Effectiveness of Monetary Policy on Residential Sector: Evidence from Saudi Arabia

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Abstract

This study intends to examine how residential prices are affected by monetary policy tools in Saudi Arabia. Quarterly secondary data for six years spanning from 2014q1 – 2019q2 were gtherered. The study analyzes the dynamic effects on housing prices of four macroeconomic variables, namely Money Supply (M2), Consumer Prices Index (CPI), Effective Exchange Rate (LEXC) and Lending Rate (LR). Vector Autoregression Analysis (VAR) is employed to capture the dynamic effect of the four macroeconomic variables on residential prices. Granger Causality, Variance Decomposition and Impulse response function are also used. The results show that residential prices are significantly and positively related to its indigeneity and to the effective exchange rate, whereas it is negatively and significantly related to lending rates. However, residential price index is negatively and insignificantly related to the levels of consumer price index. Variance decompositions show that M2 is the variable with the highest explanatory power over the variation of housing prices, followed by LER, EXCR and CPI respectively. The results of both the variance decomposition and impulse response function indicate that M2 is the most influential determinants for housing prices, implying that the future course of housing prices in KSA must be assessed accordingly.

1. Introduction

Numerous factors could be identified as the key determinants of residential prices. For instance, GDP per capita, level of money supply, consumer price index, the rate of unemployment, interest rates and so on. These factors may have a negative or a positive relationship with residential prices. Also, the degree to which each of these factor impacts the residential prices varies. Thus, understanding the relationship between residential prices and macroeconomic variables is of much importance while making investment decisions as well as policy formulations. The major goal of this study is to identify the main monetary instruments affecting the overall residential prices in Saudi economy during the period (2014-2019). Specifically, the study is intended to assess quantitatively whether major monetary policy factors such as effective exchange rate,lending rate, money supply and consumer prices have any impact upon residential prices.

This study is intended to state the following questions: Does a relationship exist between residential prices and effective exchange rates? What is the nature of the relationship between residential prices and CPI? Does lending rate have any impact on residential prices? What is the effect of money supply on residential prices?

The paper is addressing the following hypotheses: H1: the effective exchange rate has a significant impact upon changes in residential prices in Saudi economy.H2: lending rate has negative effect upon residentialprices.H3: there exists a causal relationship between inflation (changes in CPI) and changes in residential prices. H4: money supply is the most explanatory variable upon residential prices.

About significance, the study believes that the monetary policy determinants of residential prices in Saudi Arabia have not been deeply studied and researched. This study, therefore, tries to fill in this gap. Moreover, it is expected that this study will add to the body of knowledge in existence in the real estate field which will be beneficial to academicians and researchers. Results of this study are also of a special importance for investors, financiers, and the government and individuals.

The study is organized as follows: The second section briefly presents the theoretical framework and studies the previously current empirical literature on the impact of monetary policy on residential price index. After defining the empirical approach and a description of the employed dataset in section in section 3 the study turns to Section 4which reports and discusses the empirical results. As usual, the paper closes with a summary of the main findings and some conclusions.

2.Theoretical Framework and Literature Review

2.1 Theoretical Framework

Economic text books have included many definitions of monetary policy, since the concept has evolved with the development of economic ideas and theories. Some of those definitions are: monetary policy is a set of procedures and measures related to organizing the cash issuance process and controlling credit in a way that it is impossible to separate cash and credit in the impact that those procedures and measures exert on price movements(Marie De Laplace, 2003). It is also defined as a set of measures taken by the state in managing all of the cash, credit and general liquidity of the economy (Andrey Chouchane, 2001). Zakariya E. (2006) defined monetary policy as a set of measures aimed at managing the monetary mass and interest rates, with the aim of maintaining the stability of economic activity. In this sense, monetary policy includes all measures taken by the government, the central bank, and the treasury, with the intention of influencing the amount, provision and use of cash and credit, as well as government borrowing. Hence, the task of monetary policy does not stop at the limits of controlling the size of the issued currency, and offering to use bank

credit, but rather extends to form the borrowing policy of the government sector, as the latter has clear implications on the money supply.

The primary goal of monetary policy is to achieve a level of economic stability in light of balanced growth which implies a close connection between economic growth and monetary instruments. This link is clearly reflected through the relation between economic problems of unemployment, inflation and the devaluation of the national currency with monetary solutions. Thus, monetary policy, if favorable economic conditions are available, can achieve a level of domestic stability. Monetary policy may use one of its tools to absorb the surplus of purchasing power in the market for goods and services, by attracting this surplus in the form of attractive savings vessels. It can also influence the exchange rate of the national currency to the extent that reduces the severity of the deficit in the balance of payments. Thus, monetary policy is one of the tools of economic policy to be employed to besiege inflation and protect its national currency from deterioration, and to achieving economic expansion.

On the other hand, real estate market is considered as the key contributor to socio-economic development and has been acted as an engine of growth in many countries by creating new job opportunities and playing other important roles in the economy. Housing is extremely essential for all people, everywhere and at every time. For example, housing ownership provides a sense of security, independence and privacy to all households. Therefore, housing prices are important for them and are also of high significance to real estate developers, financiers and policy makers.

Over the last few decades, the Saudi real estate market has witnessed a continuous change and development, particularly, the housing sector which has been a target of several monetary and fiscal policies. The real estate sector in Saudi Arabia has witnessed continuous economic reforms, where both public and private sectors are prepared to take initiative and play the required role in developing the real estate market.

Despite the current conditions in the Saudi real estate market, it is expected that the sector might remain positive as a result of government initiatives to address key challenges facing the housing sector in Saudi Arabia. The government has also made other regulatory efforts such as the white land tax, the large housing schemes and the mortgage law to deal with barriers facing the sector.

In addition, other factors such as demographic factors will continue its impact on demand for the housing market in Saudi Arabia. This includes a high percentage of youth population which has registered a substantial growth rate over the past decades. On a macroeconomic level, the economy is expected to gradually cope with the new strategy in oil prices as it diversifies away from its dependence on this sector in line with new socioeconomic visions and reforms. Moreover, the implementation of various urban initiatives and investment in infrastructures are considered other catalysts factors for development and growth in the housing sector.

Real estate prices witnessed noticeable changes during the past period (as indicated in figure 1) which displays changes in the real estate price indicator in Saudi Arabia for the period under study from the first quarter of the year 2014 and up to the fourth quarter of 2019 in which the arithmetic mean of the indicator reached 91.3 with a standard deviation of 6.67.

Figure 1 also indicates that residence prices were declining during the period as the value of residential prices indicator was 97.9 at the beginning of the period and then took a slight upturn in the third quarter of 2014 reaching 101.8 before taking a downward trend up to the year 2019 reaching its lowest level at 81.9 in the fourth quarter of 2019.

This was due to several factors among which was the fall in demand for residences because of the economic crisis and the plummet in the oil revenues of the Kingdom in addition to the reduction in the numbers of expatriates in the Kingdom which also led to a reduction in demand for residences and the consequent reduction in prices.

Figure 1: HPI during the period (2014 Q1 – 2019 Q4)
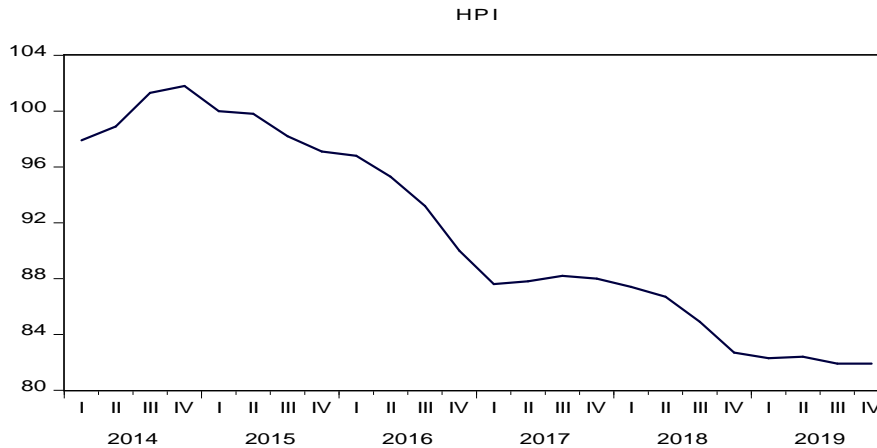
2.2 Literature Review

Although there is a large literature that focuses on interactions between asset prices and monetary policy, the relevant literature on the specific impacts of monetary policy on house prices is fairly limited (Negro and Otrok, 2007).

Jaya G. Prabhu Parrikar (2019) conducted an empirical study on the influence of GDP, interest rates, housing credit, exchange rate and inflation with House Price Index in India during 2010 Q1 - 2017 Q4. The study employed correlation and multiple regression analysis, the Johansen cointegration test and VECM to identify the dynamic relationship in short run as well long run. The study concluded that GDP, exchange rates, housing credit and inflation have strong positive correlation with house price index except for weak negative correlation with interest rates. The VEC Model observed unstable long run association presence of short run casual association of GDP, housing credit and interest rates with House price index. The study observed the absence of long run association of macroeconomic factors especially the GDP and House Price Index.

Na Yan (2019) analyzed the mechanism of monetary policy influencing real estate price, and discussed the effect of monetary policy on real estate market using empirical research method in China. The results found that both money supply and interest rate had an impact on real estate price. Finally, some policy suggestions are put forward to improve the monetary policy system for the healthy development of the real estate industry.

Shen Chen et al (2018) investigated the impact of monetary policy on housing prices in China with a VAR model. Granger causality tests, impulse response functions, and variance decompositions are used to analyze the impacts of two monetary policy variables, market-based short-term interest rates and money supply, on housing prices. The results showed that a contractionary monetary policy will cause the growth rate of housing prices to decline in China. In particular, a positive shock to market-based interest rates measured by the 7-day interbank offered rate has a significant and negative effect on housing prices in a range from five months to one and a half years after the shock takes place. However, their paper found no evidence that supports the significant impact from money supply on housing prices. The results implied that the market-based short-term interest rates are effective monetary policy instruments for the central bank in China to conduct its policy to affect housing prices.

Cuong Nguyen et al (2017) examined the relationship between monetary policy and housing bubbles using residential property market data in Japan from 2008   2015. The results showed that the change in monetary policies significantly affected the housing returns when the returns are at average and high levels, such as in cities of Tokyo, Nagoya, Osaka and Aichi prefecture.

However, there was none of such effect at the national level. These findings have not been documented in literature and will be useful for policy makers as well as property investors in Japan.

Yufang W, et al (2016) conducted a study on the main factors affecting housing price in Shanghai. The authors adopted an econometric model using seven explanatory variables, per capita disposable income in Shanghai, land transaction price index, construction cost, urbanization rate, interest rate, CPI of residence and investment in real estate in Shanghai. The study reached out that only interest rate reflected poor explanatory while the other six variables could be good explanatory variables for the housing price.

I-Chun TSAI (2015) argued that extant studies indicate that the excessive easing of monetary supplies can result in surplus liquidity, which can consequently facilitate the formation of asset bubbles. The study was based on data on house prices in the U.S. from January 1991 to August 2012 to explore the correlations between monetary liquidity and house price bubbles in the U.S. housing market. Results show a significant correlation between the formation of housing bubbles and monetary supplies. Long-term easing of monetary supplies can cause housing marketing returns to deviate from fundamentals, which then results in an increase in continuous fluctuations in house prices and the likelihood of the formation of house price bubbles.

Zhengxun Tan and Ming Chen (2013) aimed to assess empirically whether China's central bank should react to house prices. The study used three kinds of VAR models including structural VARs with a combination of short-run and long-run restrictions. Broader money supply (M2) and the one-year lending rate are used as monetary policy proxies according to the distinctive background in China. The result showed that interaction between M2 and house prices is much more evident than the effects of M2 and house prices on GDP and CPI. In the three-variable VARs, GDP reacts to the M2 shock more considerably than it does in the four-variable SVARs. In the structural

identification model, M2 and interest rates respond to a house price shock more sensitively than they do in the Cholesky identification.

This study complements the above-mentioned literature by identifying the impact of monetary policy determinants on residential prices in Saudi.

3. Data and Methodology

3.1 Data

The aim of this study is to gauge the impact of major monetary factors on the housing pricing in Saudi. Data on housing price index, interest rate is measured by the 7- day interbank offered rate and the money supply is measured by M2, and consumer price index were collected from the Saudi Arabia of Monetary Agency annual publications. Data on the real exchange rate was collected in the World Bank databases.

3.2 Methodology

VAR model allows all the four system variables (housing price index (HPI), money supply growth rate (M2), short-term interest rate (IR), and real exchange rate (EXC). to influence each other endogenously. According to Sim (1980) and McNees (1986), VAR model can give better forecasts compared with structural simultaneous equations.On the practical side, the empirical equation to capture the impact of polices' variables on economic growth is being modelled in level form as below:

$$LHPI_t = \alpha + \beta 0\, LM2_t + \beta 1\, LIR_t + \beta 2\, LEXC_t + \beta 3\, CPI_t + U_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots \ldots\ldots\ldots\ldots(1)$$

whereas:

$LHPI_t$ = Logarithm of housing pricing index, proxy of housing prices(dependent).
$LM2_t$ = Logarithm of broad money supply'M2', proxy of monetary policy (independent).
LIR_t = Logarithm of interest rate (independent).
$LEXC_t$ = Logarithm of exchange rate (independent)
$LCPI_t$ = Logarithm of inflation rate (independent)
U_t = the Error Term.

4. Results and Discussion

4.1 Unit Root Test

Firstly, for time series data the paper tested the stationarity property for all variables. The paper employed the Augmented Dickey-Fuller (ADF) test. For each variable, the paper uses the following equation:

$$\Delta Y_t = \alpha_0 + \gamma Y_{t-1} + \sum_{i=2}^{p} \psi_i \Delta Y_{t-i+1} + \varepsilon_t \qquad (2)$$

‘

where Y is the variable of interest, implies the change, t is the time trend, p is the number of time lags, and ε_t is the white noise residual with zero mean and constant variance. The parameters $\alpha_0 \gamma$ and ψ_i are to be estimated. If the parameters are significant, one rejects the null hypothesis and there is no unit root. The data series for the concerned variable is stationary. Table 1 reflects the results of the Augmented Dickey-Fuller (ADF) for the time series data of the five model variables.

Table (1)

Augmented Dicky Fuller Test Results

Variables	Level		1st Difference	
	Intercept	Intercept & trend	Intercept	Intercept & trend
LHPI	0.849	3.7128	2.7357*	3.761**
prob	*0.784*	*0.420*	*0.081*	*0.031*
LM2	2.660	0.2950	6.1689***	6.9627***
prob	*0.260*	*0.7622*	*0.000*	*0.0001*
LIR_t	1.6513	1.6552	4.4256***	4.6631***
Prob	*0.441*	*0.9712*	*0.0032*	*0.0084*
$LExc_t$	1.403	21.933***	5.781***	3.993**
prob	*0.145*	*0.000*	*0.000*	*0.0248*
$LCPI_t$	0.9661	2.070	4.322***	4.220***
prob	*0.745*	*0.531*	*0.003*	*0.0172*

Note. (*), (**), and (***) indicate the rejection of the null hypothesis of non-stationary at 10%, 5%, and 1% significance level.

As illustrated in Table (1), all five variables are non-stationary at the level with the constant and with the time trend. However, when the first difference was employed, the results for all variables revealed that they became significant, implying that they are stationary.

4.2 Estimating VAR Model

Secondly, to estimate Vector Auto Regressive Model, the VAR model has been employed in consistence to previous researches as presented earlier in the literature review. Besides, the VAR model permits for utilizing the Impulse Response Function as well as the Variance Decomposition, which assess the current and future effects of monetary policy indexes on the residential prices included in the model. The proper VAR model has the following form:

$$Y_t = \alpha + \sum_{i=1}^{p} \xi_i Y_{t-i} + \varphi X_t + \varepsilon_t \qquad (3)$$

where Y_t is an m*1 column vector of market volatility, α is an m*1 column vector of constants, ξ_i is an m*m matrix of coefficients, X_t is a q*1 vector of exogenous variables, and represents an m*1 column vector of unobserved disturbances assumed to be independently and identically distributed (i.i.d.) with $\varepsilon (\varepsilon_t = 0)$.

4.3: VAR Lag Length Order Criteria

Table (2) shows the optimal lag period that the model should include in accordance with the presented criteria.

Table (2)

VAR Lag Length Order Criteria

Lag	LogL	AIC	SC	HQ
0	-251.19	25.61	25.80	25.66
1	-173.30	20.38	21.88[*]	20.67
2	-144.34[*]	19.93[*]	22.60	20.46[*]

Note. *Indicates lag order selected by the criterion. LogL: log likelihood; AIC: Akaike information criterion; SC: Schwarz information criterion and HQ: Hannan—Quinnin formation

4.4: Model Estimation Results

After testing the stationarity of the time series and choosing the optimal lag period, the study conducts the estimation of the model for the effect of monetary policy variables on residential prices, and the results obtained were shown in estimated equation (4) and results in Table (3)

$$\text{LHPI} = 2.12 + 0.54\ \text{LHPI}_{(-1)} + 0.19\text{LHPI}_{(-2)} + 0.0096\ \text{LEXC}_{(-1)} + 0.0015\ \text{LEXC}_{(-2)} - 0.025\text{LIRT}_{(-1)} - 0.0079\ \text{LIRT}_{(-2)} + 0.0184\ \text{LCPI}_{(-1)}\ 0.0048\ \text{LCPI}_{(-2)} + 0.075\text{LM2}(-1) + 0.0147\ \text{LM2}(-2)\ (4)$$

- Residential prices with both (one and two lag periods) have a significantly positive impact upon its own prices.

- Effective real exchange rateboth (one and two lag periods) have a significantly positive impact upon residential prices. As the higher the real exchange rate, the higher the purchasing power of the currency, the higher the demand, which leads to a rise in housing prices, especially with limited supply, which is inconformity with the prevailing economic literature.

- However, interest rates reveal that it has a negative and significant impact upon residential prices in both lags. The evidence of the inverse relationship between the interest rate and housing demand, and thus lower demand leads to lower residential prices.

- While the consumer prices reveal that it has appositive but significant impact upon residential prices in both lags which indicates the lack of relationship between them in the short term.

Finally, money supply reflects a positive and significant impact upon residential prices in the first lag which is consistent with the economic literature of a positive relationship between the money supply in society with the demand for residential, and thus its prices rise. However, money supply shows a positive but insignificant effect upon residential prices in the second lag.

Table (3)

Model Estimation Results (Dependent LHPI$_t$)

Variable			S.E	T stat	Decision
Constant	2.127*		0.561	3.78	Significant
LHPI (-1)	0.540*		0.065	8.37	Significant
LHPI (-2)	0.109*		0.045	2.37	Significant
LEXC(-1)	0.009*		0.0051	1.86	Significant
LEXC(-2)	0.0015		0.0031	0.42	Insignificant
LIRT(-1)	(-0.025)*		0.0071	3.60	Significant
LIRT(-2)	(-0.0073)*		0.0043	1.70	Significant
LCPI(-1)	0.0180		0.0171	1.07	Insignificant
LCPI (-2)	0.0048		0.0091	0.527	Insignificant
LM2 (-1)	0.0759*		0.0350	2.41	Significant
LM2(-2)	0.0147		0.029	0.50	Insignificant
Adj R^2	0.93	F- Statistic	29.54		
S.E Equation	0.0181				

***Indicates that variable is significant at 5%**

4.5: Variance Decomposition

Table (4) reflects the analysis of the variance decompositions of the variables across 10 time periods to track the effect that occurs to the variables as a result of their effect on each other during the time period under study. The results showed the following: -

Table (4)

Variance Decomposition Results

Period	S.E	LHPI	*LHPI* LCPI	LEXC	LITR	LM2
1	1.93	100.00	00.00	00.00	00.00	00.00
3	2.05	85.74	0.85	4.12	7.21	2.04
5	2.94	67.05	0.82	3.02	17.79	11.31
7	3.85	62.71	1.32	3.70	16.90	16.30
10	4.57	63.98	1.30	1.97	13.19	19.54

- The effect of the HPI variable expressing the housing price was the most influential in itself across the ten time periods, as the value at the beginning of the period was 100%, but it began to decrease coinciding with the increase in the influence of other variables across the different periods, and it was the lowest value during the year Seventh, reaching 62.71.- The total money supply M2 is the most influential variable on housing prices across different periods, as its lowest value reached 2.04 in the third period, while the largest percentage was in the tenth period, reaching 19.54.

- The results of the two variables, the exchange rate and the general level of prices, had a weak effect on housing prices, as the CPI ratio did not exceed1.32 during the period, while the exchange

rate was slightly higher than the prices, with the highest impact of the variance in housing prices reaching 4.12 in the third period. However, the percentage decreased very much during the tenth time period to 1.97.

The next step is to estimate the impulse response functions, which aim to know the impact of shock in each variable and its effect on the rest of the other variables in the short term, and according to the Monte Carlo method, these functions were estimated and the results were as shown in Figure (2).

4.6 Impulse Response Function

Figure 2

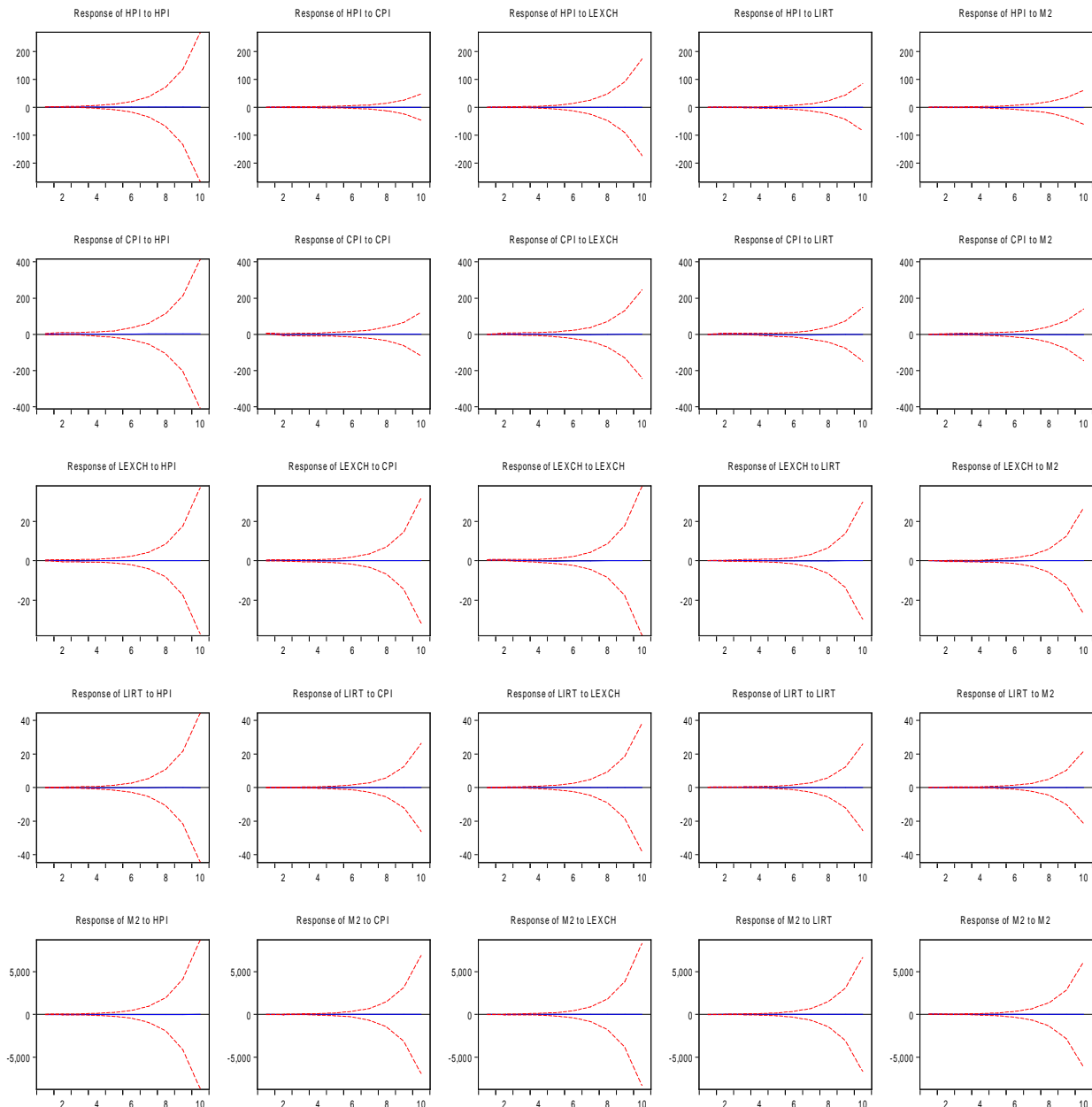### Response to Cholesky one S.D (d.f adjusted) innovations ± 2 S.E

Figure (2) on impulse response functions shows the following:

- The effect of variable prices in itself was the most influential and most responsive to changes in housing prices themselves during a period of time, as the change in LHPI responded to the positive and negative shock that occurred in the variable itself.

- While the shock that occurred in the general level of prices did not affect the housing prices during the time period, as for the LM2 variable, the HPI variable responded to shocks during one period of time, while it took a different path from the borders indicating its lack of response to changes in the money supply

- As for the changes in the interest rate, they had an impact on the changes in housing prices, as they responded to the negative shock that occurred in interest rates during two time periods.

Finally, the housing price response to the effective real exchange rate shocks was evident during the first period, but this effect disappeared during the rest of the time period

4.7: Granger Causality Test

Granger test for causality was conducted to identify the direction of the relationship between the variables and to find out whether the elasticity is one-way so that the variable x affects the variable y, or that the relationship is two-way so that each of them affects the other, and the causal relationship between the variables of the model has been estimated The independent variable, represented by housing prices, and the results were as follows:The following points are evident from the results in Table (5) related to the results of the Granger causality test:

The results showed that changes in housing prices cause changes in the consumer price index, as the null hypothesis saying that there is no causation was rejected, and the alternative hypothesis was accepted, at a significant level of 5%. In housing prices, a result that was consistent with the model's estimates.- The results reflected that a causal relationship between the effective real exchange rate and housing prices in the first period using one slowdown period, while housing prices did not cause the exchange rate. The results of both the real interest rate and the money supply showed that they cause changes in housing prices, as the null assumption that there is no causal relationship between them was rejected, while there is no trend of causation between housing prices and the money supply.

Table (5)

Granger Causality Test Results

Null Hypothesis	Relationship Direction	F - statistic	P – Value
LHPI does not Granger Cause LCPI		9.27267*	0.0070
LCPI does not Granger Cause LHPI		1.86420	0.1892
LEXCH does not Granger Cause LHPI		9.00445*	0.0071
LHPI does not Granger Cause LEXCH		0.15213	0.7001
LIRT does not Granger Cause LHPI		8.94246*	0.0072
LHPI does not Granger Cause LIRT		0.04237	0.8390
LM2 does not Granger Cause LHPI		7.64326*	0.0120
LHPI does not Granger Cause LM2		0.0016	0.963

Source: Authors based on E-views results at 5% significant level.

4.8 Problems of Estimations

Finally, the paperwould like to ensure that the model is free from measurement problems, to be reliable in the estimates obtained. As shown in Table (6) for the results of the measurement problems test, as follows:

Table (6)

Serial Correlation & Heteroskedasticity Tests

Test	Null Hypothesis	Statistical Value	P – Value
Breusch-Godfrey Serial Correlation LM Test:	No serial correlation	0.949	0.40
Heteroskedasticity Test: Breusch-Pagan-Godfrey	Homoscedasticity	1.80	0.17

As shown in Table No. 6:

- Results of the LM test to detect the serial correlation between errors, the results showed acceptance of null hypothesis, which states that the model is free from the problem of self-correlation between errors, as the value of P-value = 0.40, which is higher than the levels of significance.

As the results of the variance instability test indicated, Berusch - Pagan - Godfrey showed that the computed value of F is smaller than the tabular, and the P-value = 0.17 is greater than the three levels of significance 1%, 5%, 10% Which means accepting the null hypothesis that requires homogeneity of the variance.

- The results presented in the appendix also showed that the relationship takes the shape of the normal distribution between the variables, and that there is also no multicollinearity problem where the correlation coefficients between the independent variables were low less than 50%, with the significance of most of the model variables.

5. Conclusion

The main objective of this study was to analyze the dynamic effects of certain monetary variables (i.e.M2, CPI, EXR and LENR) on residential prices in KSA. The study provides a VAR framework to analyze the relationship between house prices and those variables in KSA during the period (2014-2019). The results suggest that housing prices do respond to the monetary variables stated in the model. More specifically, variance decompositions show that M2 is the variable with the highest explanatory power over the variation in housing prices, followed by lending rate, effective exchange rate and CPI respectively. In addition, impulse response functions show that a positively higher shock in M2 and CPI increase housing prices, and will eventually strengthen housing demand, while a positive increase shock in UNL decreases housing prices and will eventually lead to lower housing demand. After combining the results of both the variance decompositions and impulse response functions, certain policy implications should be indicated. Once M2 is shown to be the most influential determinants for housing prices, the future course of housing prices in KSA could be assessed.

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