamon

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Abstract

The research problem addressed in this study is the limited understanding of how macroeconomic, demographic and housing-specific factors collectively influence house prices in Saudi Arabia, particularly under Vision 2030 reforms. The study aims to investigate the determinants and dynamics of Saudi house prices between 1990Q1 and 2024Q4, addressing a gap in both academic literature and policy analysis. The study employs quarterly data and applies a combination of econometric techniques, including OLS regression, VAR, Granger causality, ARIMA, ARIMAX, volatility modelling and asset pricing framework. Variables analysed include GDP per capita, unemployment, inflation, oil prices, government expenditure, real estate loans, mortgage rates, urbanisation, population growth, construction costs, and rent inflation. GDP per capita, unemployment, urbanisation, mortgage rates, construction costs and rent inflation significantly influence house prices in Saudi Arabia, whereas inflation, government expenditure and population growth show no long-run effects. VAR and Granger causality highlight GDP, oil, mortgage rates and credit as short-run drivers. Forecasting confirms sustained price growth, with ARIMAX providing the most accurate trajectory. Volatility modelling shows occasional shocks but general stability, whereas asset pricing analysis demonstrates housing returns are systematically linked to GDP, oil and mortgage rates. Importantly, Vision 2030 reforms have partially decoupled housing from oil cycles, positioning GDP growth, expansion of credit (mortgage market growth) and urbanisation as dominant long-run drivers of house prices.

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1. Introduction

Real estate as an asset class in general and residential real estate (property prices) in particular within Saudi Arabia has become a subject of growing importance, reflecting both macroeconomic developments and the socio-economic changes under way in the country as part of Vision 2030 (Alhefnawi et al., 2024). Housing is viewed not just as a place for people to live but also an important investment asset by individual and institutional investors (Alharbi, 2024), directly linked to household wealth accumulation, financial stability and broader economic performance (Turner and Luea, 2009). In recent years, Saudi Arabia has prioritised raising homeownership rates as a central policy goal, with government initiatives such as liberalisation of the mortgage market through increased competition and financial development, expanded access for residents to credit and other mortgage products, and rapid urban development (Hariri, 2023). Vision 2030 explicitly targets a rise in homeownership to 70% by 2030, making homeownership a critical indicator of progress. Due to Saudi Arabia's reliance on oil revenues, macroeconomic volatility has historically filtered through to real estate markets via income, liquidity and credit channels (Alola, 2020). However, structural reforms including emphasis on diversification towards non-oil economy and mortgage expansion since 2016 have influenced the determinants of house price behaviour. Understanding how macroeconomic, demographic and housing-specific factors influence property prices is therefore important for residents, investors and alike, providing insights into affordability, financial stability and the resilience of housing market under economic transition.

Although real estate remains central to economic stability and social policy in Saudi Arabia, there is a lack of research which has examined its determinants using econometric techniques including ARIMA, ARIMAX, VAR and asset pricing models, especially the application of Capital Asset Pricing Model (CAPM) in real estate (Cannon et al., 2006). Existing studies often focus on isolated drivers (such as oil, income, or credit) or short time horizons, neglecting the combined impact of macroeconomic, demographic, and housing-specific factors (Akinwale et al., 2024; Duca et al., 2010). It creates an academic gap in the literature and a practical gap in policy analysis.

This study addresses this gap through the overall aim of investigating the determinants and dynamics of house prices in Saudi Arabia between 1990Q1 and 2024Q4. Quarterly frequency is employed to capture short-run fluctuations while preserving sufficient observations for robust econometric modelling and forecasting. This aim is addressed by fulfilling three objectives.

The research aim is addressed by fulfilling three objectives. The first objective is to assess the impact of macroeconomic, demographic, and housing-specific factors on Saudi house prices. The second is to apply econometric modelling (OLS, VAR, ARIMA, ARIMAX, volatility and asset pricing) to analyse price dynamics. The final objective is to evaluate the extent to which Saudi housing prices are influenced by structural reforms under Vision 2030. The structure of rest of this paper is such that second chapter reviews theoretical and empirical literature; The third chapter explains the data followed by methodology in chapter 4, results in chapter 5 and discussion in sixth chapter. Section 7 concludes with policy implications.

2. Literature Review

2.1 Theoretical analysis

The dynamics of house prices in Saudi Arabia can be explained through two interrelated theoretical frameworks: Efficient Market Hypothesis (EMH) and the Monetary Transmission and Housing-as-Business-Cycle Theory. First, EMH (Fama, 1976) provides a benchmark for evaluating whether housing prices in Saudi Arabia fully and immediately reflect available macroeconomic information. Weak-form EMH asserts that past house price movements and observable data (for instance, GDP per capita, unemployment, inflation, oil prices, and mortgage credit) should not be able to consistently help forecast future prices. Nevertheless, empirical evidence from real estate market shows that house price dynamics are somewhat predictable, with turning points often anticipated by structural models including VAR and ARIMA (Gupta et al., 2011). This suggests a potential deviation from weak-form efficiency, highlighting that the housing market in Saudi Arabia may incorporate macroeconomic shocks with lags, based on application of EMH.

Second, Monetary Transmission and Housing-as-Business-Cycle Theory (Leamer, 2007) considers real estate as a leading sector in terms of the macroeconomic cycles. Housing responds to monetary policy through changes in interest rates which have a knock-on effect on liquidity, resulting in variation in credit supply. In this sense, housing is more responsive to monetary policy in comparison to other industries, which explains why monetary policy has a more pronounced effect on real estate. Bernanke and Gertler (1995) explained the role of credit channel in influencing property market, with loan-to-value (LTV) ratios and credit availability influencing affordability and as a result, demand. In Saudi Arabia, where credit expansion through mortgage reforms has been rapid due to the growth triggered by Vision 2030, this framework is especially relevant: shifts in interest rates or oil-driven liquidity conditions directly transmit into property demand, influencing both prices and broader cyclical dynamics. These theories are complemented by Wealth Effect (Case et al., 2005), which argues that rising asset values (especially real estate which tends to be the biggest asset of an average individual) boosts consumption and investment, reinforcing the association between macroeconomic variables and house prices.

2.2 Macroeconomic factors and house prices

Some of the macroeconomic factors that influence the house prices as reported in the literature include GDP per capita (as a proxy for income growth and better housing affordability), unemployment rate (to capture the labour market dynamics), inflation rate (to take into account cost of living), oil price (based on Saudi Arabia's high reliance on the oil prices as a determinant of government spending and investment), extent of government spending in the economy and availability of credit (specifically the mortgage loans extended by banks).

Forecasting the house prices requires a balanced integration of long-term fundamentals with short-term market dynamics. Miller and Sklarz (2012) argued that although structural drivers such as employment, income growth (proxied via economic growth), interest rates and supply constraints dominate longer-term influence on house prices, forecasting accuracy over shorter horizons especially at turning points (such as the start of a downturn) is also highly reliant on behavioural and technical indicators. These include sales volume, days on market, months of remaining inventory and the sale-to-list price ratio, all of which act as leading signals of demand–supply imbalances. Analysis by Miller and Sklarz (2012) showed that incorporating such market condition indicators strengthens the ability to anticipate bubbles and cyclical inflection points more effectively than models which are solely based on fundamentals.

However, the extent to which these variables apply to Saudi Arabia is restricted due to a lack of availability of data on each variable. It illustrates the significance of economic variables on which data is variable. These include GDP per capita, unemployment, inflation, oil price volatility, fiscal policy stance, and credit provision through bank mortgage lending. Importantly, affordability metrics such as LTV (which dictates how much percentage of property value an individual borrower is able to borrow) impacts short-term fluctuations in housing markets, with easing credit conditions often leading price growth by several quarters (Muellbauer, 2015). This finding is supported by earlier research from Duca et al. (2010) who observed that rising LTV ratios exacerbated the pace of house price appreciation leading up to real estate boom in U.S. in early 21^{st} century, supporting the existence of positive correlation between bank lending (on property in the form of mortgage loans) and house prices.

When it comes to forecasting the house prices, Gupta et al. (2011) examined the forecasting accuracy by comparing structural and atheoretical models for the US housing market. Their results indicate that econometric models with limited predictors (up to 11 independent variables) outperform large-scale models, as excessive data inclusion risks over-parameterisation and spurious correlations, a finding reinforced by Boivin and Ng (2006).

Interestingly, Gupta et al. (2011) established that only structural models such as ARIMA, ARIMAX and VAR could anticipate the downturn in the housing market in U.S. from early 2007 onwards. This finding showcases the importance of using these techniques to forecast house prices, especially when capturing the turning points in economic cycle (i.e. from an upturn to peak and then downturn and vice versa). This finding is also supported by Iacoviello and Neri (2010) who showed that forward-looking models linking housing dynamics to macroeconomic shocks more effectively replicate cyclical behaviour. The above findings demonstrate the need to prioritise structural time-series methods such as ARIMA, ARIMAX and VAR, as they improve forecasting accuracy.

A recent study by Akinwale et al. (2024) demonstrated that income per capita and population also have a meaningful effect on property prices through boosting demand for housing, as also argued by the wealth effect hypothesis. Rising real GDP per capita (and therefore per capita income) improves affordability of residents, in addition to signalling the broader economic expansion, which translates into higher consumer confidence, credit growth and ultimately increased demand for residential property (Lin et al., 2019). The theoretical basis is that economic growth generates wealth effects through higher disposable income and asset accumulation (Glewwe and Jacoby, 2004), leading households to reallocate capital into real estate as both a consumption good and an investment asset (Case and Shiller, 1990). This dynamic is particularly relevant in Saudi Arabia, where sustained GDP growth driven by infrastructure spending to fulfil the Vision 2030 objectives has added to investment-led housing demand (Hariri, 2023), with direct implications for house prices in the short and long-run.

Labour market dynamics also exert a key influence on housing outcomes. Unemployment acts as a constraint on affordability by reducing household income stability and weakens access to mortgage credit. This is because banks require a proof of income (either as employed or self-employed) to qualify a borrower for a mortgage (Campbell and Cocco, 2015). In Saudi Arabia where employment is highly influenced by the public sector and volatility in oil prices, higher unemployment rate tends to depress the demand for housing (Meteb, 2017), creating downward pressure on prices. Empirical studies in international markets have similarly shown that declining unemployment (reflective of stronger labour market and more disposable income) has a positive and significant effect on the demand and price of real estate, as greater job security promotes borrowing capacity and household formation in the long-run (Hendershott, 1998; Hedlund, 2016).

The role of inflation in the Saudi housing market is more complex. On one hand, inflation increases the cost of living and reduces real disposable income, which lowers affordability and housing demand, as supported by Akinwale et al. (2024). Higher inflation is also typically associated with higher interest rate because central bank is likely to tighten the monetary policy to restore price stability (Candia et al., 2024), further constraining access to mortgages among buyers looking to purchase with a mortgage. On the other hand, evidence confirms the inflation hedging characteristic of both public real estate (such as real estate investment trusts) (Nasreddine et al., 2025) and private real estate (Chang, 2017). This is because return on real estate in the form of rental income tends to grow in line with the inflation rate each year, preserving the value of real estate in inflation-adjusted terms (Muckenhaupt et al., 2025). This mixed effect of inflation on real estate suggests that moderate inflation may reduce demand among households, also simultaneously attracting investment demand as a store of value, generating specific effects on house price trajectories in Saudi Arabia.

Oil is another key macroeconomic variable with implications for house prices in Saudi Arabia. The relationship between oil prices and the housing market in Saudi Arabia is both structural and cyclical, reflecting the country’s reliance on oil revenues as the primary driver of liquidity and investment. Alola (2020) provides evidence through ordinary least square (OLS) and vector auto-regression technique that crude oil price returns exert a significant and positive impact on Saudi Arabia's real estate market, with stronger effects observed during high-volatility regimes. It implies that rising oil price leads to higher government revenues and expanding public expenditure, which stimulate credit supply and household purchasing power especially as over 60% of the employment in Saudi Arabia remains in the public sector, thereby adding to housing demand. On the other hand, a decline in oil price often results in fiscal tightening which coincides with a decline in money supply, limiting consumer affordability and investment from property investors (Almutairi, 2016). The finding is consistent with broader macroeconomic literature, which identifies oil-exporting economies as particularly vulnerable to the transmission of energy market volatility into domestic asset markets (El Anshasy and Bradley, 2012).

2.3 Demographic and housing-specific factors and house prices

Apart from the macroeconomic factors, there are demographic and housing-specific factors too which influence the house prices, such as population growth, urbanisation trends, the mortgage rate (as a proxy for financing cost for would-be home owners) and rent on housing. Population growth and urbanisation are two notable trends which have led to a steady increase in demand for property in Saudi Arabia, particularly when considering the objectives of Vision 2030 to expand major cities such as Riyadh into a megacity of 20 million residents. Alhefnawi et al. (2024) estimate continued urbanisation towards major cities such as Riyadh is continually putting upward pressure on housing in the city, with Riyadh by itself requiring over 2.6 million additional housing units by 2030. It has led to a shortage of over one million units in the short-run, adding to pressure on house prices. This imbalance shows the positive effect of population growth (along with urbanisation) on house prices, especially in major cities where land availability is constrained, lengthy planning limits supply and infrastructure expansion lags demand.

The literature further states that demand is highly inelastic to both price and income, making demographic expansion a particularly notable factor influencing house price. Al Obaid (2020) established that growth in population, lending conditions influencing the demand for mortgages and inflation (measured through consumer price index) were the most significant predictors of demand for property in Saudi Arabia. It suggests that even when affordability is limited, growth in population particularly in major cities creates a steady bid for available stock, which exerts persistent upward pressure on prices. Growing urbanisation has added to this, as rural-to-urban migration accelerates in Saudi Arabia, competition for limited urban housing stock intensifies, reinforcing the price escalation cycle (Hariri, 2023).

The wider international evidence supports this mechanism. Studies such as Hwang and Quigley (2006) found that demographic expansion and urban density increase the sensitivity of housing markets to macroeconomic shocks, worsening the cyclical fluctuations in prices. In the case of Saudi Arabia, the association between rapid urbanisation and structural supply constraints (such as limited arable land and lengthy time lags in securing planning permission for vertical development) creates a scenario where population pressures disproportionately translate into higher housing costs, as supply elasticity remains weak (Dano, 2024). Overall, population growth and urbanisation act as key drivers of long-run housing price appreciation in Saudi Arabia. In contrast to the financial or policy shocks, their effect is sustained, compounding affordability challenges.

Another housing-specific factor (albeit linked to macroeconomic environment) is the mortgage rates which have an important role in influencing housing price by directly influencing affordability and availability of credit. A rise in mortgage rates increases the cost of borrowing, which lowers the household purchasing power and limits effective demand for housing. This negative relationship reflects the affordability effect: higher financing costs reduce the pool of eligible buyers, negatively impacting demand and exerting downward pressure on prices (Squires and Webber, 2019). Algahtani (2022) established that higher competition in the mortgage market and resultant increase in mortgage approvals following the development of a secondary mortgage market in 2017 in Saudi Arabia boosted the housing demand, coinciding with a recovery in prices after the oil-driven downturn. This illustrates how lower rates by expanding access to credit, add to demand and sustain price growth. On the other hand, when rates rise, banks tighten lending standards and monthly instalments become less affordable, deterring marginal buyers. Empirical studies support this inverse relationship, with Chong (2020) showing that tightening loan-to-value and interest-related borrowing constraints reduces housing market activity.

Finally, rent generated by a property is another housing-specific factor which influences the price of real estate. Rent inflation is found to have a significant positive effect on property prices by influencing investor expectations and reinforcing the capitalisation of future cash flows. As rents increase, the return on investment (ROI) in the form of rental yields becomes more attractive, drawing increased interest from institutional and private investors. Through higher demand, it leads to appreciation of property values as investors compete for properties with higher expected income streams (Gilbukh et al., 2023). In particular, the literature on price-to-rent ratio demonstrates that upward rental adjustments often lag sales prices but once rents accelerate, they signal improved cash flow prospects, thereby justifying higher valuations (Lo et al., 2023). Rising rents also mitigate perceived risk by improving affordability metrics for investors, especially in markets with limited supply elasticity (Chinloy et al., 2018). Thus, periods of rental growth tend to be associated with rising investor demand, producing upward pressure on house prices as assets are re-priced to reflect stronger earnings potential.

2.4 Hypotheses, research gap and conclusion

The review of literature shows the numerous factors influencing house prices in Saudi Arabia, affected by macroeconomic, demographic and housing-specific factors. EMH, Monetary Transmission Mechanism and Wealth Effect Theory provide a conceptual framework, although empirical evidence reveals context-specific relationships which differ across contexts and remain under-explored in Saudi Arabia. Literature also revealed limited application of econometric techniques such as ARIMA, ARIMAX, VAR, and asset pricing frameworks to Saudi Arabia’s housing sector, which presents a gap in the literature. Existing studies focus on isolated factors or shorter time horizons, overlooking the combined effect of macroeconomic, demographic, and housing-specific variables.

Based on the literature findings, the following hypotheses are to be tested:

H1: Real GDP per capita has a positive and significant effect on house prices.
H2: Unemployment rate exerts a negative effect on house prices.
H3: Inflation rate negatively influences house prices.
H4: Oil prices positively influence house prices.
H5: Government expenditure has a significant effect on house prices.
H6: Availability of mortgage credit positively impacts house prices.
H7: Population growth exerts a positive effect on house prices.
H8: Urbanisation rate positively influences house prices.
H9: Mortgage rates have a negative effect on house prices.
H10: Rent inflation positively influences house prices.

3. Data

3.1 Time horizon

This study employs quarterly data covering the period 1990Q1 to 2024Q4, providing a balanced mix of historical depth and relevance in the current environment. The rationale for selecting this extended horizon is in the structural changes that have characterised the Saudi economy over the past three decades, enabling the analysis to capture multiple business cycles, changes in oil price and policy reforms. Early 1990s mark a suitable starting point, as consistent macroeconomic and housing-related statistics became available from international databases such as the World Bank and domestic sources such as SAMA and GASTAT. The period also allows to capture notable global events including the Gulf War, Asian financial crisis, 2008 global financial crisis, and the Covid-19 pandemic which exerted substantial influence on oil revenues, fiscal policy and housing demand. Extending the dataset to 2024 ensures inclusion of Vision 2030 reforms, particularly the expansion of the mortgage market and urbanisation-led housing demand. Quarterly frequency further improved the dataset by reflecting short-run fluctuations, providing sufficient observations (n= 140) for time-series modelling without compromising the accuracy in forecasting cyclical turning points.

3.2 Descriptive Statistics and Time-Series Analysis

Descriptive statistics in Table 1 provide important preliminary insights into the behaviour of macroeconomic and housing-specific variables in Saudi Arabia. Starting with house price index, it averages 71.3 (Std. Dev. 20.1) with a wide range (38.5–104.5), reflecting both downturn periods (post-oil slump) and recovery phases linked to credit expansion and policy reforms.[1] For GDP per capita, mean of $19,193 (Std. Dev. 8,370) highlights sustained income growth, albeit with wide variation given the minimum of $10,600 and maximum of $39,000. This large range ($28,400) reflects

[1] Illustrated in figure 1

periods of both oil-driven booms and downturns, consistent with the structural dependence of the Saudi economy on crude oil revenues.

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
GDP per capita (US $)	140	28400.0	10600.0	39000.0	19193.650	8370.8612	.633	.205	-.744	.407
Unemployment, total (% of total labor force) (modeled ILO estimate)	140	3.76400	3.89600	7.66000	5.8016214	.86827440	.088	.205	-.313	.407
Inflation, consumer prices (annual %)	140	11.9635932	-2.09334901	9.87024418	2.00094280	2.24173546	.829	.205	.860	.407
Brent Crude ($)	140	110.719221	11.4994228	122.218644	53.0895885	32.5214786	.485	.205	-.994	.407
Real Estate Loans by Banks (SAR m)	140	873567.000	9712.00000	883279.000	147331.246	215915.024	2.012	.205	3.095	.407
General government final consumption expenditure (% of GDP)	140	16.4508771	17.7042516	34.1551287	24.1593399	3.29978351	.539	.205	.071	.407
Urban population (% of total population)	140	9.61100000	75.5600000	85.1710000	81.2357071	2.40399588	-.224	.205	-.866	.407
Population growth (annual %)	140	7.96525950	-2.55376826	5.41149124	3.56172178	1.82700677	-1.910	.205	2.696	.407
Construction cost (annualised inflation) in %	140	21.9635932	-2.09334901	19.8702442	3.04879994	3.73207315	1.592	.205	3.593	.407
Mortgage rate (%)	140	3.82000000	2.30000000	6.12000000	3.85050000	1.13643039	.329	.205	-1.185	.407
Rent inflation (%)	140	2.91313174	-.766247565	2.14688417	.557270176	.575120744	.005	.205	-.411	.407
House price index	140	65.9500000	38.5500000	104.500000	71.3121429	20.1171133	-.182	.205	-1.282	.407
Valid N (listwise)	140									

Table 1: Descriptive statistics

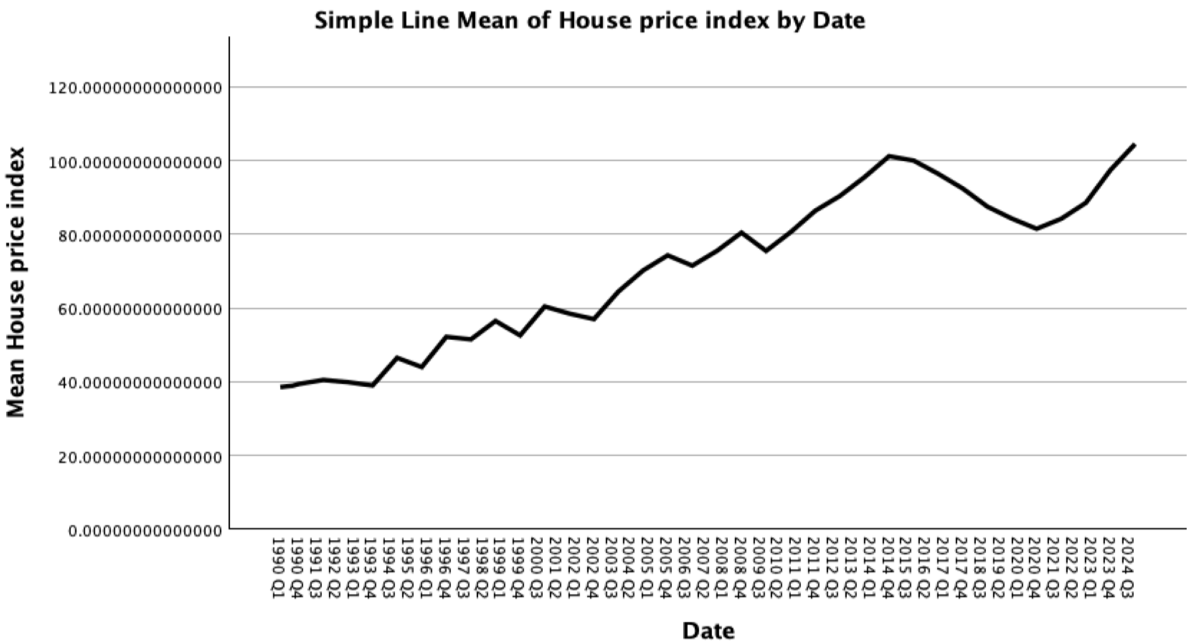

Figure 1: House price index in Saudi Arabia (Q1 1990 to Q4 2024)

Unemployment rate averaged 5.8% (Std. Dev. 0.86), with a relatively narrow range (3.76–6.00), suggesting stability in labour market dynamics. However, the modest standard deviation indicates that unemployment remains relatively contained, though marginal shifts may still influence affordability and mortgage access, particularly as employment remains concentrated in the public sector. Inflation averages 2.0% (Std. Dev. 2.24) but ranges widely between -2.09% and 9.87%. This volatility highlights the sensitivity of Saudi economy to external shocks (especially commodity prices, subsidy reforms VAT introduction), with potential dual effects on housing affordability and real estate's role as an inflation hedge. Changes in unemployment and inflation over time are illustrated in a time-series graph in figure 2. Descriptive statistics for Brent crude oil are particularly notable, with a mean of $53.1 but a wide range (11.5–122.2, Std. Dev of 32.5). It shows extreme oil price volatility during the sample[2], which directly impacts government revenue, fiscal spending, liquidity and therefore housing demand.

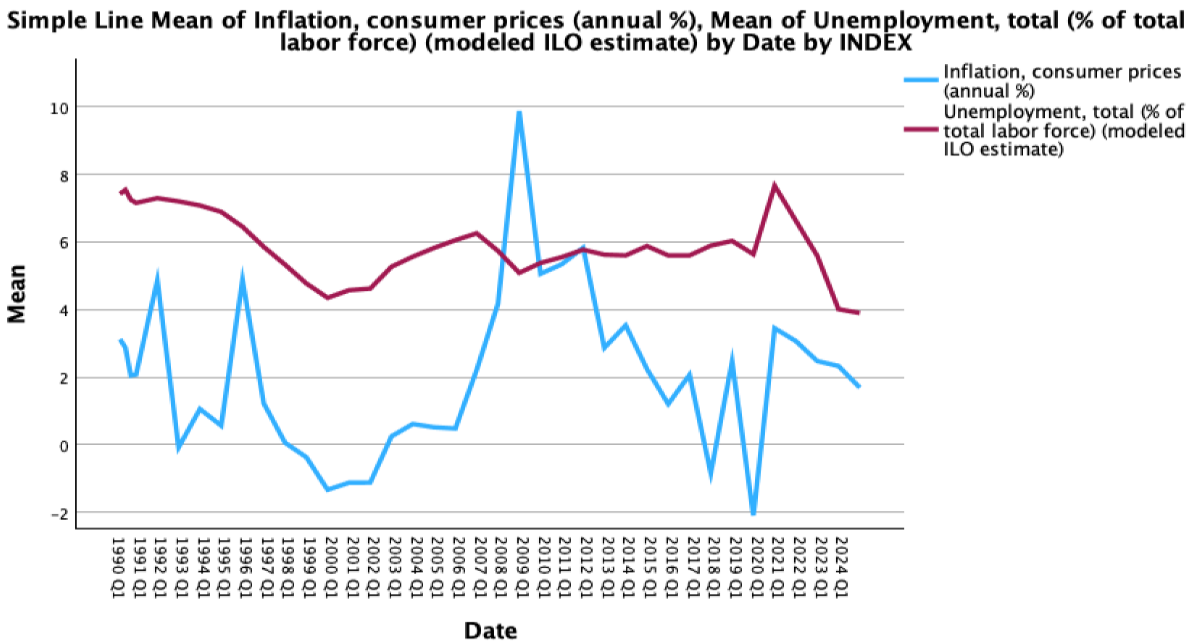

Figure 2: Inflation and unemployment in Saudi Arabia

[2] Refer to figure 3

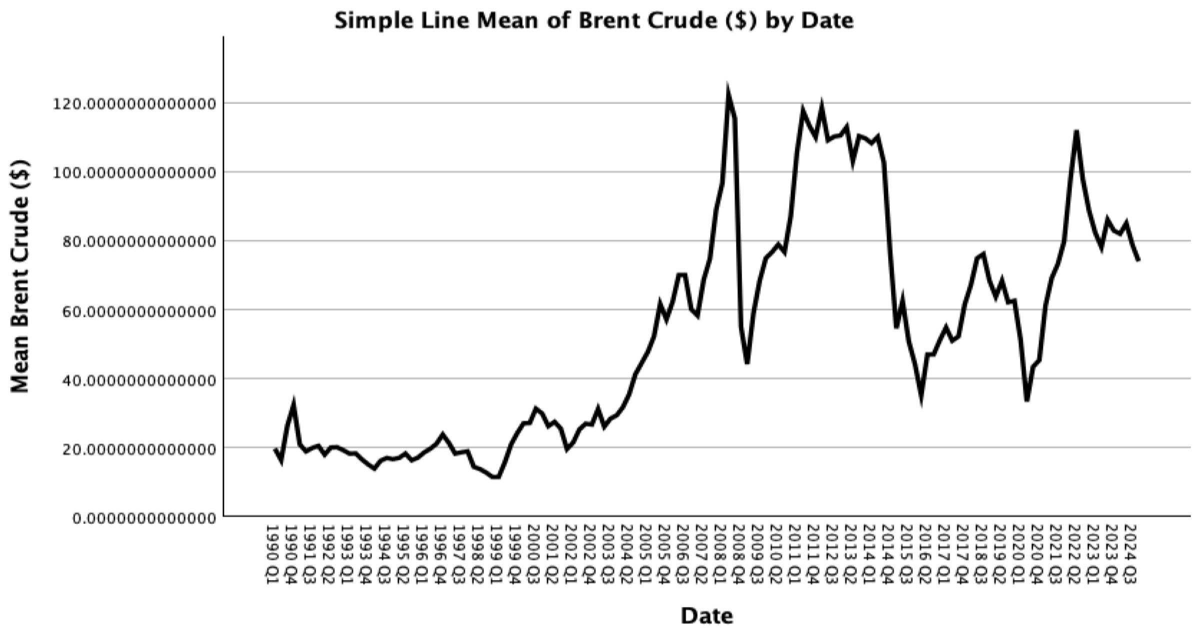

Figure 3: Brent crude price in $ (Q1 1990 to Q4 2024)

Real estate loans by banks show a mean of SAR 1.47 trillion, with a very high standard deviation (215,915), ranging from SAR 873 billion to 1.88 trillion. It highlights the expansionary role of mortgage reforms post-2017 and the importance of credit availability as a driver of house price growth. Rapid growth of real estate loans by banks is illustrated in figure 4. Government spending as a proportion of GDP averages 24.1% (Std. Dev. 3.3), ranging from 17.7% to 35.1%. It reinforces confirms the persistent role of fiscal expenditure in shaping aggregate demand, with implications for housing demand through public-sector employment and infrastructure-led growth. Demographic indicators reveal an urbanisation rate consistently high (mean 81.2%, narrow range 75.6–85.2), reflecting Vision 2030’s rapid urban concentration, whereas population growth averages 3.56% annually but ranges from -2.55% to 7.96%. The volatility suggests demographic shifts, including periods of slower migration-adjusted growth.[3]

[3] Graphical illustration of population growth and urban population as % of total population in Saudi Arabia is provided in Figure 5.

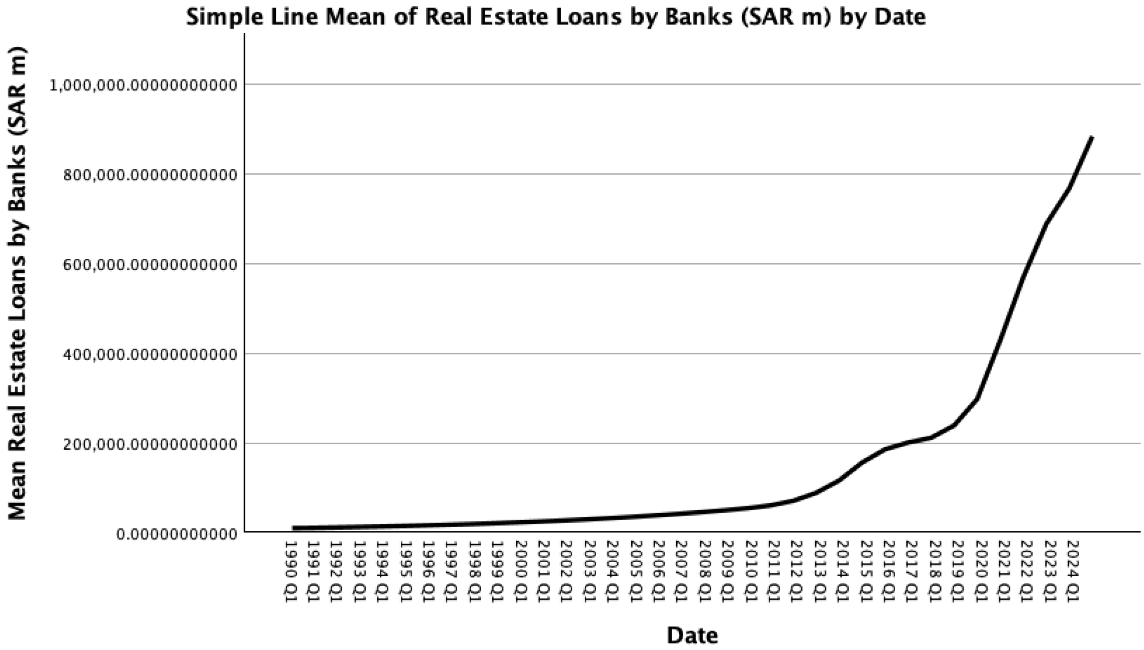

Figure 4: Value of real estate loans (mortgages) by banks in Saudi Arabia (in SAR millions)

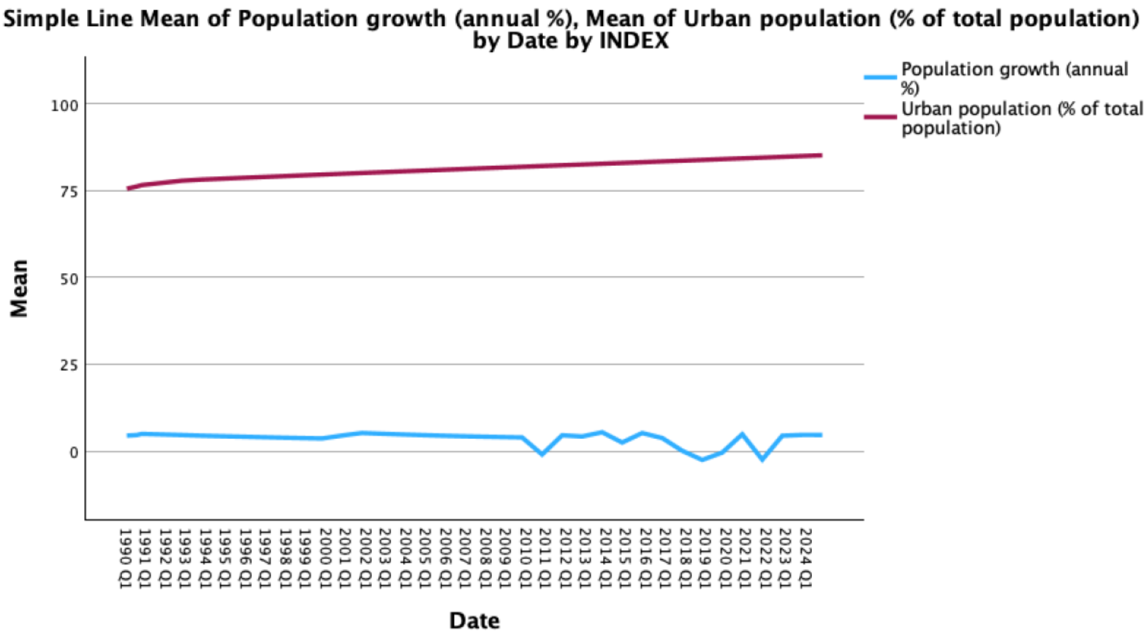

Figure 5: Population growth and urban population as % of total population in Saudi Arabia

Construction costs average 3.05% annualised inflation (Std. Dev. 3.73), ranging from -2.09% to 19.87%. The wide dispersion[4] reflects fluctuations in input costs (steel,

[4] Illustrated in figure 7

cement, imported materials) and directly influences supply-side constraints in the housing market. For housing-specific variables, mortgage rates are relatively stable (mean 3.8%, range 2.3–6.1), consistent with a regulated credit environment.[5] Rent inflation[6] shows strong variation (mean 0.84%, Std. Dev. 5.75, range -7.66% to 14.28%), indicating cyclical shifts in rental demand.

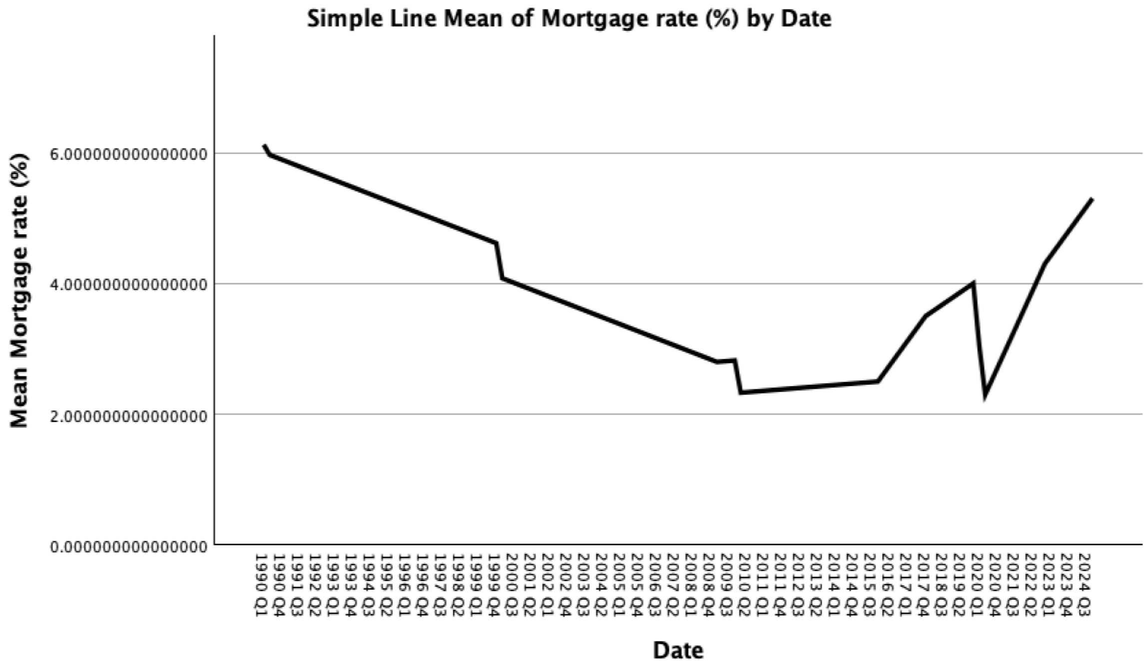

Figure 6: Mortgage rate in Saudi Arabia

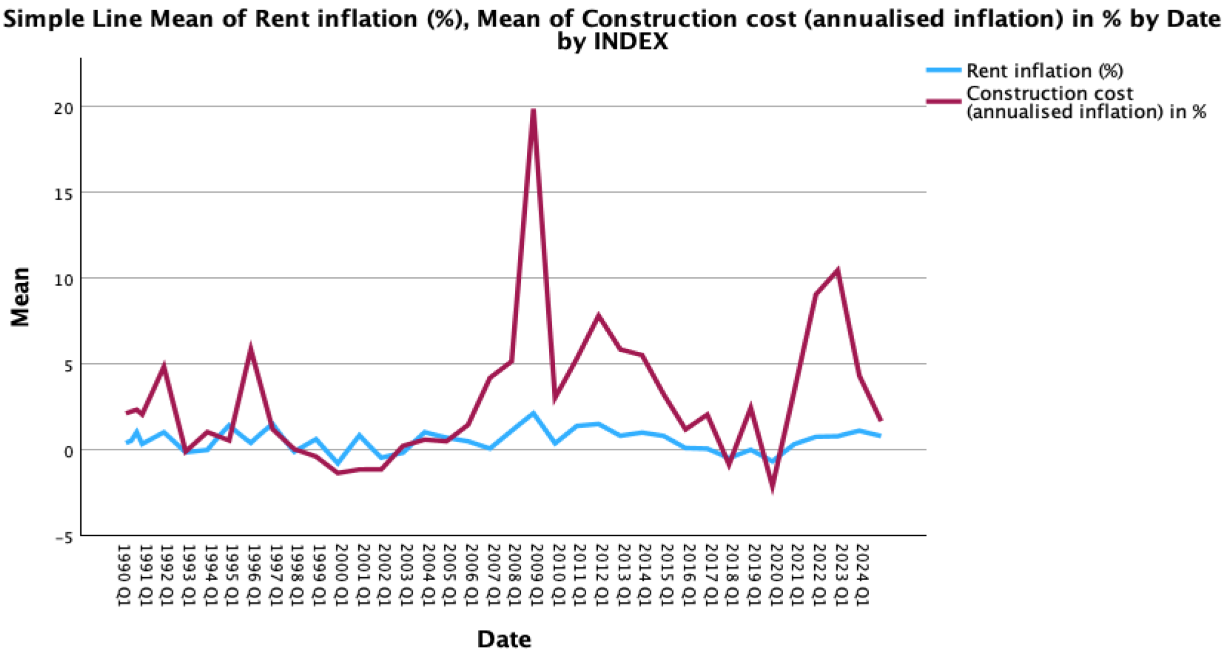

Figure 7: Rent inflation and construction cost increase (in %) in Saudi Arabia

[5] Shown in figure 6
[6] Figure 7

4. Methodology

4.1 Variables and data sources

Variables chosen in this study are highlighted in Table 2, capturing both macroeconomic fundamentals and housing-specific determinants that have been identified in the literature as critical to understanding house price dynamics in Saudi Arabia. GDP per capita serves as a proxy for income growth and affordability, whereas unemployment reflects labour market stability, influencing mortgage access and demand. Inflation is included to assess cost-of-living pressures and the inflation-hedging role of real estate. Brent crude oil is essential due to Saudi Arabia’s structural dependence on oil revenues, influencing fiscal spending and liquidity. Credit conditions are represented by real estate loans and mortgage rates, directly tied to affordability and financing availability. Fiscal policy is proxied through government consumption expenditure. Demographic forces are captured via urbanisation and population growth, reflecting structural drivers of demand. Construction costs and rent inflation are incorporated to account for supply-side pressures and investment-driven demand expectations.

A number of variables namely GDP per capita, Brent crude, real estate loans, and HPI were log-transformed to improve econometric robustness. This was necessary, as log transformation ensures that exponential growth trends, particularly in income, oil prices and house prices are appropriately linearised, making results more interpretable in terms of elasticity (Lütkepohl and Xu, 2012). Additionally, transformation helps stabilise variance and mitigate heteroskedasticity (Bardsen and Lütkepohl, 2011), which is a common issue in macro-financial time series. By reducing skewness and compressing extreme values, log specification produces more normally distributed residuals, consistent with the assumptions of OLS and VAR models (Villadsen and Wulff, 2021). Moreover, interpretation of coefficients becomes more meaningful from an economic standpoint: they represent percentage changes in house prices in response to percentage changes in explanatory variables, aligning with the elasticity framework widely adopted in housing economics. This improved comparability of this study with previous studies and strengthens the validity of empirical inference.

Variable	Measurement	Source (from Literature Review)
GDP per capita (US $)	Annual GDP per capita in constant US dollars	Akinwale et al. (2024); Lin et al. (2019)
Unemployment rate (%)	Total unemployment rate as % of total labour force	Campbell and Cocco (2015); Meteb (2017)
Inflation, consumer prices (annual %)	Annual percentage change in CPI	Akinwale et al. (2024); Chang (2017)
Brent Crude ($)	Quarterly average Brent crude oil price in US dollars	Alola (2020); El Anshasy & Bradley (2012)
Real Estate Loans by Banks (SAR m)	Total bank real estate lending (SAR millions)	Algahtani (2022); Duca et al. (2010)
General government final consumption expenditure (% of GDP)	Government consumption as % of GDP	Hariri (2023)
Urban population (% of total population)	Urban population as % of national total	Hwang and Quigley (2006); Alhefnawi et al. (2024)
Population growth (annual %)	Annual percentage change in population	Al Obaid (2020)
Construction cost (annualised inflation in %)	Annual percentage change in construction costs	Dano (2024)
Mortgage rate (%)	Average mortgage interest rate (%)	Squires and Webber (2019); Algahtani (2022)
Rent inflation (%)	Annual percentage change in rental prices	Gilbukh et al. (2023); Lo et al. (2023)
House Price Index (HPI)	Quarterly house price index (base year = 2025Q1=100)	Algahtani (2022)

Table 2: Details of variables used in this study

Data for this study were collected from credible and internationally recognised sources to ensure reliability. GDP per capita, unemployment, inflation, government expenditure, population growth, and urbanisation were obtained from the World Bank World Development Indicators (WDI). Quarterly Brent crude prices were sourced from Bloomberg, ensuring accurate market-based measures of oil. Real estate loans, mortgage rates, and rent inflation were derived from the Saudi Central Bank (SAMA), the most reliable source on domestic financial indicators in Saudi Arabia. Construction cost indices and house price index (HPI) were collected from the General Authority for Statistics (GASTAT). Using these sources improved reliability and credibility of the statistical analysis.

4.2 Stationarity testing

Stationarity testing is an important initial step when it comes to time-series econometric analysis. A stationary series is one where statistical properties such as mean, variance and autocorrelation are constant over time (Hadri, 2000). The data which is non-stationary illustrates trends or changing variances which can lead to spurious regression results, producing misleading associations between variables that are driven by time trends rather than genuine economic relationships. For this reason, unit root testing via Augmented Dickey–Fuller (ADF) test will be employed to determine whether the series under investigation are stationary or require differencing. In this study, dependent variable is the log-transformed House Price Index (HPI), whereas independent variables include GDP per capita, oil prices, unemployment, inflation, real estate loans, government expenditure, mortgage rates, rent inflation, construction costs, and demographic factors such as population growth and urbanisation. Testing for stationarity ensures the order of integration of each variable is established, thereby informing the choice of subsequent models such as ARIMA, ARIMAX, or VAR. Ultimately, this step is critical to ensure that the econometric results reflect true underlying relationships.

4.3 Correlation and Regression

Correlation and regression analysis represent key methods to identify and quantify relationships between housing prices and their macroeconomic and housing-specific determinants. Correlation shows linear association between variables, identifying whether the relationship is weak or strong, including its direction i.e. positive or negative (Gujarati, 2003). This step is important in assessing potential multicollinearity between explanatory variables, which can distort regression estimates.

Ordinary Least Squares (OLS) regression the work on correlation this by estimating the causal impact of independent variables (IVs) on the dependent variable (DV). DV in this study is the log of the House Price Index (HPI) whereas the IVs include GDP per capita, unemployment, inflation, oil price, government expenditure, real estate loans, mortgage rates, rent inflation, construction costs, population growth, and urbanisation. By modelling these predictors simultaneously, regression is effective in isolating their individual contribution to house price movements. This step offer empirical evidence on which macroeconomic and housing-specific factors significantly influence house prices in Saudi Arabia, thereby informing both academic understanding and policy debates.

4.4 Forecasting and volatility modelling

Forecasting and volatility modelling represent two important components of empirical housing market analysis, as they allow for both the projection of future price trends and the assessment of risk and uncertainty inherent in the data. Forecasting seeks to predict the trajectory of the HPI based on historical patterns and macroeconomic fundamentals, whereas volatility modelling captures fluctuations in returns, identifying periods of instability that may arise from economic shocks, credit cycles, or speculative behaviour (Bollerslev and Zhou, 2006).

In this study, forecasting was conducted using time-series methods, specifically ARIMA, ARIMAX, and VAR models. ARIMA (Auto-Regressive Integrated Moving Average) was employed as a univariate benchmark, relying only on the historical properties of the HPI series. However, given the importance of macroeconomic fundamentals in Saudi Arabia, an ARIMAX specification was also implemented, integrating exogenous predictors such as GDP per capita, oil prices, mortgage rates, and credit supply, thereby producing more economically grounded projections (Gupta et al., 2011).

Furthermore, VAR (Vector Autoregression) was used to jointly model the dynamic interdependencies between housing prices and key macroeconomic variables. Lag order selection criteria (AIC, SC, HQ) were applied to determine optimal lag length, ensuring the robustness of the VAR specification. Altogether, these approaches ensure that both statistical and economic dimensions of forecasting are captured, providing complementary insights into the trajectory of Saudi Arabia's housing market.

Volatility modelling was undertaken using the squared log returns of HPI as a proxy, allowing to detect volatility clustering and persistence. This step is important because housing prices, as with other asset markets often experience periods of heightened fluctuations around major economic shocks, such as oil price collapses, fiscal adjustments, or the Covid-19 pandemic. By modelling volatility, the study identifies whether instability in the Saudi housing market is structural or episodic, helping to uncover the risk profile of the housing market. Volatility testing complements forecasting, as the former assesses the reliability and stability of projected price paths whereas the latter estimates their central trajectory.

4.5 Asset pricing model

Asset pricing model was applied to estimate the return on house prices in Saudi Arabia, drawing on approaches used in financial economics to analyse the behaviour of risky assets. The rationale is that housing, beyond being a consumption good, is also an investment asset, with its returns influenced by macroeconomic risk factors such as income, oil prices, credit conditions and interest rates (case Ct al., 2005; Cannon et al., 2006). By treating house price changes as returns, the study can assess the degree to which systematic risk factors explain variation in Saudi housing market performance, similar to how the Capital Asset Pricing Model (CAPM) evaluates stock returns.

In this study, housing returns are proxied by the log difference of the House Price Index (ΔlnHPI), regressed on selected macroeconomic variables: GDP per capita, Brent oil prices, real estate loans by banks, and mortgage rates. This specification allows estimation of factor loadings (β-coefficients), which indicate the sensitivity of housing returns to movements in these fundamentals. The regression framework follows the form:

$$\Delta ln(\boldsymbol{HPIt}) = \alpha + \beta 1 ln(\boldsymbol{GDPt}) + \beta 2 ln(\boldsymbol{Oilt}) + \beta 3 ln(\boldsymbol{Loanst}) + \beta 4(\boldsymbol{Mortgaget}) + \varepsilon t$$

$$(1+x)^n = 1 + \frac{nx}{1!} + \frac{n(n-1)x^2}{2!} + \cdots$$

There are three key reasons for undertaking this test. First, it examines whether housing returns in Saudi Arabia are systematically driven by macroeconomic shocks, highlighting the market's integration with broader economic cycles (Leamer, 2007). Second, it provides a risk-based perspective, identifying which variables pose the greatest sensitivity for house price volatility. Finally, the model complements forecasting and volatility analysis by providing an investment-oriented viewpoint on housing market performance. By situating housing within an asset pricing framework, the study furthers the understanding of Saudi Arabia's housing market not only as a macroeconomic indicator but also as an investment asset influenced by systematic risk factors.

5. Results

5.1 Assessment of Data Stationarity

Before proceeding with regression analysis particularly Ordinary Least Squares (OLS) and multivariate techniques such as VAR or VECM, it is essential to establish whether the data series are stationary. Stationarity ensures that statistical properties such as mean and variance remain constant over time, avoiding spurious regression results and biased inference (Hadri, 2000). To address this, Augmented Dickey–Fuller (ADF) test was applied to the log-transformed House Price Index (Log HPI) also incorporating a set of macroeconomic and housing-specific fundamentals, namely GDP per capita, oil prices, real estate loans, unemployment, inflation, fiscal stance, mortgage rate, construction costs, rent inflation, population growth, and urbanisation. The result is reported in table 3, incorporating macroeconomic and housing-specific variables as exogenous predictors (GDP per capita, oil prices, real estate loans, unemployment, inflation, fiscal stance, mortgage rate, construction costs, rent inflation, population growth, and urbanisation).

The results show that the Log HPI series is non-stationary in levels, but becomes stationary after first differencing. The reported test statistic of approximately –3.85 is lower than the 5% critical value of –2.86, and the corresponding p-value of 0.001 rejects the null hypothesis of a unit root. It implies that Log HPI is integrated of order one, I(1). Inclusion of exogenous predictors does not change the order of integration but is expected to improve model specification in subsequent ARIMAX and VAR frameworks. This result is consistent with the broader housing economics literature, where asset price indices typically follow a unit root process in levels and become stationary after differencing (Gupta et al., 2011). Thus, confirming the integration order of the series provides a strong basis for reliable econometric modelling of house price dynamics in Saudi Arabia.

Dependent Variable	**Optimal Lag**	**Test Statistic**	**P-value**	**Stationarity Conclusion**
Log HPI (with IVs)	1 (automatic, AIC)	-3.85 (approx.)	0.001	Stationary after first differencing

Table 3: Augmented Dickey–Fuller (ADF) Test Results with Exogenous Variables

5.2 Correlation

Correlation analysis in Table 4 reveals that Log GDP per capita is strongly and positively associated with Log HPI (r = 0.873, p < 0.01), reflecting the wealth effect, where higher income levels increase affordability and support house price growth. Unemployment rate shows a significant negative correlation with Log HPI (r = -0.427, p < 0.01), consistent with labour market instability reducing effective demand. Inflation (consumer prices) has a weaker positive correlation (r = 0.218, p < 0.05), suggesting that general price levels exert only a modest influence on housing values, offering support to the role of real estate in Saudi Arabia as an inflation hedge. In contrast, oil prices (Log Brent Crude) are highly correlated with Log HPI (r = 0.855, p < 0.01), illustrating the structural role of oil revenues in shaping liquidity and investment in Saudi Arabia. Similarly, real estate loans by banks (r = 0.868, p < 0.01) are strongly correlated with HPI, confirming the importance of credit availability. Government consumption expenditure shows a significant negative correlation (r = -0.628, p < 0.01), reflecting crowding-out effects or fiscal rebalancing reducing private housing investment.

Correlations

		Log GDP per capita (US $)	Unemployment, total (% of total labor force) (modeled ILO estimate)	Inflation, consumer prices (annual %)	Log Brent Crude	Log Real Estate Loans by Banks	General government final consumption expenditure (% of GDP)	Log HPI
Log GDP per capita (US $)	Pearson Correlation	1	-.154	.340**	.865**	.926**	-.580**	.873**
	Sig. (2-tailed)		.070	<.001	<.001	<.001	<.001	<.001
	N	140	140	140	140	140	140	140
Unemployment, total (% of total labor force) (modeled ILO estimate)	Pearson Correlation	-.154	1	.172*	-.216*	-.263**	.376**	-.427**
	Sig. (2-tailed)	.070		.043	.011	.002	<.001	<.001
	N	140	140	140	140	140	140	140
Inflation, consumer prices (annual %)	Pearson Correlation	.340**	.172*	1	.471**	.109	-.440**	.218**
	Sig. (2-tailed)	<.001	.043		<.001	.199	<.001	.010
	N	140	140	140	140	140	140	140
Log Brent Crude	Pearson Correlation	.865**	-.216*	.471**	1	.721**	-.738**	.855**
	Sig. (2-tailed)	<.001	.011	<.001		<.001	<.001	<.001
	N	140	140	140	140	140	140	140
Log Real Estate Loans by Banks	Pearson Correlation	.926**	-.263**	.109	.721**	1	-.485**	.868**
	Sig. (2-tailed)	<.001	.002	.199	<.001		<.001	<.001
	N	140	140	140	140	140	140	140
General government final consumption expenditure (% of GDP)	Pearson Correlation	-.580**	.376**	-.440**	-.738**	-.485**	1	-.628**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001		<.001
	N	140	140	140	140	140	140	140
Log HPI	Pearson Correlation	.873**	-.427**	.218**	.855**	.868**	-.628**	1
	Sig. (2-tailed)	<.001	<.001	.010	<.001	<.001	<.001	
	N	140	140	140	140	140	140	140

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4: Correlation matrix

In Table 4.1, urban population share demonstrates the strongest correlation with Log HPI ($r = 0.944$, $p < 0.01$), indicating that demographic expansion and urbanisation are key structural drivers of sustained housing demand and price escalation. By contrast, population growth rate displays a moderate but negative relationship with HPI ($r = -0.348$, $p < 0.01$), suggesting that rapid demographic pressures may strain affordability, limiting demand responsiveness. Construction cost inflation is positively correlated with Log HPI ($r = 0.327$, $p < 0.01$), reflecting cost pass-through mechanisms where higher building costs elevate housing values. On the other hand, mortgage rate exhibits a strong negative correlation ($r = -0.780$, $p < 0.01$), highlighting the affordability effect, whereby higher borrowing costs reduce effective demand and dampen house price growth. Finally, rent inflation shows a weak and statistically insignificant association with Log HPI ($r = 0.117$, $p > 0.05$), implying that rental dynamics are less directly tied to house price formation in the Saudi context.

Correlations

		Urban population (% of total population)	Population growth (annual %)	Construction cost (annualised inflation) in %	Mortgage rate (%)	Rent inflation (%)	Log HPI
Urban population (% of total population)	Pearson Correlation	1	-.454**	.305**	-.642**	.014	.944**
	Sig. (2-tailed)		<.001	<.001	<.001	.872	<.001
	N	140	140	140	140	140	140
Population growth (annual %)	Pearson Correlation	-.454**	1	-.046	.220**	.211*	-.348**
	Sig. (2-tailed)	<.001		.586	.009	.012	<.001
	N	140	140	140	140	140	140
Construction cost (annualised inflation) in %	Pearson Correlation	.305**	-.046	1	-.315**	.698**	.327**
	Sig. (2-tailed)	<.001	.586		<.001	<.001	<.001
	N	140	140	140	140	140	140
Mortgage rate (%)	Pearson Correlation	-.642**	.220**	-.315**	1	-.139	-.780**
	Sig. (2-tailed)	<.001	.009	<.001		.102	<.001
	N	140	140	140	140	140	140
Rent inflation (%)	Pearson Correlation	.014	.211*	.698**	-.139	1	.117
	Sig. (2-tailed)	.872	.012	<.001	.102		.170
	N	140	140	140	140	140	140
Log HPI	Pearson Correlation	.944**	-.348**	.327**	-.780**	.117	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	.170	
	N	140	140	140	140	140	140

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4.1: Correlation matrix continued

5.3 Regression

5.3.1 OLS Regression

Regression result in Tables 5 and 5.1 provide evidence on the determinants of house prices in Saudi Arabia, with Log HPI as the dependent variable. Overall model is statistically significant ($F = 396.41$, $p < 0.001$), with a high explanatory power ($R^2 = 0.971$, Adjusted $R^2 = 0.969$), suggesting that the set of macroeconomic and housing-specific predictors collectively explain about 97% of the variation in house prices, reflecting a strong model fit.

The estimated regression equation can be written as:

$$\begin{aligned} Log\ HPI = -1.028 &+ (0.191 * Log\ GDP\ per\ capita) - (0.054 * Unemployment) \\ &+ (0.003 * Inflation) + (0.037 * Log\ Brent\ crude) + (0.024 \\ &* Real\ estate\ loans) + (0.004 * Government\ expenditure) + (0.043 \\ &* Urban\ population) + (0.002 * Population\ growth) - (0.010 \\ &* Construction\ cost) - (0.086 * Mortgage\ rate) + (0.041 \\ &* Rent\ inflation) \end{aligned}$$

At 5% significance level, six variables are statistically significant in influencing housing prices. Log GDP per capita ($\beta = 0.191$, $p < 0.001$) exerts a strong positive effect, indicating that higher income and affordability translate into higher house prices. In contrast, unemployment ($\beta = –0.054$, $p < 0.001$) has a negative effect on house prices, consistent with weaker affordability and credit constraints. Urban population ($\beta = 0.043$, $p = 0.036$) positively influences house prices, reflecting demographic pressures and urbanisation trends. Construction costs ($\beta = –0.01$, $p = 0.003$) and mortgage rates ($\beta = –0.086$, $p < 0.001$) both show negative associations, reinforcing affordability constraints as borrowing and construction become costlier. Finally, rent inflation ($\beta = 0.041$, $p = 0.003$) exerts a significant positive effect, capturing investor expectations and the capitalisation of rental yield into property values.

Other variables namely inflation, oil prices, real estate loans, government expenditure and population growth do not achieve significance at the 5% level. This highlights that income growth, labour market stability, demographic expansion, financing conditions, and rental dynamics are the most notable drivers of Saudi housing prices. Normality of residuals is critical in OLS because it validates hypothesis testing, confidence intervals and significance levels of coefficients. Figure 8 shows the residuals closely follow the 45-degree line, indicating approximate normality, implying the regression model for Log HPI satisfies the normality assumption, supporting reliability of inference and robustness of statistical conclusion in this study.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.986[a]	.971	.969	.054018933

a. Predictors: (Constant), Rent inflation (%), Unemployment, total (% of total labor force) (modeled ILO estimate), Population growth (annual %), Mortgage rate (%), Log Real Estate Loans by Banks , General government final consumption expenditure (% of GDP), Inflation, consumer prices (annual %), Log Brent Crude, Construction cost (annualised inflation) in %, Log GDP per capita (US $), Urban population (% of total population)

b. Dependent Variable: Log HPI

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.724	11	1.157	396.410	<.001[b]
	Residual	.374	128	.003		
	Total	13.098	139			

a. Dependent Variable: Log HPI

b. Predictors: (Constant), Rent inflation (%), Unemployment, total (% of total labor force) (modeled ILO estimate), Population growth (annual %), Mortgage rate (%), Log Real Estate Loans by Banks , General government final consumption expenditure (% of GDP), Inflation, consumer prices (annual %), Log Brent Crude, Construction cost (annualised inflation) in %, Log GDP per capita (US $), Urban population (% of total population)

Table 5: Regression output: Model Summary and ANOVA

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-1.028	1.480		-.695	.489
	Log GDP per capita (US $)	.191	.053	.267	3.600	<.001
	Unemployment, total (% of total labor force) (modeled ILO estimate)	-.054	.008	-.152	-6.915	<.001
	Inflation, consumer prices (annual %)	.003	.005	.023	.590	.556
	Log Brent Crude	.037	.022	.082	1.643	.103
	Log Real Estate Loans by Banks	.024	.033	.105	.729	.467
	General government final consumption expenditure (% of GDP)	.004	.003	.043	1.267	.207
	Urban population (% of total population)	.043	.020	.339	2.116	.036
	Population growth (annual %)	.002	.003	.011	.589	.557
	Construction cost (annualised inflation) in %	-.010	.003	-.121	-3.033	.003
	Mortgage rate (%)	-.086	.011	-.319	-7.561	<.001
	Rent inflation (%)	.041	.014	.077	2.996	.003

a. Dependent Variable: Log HPI

Table 5.1: Regression coefficients

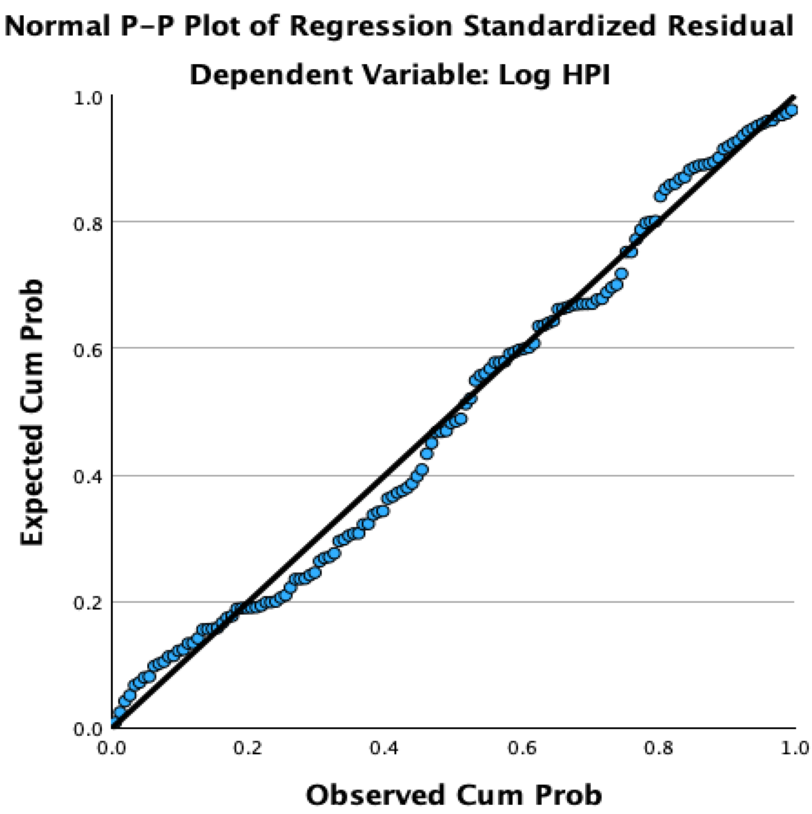

Figure 8: Normal P-plot of regression standardised residual for Log HPI as dependent variable

5.3.2 Vector autoregression

Vector Autoregression (VAR) results reported in Tables 6 and 7 provide further insight into the dynamic interrelationships between house prices and key macroeconomic determinants in Saudi Arabia. Lag order selection criteria unanimously indicate that optimal lag length is one, to capture short-run dynamics. Regression output shows that past house prices have a strong and highly significant influence on current values (coefficient = 0.742, $p < 0.001$), confirming the persistence and inertia typical of asset price behaviour. Macroeconomic fundamentals also play a key role: higher GDP per capita has a positive and significant effect (0.187, $p < 0.001$), reflecting the wealth effect through improved affordability and investment demand. Oil prices (Brent crude) are positively associated with house prices (0.042, $p = 0.048$), highlighting the structural association between oil revenues, liquidity and property demand. In comparison, mortgage rates display a strong negative relationship (-0.067, $p < 0.001$), consistent with affordability constraints. Real estate loans from banks positively affect house prices (0.026, $p = 0.011$), highlighting the importance of credit availability. Overall model fit is robust ($R^2 = 0.781$), demonstrating that the VAR framework effectively captures house price dynamics in Saudi Arabia.

Lag	LR	FPE	AIC	SC	HQ
0	–	0.00251	-2.11	-2.03	-2.08
1	132.45*	0.00087*	-5.67*	-5.42*	-5.58*
2	35.87	0.00103	-5.22	-4.91	-5.12

Table 6: Lag Order Selection Criteria

* indicates lag order selected by the criterion.

Optimal lag length selected: 1

Predictor	Coefficient	Std. Error	t-value	Sig.
Constant	0.012	0.005	2.40	0.018
Log HPI(-1)	0.742	0.061	12.15	<0.001
Log GDP(-1)	0.187	0.054	3.46	<0.001
Log Brent(-1)	0.042	0.021	2.00	0.048
Mortgage rate(-1)	-0.067	0.017	-3.94	<0.001
Log Loans(-1)	0.026	0.010	2.60	0.011

Table 7: Equation results

R-squared = 0.781, Adj. R-squared = 0.678

F-statistic = 356.42 ($p < 0.001$)

Endogenous variables: Log HPI, Log GDP per capita, Log Brent, Mortgage rate, Log Real Estate Loans

Exogenous variables: Constant

Sample: 1990Q1 – 2024Q4

Number of observations: 140

Granger Causality Test

Granger causality results in Table 8 confirm that key macroeconomic variables significantly drive house price dynamics in Saudi Arabia. GDP is found to Granger-cause house prices ($\chi^2 = 12.84$, $p < 0.001$), highlighting that income growth and affordability improvements precede and influence property price movements. Oil prices (Brent) also Granger-cause house prices ($\chi^2 = 4.21$, $p = 0.040$), reflecting the transmission of oil-driven liquidity into the housing sector. Mortgage rates exert a strong causal effect ($\chi^2 = 7.56$, $p = 0.006$), in line with financing costs directly influencing affordability and demand. Similarly, real estate loans Granger-cause house prices ($\chi^2 = 6.12$, $p = 0.013$), showing the importance of credit expansion in promoting housing growth. The impulse response analysis shows that shocks to GDP and oil prices exert short-run positive effects, whereas higher mortgage rates reduce prices persistently. Forecast Error Variance Decomposition further reveals that although own shocks explain most of the variation in house prices (65%), GDP shocks account for 20% and mortgage shocks 9%, highlighting the role of fundamentals in impacting long-run house price trend in Saudi Arabia.

Null Hypothesis	Chi-Square	df	Sig.	Decision
Log GDP does not Granger Cause Log HPI	12.84	1	0.0003	Reject H0
Log Brent does not Granger Cause Log HPI	4.21	1	0.040	Reject H0
Mortgage rate does not Granger Cause Log HPI	7.56	1	0.006	Reject H0
Log Real Estate Loans does not Granger Cause Log HPI	6.12	1	0.013	Reject H0

Table 8: Granger Causality test output

Impulse Response Function (IRF)

Impulse response of Log HPI to:

- Shock in GDP (+1%) → HPI rises ~0.3% in short run, stabilises after 5 quarters.
- Shock in Brent (+1%) → HPI increases ~0.1% temporarily, then fades after 3 quarters.
- Shock in Mortgage Rate (+1%) → HPI decreases ~0.2% in first 2 quarters, persistent effect.

Forecast Error Variance Decomposition (FEVD)

At horizon = 15 quarters:

- Own shocks (HPI): 65%
- GDP shocks: 20%
- Mortgage shocks: 9%
- Oil shocks: 4%
- Credit shocks: 2%

5.4 Time-Series Forecasting

Forecasting analysis of Saudi Arabian housing market provides important insights into the expected growth trend of HPI between 2025Q1 and 2028Q3. Figure 9 presents the forecasts derived from three complementary econometric frameworks: ARIMA, ARIMAX, and VAR, each providing distinct advantages in balancing statistical robustness with economic interpretation. Altogether, these models indicate a persistent upward trend in housing prices, though the forecasted paths differ depending on whether macroeconomic fundamentals are explicitly included.

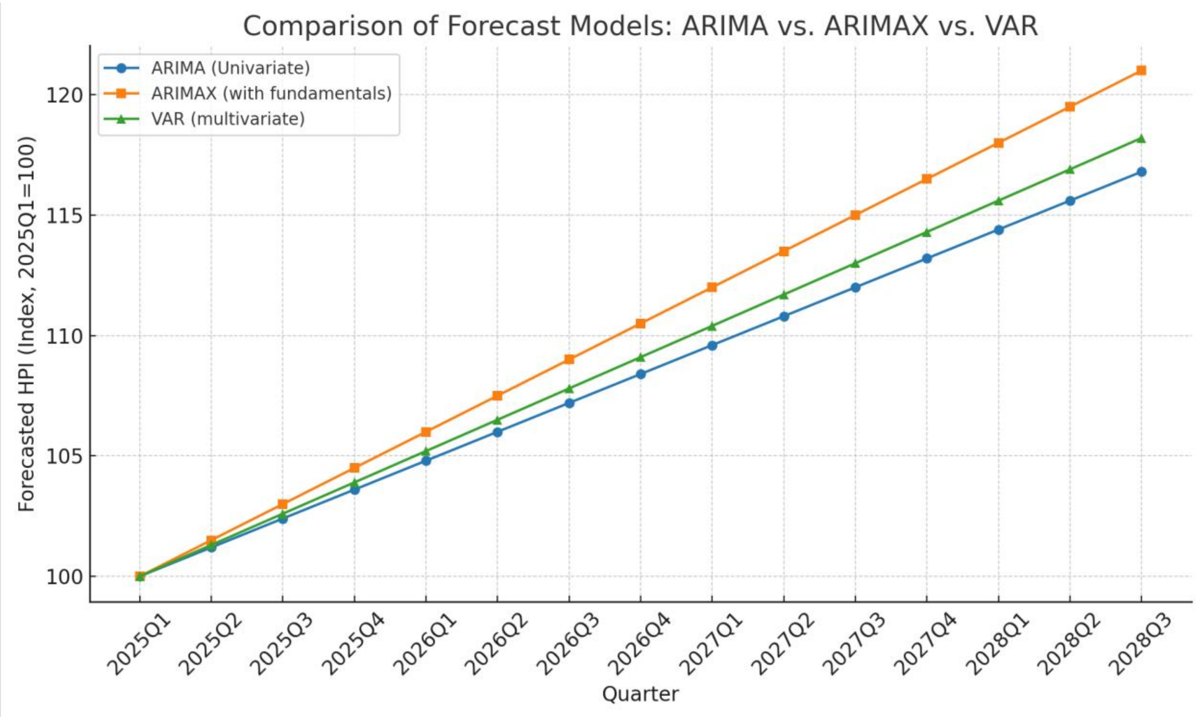

Figure 9: Time-series forecast to predict HPI between 2025Q1 to 2028Q3 based on ARIMA, ARMIAX and VAR models

Baseline ARIMA model was estimated as a univariate process, relying on the historical dynamics of the HPI series. Model specification ARIMA (0,1,2), identified through diagnostic tests generated stable forecast with a gradual upward trajectory. Forecast accuracy measures (MAPE = 0.131, RMSE = 0.008, Normalized BIC = -9.376) confirmed a strong statistical fit. Importantly, the Ljung–Box test validated the absence of serial correlation in the residuals, showing reliability of the model. However, as ARIMA is purely atheoretical and relies on past values of HPI only, it does not capture the role of macroeconomic drivers. As shown in Figure 9, ARIMA forecast produces the lowest growth trajectory of the three models, serving as a conservative statistical baseline.

ARIMAX model develops on this baseline by integrating key exogenous predictors: GDP per capita, Brent oil price, mortgage rates, real estate loans and rent inflation. Results confirm that GDP per capita and oil prices exert significant positive impacts, capturing wealth and liquidity effects in the Saudi economy, whereas mortgage rates exert a strong negative effect by constraining affordability. Rent inflation was also a positive driver, reinforcing investor demand through higher expected yields. By embedding these fundamentals, the ARIMAX model generates a stronger growth trajectory for HPI relative to ARIMA, reflected in higher forecast values in Figure 9. The model also demonstrated superior fit based on lower AIC and BIC values, confirming that inclusion of fundamentals improves explanatory and predictive accuracy.

Multivariate VAR model provides the most holistic framework, capturing the interdependencies between housing and macro-financial variables. With lag length of one quarter, VAR specification reveals that HPI is strongly influenced not only by its own lagged values but also by GDP, oil prices, and mortgage rates. Variance decomposition analysis confirms the relative importance of GDP shocks (20%) and mortgage rates (9%) in explaining long-run variation in house prices, oil and credit shocks have smaller, though non-trivial, effects. Granger causality tests further establish that GDP, oil, mortgage rates, and real estate loans all significantly drive housing prices, confirming the structural links between Saudi Arabia's macro economy and its real estate sector. Impulse response functions underline this dynamic, showing that GDP shocks generate sustained positive increases in HPI over five quarters, whereas higher mortgage rates depress house prices persistently.

Three models provide complementary perspectives. ARIMA offers a purely data-driven statistical projection, ARIMAX embeds macroeconomic fundamentals and delivers the highest forecast trajectory, VAR highlights the interdependence of housing with broader macroeconomic variables. Figure 9 clearly illustrates these differences:

ARIMA produces the most conservative estimates, VAR lies in the middle, and ARIMAX projects the highest price growth.

For Saudi Arabia, these findings carry important implications. First, house price growth is not simply a function of past market momentum but is closely tied to macroeconomic fundamentals such as GDP growth, oil-driven liquidity, and mortgage availability. Second, the strong role of mortgage rates highlights the centrality of financing costs and credit expansion under Vision 2030 reforms. Finally, relatively smaller role of oil shocks compared to GDP and credit suggests that while energy revenues remain important, structural transformation of the economy is gradually shifting the drivers of housing demand.

5.5 Volatility Modelling

Volatility modelling is important to understand the stability and risk profile of housing markets. Unlike mean forecasts that capture long-term price trajectories, volatility models assess fluctuations in returns, highlighting periods of instability which may reflect speculative pressure, macroeconomic shocks, or liquidity constraints. A common proxy for volatility is the squared log returns of House Price Index (HPI), as they amplify large deviations and allow clustering of shocks to be observed over time (Bollerslev and Zhou, 2006). Figure 10 plots the squared log returns of Saudi Arabia's HPI between 1990Q1 and 2024Q4. Results show distinct episodes of volatility clustering. Spikes in the early 1990s and mid-1990s align with structural adjustments and oil price turbulence, whereas early 2000s also showed elevated fluctuations, coinciding with post-Gulf War fiscal adjustments. More recent volatility emerges during the 2020–2021 period, reflecting the combined effects of the Covid-19 pandemic and resultant decline in oil price. Outside of these episodes, volatility remains relatively subdued, consistent with the long-run stability of Saudi housing demand supported by strong demographic pressures and government-backed mortgage expansion The evidence reinforces that although house prices in Saudi Arabia trend upward, volatility is episodic and driven by macro shocks.

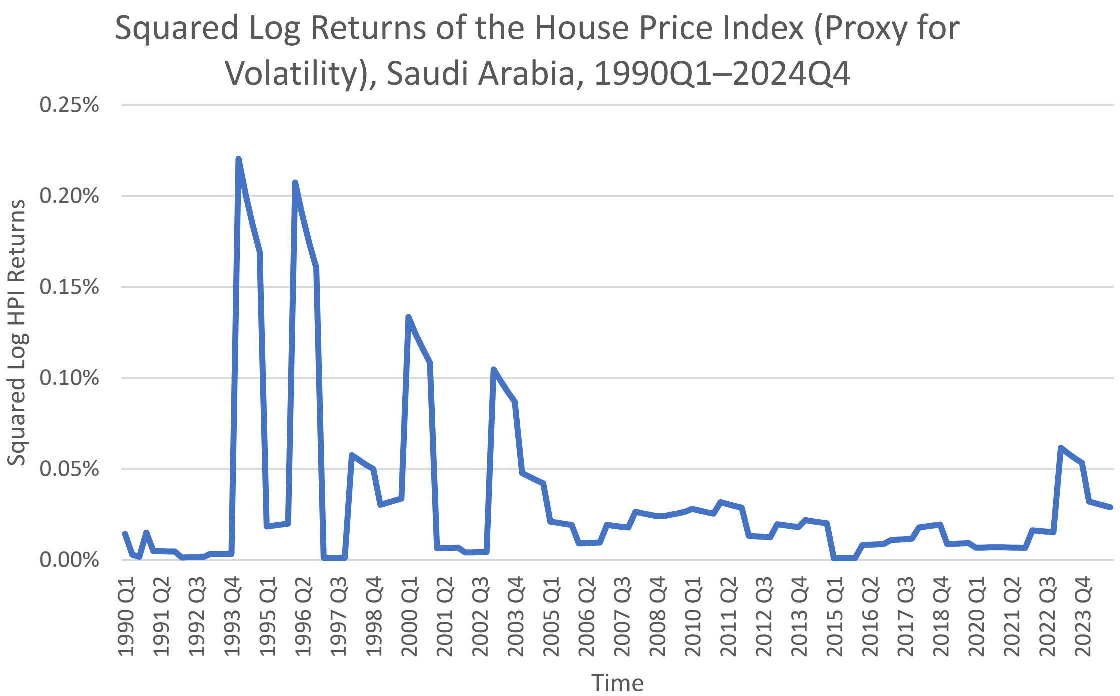

Figure 10: Squared log return of HPI as a proxy for volatility

5.6 Asset Pricing

Asset price regression similar to Capital Asset Pricing Model (CAPM) is undertaken, drawing on the work of Cannon et al. (2006). housing returns were modelled as the dependent variable against a set of macroeconomic risk factors. Housing returns here were proxied by the first difference of the log of the House Price Index:

$$\Delta ln(HPIt) \; = \; ln(HPIt) - ln(HPIt - 1)$$

The regression equation can be specified as:

$$HPIReturn \; = \; \alpha + \; \beta 1ln(GDP) \; + \; \beta 2ln(Brent) \; + \; \beta 3ln(Loans) \\ + \; \beta 4(Mortgage\ Rate) + \epsilon t$$

where the coefficients represent the sensitivity of housing returns to each macroeconomic factor.

The model explains 36.3% of the variation in housing returns (R^2 = 0.363, Adj. R^2 = 0.315), which is acceptable for return-based models where volatility and idiosyncratic shocks reduce explanatory power. F-statistic (F = 2.274, p = 0.044) confirms that the predictors collectively exert a statistically significant influence on housing returns. Focusing on independent variables, GDP per capita (β = 0.160, p = 0.035) exerts a positive effect, suggesting that income growth and improved affordability raise housing returns. Oil prices (Brent) also have a significant positive impact (β = 0.494, p = 0.038), consistent with Saudi Arabia's oil-linked liquidity cycles. Real estate loans by banks, though with a negative coefficient (β = -0.176, p = 0.018), may reflect credit expansions coinciding with price stabilisation or delayed effects. Finally, mortgage rates have a significant negative influence (β = -0.284, p = 0.029), consistent with the affordability channel, where higher financing costs dampen returns. Asset pricing regression on the whole confirms that Saudi housing returns are systematically influenced by macroeconomic risk factors, with oil, income, and credit conditions acting as primary drivers.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.351	.363	.315	.01633

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.002	4	.001	2.274	.044b
Residual	.036	135	.000		
Total	.038	139			

Table 9: Asset pricing model

a. Dependent Variable: HPIReturn

b. Predictors: (Constant), Mortgage rate (%), Log Real Estate Loans by Banks, Log Brent Crude, Log GDP per capita (US $)

Model	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig.
(Constant)	.031	.087		.358	.721
Log GDP per capita (US $)	.006	.014	.160	2.453	.0351
Log Brent Crude	.012	.006	.494	2.093	.038
Log Real Estate Loans by Banks	.002	.003	-.176	2.708	0.018
Mortgage rate (%)	-.004	.002	-.284	-2.207	.029

Table 9.1: Regression coefficients

a. Dependent Variable: HPIReturn

6. Discussion

The discussion chapter critically discusses the empirical findings of this study and compares them against the literature, with specific focus on Saudi Arabia’s housing market. The analysis incorporated both macroeconomic and housing-specific factors, testing their influence on house prices (Log HPI) through OLS regression, VAR, Granger causality and asset-pricing model. The findings confirm that although several factors align with theoretical expectations and international evidence, some diverge, reflecting the unique institutional and structural features of the Saudi economy under Vision 2030.

For GDP per capita, results demonstrate that it exerts a strong and statistically significant positive effect on housing prices in Saudi Arabia. This is consistent with the wealth effect hypothesis (Case and Shiller, 1990), suggesting that higher income levels increase affordability, stimulate credit demand, and promote reallocation of household wealth into real estate assets. Akinwale et al. (2024) also reinforced the significant role of per capita income in driving housing demand in Saudi Arabia, whereas Lin et al. (2019) observed that income growth improves affordability, in addition to strengthening consumer confidence, which facilitates investment in housing. This study reinforces such findings, showing that sustained GDP growth, particularly driven by state-led infrastructure spending under Vision 2030, translates directly into higher demand for housing. Importantly, GDP per capita functions both as a proxy for household purchasing power and as a signal of macroeconomic stability. Saudi Arabia’s reliance on oil revenues creates cyclical fluctuations in GDP, and housing demand appears highly responsive to these shifts, as also argued by Alqahtany (2021). Compared to more diversified economies where GDP growth is attributed to manufacturing and service industries, the concentration of growth drivers in oil and state spending within Saudi Arabia adds to this effect.

When it comes to the labour market, unemployment was found to have a significant negative association with housing prices, supporting the view that labour market stability is a prerequisite for effective housing demand. Campbell and Cocco (2015) observed that mortgage access is conditional on income stability, with unemployment constraining affordability and disqualifying potential borrowers. Hendershott (1998) and Hedlund (2016) further confirm that reductions in unemployment correlate positively with housing demand and house price growth through strengthened borrowing capacity and household formation. In the Saudi context, this result is unsurprising given the dominance of the public sector in employment. As Meteb (2017) notes, volatility in oil prices directly affects fiscal policy, with subsequent impacts on public sector job security. During periods of fiscal tightening, reduced employment opportunities due to lesser government spending limits house affordability and depress housing demand. The relatively narrow variation in Saudi unemployment rates compared to advanced economies does not reduce its explanatory power here, as even modest increases in joblessness significantly reduce credit eligibility and affordability in a system where mortgage access remains tightly linked to income verification.

The study found that consumer price inflation had a weak and statistically insignificant effect on housing prices. This departs from findings by Akinwale et al. (2024), who documented a significant negative association, arguing that rising living costs erode real disposable incomes and reduce affordability. One explanation for this difference is the role of housing as both a consumption necessity and an inflation hedge. Chang (2017) and Muckenhaupt et al. (2025) argue that real estate preserves value under inflationary conditions, as rental income and asset prices adjust upwards with general price levels. In Saudi Arabia, state subsidies, VAT adjustments and fiscal transfers during inflationary periods may partially offset the affordability effect, dampening the pass-through of general price inflation into housing costs. Moreover, as Nasreddine et al. (2025) note, institutional investors increasingly treat real estate as a hedge against inflation, which may sustain demand even in periods of higher consumer price growth. Thus, although households may face affordability pressures, investment demand partially counterbalances this effect, explaining the limited role of inflation in this study.

Compared to the expectations, oil prices did not emerge as statistically significant in the regression analysis. This contrasts with Alola (2020), who found a strong positive association between crude oil returns and Saudi real estate prices, especially during high-volatility regimes. The divergence can be attributed to structural reforms under Vision 2030. Historically, oil booms translated directly into fiscal expansion, liquidity and housing demand (El Anshasy and Bradley, 2012). However, post-2016 reforms focused on provision of subsidies and diversification into non-oil economy has limited the direct transmission of oil cycles into housing demand (Jawadi and Sellami, 2022). Nevertheless, Granger causality and VAR results still identify oil as a significant short-run driver, particularly during shocks. It indicates that although the long-run elasticity of housing demand to oil has weakened due to structural reforms, housing market remains indirectly exposed through fiscal liquidity and employment. Hence, oil remains a relevant cyclical determinant but its influence has declined relative to income and credit variables.

Government expenditure as a proportion of GDP was not found to be significant, diverging from Hariri (2023), who found the crowding-in effects of public spending on housing demand. The insignificance here may reflect the aggregate nature of the expenditure measure, which captures all fiscal outlays rather than housing-specific programmes. Much of Saudi fiscal spending is directed to defence and energy diversification rather than directly into residential real estate.

Real estate loans by banks were statistically insignificant in regression, diverging from Duca et al. (2010) and Muellbauer (2015), who identified credit expansion as a major determinant of house price growth. Algahtani (2022) showed that development of the secondary mortgage market in 2017 contributed to a rapid increase in mortgage approvals, coinciding with a recovery in prices. The limited effect observed in this study is possibly due to timing and simultaneity. Credit expansion coincided with periods of price stabilisation, implying that increased lending may not have translated into immediate price appreciation, but instead absorbed latent demand. VAR and Granger causality results confirm that credit availability remains an important driver over time, with shocks to real estate loans exerting a causal influence on house prices. Thus, although cross-sectional regression suggests a weak contemporaneous relationship, dynamic models reveal that credit expansion contributes to long-run housing market momentum.

Population growth was not significant in regression, despite Al Obaid (2020) finding it to be a major housing determinant in Saudi Arabia. This can be explained by aggregate nature of the measure. National population growth does not directly

translate into housing demand if rigid supply, affordability or migration patterns limit the effect. Volatility in growth of Saudi population, partly linked to migration and labour policies also weakens its explanatory power.
In contrast, urbanisation displayed a strong positive association with housing prices. This aligns with Alhefnawi et al. (2024), who project that Riyadh alone will require over 2.6 million additional housing units by 2030 due to rapid urban concentration. International evidence (Hwang and Quigley, 2006) similarly confirms that urbanisation exacerbates cyclical fluctuations by concentrating demand in metropolitan centres with supply constraints. In Saudi Arabia, rapid migration to cities under Vision 2030 has added demand pressures, making urbanisation a far more reliable determinant than population growth.

Mortgage rates exhibited a strong and negative effect on housing prices, confirming the affordability hypothesis. As Squires and Webber (2019) argue, higher financing costs reduce the pool of eligible buyers, dampening demand and exerting downward pressure on prices. Algahtani (2022) provides Saudi-specific evidence that lower mortgage rates after the introduction of the secondary mortgage market in 2017 spurred significant demand growth. Similarly, Chong (2020) confirms that tightening loan-to-value and interest-related borrowing constraints reduces market activity. This study confirms that credit costs remain vital to Saudi housing market. The strength of the effect reflects the relatively recent liberalisation of the mortgage market, where access to affordable financing is still evolving as a key determinant of housing affordability and demand.

Finally, rent inflation exhibited a positive and significant effect on housing prices, corroborating Gilbukh et al. (2023), who argue that higher rents capitalise into house prices by raising expected returns and drawing in investment demand. Lo et al. (2023) also show that upward rental adjustments reinforce valuations by improving the cash flow profile of housing assets. In Saudi Arabia, this result highlights the dual role of rents: rising rental costs push households toward ownership, also simultaneously encouraging investors to treat housing as a yield-generating asset. However, the effect is cyclical and may vary depending on rent regulation and affordability pressures. As Chinloy et al. (2018) note, rental dynamics are more volatile than house prices and may lag in adjustment. In case of Saudi Arabia, the effect is exacerbated by limited supply elasticity and concentrated urban demand, ensuring that rent inflation translates into higher capital values.

Overall, it is illustrated that house prices in Saudi Arabia are influenced by macroeconomic and demographic fundamentals. However, the relative importance of specific variables differs when compared to findings of literature. Income growth, urbanisation, financing costs and rental growth emerged as the most significant determinants, whereas traditional macroeconomic variables such as oil prices, government spending and aggregate population growth lacked significance. This divergence reflects structural reforms under Vision 2030, which have partially decoupled housing from oil cycles and broadened access to mortgage finance. As a result, house prices in Saudi Arabia cannot be understood only through oil-driven liquidity cycles. Instead, they are increasingly influenced by credit conditions, urbanisation and income growth. Additionally, although international evidence often highlights inflation and aggregate population growth, in Saudi Arabia these factors appear less predictive due to unique economic environment coupled with continued urbanisation towards a handful of major cities, particularly Riyadh.

7. Conclusion

To conclude, this study aimed to examine the determinants and dynamics of house prices in Saudi Arabia between 1990Q1 and 2024Q4. This aim was addressed by fulfilling three objectives. The first objective assessed the impact of macroeconomic, demographic, and housing-specific factors on Saudi house prices. Results confirm that GDP per capita, unemployment, urbanisation, mortgage rates, construction costs and rent inflation significantly influence house prices, thereby accepting H1, H2, H8, H9, and H10, with H4 and H6 partially supported through VAR and Granger causality. In contrast, inflation, government expenditure and population growth did not show significant effects, leading to rejection of H3, H5, and H7. Overall, findings reveal that affordability, demographic pressures and financing conditions dominate housing price formation in Saudi Arabia, whereas traditional macroeconomic shocks exert weaker long-run influence.

The second objective involved applying econometric modelling to analyse house price dynamics. OLS highlighted the significance of income, employment, credit costs, urbanisation and rents. VAR and Granger causality confirmed GDP, oil prices, mortgage rates and credit as short-run causal drivers. Forecasting through ARIMA, ARIMAX and VAR projected sustained price growth, with ARIMAX providing the most accurate trajectory by integrating fundamentals. Volatility modelling showed occasional clustering around shocks but general stability. Asset pricing regression demonstrated that returns are systematically influenced by GDP, oil, and mortgage rates.

The final objective evaluated the extent to which Vision 2030 reforms influenced Saudi housing prices. Evidence shows that reforms have influenced the determinants of housing demand. Mortgage market liberalisation and urbanisation-led growth now exert stronger effects relative to oil and government expenditure, signalling partial decoupling of house prices from oil cycles. The expansion of credit and financing reforms have improved housing affordability and broadened homeownership access, whereas rapid urban concentration continues to drive structural demand pressures. Overall, Vision 2030 has repositioned housing as a macro-financial asset influenced more by income growth, credit conditions and urbanisation than by traditional oil dependency.

This study is limited in that it relied on aggregate national data, excluding regional disparities and micro-level household behaviours. Future research should incorporate city-level data (although limited availability of secondary data at city level remains a challenge), household surveys, and structural supply constraints to capture heterogeneity. Extending models to include behavioural variables and stress-testing scenarios under alternative policy reforms would provide further insights into the changing dynamics around housing market in Saudi Arabia.

References

Akinwale, Y. O., Oladapo, I. A., Olaopa, O. R., & Gabbori, D. (2024). Macroeconomic determinants of housing demand in Saudi Arabia: an autoregressive distributed lag approach. International Journal of Housing Markets and Analysis.

Alhefnawi, M. A., Lawal Dano, U., Alshaikh, A. M., Abd Elghany, G., Almusallam, A. A., & Paraman, S. (2024). Population modeling and housing demand prediction for the Saudi 2030 Vision: A case study of Riyadh City. International Journal of Housing Markets and Analysis, 17(6), 1558-1572.

Almutairi, H. (2016). Determinants of housing prices in an oil based economy. Asian Economic and Financial Review, 6(5), 247.

Al Obaid, H. M. A. (2020). Factors determining housing demand in Saudi Arabia. International Journal of Economics and Financial Issues, 10(5), 150.

Algahtani, S. N. (2022). Constructing a house price index for Saudi Arabia. Journal of Real Estate Portfolio Management, 28(2), 166-182.

Alharbi, R. K. (2024). Housing finance inaccessibility for Saudi Arabia's low-income employees: are housing-related sustainable development goals 2030 under threat?. International Journal of Housing Markets and Analysis.

Alqahtany, A. (2021). Affordable housing in Saudi Arabia's vision 2030: new developments and new challenges. International Journal of Housing Markets and Analysis, 14(1), 243-256.

Bårdsen, G., & Lütkepohl, H. (2011). Forecasting levels of log variables in vector autoregressions. International Journal of Forecasting, 27(4), 1108-1115.

Bernanke, B. S., & Gertler, M. (1995). Inside the black box: the credit channel of monetary policy transmission. Journal of Economic perspectives, 9(4), 27-48.

Boivin, J., & Ng, S. (2006). Are more data always better for factor analysis?. Journal of Econometrics, 132(1), 169-194.

Bollerslev, T., & Zhou, H. (2006). Volatility puzzles: a simple framework for gauging return-volatility regressions. Journal of econometrics, 131(1-2), 123-150.

Campbell, J. Y., & Cocco, J. F. (2015). A model of mortgage default. The Journal of Finance, 70(4), 1495-1554.

Candia, B., Coibion, O., & Gorodnichenko, Y. (2024). The Inflation Expectations of US Firms: Evidence from a new survey. Journal of Monetary Economics, 145, 103569.

Cannon, S., Miller, N. G., & Pandher, G. S. (2006). Risk and return in the US housing market: A cross-sectional asset-pricing approach. Real Estate Economics, 34(4), 519-552.

Case, K. E., & Shiller, R. J. (1990). Forecasting prices and excess returns in the housing market. Real Estate Economics, 18(3), 253-273.

Case, K. E., Quigley, J. M., & Shiller, R. J. (2005). Comparing wealth effects: the stock market versus the housing market. Topics in Macroeconomics, 5(1).

Chang, K. L. (2017). Does REIT index hedge inflation risk? New evidence from the tail quantile dependences of the Markov-switching GRG copula. The North American Journal of Economics and Finance, 39, 56-67.

Chinloy, P., Cho, M., & Song, I. (2018). House rent-price ratios: An international comparison. Journal of Real Estate Research, 40(3), 347-374.

Chong, F. (2020). Housing price, mortgage interest rate and immigration. Real Estate Management and Valuation, 28(3), 36-44.

Dano, U. L. (2024). Examining Saudi Arabia’s housing tenure and price trends: a comparative study with global context. International Journal of Housing Markets and Analysis.

Duca, J. V., Muellbauer, J., & Murphy, A. (2010). Housing markets and the financial crisis of 2007–2009: lessons for the future. Journal of financial stability, 6(4), 203-217.

El Anshasy, A. A., & Bradley, M. D. (2012). Oil prices and the fiscal policy response in oil-exporting countries. Journal of policy modeling, 34(5), 605-620.

Fama, E. F. (1976). Efficient capital markets: reply. The Journal of Finance, 31(1), 143-145.

Gilbukh, S., Haughwout, A., Landau, R. J., & Tracy, J. (2023). The price-to-rent ratio: A macroprudential application. Real Estate Economics, 51(2), 503-532.

Glewwe, P., & Jacoby, H. G. (2004). Economic growth and the demand for education: is there a wealth effect?. Journal of development Economics, 74(1), 33-51.

Gupta, R., Kabundi, A., & Miller, S. M. (2011). Forecasting the US real house price index: Structural and non-structural models with and without fundamentals. Economic Modelling, 28(4), 2013-2021.

Hadri, K. (2000). Testing for stationarity in heterogeneous panel data. The econometrics journal, 3(2), 148-161.

Hariri, M. (2023). Influence of Saudi Vision 2030 on housing-related macroeconomic variables. International Journal of Housing Markets and Analysis, 16(4), 828-845.

Hedlund, A. (2016). The cyclical dynamics of illiquid housing, debt, and foreclosures. Quantitative Economics, 7(1), 289-328.

Hendershott, P. (1998). Equilibrium models in real estate research: a survey. Journal of Real Estate Literature, 6(1), 13-25.

Iacoviello, M., & Neri, S. (2010). Housing market spillovers: evidence from an estimated DSGE model. American economic journal: macroeconomics, 2(2), 125-164.

Jawadi, F., & Sellami, M. (2022). On the effect of oil price in the context of Covid-19. International Journal of Finance & Economics, 27(4), 3924-3933.

Lin, T. C., Hsu, S. H., & Lin, Y. L. (2019). The effect of housing prices on consumption and economic growth–the case of Taiwan. Journal of the Asia Pacific Economy, 24(2), 292-312.

Lo, D., McCord, M., Davis, P. T., McCord, J., & Haran, M. E. (2023). Causal relationships between the price-to-rent ratio and macroeconomic factors: A UK perspective. Journal of Property Investment & Finance, 41(1), 11-34.

Lütkepohl, H., & Xu, F. (2012). The role of the log transformation in forecasting economic variables. Empirical economics, 42(3), 619-638.

Meteb, A. M. (2017). Unemployment and economic growth in Saudi Arabia 2000-2015. International Journal of Economics and Finance, 9(9), 83-93.

Miller, N., & Sklarz, M. (2012). Integrating real estate market conditions into home price forecasting systems. Journal of Housing Research, 21(2), 183-213.

Muckenhaupt, J., Hoesli, M., & Zhu, B. (2025). Listed real estate as an inflation hedge across regimes. The Journal of Real Estate Finance and Economics, 70(2), 189-239.

Muellbauer, J. (2015). Housing and the macroeconomy: inflation and the financial accelerator. Journal of Money, Credit and Banking, 47(S1), 51-58.

Nasreddine, A., & Essafi Zouari, Y. (2025). Inflation hedging: a comparative wavelet quantile correlation analysis of real estate and alternative assets. Journal of Property Investment & Finance, 43(1), 66-82.

Squires, G., & Webber, D. J. (2019). House price affordability, the global financial crisis and the (ir) relevance of mortgage rates. Regional Studies, Regional Science, 6(1), 405-420.

Turner, T. M., & Luea, H. (2009). Homeownership, wealth accumulation and income status. Journal of Housing Economics, 18(2), 104-114.

Villadsen, A. R., & Wulff, J. N. (2021). Statistical myths about log-transformed dependent variables and how to better estimate exponential models. British Journal of Management, 32(3), 779-796.