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Exploring Determinants of Housing Price Index in the Saudi economy

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Different macroeconomic factors affect the housing price index. In this study, the Saudi Arabian gross domestic product per capita and the consumer price index are two determinants that are examined using the Vector Error Correction Model (VECM). The analysis discovered two co-integration correlations between the three variables. Over time, consumer prices have a favorable effect. The three variables seem to mutually promote one another over the long run. Future studies in the area should investigate additional monetary and fiscal variables that might affect Saudi house prices.

KEYWORDS: ***HPI, GDPP, CPI, VECM, KSA***

1. INTRODUCTION

The property market has served as a growth engine for the entire country's economy, and it is regarded as one of the key contributors and leading drivers to socioeconomic development in any economy (Nuri, 2022; Morana, 2010). Additionally, it helps the labor market by creating new employment prospects (Nuri, 2022). Every family, everywhere and at any moment, needs their own home (Aaronson, 2000). For both the individual and the family, it serves as the cornerstone of stability and security. It promotes a sense of security, self-reliance, and solitude. In every economy, housing has an impact on the economy at a variety of socioeconomic levels (NACCA, 2005). However, housing prices are important and have significant effects on real estate developers, financiers, policymakers, and average people (Augusto, 2022).

Additionally, a sizable portion of the wealth of the majority of households is derived from the value of their homes. It affects the amount of consumption and makes up a large portion of personal income (Muellbauer and Murphy, 1997). Changes in house prices have an impact on businesses operating in the financial markets. As a result, the portfolios of numerous other real estate firms are impacted by housing prices (Panos, P., et al., 2009).

Saudi housing prices are examined in this study based on both gross domestic per capita and consumer prices. To achieve this aim, the study addresses the following questions: Is there a relationship between housing prices and GDP per capita? What is the relationship between house prices and consumer prices? In addition, the study would test the following two hypotheses:

H1: The GDPP significantly affects the HPI, and

H2: The HPI is significantly impacted by changes in the CPI.

The significance of the study is outlined below: The significance of this study is firstly derived from its topic, which is one of the current issues in the Saudi economy as well as its present and foreseeable difficulties. Additionally, only a few recent research studies have examined the connection between Saudi Arabia's property prices, GNP per capita, and consumer price index. This study makes an effort to look into this connection. Secondly, the study focuses on both the short- and long-term correlations between these variables using the Vector Error Correction Model (VECM). Thirdly, based on the outcomes, market participants, financiers, governments, and people must act. Finally, the expected outcome of this study will contribute to the knowledge base and inspire further research in this area.

The rest of this study is organized as follows: The Saudi real estate market is briefly introduced in the second segment, with a focus on housing. The widespread literature and theoretical framework surrounding the fundamental subject are discussed in Section 3. Section 4 describes an empirical model, methodology, and data. Section 5 offers the results and discussion. Some generalizations, key findings, and policy implications are outlined in the final part.

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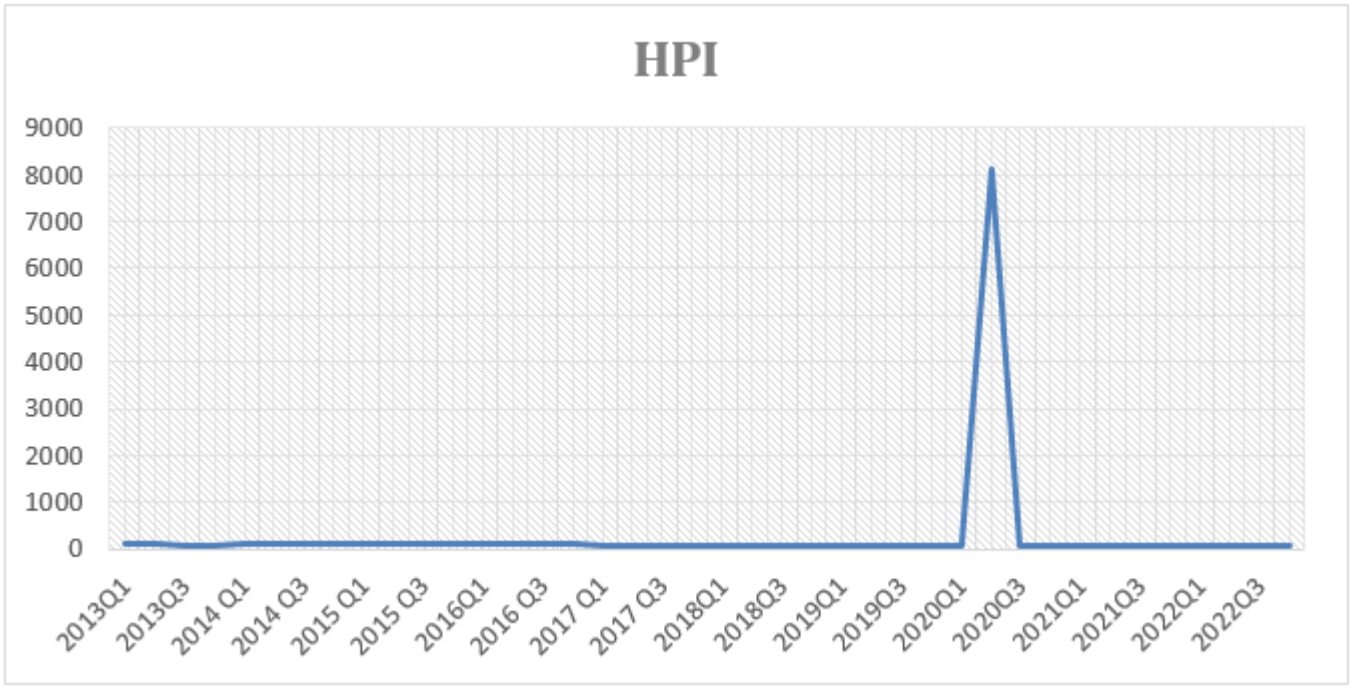
2. The Performance of the Saudi Real Estate Sector

The Saudi real estate sector has seen remarkable developments in recent years and has been the subject of ongoing fiscal and monetary policies. Thus, affirming the importance of house ownership as a necessary backbone of family stability and wealth creation in society. Therefore, the use of housing is no longer just for dwelling or investment but rather has become an indispensable component of the infrastructure of the Saudi economy. Real estate prices, including housing, are connected to the gross domestic product per capita.

The residential sector in Saudi Arabia also plays an important and active role in the national economy. According to the Saudi General Statistics Authority, nearly 50% of citizens owned houses in Saudi Arabia in 2017. The sector has experienced continuously high growth rates for the past four decades. According to SAMA statistics, the housing sector recorded high growth rates over the period (SAMA: 2003-2012). The annual growth rate in the sector was 11.4% during the said period. Given the social, economic, and developmental roles played by the housing sector, the government continued to pay great attention to the development of this sector. This interest has been reflected in the public development policies and strategies to ensure that the housing sector plays a positive role in national development. For instance, in the year 2008, the government agreed to establish the so-called "General Housing Authority", in addition to formulating a comprehensive housing strategy to encourage investment in housing. Figure 1 illustrates the index of the levels of the HPI over the study period.

Housing is one of the largest areas of spending under the National Transformation Program, with a dedicated budget of SR59 billion over the period (2015-2020) which represents a stimulating step for the sector. With a share of 65% of the total real estate market, a sustainable residential sector is formed to achieve ambitious reforms as expressed in the National Transformation Program and Vision 2030. As for the contribution of the construction sector to the GDP, this percentage varied between 6.71% in the year 2015 to 5.18% in the year 2018 (SAMA Annual Report, 2019).

Figure (1): Housing Pricing Index in Saudi Economy (2013-2022)



Source: Author's data analysis

The Saudi Credit Bureau (SIMAH) took the initiative to compute the (HPI) in Saudi Arabia in the first quarter of the year 2013. Using hedonic regression**,** a sample of more than 40,000 real estate firms was collected to measure the volatility of residential property prices. To recognize changes in housing prices, selected variables were nominated. Because housing is a certain type of asset that plays a great dual act as an investment and a commodity for consumption. Some of the ongoing literature indicates that developments in housing prices are firmly related to certain macroeconomic factors. The demand for housing is almost due to macroeconomic fundamentals. Such as GDP per capita, inflation, unemployment, interest rates, and other demographic factors. These macroeconomic variables are affected by economic developments. However, other variables on the supply side are almost rigid to react to economic changes, at least in the short term. Thus, most prevailing literature focuses on the demand side when estimating housing price determinants.

According to the General Authority for Statistics (GASTAT), the real Gross Domestic Product (GDP) of Saudi Arabia grew by 5.5% in Q4/2022 compared to Q4/2021 and Seasonally Adjusted Real GDP grew by 1.3% compared to Q3/2022. This positive growth was driven by the increase in non-oil related activities by (6.2% YoY; 1.3% QoQ), oil activities grew 6.1%

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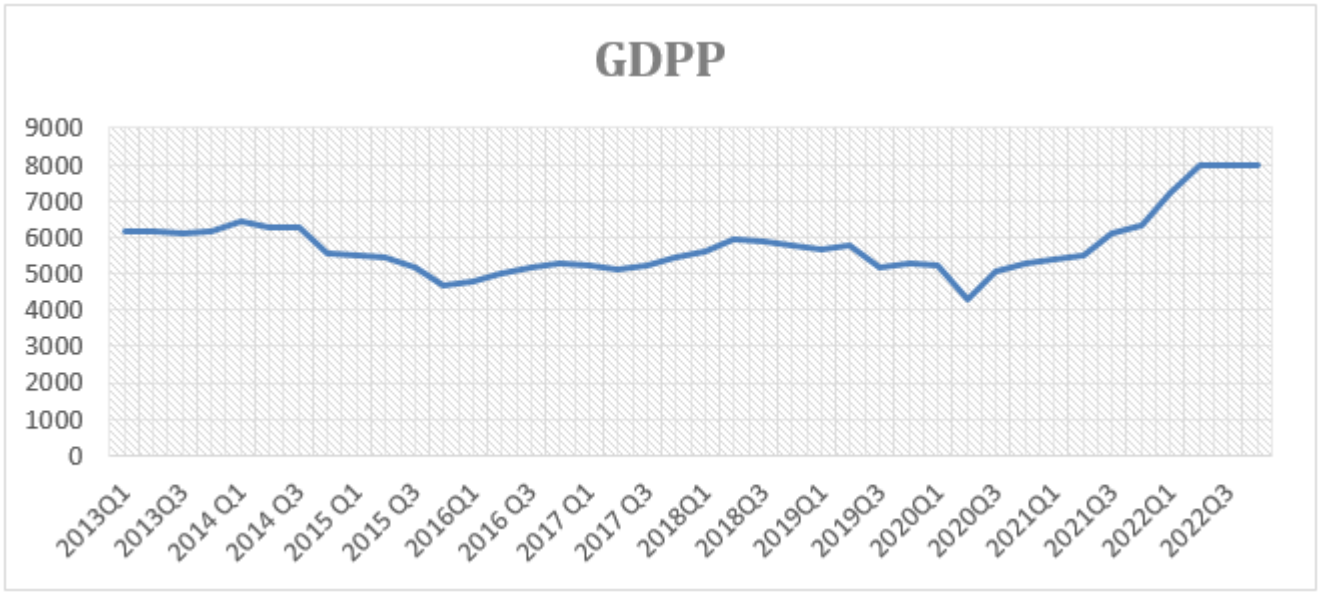
annually and declined 0.3% quarterly, and government activities grew by (2.9% yoy); 0.8% quarterly). Figure 2 illustrates the development of the GDP of the Saudi economy over the period (2013-2023).

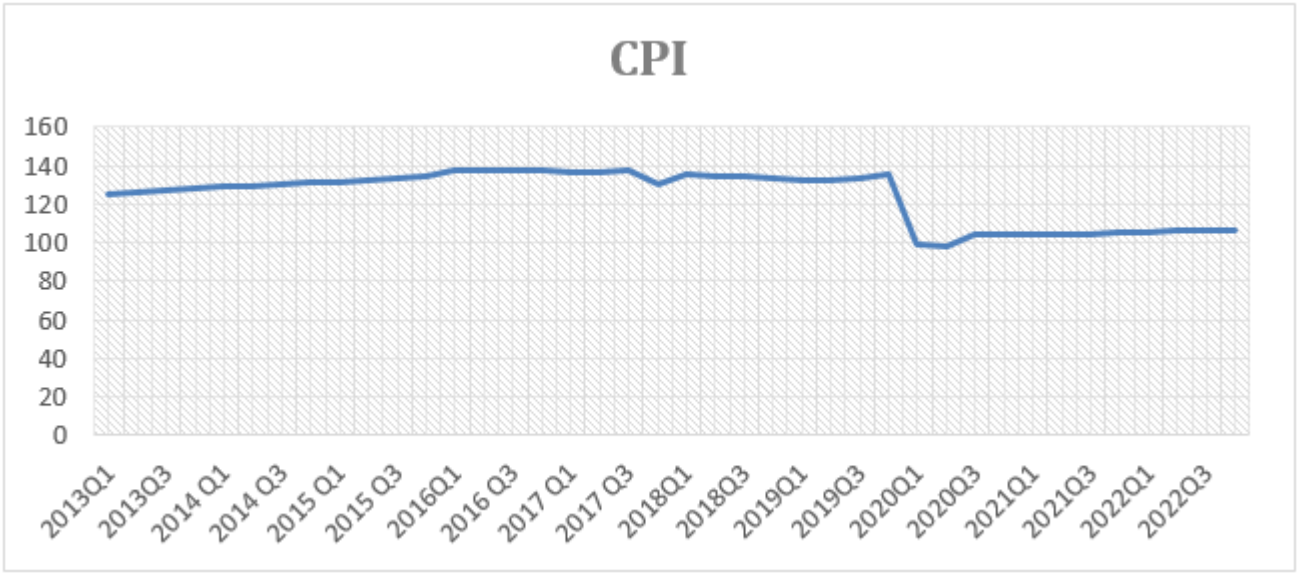
Figure (2): GDPP in Saudi Economy (2019-2022)



Source: Author's data analysis

Saudi Arabia's average inflation rate recorded an annual growth of 2.5% in 2022. The cost-of-living index for 2022 rose to 106.97 points, according to base year 2018, compared to 104.38 points a year earlier. The increase in the consumer price index (CPI) was mainly due to a 3.7% annual increase in average food and beverage prices and a 4.1% increase in transport, which are the main upward pressures on inflation. Figure 3 reflects the CPI rates of the Saudi economy over the period.

Figure (3): Consumer Price Index in Saudi Economy (2019-2022)



Source: Author's data analysis

3. Reviewing theories and Literature

3.1 Theoretical background

Housing is a science that describes the housing units in which people live as an integrated system consisting of land, housing units, and infrastructure services social and artistic (Davidson and Malloy, 2013). It is also a market study of housing production as well as a study of people's desires and requirements for their homes and the problems that people face to obtain adequate housing, as well as the impact housing affects people psychologically, socially, and culturally (Noyes and Hammond 2009). Research on housing requires determining the factors affecting this market and related to different disciplines, such as politics, economics, management, marketing and sciences sociology, psychology, law, home economics, architecture, civil engineering, Population geography, city planning, and statistical studies on migration Population, growth rates and urban planning (French, 2006).

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The relationship between selected macroeconomic factors and the sector of housing could stem from the approach of the credit theory which was proposed by (Mishkin, 2001) in his price channel theory. He argued that, in general, since housing loans are provided by different funds and financial institutions, it is expected that demand for a house to rise which pushes the housing prices to increase as well. This argument was later endorsed by (Nuri, 2022) who emphasized the role of monetary tools in affecting the real estate market.

The Modigliani (1950) model and theory of spending at different ages might also be relevant in describing the behavior of house price changes. In particular, different direct and indirect effects cost of capital, interest rates, wealth effect, and collateral, had their impact on both investments and expenditures of households (Milcheva, 2017). The mechanism works as follows: rising real estate prices lead to rising prices, household net worth increases, consumption increases and consequently has a positive effect on economic output. The opposite happens in the same direction.

Thus, examining the fluctuations of effects and causes on the residential sector depends on the aims and perspective of the issue, (Fordham, 1998). From an economic viewpoint, those factors are related to income, costs, loans, return, support, and being a source of long-term investment long term, and a means of saving, and the producer and marketer and other factors linked to production housing, industry, marketing, furnishing, and the construction of housing units at the lowest cost. From the business perspective, the factors are related to the organization, administration, operation, and maintenance of buildings and public utilities, and from the legal see the factors as more linked to contracts buying and selling, mortgage, the relationship between landlord and tenant, and the process of achieving justice between owners, sellers, tenants, and buyers, and analyze regulations and systems and legislation established by legislators. Finally, from a social viewpoint, factors affecting housing are those associated factors mainly related to the family, society, and a sound social life that is not marred by obscenity or crime, as it is the basis for the requirements of living, which is an association local environment, and settlement in new areas, which is the movement of the interaction of varieties ideologically, socially, and culturally different from humans (Carmona and Gallant).

Since the topic of housing is considered to be a complex topic that has attracted the attention of researchers from various disciplines and many of them have tried to explain and discuss this topic from different perspectives, this study aims to highlight selected factors affecting the housing market in the US affects Saudi economy.

3.2 Literature Review

The relationship between house prices and other macroeconomic factors is well documented (Serhan, 2022). Several empirical studies have attempted to explore the link between house prices, gross domestic product per capita, and inflation, and determine whether there is a cointegration relationship between these three variables. This section reviews relevant literature since the year 2000.

Four different studies during the period (2020-2022) were reviewed. Serhan (2022), examined the impact of selected economic, financial, and demographic factors on the housing prices in ten emerging European economies over the period (1998–2022) using the panel quantile regression method. The study's major findings revealed that income growth has a higher impact on higher housing prices. Whereas, changes in interest rates have a negative response on housing prices in the short-term or long-term. Another study by Augusto B. (2022), investigated the impact of selected macroeconomic factors such as GDPP, inflation, and unemployment on housing prices in the Philippines over the span (2000-2020) using the Engel-Granger. The econometrics findings revealed that an increase in GDP per capita, the level of prices, the unemployment by 1% caused a rise of 1.24%, 0.08%, and 0.398% respectively in the housing prices in the long term. Alfredas (2021) examined the impact of selected macroeconomic variables such as unemployment, GDP, inflation, wages, and internal migration on Vilnius property prices. The study concluded that lower unemployment, higher GDP per capita, and higher inflation had a positive impact on house prices. On the other hand, higher GDP per capita, wages, and internal migration had a positive effect on housing rents. Finally, the explanatory variables explained about 88% of the variance in home prices and 80% of the variance in home rental prices. Liu (2021) conducted a study in China to explore the impact of selected factors on housing prices. The study concluded that the property price, volumes of loans, and personal savings. The level of education had a positive impact on the house prices. However, the rate of unemployment had a significant negative effect.

Four other studies were summarized over the period (2010-2019). Shen (2018) used the VAR model to examine how selected monetary instruments, namely the interest rate, and the size of the money supply, affect property prices in China. The results showed that a decrease in the money supply led to a decrease in house prices. On the other hand, Yufang W. (2016) aimed to examine the impact of specific factors such as per capita income, land price index, construction costs**,** urbanization rate, interest rates, and CPI on property prices in Shanghai**.** Except interest rate, the rest of the selected factors had a positive impact on the housing price. Ong (2013) analyzed the impact of selected variables, namely, population, gross domestic product, employment, lending rates, price levels, and real property gain tax housing prices in Malaysia (2001 – 2010). The study found a significant correlation between house prices and the GDP, population, and real property gain tax. Julius (2012), on the other hand, chose another variable, namely interest rates, money supply, inflation, employment rate, and population growth, and their impact on Nairobi property prices. Only employment, GDP, and money supply had a direct impact on house prices. However, interest rates hurt real estate prices.

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Finally, three studies were outlined during (2000-2009). Panos (2009) investigated the impact of selected variables, namely, the construction cost, population, GDP growth, and the exchange rate on the housing prices in Cyprus over the period (1988-2008). The findings revealed that all the explanatory variables had a direct impact on house prices. Egert (2007) used panel data from 19 OECD economies to examine the impact of real income, real interest rates, and demographic factors on housing prices. The study found that GDP; real interest rates, demographic factors, and interest rates had a significant impact on housing prices. Nicolas (2003) used the (ECVAR) model to explore the effects of housing lending rates, inflation, employment, and money supply, on the housing price in Greece. The results concluded that all explanatory variables had a direct response to house prices. The interest rate on house loans, inflation, and employment were the variables with the greatest power to explain the variation in house prices. The money supply, on the other hand, showed only minor significant effects.

A review of cited and previous literature reveals a lack of studies examining the nature and determinants of residential prices in the Saudi economy. To fill this research gap, the present study aims to examine the short-run and long-run relationships between several determinants of the Saudi Arabian economy over the period (2013-2022).

4. Data and Model Specification

4.1 Data Collection

Data were collected every quarter from Saudi official sources over the period (2013q1-2022q4). Table 1 reflects the independent and dependent variables proposed by the study.

Table 1: Description of the Variables

Variables	Proxy	Unit measurement
		Dependent variables
Housing Price Index (Dependent variable)	Lg HPI	Index (2013-11= base year)
		Independent Variables
Gross Domestic Product per capita	Lg GDPP	Amount in Riyals (cumulative figures)
Consumer Price Index	Lg CPI	Index (2013-11=base year)

4.2 Model specification

According to Granger (1981) and Engle and Granger (1987), variables with a common stochastic tendency are identified as cointegrating. When cointegrating relationships exist in a system of variables, the VAR form is not suitable for use and it makes sense to consider certain parameterizations that support the analysis of the cointegrating structure. These models are referred to as VECMs. To examine the long-term equilibrium and short-term corrective relationships between variables in this study, VEC models for LnHPI, LnCPI, and LnGDP were built in the following form:

$$DYt = \alpha + \sum \alpha t DYt\text{-}i + \sum \beta DYt\text{-}j + \phi VECMt1 + \varepsilon i \quad (1)$$

Where:

DYt: the first difference of Yt,
Mt: the lag order, and
εi: the error term.

4.2.1 Descriptive Statistics

Table 2 illustrates the summary statistics of the three variables, namely, the HPI, GDDP, and the CPI. The statistics revealed that the mean of the three variables is greater than the median, indicating that the distribution of the data is positively skewed. Therefore, these variables have a high value, indicating that the data deviate from the mean.

Table 2: Descriptive Statistics

Variables	HPI	CPI	GDPP
Mean	288.945	124.25075	5758.125
Median	87.2	130.95	5530
Maximum	8102	138	7952
Minimum	80.5	98.2	4297
Std. Dev.	1267.049025410963	13.87228585373342	839.7929899836274
Skewness	6.08455364305975	-0.7610982491332684	1.212886676791173
Kurtosis	38.02314231862885	1.834458291692813	4.375105008537141
Jarque-Bera	2291.179450020028	6.12594942189757	12.95881691242345
Probability	0.0884	0.0767	0.0915
Sum	11557.8	4970.030000000001	230325
Sum Sq. Dev.	62611116.07900001	7505.172277500001	27504838.375
Observations	40	40	40

5. Results and Discussion

5.1. Stationarity Test

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It is necessary to check the stationarity of the variables using ADF and PP tests to avoid the problem of "pseudo regression" (Van and Bourles, 2018), which is caused by the existence of a unit root. The results of the unit root tests at the first level and the first difference are shown in Table 3. These three series are all stationary at the first level.

Table 3: The Stationarity Tests using ADF & PP

Variable	ADF Test	t-statistics	Prob.	PP Test	t-statistics	Prob.
	Constant & Trend			Constant & Trend		
LnHPI	-2.628961	-0.314939	0.5652	-2.625606	-0.409432	0.5294
	-1.950117			-1.949609		
	-1.611339			-1.611593		
LnCPI	-4.211868	-2.223846	0.4637	-4.211868	-2.177040	0.4885
	-3.529758			-3.529758		
	-3.196411			-3.196411		
LGDP	-4.219126	-0.812537	0.9557	-4.211868	-0.916629	0.9438
	-3.533083			-3.529758		
	-3.198312			-3.196411		
DLnHPI	-2.628961	-7.260430	0.0000	-2.627238	-38.81586	0.0000
	-1.950117			-1.949856		
	-1.611339			-1.611469		
DLnCPI	-4.219126	-6.344032	0.0000	-4.219126	-6.344032	0.0000
	-3.533083			-3.533083		
	-3.198312			-3.198312		
DLGDP	-4.219126	-6.388783	0.0000	-4.211868	-6.390393	0.0000
	-3.533083			-3.529758		
	-3.198312			-3.196411		

All variables transformed. The symbols ***, **, and * denote significance at 1%, 5%, and 10%, respectively.
D denotes a difference of the first order. The unit root of existence serves as the null hypothesis for both the ADF and PP tests.

5.2 Selection of optimal lag

Using the criteria of the smallest values of the information criteria AIC, FPE, HC, LogL, LR, and AIC, the lag optimum for the VAR model from endogenous variables HPI, GDPP, and CPI was determined. The results are shown in Table 4, and they indicate that the ideal lag order is 1.

Table 4: Optimal Lag Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	12.58302	NA	0.000120	-0.518001	-0.387386	-0.471953
1	82.11583	124.0315	4.55e-06*	-3.790045*	-3.267585*	-3.605853
2	131.0061	79.28152*	5.32e-07	-5.946275	-5.031971	-5.623940*
3	137.2347	9.090375	6.36e-07	-5.796470	-4.490320	-5.335991

* 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

5.3 Correlation Tests

To investigate the correlation between variables, it is necessary to conduct the cointegration test (Granger, 1980, Engle and Granger, 1987). The study carried out the Johansen cointegration test (Johansen, 1988). The trace statistics are lower than the critical values at 95% confidence level only when rank=1, showing that the null hypothesis is accepted, whereas all other values reject the null hypothesis with a co-integration relationship, according to both Table 5 and Figure 4. The three variables exhibit a co-integration relationship, according to the Johansen co-integration test.

Table 5: Johansen Co-integration

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.840179	81.30200	29.79707	0.0000
At most 1	0.233394	11.62134	15.49471	0.1760

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At most 2	0.039251	1.521590	3.841465	0.2174

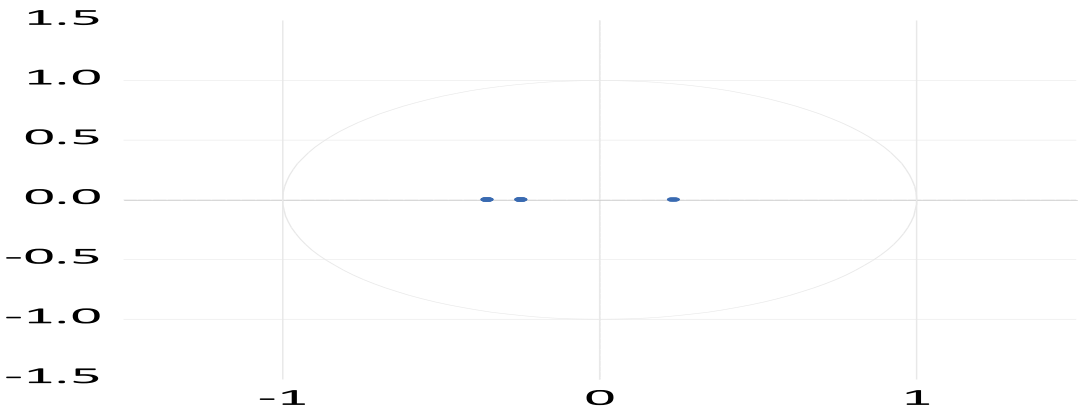
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.840179	69.68066	21.13162	0.0000
At most 1	0.233394	10.09975	14.26460	0.2055
At most 2	0.039251	1.521590	3.841465	0.2174

The max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level.
* Denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Figure (4): Eigenvalues & Modulus of the VECM



5.4 Analyzing the VECM Estimates

HPI, GDPP, and CPI do exhibit long-run equilibrium correlations, according to cointegration research, but they are out of equilibrium in the short term. The VECM, shown in Table 6, is used to examine the short-term disequilibrium and dynamic structure. The table shows, firstly, the R-squared value, which indicates that the model adequately accounts for or predicts 80% of the relationship between the dependent and independent variables. Second, the VECM estimates aim to interpret both short-term departures from the equilibrium and the long-term equilibrium relationships between the variables. The long-term link between one lag period and the VECM is represented by Ecm1 (t-1). Their coefficients show the degree to which the long-term relationship to short-term volatility is adjusted. The one-stage lag values of the first differences of each variable are DlnHPI (-1), DLn GDPP(-1), and Dln CPI(-1), and their coefficients show how they affect the short-term volatility in the dependent variable.

Table 6: VECM Estimation

	Model 1 DLHPI	*Model 2 DLCPI*	*Model 3 DLGDP*
Ecm(t-1)	-0.563**	-0.482***	-0.602***
	(0.041)	(0.000)	(0.000)
DLnHPI(-1)	0.440***	0.521***	0.378**
	(0.002)	(0.005)	(0.041)
DLnCPI(-1)	0.649**	0.310**	0.248**
	(0.010)	(0.022)	(0.032)
DnLGDP(-1)	0.964***	0.763*	0.630*
	(0.000)	(0.066)	(0.055)
Cons	0.077*	0.052***	0.093***
	(0.081)	(0.009)	(0.000)
R-squared	0.8015	0.7080	0.8530

Note: (1) ***, **, and * respectively indicate significance at the 1%, 5%, and 10% levels; (.) probabilities are reported in parentheses

Additionally, Table 6 showed that all three models' error correction coefficients are negative, indicating that when DLnHPI, DLnCPI, and DLnGDP deviate from their long-term equilibrium states in the short term, they will return to that state at rates of -0.563, -0.482, and -0.602, respectively.

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In Model 1, the correlation coefficient between the lag terms DLnCPI and DLnGDP and the DLnHPI is substantial at 1% and 10%, respectively. This shows that the prior variation of each variable has a considerable impact on the short-term fluctuation of the housing price index in the current period. Additionally, Model 2 shows that the lag terms DLnHPI and DLnGDP have significant correlation coefficients with DLnCPI at 10% and 1%, respectively, demonstrating that the short-term fluctuation of the consumer price index in the current period is significantly influenced by the past variation of each variable. Last but not least, Model 3 demonstrates that the correlation coefficient between DLnGDP and the lag terms DLnHPI and DLnCPI are significant at 5%, demonstrating that the prior variation of each variable does considerably influence the short-term fluctuation of gross domestic product per capita in the current period.

The fact that the error correction terms coefficients in all three models are significant at values of 1%, 5%, or 10% suggests that the influence of the equilibrium's earlier stages is what primarily affects the three variables' short-term variations. The fact that the error correction process had a detrimental impact on fluctuations in the CPI is shown by the negative signs of the error correction coefficients.

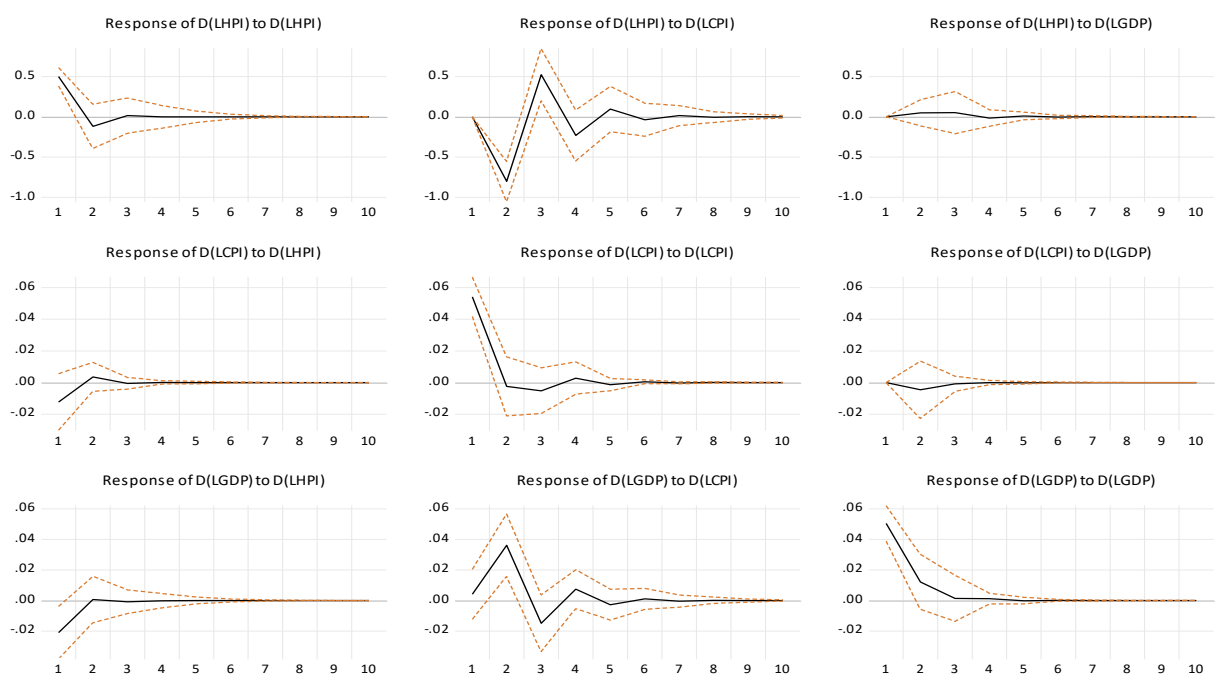
5.5 The Dynamic Response Analysis

Further study is necessary using both the impulse response function and variance decomposition based on VECM, and the findings for consideration for 10 periods, to investigate the dynamic effects of the model reacting to specific shocks as well as how the effects are among the three variables.

5.5.1 The Impulse Response Analysis

The impulse response analysis of the VECM is shown in Figure 5. The effects of D(LHPI) on D(LCPI), D(LGDP), and D(LHPI) are displayed in the first row. These details are shown in Figure 4: First, it is discovered that positive shock has a significant impact after examination of the impacts of HPI shock. After a positive shock, HPI drops quickly, reaches its lowest point in the second period, and then slowly climbs to its peak during the sixth and seventh periods, where it subsequently stabilizes. This shows that HPI's positive shock has a big impact on the index's increase. Second, D(LCPI) negatively impacted D(LHPI), reaching its lowest impact in the second period, then rising rapidly in the third period, dropping once again in the fourth period, and stabilizing in the ninth period. Last but not least, D(LGDP) had a minor impact on D(LHPI) in the first period, reaching its maximum influence in the third period, and stabilizing after the ninth period.

Figure (5): Impulse Response



5.5.2 The Variance Decompositions

The term "variance decomposition" refers to the breakdown of mean square error into the individual contributions of each variable. This technique can be used to examine how each variable's update affects the other variables and to show the relative effects. Table (8) shows that the variance in house price projections is not accurate, and that part of it may be due to arbitrary innovation shocks to various macroeconomic variables, including itself. The study's findings suggest that there are two co-integration relationships existing between the three variables. Consumer pricing has a favorable effect in the long run. These results suggest that the three variables have a long-term mutually beneficial relationship. Future studies on the subject are recommended by the study, and they should take additional fiscal and monetary aspects into account that could have an impact.

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Table 7: Variance Decomposition

Variance Decomposition of D(LHPI): Period			
	S.E.	D(LHPI)	D(LCPI)
1	0.498019	100.0000	0.000000
2	0.953069	28.87690	70.86271
3	1.088225	22.16772	77.41078
4	1.112830	21.19854	78.37837
5	1.117000	21.04062	78.53223
6	1.117606	21.01782	78.55466
7	1.117692	21.01462	78.55778
8	1.117703	21.01419	78.55819
9	1.117704	21.01414	78.55825
10	1.117705	21.01413	78.55825
Variance Decomposition of D(LCPI): Period			
	S.E.	D(LHPI)	D(LCPI)
1	0.055498	4.825750	95.17425
2	0.055845	5.176343	94.17581
3	0.056090	5.138958	94.19875
4	0.056161	5.126424	94.21292
5	0.056178	5.123433	94.21559
6	0.056180	5.122964	94.21607
7	0.056181	5.122893	94.21613
8	0.056181	5.122883	94.21614
9	0.056181	5.122882	94.21614
10	0.056181	5.122882	94.21614
Variance Decomposition of D(LGDP): Period			
	S.E.	D(LHPI)	D(LCPI)
1	0.054782	14.70901	0.554944
2	0.066758	9.914798	29.70441
3	0.068400	9.457775	32.98735
4	0.068811	9.345507	33.75318
5	0.068865	9.330651	33.85822
6	0.068874	9.328278	33.87474
7	0.068875	9.327972	33.87689
8	0.068875	9.327930	33.87718
9	0.068876	9.327925	33.87722
10	0.068876	9.327924	33.87723
Cholesky Ordering: D(LHPI) D(LCPI) D(LGDP)			

6. Conclusion, policy implications, and limitations

6.1 Conclusion

The goal of the study was to investigate how certain macroeconomic variables namely, the GDPP, and the CPI affected the HPI in the Saudi economy over the period from (2013 Q1-2022 Q3) using the VECM estimations. Two co-integration relationships between the three variables are present, according to the results. The econometric analysis revealed that both the GDP per capita and the CPI had notable effects on the housing sector, especially prices. The results also indicate that HPI, GDPP, and CPI do exhibit long-run equilibrium correlations, according to cointegration estimates, but they are out of equilibrium in the short term. The findings also revealed that the R-squared value is 80%, which indicates that the model adequately accounts for or predicts 80% of the relationship between the dependent and independent variables. Consumer pricing has a favorable effect in the long run. These results suggest that the three variables have a long-term mutually beneficial relationship. The study recommends further research in the area that takes into account more financial and economic variables that could affect home prices in the Saudi economy.

6.2 Policy Implications

Several policy implications and learned lessons could be derived from the results obtained from this study. In general, shocks to macroeconomic variables such as GDP per capita and CPI have a significant impact on the performance of the real estate market. Regarding what we call the feedback effect the impact of the residential market on macroeconomic variables the results provide some support for the claim that investing in the residential market plays an essential role in economic growth through its multidimensional relationships. In addition, this outcome will be important to participants and other players in the residential and construction industry, who may find it helpful to know what can happen to real estate investment following macroeconomic shocks. Furthermore, ultimately, the results of the study provide insights into the relationship between residential investment and other macroeconomic factors in other economies. Finally, the outcomes of this study will contribute to the knowledge base and will inspire further research and academia in this area.

6.3 The study's Limitations

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1/ For methods, since there are different econometrics tests to perform unit root, cointegration, and other analyses, the use of alternative econometrics methods may lead to different results.
2/ Although the study focuses on residential real estate, it is useful to compare and contrast the impact of the commercial real estate sector or another sector with that of the residential sector.
3/ The model chooses only two explanatory variables, GDP per capita, and CPI. Other monetary and financial elements can be added to the model.
4/ In terms of the period, the study was only limited to the years (2013-2022). Further studies could be conducted for more periods.
5/finally, the study is limited to the Saudi Arabian economy. In-depth research could be conducted on more markets in the region, such as in the Gulf countries.

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