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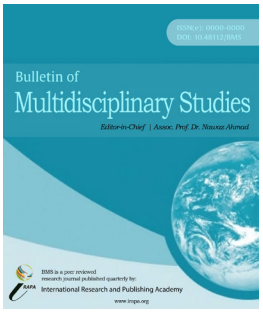

Original Article

A Time Series Analysis of Housing Prices, Monetary Policy, and Stock Market in Pakistan

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ABSTRACT

This study analyses the relationship between monetary policy and housing prices in Pakistan. It also includes factors such as the stock market index and inflation, in addition to interest rates and housing prices, during the years 2016 to 2021. The dependent variable is housing prices, and the independent variables are the discount rate, inflation and the stock market index. These relationships are analysed in the study using the Vector Error Correction Model (VECM). Findings indicate that monetary policy cannot reduce housing prices in the short term. A short-term, positive, and unidirectional link exists between interest rates and house prices in the Pakistani context. Moreover, inflation has a short-term negative impact on house prices. Further, a bidirectional causation is found between home prices and inflation in Pakistan. Moreover, the stock market index in Pakistan has a long-term, unidirectional negative correlation with the housing prices in Pakistan. The study highlights the relationship between inflation and housing prices, providing valuable implications for policymakers and investors in emerging markets, particularly in the context of Pakistan's real estate sector.

Keywords: *Houses prices, Inflation, Interest rate, Monetary policy, Stock market index*

INTRODUCTION

Housing is a fundamental human need; however, millions continue to struggle to secure adequate shelter. Rapid urbanization and population growth in many developing economies have intensified the housing crisis. Over 980 million urban inhabitants lack proper housing, with an estimated additional 600 million expected to face similar challenges by 2030. To address the increasing demand, approximately one billion new housing units are projected to be required globally in 2025 which approximately cost $650 billion (Kavishe et al., 2025). Therefore, an effective housing finance mechanism can stimulate economic growth by fostering property development, generating employment in the construction sector, improving resource allocation, and enhancing macroeconomic stability. The demand for housing not only stimulates production in related industries but also generates economic output, thereby creating jobs. Additionally, improved housing quality can significantly enhance the standard of living for residents. However, property purchases represent a substantial financial burden for individuals, often necessitating mortgage financing as they typically constitute the most valuable asset held by households.

This study provides significant insights into the housing market, inflation and monitory policy in Pakistan. As housing plays a vital role as both a basic necessity and a primary investment option, knowing how monetary conditions influence this sector is important for policymakers, investors, as well as households. The findings of the study can guide more effective monetary, especially in relation to controlling inflation, interest rates, and real estate forces, which are crucial to economic stability and growth. The study emphasizes the strong relationship between Discount rate, Inflation and, Stock market performance on housing prices with strong implications for policymakers and investors in emerging economies, including that of Pakistan's real estate market.

Objective of the Study and Research Questions

The main objective of this study is to find the relation between the housing prices and the interest rate, inflation rate and the stock market performance. The study uses cointegration test to find the cointegrating vectors. Later, the Vector Error Correction Model (VECM) has been used to find the short- and long-term relationship among the selected series and the housing prices. The research questions of the study are:

- What is the impact of the change in the interest rate on the housing prices in Pakistan?
- What is the impact of the inflation rate on the housing prices in Pakistan?
- What is the impact of the stock market performance on the housing prices in Pakistan?

The second part of the study include literature review, hypothesis and conceptual framework of the study. The third part of the study carries the data and methodology of the study, subsequently the results have been provided along with the discussion of the study. The last section is dedicated to the conclusions of the study.

LITERATURE REVIEW

The relationship between monetary policy and home prices has garnered substantial attention in academic research (Feng, 2022; Meltzer, 1974; Tsai, 2013; Umar et al., 2020). Studies suggest that credit

availability is a crucial determinant of home prices (Adelino et al., 2025; Meltzer, 1974). This view was reinforced by research from Miles (1992), which found that credit supply influenced real estate values in industrialized nations, including the U.S., the U.K., and Japan. Similarly, Woodford and Walsh (2005) observed that monetary policy indirectly impacts housing markets by influencing credit conditions.

Further, researches have been done in different geographical locations. Iacoviello and Minetti (2003) analyzed data from Sweden, Finland, and U.K. concluding that house prices affect monetary policy, which reflects their importance in monitory policy design. Koh et al., (2005) found that extreme bank borrowing and reduced mortgage rates led to housing bubbles in Asian economies, while (Giuliodori, 2005) reported similar findings in European countries, where monetary policy shocks influenced housing prices. Del Negro and Otrok (2007) focused on U.S. state-level data from 1986-2005, showing that a loose monetary policy contributed to the housing bubble between 2001 and 2005.

Mishkin (2007) stressed that lower interest rates eased access to mortgages and drives the housing demand and prices. Taylor (2007) pointed out that the deviation from stable monetary policy in the early 2000s exacerbated the U.S. housing bubble. Studies conducted in OECD countries by Belke et al., (2008) and Simo-Kengne et al. (2013) found that global liquidity shocks and monetary policy changes directly impacted housing prices, with positive monetary policy shocks generally lowering property values. Berlemann and Freese (2013) also observed that interest rate hikes reduced home prices in residential and commercial property markets.

Bjørnland and Jacobsen (2010) examined housing prices in the U.K., Sweden, and Norway, concluding that expansionary monetary policy correlated with rising home prices, while restrictive policies led to declines. Similar conclusions were drawn from studies by Kuttner and Shim (2012), who noted that higher short-term interest rates dampened housing finance growth in Asia-Pacific regions. Luciani (2015) reaffirmed the significant impact of monetary policy on home prices, particularly through its effect on credit availability. Eickmeier and Hofmann (2013) noted that loose monetary policy also influenced private sector borrowing, contributing to real estate market volatility. Simo-Kengne et al. (2013) observed that in South Africa, monetary policy affected bear markets more than bull markets.

In Australia, studies by Lee and Reed (2014) and Bangura and Lee (2020) examined the short-term and long-term effects of monetary policy on housing prices, concluding that temporary shocks were less impactful than permanent ones. Similar trends were found in Malaysia by Lin Lee (2014) and Umar et al. (2020), who noted that real estate served as an inflation buffer and that housing prices were inversely related to the discount rate. A global analysis of 57 economies by McDonald and Stokes (2013) revealed that housing price inflation was linked to lose monetary policies, with Asia-Pacific regions showing particular sensitivity. Meanwhile, studies in Norway and China highlighted that tight monetary policies had more impact on housing values in first-tier cities than in second- and third-tier markets (Robstad, 2018; Wu & Bian, 2018).

A sufficient volume of literature stresses the key importance of interest rates as one of the most dominant tools of monetary policy. Kuttner and Shim, (2012) argue that lower interest rates mainly stimulate housing demand as borrowing becomes cheaper, and so tends to increase property values. This is generally based on the mainstream economic theory that reduced costs of borrowing can be heaped up on consumers in increasing consumer spending and investment on the housing market. In contrast, when interest rates rise, the cost of borrowing does so, and hence potential home buyers may find home buying to be much less affordable, and where sometimes decrease in housing prices are possible (Glaeser et al., 2012).

The undesirable correlation between interest rates and house prices lies at the heart of monetary policy's understanding and its effects on housing markets. Inflation is a highly significant variable employed in the literature due to the various ways in which it could influence house prices. As Malpezzi and Wachter (2005) noted, inflationary shocks interact interdependently with house prices, where the effect of inflation on house prices and house prices on inflation is mutual. This makes it difficult to discern the direction of influence of monetary policies to the housing market and suggests that policymakers should consider the interactive context and possibly the impact of the loop back of such interactivity.

Determinants of housing prices may involve external shocks such as fluctuations in stock markets and fiscal policies. According to Case and Shiller (2003), an increase or decrease in a stock market can be inversely related to house prices, hence, investors will make undesirable decisions since overall market sentiments may be affected. Increased rising stock

prices could take away investments from real estate sectors, thereby decreasing housing demands. This relationship brings out the linkage of several economic indicators and how their aggregation often impacts the housing market. Other regional studies have revealed that local economic, demographic, and urbanization factors affecting house price movements create numerous layers for the complexity of the problem. For instance, metropolitan area studies have shown that there are causality relationships between job growth, population density, infrastructure, and demand for housing (Gyourko & Molloy, 2015).

This increases the necessity of contextual matters at the regional level in deciding the way monetary policy combines with house price determinants. In general, the literature already suggests a housing market that is multifaceted and involves various determinants for examining the various sets of economic indicators, like monetary policy influence and determine house prices. But much effort is yet to be done in this field of research, and in developing economies, the effort is yet to be undertaken on the part of Pakistan, which is an underlying requirement. Such investigations can also be useful in bringing to light the relationships between local circumstances and housing market policies and how they are segmented to promote the better design and development of policies. In this context, it not only makes sense from an academic or scientific research perspective but will also shed light on appropriate designs for plans intended to enhance housing affordability and market stability.

Theoretical Framework and Hypotheses Development

The conceptual model for this study is reconstructed from the framework proposed by Umar et al. (2020). This framework has been further extended and contextualized to capture the dynamics of the Pakistani housing market and the transmission mechanism of monetary policy through various channels. The monetary policy is represented by three core indicators: the discount rate, inflation, and stock market performance. These variables have been chosen because they are widely recognized in economic literature as major transmission channels through which monetary policy affects asset prices, including real estate. The housing market, in turn, serves as the dependent variable, represented by housing prices in the Pakistan.

The rationale behind this model is that monetary policy decisions influence borrowing costs, liquidity, and investment behavior. For example, an increase in the discount rate generally raises the cost of credit, reducing housing demand and thereby exerting downward pressure on prices. Inflation, on the other hand, affects the purchasing power of households and the cost of construction materials, which may drive housing prices upward. Similarly, stock market performance reflects overall investor sentiment and wealth effects; when markets perform well, investors may channel surplus gains into real estate, pushing housing prices higher. The model also builds on the idea that these monetary policy channels do not act in isolation but interact to shape the dynamics of the housing market. The framework thus provides a structured pathway to test how strongly each factor influences housing prices in the Pakistani context.

The following diagram illustrates the conceptual framework of the study:

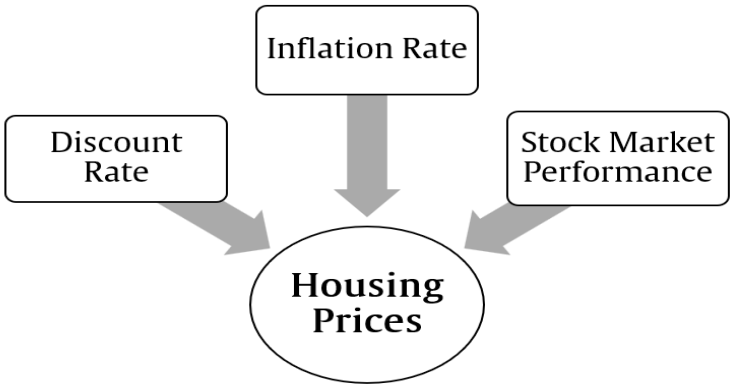

Fig. 1. Conceptual framework of the relationship of housing prices with interest rate, Inflation rate, and stock market performance

The research framework for this study is based on a quantitative method, which would allow a systematic analysis regarding the relationship between housing prices and monetary policy within the Pakistani context.

This analysis discusses how variations in housing prices are influenced by various monetary policy measures. The data sets used are time series data of these various key economic indicators: inflation rates, interest rates, and the stock market index, among others. The variable under study for this research is house price, as it reflects the market value of residential properties in Pakistan. For this analysis, the primary independent variable is the discount rate. Such a monetary policy tool is important for the central bank to influence lending rates and, thereby, economic activity. To specify more specifically the drivers that might be influencing the housing prices, this analysis is also featured with variables through inflation and a stock market index. This will take into account the external influences that may determine house prices with them.

Hypotheses of the Study

Based on the literature review and the theoretical framework the study proposes following hypotheses.

H_1: Changes in the discount rate have a significant impact on housing prices in Pakistan.

H_2: Inflation has significant impact on housing prices in Pakistan.

H_3: Stock market performance has significant impact on housing prices in the Pakistan.

METHODOLOGY

The data used in this research are monthly time series for the period 2017 to 2022. This duration will enable a detailed examination of the trajectory of housing prices and its relationship with monetary policy over this duration. By examining this data, the research should hence be able to provide keen insights into monetary policy impacts and the dynamics of the housing market in Pakistan. Data on inflation and interest rates are sourced from the State Bank of Pakistan website. For the stock market index, this article utilizes data collected through Pakistan's Economic Survey. The foundation is strong for a generalized analysis on the economy of the country.

The one limitation of this study is the lack of an existing database of housing price index in Pakistan. Therefore, data have been derived from Zameen.com, a website with an online real estate forum that is now widely utilized to track property prices in the largest cities of Pakistan (Umar et al., 2020). More specifically, it was utilized as a measure of the price of housing per square foot, which is a crucial measure in terms of identifying the dynamics of the housing market in Pakistan. Further, Descriptive statistics for calculation average, standard deviation, skewness and kurtosis, which helps to verify whether the data is normal or not. This also indicates the extent of deviation of the data points from a normal distribution.

The Augmented Dickey-Fuller test would be used to identify the order of stationarity of the data. The ADF test serves as an important step in attempting to establish whether the time series data have invariant statistical properties over time; it is a prerequisite to many analyses of time series. Besides that, the Johansen test is used to determine the presence of cointegration amongst the series. Co-integration should be there if the long-run equilibrium relationship is possible and depicts the fact that the specified linear combination of such variables will be stationary; hence, it depicts the long-run behavior of these variables and helps one to understand their relationship over time. Study then applies the Vector Error Correction Model (VECM) to the variables about which questions are asked to find short-term and long-term correlations by way of co-integration. In this regard, the VECM can capture the dynamics of relationships between these variables and give insights into how they adjust toward equilibrium after a short-term disturbance.

$$\Delta Y_t = \alpha_1 + \alpha_2 ect_{t-1} + \alpha_3 \Delta Y_{t-1} + \alpha_4 \Delta X_{t-1} + \alpha_5 \Delta Z_{t-1} + \alpha_6 \Delta S_{t-1} + \varepsilon_t \quad (1)$$

Where: Y denotes housing price, ECT stands for error correction term, X represents the interest rate, z represents inflation, and S stands for stock market index. Alpha are the coefficients for respected varias bles. To determine normality, the analysis will first use EViews software to calculate skewness and kurtosis from a descriptive statistic to assess the shape of the distribution and how well it fits a normal distribution. The Augmented Dickey-Fuller (ADF) test is further applied to determine whether the series is stationary (Ahmed et al., 2021). It is, therefore important for determining the stability of the time series or data over time or if the data undergoes patterns or trends that may be an issue to analyze. To further elaborate the analysis regarding the relation between the time series data, the Johansen test for co-integration is conducted to check out their existence.

The test determines whether or not a long-run equilibrium relationship exists amongst the variables in question, which is of prime importance for knowing their relations with each other. Finally, the VECM is applied to analyze the links between the variables according to the observed data patterns. In addition to showing how the variables correct toward their long-run equilibrium after short-run fluctuations, the VECM

captures the short-term and long-term relationships of the variables.

RESULTS & FINDINGS

Descriptive Statistics

Table 1 shows the descriptive statistics of the selected log transformed variables employed in the model. The variables include: House Price Index (HPI), Interest Rate (IR), Inflation Rate (INF), and Stock Market Index (SMI). The mean value of the HPI is 9.92, while the standard deviation is found to be 0.095. The IR shows a mean of 2.01, and its standard deviation is 0.2866. The mean value of the INF is 1.84, while the standard deviation of INF is found to be 0.4588, which is the highest standard deviation among the selected variables. The highest mean is found in the SMI, and its standard deviation is 0.1317. The descriptive statistics shows the skewness value of the housing prices positively skewed (0.7875). which means that the distribution of the has longer tail towards right side. Similarly, the interest rate also shows the positive skewness however, it has stronger value than the housing prices. The distribution of the interest rate is more on the right side. The value of the skewness is (0.9018).

The value of the skewness of the inflation (-0.0231) appears very close to the mean value of zero. Thus, making it near to symmetrical. Among the selected series the skewness value of the stock market index shows the negative value of the skewness (-0.5528). The tails of this distribution are more inclined towards the left side of the center of the distribution thus carrying more negative values in the distribution. The kurtosis values show whether the tail is heavier or lighter than the normal tails. The normal range of the kurtosis is the 3. The results show that none of the kurtosis values are above the normal range thus all of the selected series are flatter and light weighted. The flatness of the tails shows that there are no extreme values present in the series.

Table 1
Descriptive Statistics Results

Variables	N	Mean	Minimum	Maximum	SD	Kurtosis	Skewness
HPI	72	9.299	9.155	9.548	0.095	2.917	0.787
INF	72	1.847	1.064	2.681	0.458	1.577	-0.023
IR	72	2.015	1.749	2.583	0.286	2.466	0.901
SMI	72	10.607	10.283	10.838	0.131	2.577	-0.552

Table 2 reports the unit root test results of the properties of stationarity for all of the variables under consideration. For the Housing Price Index, the test statistic is 4.2626 while the p-value is 1.000. This implies that the series is not stationary at the levels. Yet, after taking one first difference, the test statistic drops to -5.4400, and the p-value is 0.0000. At this juncture, it is seen that the series is stationary after one order of difference. The Interest Rate also is non-stationary at level with a test statistic of -1.3768 (p-value = 0.5888), yet after first differencing, it is stationary with a test statistic of -4.7375 and a p-value of 0.0002 The Inflation variable is non-stationary at the level result of -1.3105 (p-value = 0.6204) but is stationary following first differencing with statistic of -8.5156 and a p-value of 0.0000. Stock Market Index: Excerpted nearly non-stationary level by -2.8829 with p-value = 0.0525 and becomes stationary after first differencing with very strong statistic by -13.1712 and p-value = 0.0001. The main outcome from the result is that all variables under consideration are not stationary at their levels, but they are stationary after first differencing, thus, can have long-run equilibrium. Using the Johansen test, we establish that there exists a co-integration among these variables. It is, therefore, true that even though the variables remain non-stationary in their levels, these co-integration relations will point to the long-term stability between the variables. We shall, therefore, reject the null hypothesis if the combined maximum eigenvalue and trace statistics are more than the 5 percent critical value, hence giving evidence of the co-integration of the variables.

Table 2
Unit root test

Variable in first difference	Test in level	Test
HPI	4.262(1.000)	-5.440***(.0000)
INTREST TATE	-1.376(0.588)	-4.737***(.0002)
INF	-1.310(0.620)	-8.515***(0.000)
SMI	-2.882 **(0.052)	-13.171***(0.0001)

Co-integrated variables imply that there exists a linear, long-term stable relationship amongst the variables, and errors are imbalanced, clustering around zero. Holding other things constant, there are several tests of cointegration used in the literature to ascertain whether any such long-term relationships exist between two variables. Among them, notable ones are the method developed by Engle and Granger (1987) and Johansen (1988), the approach by Johansen and Juselius (1990), and the methodology developed by Pesaran et al. (2001). Therefore, for testing the present study, the Johansen test was used to check on the validity of the variables' collinearity.

The cointegration statistics can be compared against the hypotheses. The null hypothesis is to be rejected if the 5% critical value is lower than the combined maximum-eigenvalue and trace statistics. In this study, the null hypothesis was rejected using both the maximum-eigenvalue and trace statistics such that the series indicate a long-run relationship. In the case of establishing cointegration, if the order of the variables is of I (1), VECM will be applied for further analysis, as VECM would come into play after the confirmation of cointegration, which is preferably used to grasp short-term dynamics with equilibrium relationships between the variables. The cointegration results are given in the table.3

Table 3
Cointegration Results Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value	Prob.
None *	0.369	70.341	47.856	0.000***
At most 1 *	0.273	38.483	29.797	0.003***
At most 2 *	0.178	16.440	15.494	0.035**

Table 4
Unrestricted Cointegration Rank Test (Max-Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value	Prob.
None *	0.369	31.858	27.584	0.013**
At most 1 *	0.273	22.047	21.131	0.037**
At most 2 *	0.178	13.606	14.264	0.063*

The selection of the number of lag values to be selected is necessary in time series models. We selected the LR, FPE, AIC, SC, and HQ criteria for the determination of the number of lags to be selected in the VECM model. Table 4 shows that mostly the number of the optimal lags is one.

Table 5
Lag selection criteria

Lag	LogL	Lr	FPE	AIC	SC	HQ
0	151.472	NA	1.350	-4.468	-4.336	-4.416
1	482.682	612.235*	9.582*	-14.020*	-13.357*	-13.758*
2	496.512	23.888	1.031	-13.954	-12.760	-13.482
3	508.430	19.140	1.181	-13.831	-12.106	-13.149

The short-run and long-run estimates with their probability values are given in Table 6. The long-run coefficients will reveal how each variable acts as a contributory cause to the long-run HPI. Notably, with the interest rate, its coefficient is 21.93996, and it portrays a strong positive correlation with housing prices. Contrarily, the inflation coefficient is -11.66021, meaning that the former is inversely related to an increase in the latter, which in this case, the housing prices decline as inflation increases. The stock index had a positive coefficient of 30.10849, indicating that it has a very strong cause-and-effect action toward the HPI. The short-run estimates are crucial for understanding the dynamics of the model. The error correction term, ECT, represents the speed at which the system converges to equilibrium following a shock. The coefficient of ECT is -0.000530, implying that after a disturbance, the HPI converges towards equilibrium at 0.053%. The relationship of changes in house prices with other variables change in interest rates, inflation, and the stock market index-is examined in detail.

The VECM model can be expressed as follows:

The general form of the VECM model used is:

$$\Delta Y_t = \alpha_1 + a_2 ect_{t-1} + a_3 \Delta Y_{t-1} + a_4 \Delta X_{t-1} + a_5 \Delta Z_{t-1} + a_6 \Delta S_{t-1} + \varepsilon_t \quad (2)$$

The significance level of these coefficients of the variables can be determined by using the probability values (p-values) in the VAR model.

$$Y_t = 0.002745 - 0.000530 ect_{t-1} + 0.000530 Y_{t-1} + 0.032697 X_{t-1} - 0.011666 Z_{t-1} - 0.019451 \Delta S_{t-1} \quad (3)$$

The long run cointegration equation is given below:

$$Ect_{t-1_t} = \alpha_1 + a_2 Y_{t-1} + a_3 X_{t-1} + a_4 Z_{t-1} + a_5 S_{t-1} \quad (4)$$

By substituting values in the equation:

$$Ect_{t-1_t} = 351.4239 + 1.000 Y_{t-1} - 21.93 X_{t-1} + 11.66 Z_{t-1} - 30.10 S_{t-1} \quad (5)$$

The coefficients of the short-run estimates indicate significant relationships with a significance level below 5%. The coefficient for the ECT suggests that after a disturbance, the housing prices move towards equilibrium. Specifically, housing prices positively correlate with previous housing prices and interest rates while exhibiting an inverse relationship with inflation and the stock market index. A one-unit change in inflation results in a 1.1% decrease in housing prices. Similarly, one unit change in stock market performance results in 2% change in the stock market index.

Table 6
Vector error correction model Results (Long run estimates)

HPI	Coefficient	Std. Err.	T-stat.
Inflation	-11.660	-2.829	[-4.120]
Interest rate	21.939	-4.726	[4.641]
Stock market index	30.108	-6.866	[4.384]
Cons.	-351.424		

Table 7
Vector error correction model Results (short-run estimates)

ΔHPI	Coefficient	Std. Err.	T-stat.	p-values
ECT(t-1)	-0.000	0.000	-2.836	0.006***
ΔHPI(t-1)	0.520	0.105	4.920	0.000***
ΔIR(t-1)	0.032	0.012	2.615	0.011**
ΔInf(t-1)	-0.011	0.004	-2.528	0.013**
ΔSMI(t-1)	-0.019	0.006	-2.782	0.007***

Table 8 shows the results of the grangers causality test (Granger, 1969). This shows the short-term causal relationship between the variables. In cases where the Granger causality test all the probability values are below 0.05 significance level, thus the null hypotheses is rejected. Thus, it shows unidirectional causality between housing prices and other variables. Similarly, in case of interest rate the null hypothesis of no causality couldn't be rejected as the probability values are above the 0.05 significance level. It revealed that there is no causation from Housing prices to interest rates in Pakistan. There is evidence of Granger causation

from the inflation rate to house prices in Pakistan. However, a causal effect is observed from house prices to the interest stock market index of Pakistan. Thus, the causality results show that all the variables in the model affect the housing price, while the housing price only causes inflation in Pakistan.

Table 8

Results of Granger Causality

Variables	Chi-sq	Probability	Null hypothesis	DECISION
			NHP dep)	
NIR	6.839	0.008	IR doesn't Granger cause HP	Reject the null hypothesis
INFLATION	6.394	0.011	INF doesn't Granger cause HP	Reject the null hypothesis
SMI	7.743	0.005	SMI doesn't Granger cause HP	Reject the null hypothesis
			IR (Dep)	
HP	1.153	0.282	HP doesn't Granger cause IR	Accept null hypothesis
INFLATION	0.270	0.603	INF doesn't Granger cause IR	Accept null hypothesis
SMI	0.014	0.904	SMI Granger does not induce to IR	Accept null hypothesis
			INF (Dep)	
HP	5.007	0.025	HP doesn't Granger cause INF	Reject the null hypothesis
IR	0.005	0.943	IR doesn't Granger cause INF	Accept null hypothesis
SMI	0.246	0.619	SMI doesn't Granger cause INF	Accept null hypothesis
			SMI (Dep)	
HP	0.232	0.629	IR doesn't Granger cause SMI	Accept null hypothesis
IR	0.973	0.323	INF doesn't Granger cause SMI	Accept null hypothesis
INFLATION	0.809	0.368	SMI doesn't Granger cause SMI	Accept null hypothesis

To evaluate the dependability of coefficients, diagnostic tests are essential. The LM test for VEC residual serial correlation for one lag period was used by the researcher to investigate serial correlation. In contrast to the null hypothesis, which asserts that there is no serial correlation at lag h, the alternative hypothesis suggests that there might be serial correlation at lag h. The alternative hypothesis is rejected and the null hypothesis is supported by a statistical analysis of the autocorrelation table 7. This demonstrates the stability of the model and shows that there are no problems with serial correlation.

Table 9

VEC Residual Serial Correlation LM Tests

Lag	Rao f-test	Df	Probability	Lre*stat	Df	Probability
1	1.042	16	0.414	16.56	16	0.414

Heteroskedasticity is tested with the white VEC residual heteroskedasticity test. When an error is homoscedastic, the null hypothesis is developed; when an error is heteroscedastic, the alternative hypothesis is developed. The joint heteroskedasticity results demonstrate that the residual is not heteroskedastic, meaning that the variance is equal, with probability values greater than 5%. This is also a good thing for the model's dependability. The inverse roots test was used to assess the model's stability, and as Figure 2 illustrates, all of the roots are inside the circle.

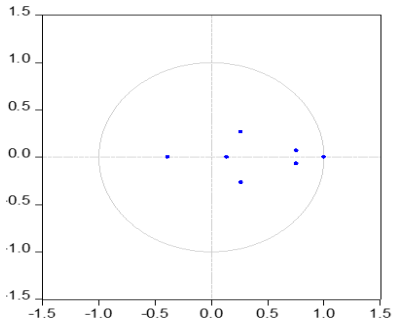

Fig. 2. AR root model

Discussion

The aim of this study is to find the relationship of the housing prices with the interest rate, inflation, and the stock market performance in Pakistan during the stipulated period of the study. In order to find the such relationship VECM model has been applied which has the capacity to find the not only the long-term relationship of the different variables but also the short adjustments. The long-run coefficients indicate that interest rates, inflation, and the stock market index exert substantial influence on housing prices. Notably, the coefficient for the interest rate (21.93) shows a strong positive long-run relationship with housing prices. This is counterintuitive to conventional economic theory, which often associates rising interest rates with reduced housing demand and lower prices. However, in the context of Pakistan, this relationship may reflect complex structural factors such as interest rate pass-through mechanisms, credit availability, or speculative investment behaviors that buffer the dampening effects of higher rates.

The inflation coefficient, estimated at -11.66, signifies a clear negative relationship between inflation and housing prices in the long run. This supports the notion that as inflation rises, real purchasing power diminishes, potentially weakening demand for housing and thereby lowering prices. The stock market index coefficient of 30.10 also surprisingly indicates a strong relationship with housing prices in the long term. This may suggest a substitution effect, where investors shift their capital between housing and the stock market depending on expected returns. A buoyant stock market may attract real estate, increasing demand for property in Pakistan. The short-run estimates and the error correction term (ECT) provide additional depth. The ECT coefficient of -0.00053 implies that deviations from the long-run equilibrium are corrected very slowly, at approximately 0.053% per period. This sluggish adjustment suggests that the housing market in Pakistan may not be highly responsive to shocks in the short term, possibly due to structural rigidities or information lags in the market.

CONCLUSION

Findings of this study indicate that, comparatively speaking, monetary policy is not particularly effective in controlling house prices in the short term. The short-run estimation finds a one-way, positive causal relationship between interest rates and house prices; therefore, it appears that an increase in interest rates might not cause the expected decrease in house prices. Surprisingly, the analysis reveals that while it lowers house values by 1.2% in the short term, this inflation has a positive effect on the determination of house prices in the long term. Apart from that, the feedback relationship between inflation and house prices means that the change in one induces the adjustment in the other, which further increases the complexity of the dynamics of housing markets. There is a long-term, one-way negative correlation between house prices and the stock market index, so whenever the stock market index goes up, house prices tend to come down over time. This depicts how close these two markets are, interlinked with each other. Such dynamics may, therefore require further research to fully understand their implications in housing markets. These include, but are not limited to, fiscal policies, effects of the government's policies and decisions on housing markets, market sentiments, and global economic conditions, among others. They will help dig deeper into the drivers of housing prices and their responses to monetary policy changes.

Competing Interest

The authors had no competing interests.

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