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Economic Factors Influencing Housing Prices in Pakistan

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ABSTRACT

The **aim** of this research is to explore the factors influencing housing prices in Pakistan. The author used monthly time series **data** for the period from 2011 to 2020, which were obtained from different sources: housing prices data from zameen.com, Karachi interbank offered rate (KIBOR) as a proxy for monetary policy, consumer price index as a proxy for inflation, and exchange rate data from the State Bank of Pakistan. Various **methods**, such as autoregressive distributed lag (ARDL), comparative analysis and deductive analysis were employed. Before using the ARDL technique, a proper lag length was selected, which turned out to be 11 months. Various diagnostic tests indicated model stability with no autocorrelation or structural breaks. The author **concluded** that the KIBOR rate negatively affected housing prices, while inflation and exchange rates affected house prices positively.

Keywords: monetary policy; housing prices; inflation; exchange rate; ARDL; Pakistan

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ОРИГИНАЛЬНАЯ СТАТЬЯ

Экономические факторы, влияющие на цены на жилье в Пакистане

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АННОТАЦИЯ

Целью данного исследования является изучение факторов, влияющих на цены на жилье в Пакистане. Автор использовал ежемесячные данные за период 2011–2020 гг., которые были получены из разных источников: данные о ценах на жилье, публикуемые на сайте zameen.com, ставка межбанковского предложения в Карачи (KIBOR) как показатель денежно-кредитной политики, индекс потребительских цен в качестве показателя инфляции и данные о валютном курсе государственного банка Пакистана. Были использованы различные **методы**, такие как метод авторегрессии и распределенного лага (ARDL), сравнительный анализ и дедуктивный анализ. Перед использованием метода ARDL была выбрана подходящая продолжительность лага, которая составила 11 месяцев. Различные диагностические тесты показали устойчивость модели, отсутствие автокорреляции и структурных разрывов. Автор пришел к **выводу**, что ставка KIBOR отрицательно влияет на цены на жилье, в то время как инфляция и обменный курс влияют на цены на жилье положительно.

Ключевые слова: денежно-кредитная политика; цены на жилье; инфляция; обменный курс; ARDL; Пакистан

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1. Introduction

Across the world, upholding prices and safeguarding financial system stability are the main objectives of central banks. Low and stable inflation, a precondition for supportable economic growth, reflects effective monetary policy. It ensures business' and individuals' decision-making ability pertaining to saving, investment and consumption, which leads to a spillover effect on employment and economic growth in the long run, thus enlightening the whole economic welfare of the state. In prior investigations, it was found that monetary policy had an impact on the residential housing sector due to credit availability. It influenced the cost and accessibility of credit, altering consumer debt levels and current housing demand [1]. House prices are heavily influenced by credit availability [2]. It has also been observed in developed nations such as the USA, UK and Japan that liberalization and easy accessibility of credit are sources of billow house prices. Monetary policy fluctuations affect real estate prices through numerous channels [3].

A tight policy rate lowers inflation while raising the after-tax user cost of housing [4]. Higher user costs reduce housing demand, which leads to reduced output. On the supply side, a tight policy rate of the central bank may have an immediate impact on housing building costs, resulting in a reduction in real estate output. On the other side, through the excess reserves ratio, a state bank can influence how much money banks have to provide loans by employing monetary policy tools such as open market operations, utilizing government bonds and the central bank's discount interest rates on loans to private sector banks. If the state bank tracks a loose policy rate, for instance, the supply of credit (money) will expand, lowering market interest rates and the decrease in mortgage interest rates will enhance demand for houses, resulting in an increase in housing values [5].

The reason behind the study of monetary policy and its impact on housing prices in Pakistan is that the residential sector is rapidly expending in Pakistan. Annually, Pakistan spends roughly US$ 5.2 billion on building, accounting for nearly 2% of the country's gross domestic product (GDP), according to the Pakistan Bureau of Statistics. The real estate sector's total value is US$ 700 billion, and the tendency to purchase luxury apartments and houses increased by 7–9% in the beginning of the twenty-first century, according to the Federal Bureau of Revenue[1] (FBR). According to the country's twelve-monthly Economic Survey, apartment prices have increased by more than 120 percent from 2010 to 2016. It has been also observed that the newspaper opinion writers and many bankers claimed that buyers borrow money from financial institutions and invest in property instead of investing in their other businesses because the return on investment in property is significantly larger than the rate of interest they must pay to financial institutions on loans because of rising house prices [6].

People desire to protect their future and invest in Pakistan's real estate market. However, due to the previous government's high taxation on the real estate industry, investment tendencies in real estate have diminished. Even as foreign direct investment diminishes and infrastructure funding remains tight, Pakistan's real estate market contributes significantly to economic growth. The real estate sector accounts for 60–70 percent of the country's wealth, or around USD 300–400 billion, according to World Bank estimates. After agriculture, it is Pakistan's second-largest source of employment. Apart from direct employment, it boosts demand in over 400 different industries, such as construction, steel, cement, paint, architecture, building materials, etc. As the government has increased the amount of taxes, particularly in the areas of purchasing and selling, severe measures have been realized behind investments made in the last three years. As a result, this industry has been hit hard by the recession; numerous real estate consulting offices have closed, and many people who worked in this field are now starving [7].

The FBR's severe rules (ban on non-filers, mandatory registrations when purchasing property worth more than PKR 5 million (Pakistani rupee), and expensive property transfer taxes) have deterred investors in this field. Even though financial markets are volatile, it isn't the economic signal one might imagine. However, a common misconception about real estate as an investment option is that it makes a lot of money. This is not the case. The real estate sector fills the void in most nations

[1] Federal Bureau of Revenue (FBR). Pakistan. 2018.

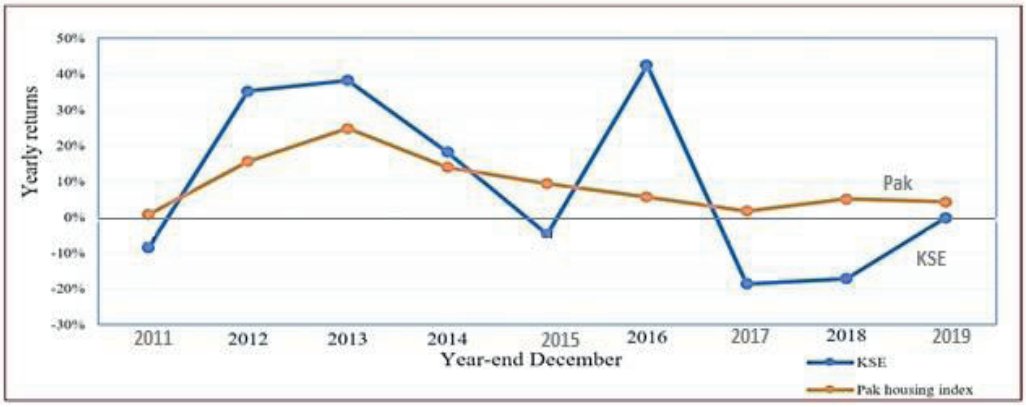

Fig 1. **The KSE-100 Index and the returns of Pakistan's Housing Index**

Source: Pakistan Stock Exchange. www.zameen.com

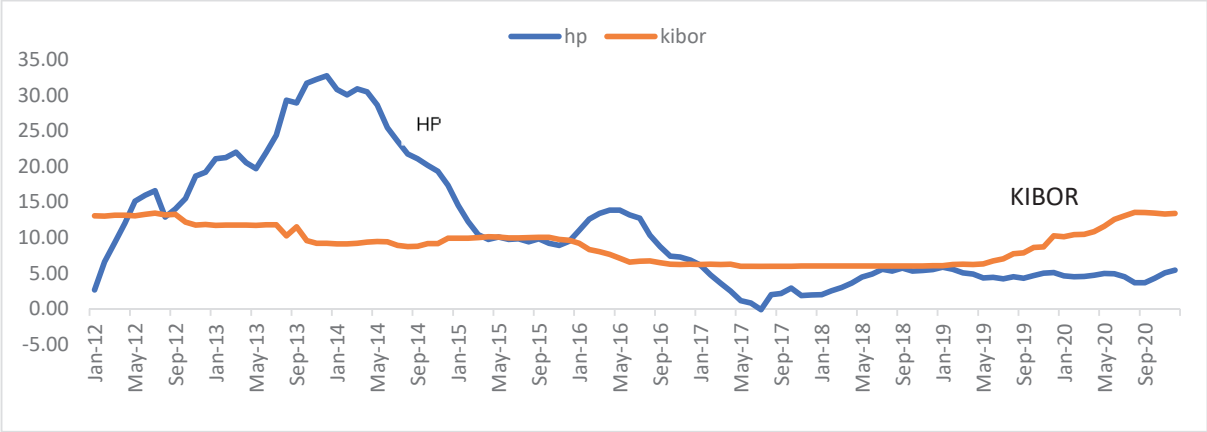

Fig. 2. **Monetary policy and house prices from 2012M1 to 2020M9**

Source: State Bank of Pakistan and www.zameen.com (2021).

where the role of financial markets is minimal in economic growth. Unfortunately, due to excessive regulation by the government and the FBR, this industry is unable to do so. Consider the Karachi Stock Exchange KSE-100 index and the house price index (*Fig. 1*). For only three years between 2011 and 2019, the cumulative return on property prices was higher than the KSE-100. The KSE-100 index has climbed by 230% over the same period, compared to 147% for house prices.

Investing cycles do occur sometimes, and the real estate sector in Pakistan experienced one from 2012 through 2015, when the annual returns were 16%, 25%, and 14%. During all prior years, the return on the housing index has been in the single digits, ranging from 1% to 9%. The KSE-100 index, on the other hand, is more volatile and offers both large returns and low profitability; its best return was 42 percent, and it recorded a 19% loss in 2017. The motivation of this study is to determine whether there is an effect of the state bank policy on real estate sector or not. That is why *Fig. 1* shows how these two economic variables are changing over time. The purpose of *Fig. 2* is to demonstrate the monetary policy and house prices values in general from 2012M1 to 2020M09. The Karachi Interbank Offered Rate (KIBOR) is the proxy of monetary policy and HP line represents house prices in Pakistan.

The real estate industry has struggled since the change of government in 2017. It has had to deal with financial, economic, and political difficulties, a variety of policy problems, and a lack of assurance. It barely made it through the previous recession. This is primarily because of the massive investments made by Pakistanis living abroad. Due to exchange rate gains for outside investors, the depreciation of the Pakistani rupee made property investment more affordable. Almost 30% of traffic on the website Zameen.com comes from foreign Pakistanis looking for investments, according to the website. However, investing in Pakistan's real estate market is already dangerous since the country is now ranked 120th out of 129 countries

Table 1
Housing loan pricing

Loan Tiers	Amount	Customer Pricing	Bank Pricing
Tier 0	Rs 2 million	5% for 1st five years and 7% for next seven years	KIBOR plus 700 BPS
Tier 1	Rs 2.7 million	3% for 1st five years and 5% for next five years	KIBOR plus 250 BPS
Tier 2	Rs 6 million	5% for 1st five years and 7% for next five years	KIBOR plus 400 BPS (Spread may vary)
Tier 3	Rs 10 million	7% for 1st five years and 9% for next five years	

Source: State Bank of Pakistan. URL: http://www.sbp.org.pk/fsr/index.htm

(with a score of 3.9/10). For international investors, this type of ranking is quite crucial. Thousands of foreign investors have moved their money elsewhere because of the uncertainties and tax policy. Because some nations (such as the United Arab Emirates and the United Kingdom) are providing stronger incentives, the amount of foreign exchange used to invest in real estate has declined.

Pakistan received USD 21.84 billion in remittances because they face constraints in doing other businesses, most international investments are in the real estate sector. Overregulation of the property market discourages foreign investment, which decreases remittances to Pakistan. Furthermore, the government's stance of not using development budgets has caused this sector's activity to decline.[2] The demand for consumer loans has expanded significantly, owing mostly to the construction of new homes. As a result, compared to the previous year, house construction loans increased by 17.2%. The State Bank of Pakistan's (SBP) obligatory objectives for banks to boost building and construction loans are likely to be the cause of this higher growth. The SBP has implemented several steps to promote housing finance, in keeping with the government's goal of providing affordable housing to all citizens of the country [8].

Banks have been given required targets to lend mortgage loans and finance to developers and builders by the SBP and have also presented the means through the Government's Mark-Up Subsidy Scheme (G-MSS). In order to encourage affordable housing schemes among the lower and middle groups, this program offers supported financing to those who don't even have a house. The government has set aside Rs 36 billion for the payment of mark-up subsidies over a ten-year period. The Pakistani government has changed and reduced the rates of mark-up subsidy schemes for housing finance, as shown in *Table 1*.

The rest of the article is structured as follows. Section 2 describes the methodology of the study. Section 3 provides an evaluation of the related literature on the association of housing prices with monetary policy, both theoretically and empirically. Section 4 explains the econometric method. Section 5 offers results and discussion. Finally, Section 6 outlines the conclusions and recommendations of the research.

2. Methodology of the study

Problem statement

Only one published study has been found to be directly related to current research. That study concluded that monetary policy affects housing prices in Pakistan. Furthermore, housing prices drop when the policy rate is too low, and vice versa. Prior research has found that stock market index fluxes have no effect, while high level inflation increases house prices [6]. Also, no research has been conducted in Pakistan on the effect of monetary policy on housing prices. The housing market is integrated with several other economic factors. As a result, growth in housing market activity may increase aggregate demand, placing higher stress on the value of commodities. Furthermore, house rent is directly linked to house prices, and it accounts for a significant portion of the consumer price index (CPI); in-

[2] State Bank of Pakistan. URL: https://www.sbp.org.pk/reports/annual/arFY 20/Complete.pdf (accessed on 20.07.2023).

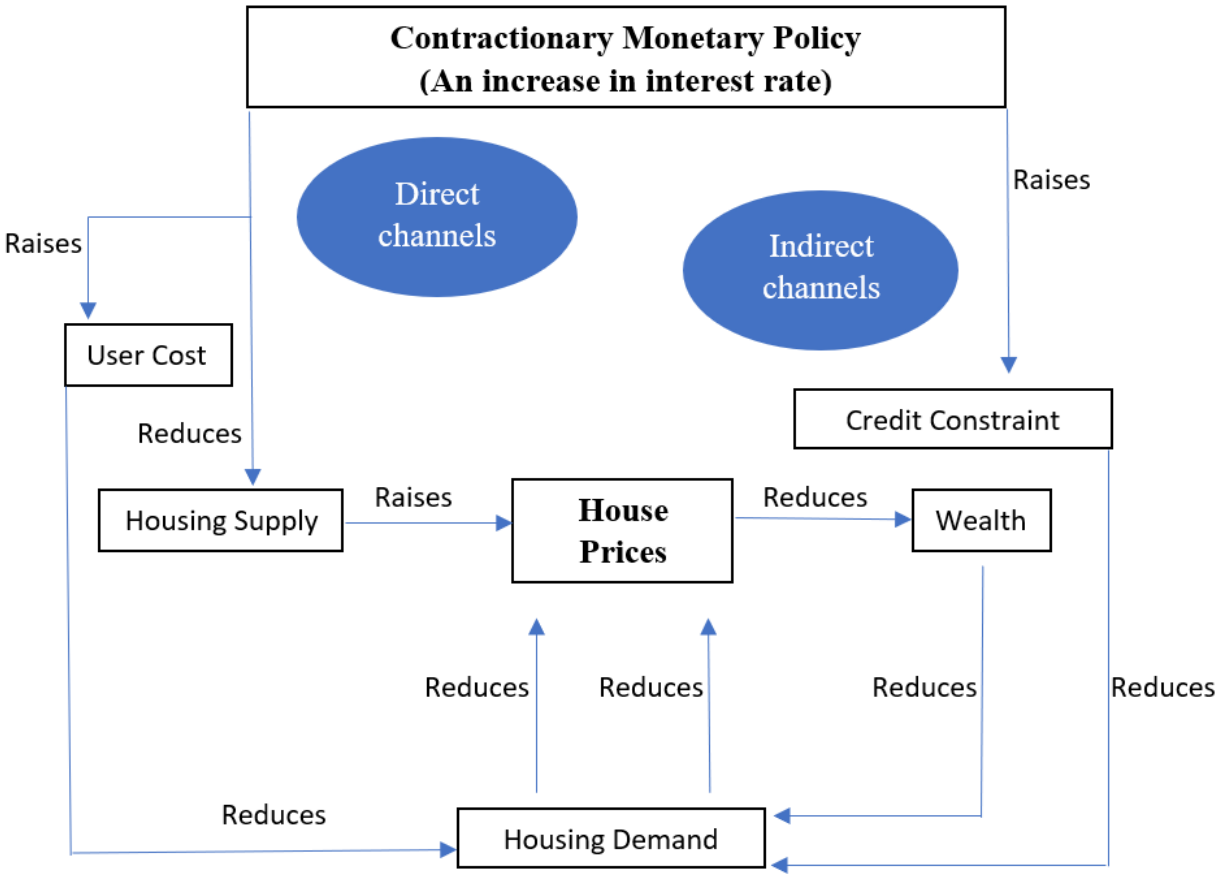

Fig. 3. **A flow diagram of a detailed theoretical framework**

Source: Based on Wadud et al, 2012 [11].

creases in house prices are reflected quickly in the CPI. Because of these qualities, central banks react to rising house prices more swiftly than stock prices. However, central banks usually respond to asset prices indirectly through their responses to economic activity and inflation [9].

Research Gap

The above-mentioned studies disclose the effect of monetary policy on house prices through different channels. The current study is investigating this area from a new aspect — a methodology called Auto Regressive Distributed Lag (ARDL). This methodology considers ways to overcome the short- and long-run co-integration among the variables [10], and therefore, this study attempts to enrich the existing literature and to overcome the effect of monetary policy on house prices in Pakistan so that policy makers and investors could make better decisions.

Relevance of the research

The scope of property value is increasing globally due to the increase in population. Keeping in view the importance of monetary policy and how it affects housing prices in Pakistan, this activity became a motivating point of this research work. Therefore, the current study investigates the effect of monetary policy on housing prices in Pakistan. The reaction of the policy rate is necessary to understand various economic variables, just like housing prices. This leads to improved policymakers' decisions by employing the contractionary or expansionary policy rate, and it is possible by exploring the effects of the new economic variables related to the policy rate. The linkage between monetary policy and housing prices is given in *Fig. 3,* which is proposed by [11].

Objectives of the study

In any economy, monetary policy plays a major role. That's why it is necessary to catch on to the impact of this policy rate at the bottom level. Globally, much research has been conducted to estimate the monetary policy impact on other economic indicators. But there are many other economic variables that have transmission effects related to monetary policy. The objective

of this study is to investigate the impact of monetary policy on housing prices in Pakistan.

Research questions

1: Is there any relationship between house prices and monetary policy in Pakistan?

2: What is the effect of monetary policy on house prices in Pakistan?

3: Does the monetary policy affect house prices in Pakistan?

Research hypotheses

The null and alternative hypotheses of the study set as:

*H*0: Monetary policy does not affect house prices.

*H*1: Monetary policy affects house prices.

Contribution of the study

Academic scholars, policymakers, and media commentators have recently focused their attention on the impact of the housing sector on economic activity. The need to analyze the possible implications for financial system stability is partly justified by the considerable increase in housing prices and consumer debt in various industrialized countries during the last decade. There is minimal study done on the term "housing prices" and the impact of policy rate in Pakistan, and their conclusions specify the link of monetary policy with housing prices based on a very small body of research [6]. In terms of future research, the current study will condense this gap and work on the most recent data on Pakistan to hit upon the association of monetary policy and houses prices. The current study's outcome contributes knowledge to policymakers in the area of expansionary and contractionary policy rates, explaining which policy will have a considerable effect on the fluctuations of housing prices.

3. Literature review

Literature on the determinants of housing prices in Pakistan

The vector autoregressive (VAR) model was used to determine the effect of monetary policy on housing prices in Pakistan while taking data from January 2011 to December 2016. The study further demonstrated that tight policy rates lead to lower house prices. It was also discovered that an increase in inflation results in higher housing prices [6]. The role of monetary policy in asset price transmission and good price transmission was also studied. Stock prices, property prices, and the Forex rates are all included in the asset price index. Monthly data on GDP, inflation, interest rates and asset prices were used for the period from 2000M01 to 2019M06. A VAR model was employed to select lags using likelihood ratio statistics. According to the findings, housing prices are directly connected to house rent, which has a major weight in the CPI, and increases in housing prices are swiftly reflected in the CPI. As a result, state banks respond more quickly to rising housing prices than stock prices. However, state banks respond to asset values indirectly through inflation and economic activity [9].

Global literature on the determinants of housing prices

The real estate market is becoming a challenging area because of numerous factors. The main factor that could be considered is the size of the population, and it is a universal fact that the population is increasing every day. Similarly, when population increases, the demand for consumable goods increases in every sector. Real estate is one of these. Various studies explored the impact of monetary policy at the general level, however, the current study investigated more detailed dependences, such as the linkages of housing prices, and found that monetary policy affects housing demand through credit availability and is considered a key predictor of housing prices [2]. Similarly, the ease of access to credit was responsible for the surge in housing prices in developed countries such as Japan, the United Kingdom, and the United States [12]. Changes in the policy rate affect real estate values through a variety of channels. A tight policy rate reduces the rate of inflation and pushes the user cost of housing upward. As a result, when user costs become high, it reduces housing demand, and, at the end, housing prices and productivity decline [3]. A contractionary monetary policy, in the eyes of the supply side, might have an immediate impact on house building costs and decrease the activity of housing output [4].

Many scholars have investigated monetary policy transmission channels, concentrating on how the economy is affected by monetary policy,

specifically, how the policy rate affects various asset prices. Monetary policy has a transmission effect on asset prices, which contribute to the economy. Therefore, due to a healthy policy rate, economic growth can be achieved [13]. The author [14] used quarterly data on the United States from 1987 to 2007 and employed Factor-Augmented Vector Autoregressive model (FAVAR) to explore monetary transmission and suggested long-run relationships between the policy rate and housing prices.

Data for the period 1986–2008 revealed residential property prices and their response to the monetary policy rate in 18 countries. According to panel VAR, the effect of the policy rate was measured and revealed that housing prices are broadly related to economic activity [15].

Monetary policy is a precious tool that protects the economy and brings financial stability. The study [15] found the variation in housing prices due to the policy rate and furthermore explained the real estate sector given its large portion in GDP. All these things will be possible with the help of a feasible policy rate.

To compare the effect of the policy rate on housing prices, the current study also looked at developed and developing countries because these countries mostly differ in nature. In the United States and Eurozone, property markets were examined with the help of structural vector autoregression (SVAR) method, which suggests that monetary policy shocks affect housing prices due to the transmission effect, and the Eurozone was more clearly affected by this shock [16].

On the other hand, to showcase a developing country, real estate demand and its pricing fluctuations were tested for China. China is a developing country that makes a large contribution to the world's economy. The study [17] observed outcomes by using monthly data from 1998 to 2009 and came up with evidence that, in the case of China, monetary policy had an impact on housing prices. This observation was made based on both the contractionary and expansionary policy rates and suggested that the expansionary policy rate increases housing prices. The tight policy rate had a negative influence on Chinese property prices, particularly in large cities [18].

If the state bank applies an expansionary policy that increases the amount of money by providing loans at a low interest rate. When the mortgage interest rate falls, the demand for housing increases, and as a result real estate market activities move faster [5].

Colombian housing prices were examined for the period 1994–2015 with the help of the Markov switching model. According to empirical findings, a contractionary monetary shock reduces house price growth by a bigger magnitude in high-volatility periods than in low-volatility periods. This shows that monetary policy is more successful in lowering house price growth during times of crisis than when the economy is doing well [19]. In Turkey, the dynamic relationship between property prices, income, interest rates, housing permits, and stock prices was studied by using structural vector autoregressive (SVAR) models, which were employed for monthly and quarterly data and applied using four distinct SVAR models to reveal this dynamic link between 2003 and 2016. The study found statistically significant and considerable connections between the variables, leading to the conclusion that home prices and housing permits are highly sensitive to monetary policy and income shocks as housing market variables [20]. Mortgages influence housing demand because the liquidity of money is boosted by the selling and purchasing of houses [21]. The negative effect of higher interest rates on property values is bigger than the effect of lower interest rates [22]. Since the 1980s, researchers have been studying the effects of monetary policy, with most studies relying on vector autoregressions (VARs). To avoid some of the specification issues of VARs, the study employed the local projection method and showed a clear effect of monetary shocks on housing variables.

Most of the prior studies support the idea that the policy rate has a transmission effect on housing prices, but it is claimed [23] in the case of Turkey that the Turkish economy does not have a transmission effect on housing prices. The study employed the VAR model for empirical analysis, which covered the period of monthly data from 2010 to 2019. The findings reveal that monetary policy has an impact on housing prices, but the impact of housing prices on housing investment, the industrial production index, and inflation is not statistically significant. The Turkish economy does not have a housing price transmission channel, according to the findings [23]. In the case of India, it is suggested that the role of monetary

policy or policy rate is slightly affecting Indian real estate prices, and that 13 percent of the variation occurs due to policy rate in a 10-month period [24].

According to empirical data, the high level of variation in interest rates affects different countries' housing prices, such as Belgium, the Netherlands, Canada, Denmark, South Africa, Switzerland and Sweden. Financial liberalization influences the connection between housing prices and monetary policy, but that response varies in different nations. Interest rate shock appears to play a significant role in Australia, Ireland, Spain, the Netherlands, the United States, and South Africa. During 2002–2006, monetary policy shocks were responsible for almost 24 percent of house price increases in the United States. Finally, the research found indications that state banks respond to housing prices through inflation-targeting policies [25].

Summary of the literature

Recent studies have revealed that housing prices broadly relate to economic activity, and monetary policy is considered a precious tool that protects the economy and brings financial stability. According to many studies, house prices increase due to expansionary policy. While contractionary policy rates reduce them.

4. Data and methods

Data description and conceptual framework

The current research is based on monthly time series data that span the period from 2011M1 to 2020M12. The study took the dependent variable, housing prices (HP), from the www.zameen.com website and made calculations in average per square foot prices for major cities. The control variable is Karachi Interbank Offered Rate (KIBOR), which is used as proxy of monetary policy taken from (SBP) state bank of Pakistan. Some reports (particularly, [26]) utilize the discount rate as a proxy for policy, which is not appropriate for analysis. Furthermore, in Pakistan, the committee on monetary policy meets every two months, and rarely revises the discount rate. As a result, the discount rate is an ineffective monthly indicator of monetary policy [9]. The data of consumer price index (CPI), the proxy for inflation (INF) and exchange rate (EXR) have been taken from SBP (State bank of Pakistan).

Specification: ARDL model

The current study adopted autoregressive distributed lag (ARDL) and bound testing approach to sort out the movement of dependent and independent variables in long and short run. According to many researchers, this model is used for the purpose of co-integration among the variables [27]. As per the assumption of this model, the variables must be stationary at order I(0) and I(1) [28]. The ARDL model is regarded as the best econometric technique compared to others, but it fails when the order of I(2) is present in any variable. Based on the study purpose, the current study will also use the ARDL approach to analyze the co-integration between house prices and monetary policy with some other variables of Pakistan, as shown in *Fig. 4*.

The generalized ARDL (p, q) model is given below to understand the relationship between both dependent and independent variables:

$$Y_t = \gamma_{oi} + \Sigma_{i=1}^{p} \delta_i Y_{t-i} + \Sigma_{i=0}^{q} \beta_i' \mathrm{X}_{t-i} + \varepsilon_{it}, \qquad (1)$$

where Y_t is a vector and the variables in X_t are allowable to be purely *1*(0) or *1*(1) and β and δ_i are coefficients; γ is the constant; $i = 1,\ldots, k$; optimal lags are p and q order; ϵ_{it} is the error term.

In the empirical methodology, the current study will disclose the impact of monetary policy on housing prices with the help of the ARDL model. This model is widely employed when variables are in different order or not stationary [10]. To determine the long- and short-run linkages among any dependent and independent variables, this model is considered the best. Furthermore, equation two shows the general model which consists of the current study variables.

$$HP_t = a_0 + a_1 KIBORE + a_2 INF + a_3 EXR + e_t, \quad (2)$$

where *HP* represents houses prices, while *t* signifies the time period from 2011M1 to 2020M6; a_0 signifies the constant; while a_1 to a_3 are the coefficients of variables; KIBORE (Karachi Interbank Offered Rate) signifies monetary policy; INF denotes inflation and EXR is representing the exchange rate; while e_t signifies the error term. To perform the bound test for cointegration, the conditional ARDL (p, q_1, q_2, q_3) model with the four variables is specified as:

$$H_o : a_{1i} = a_{2i} = a_{3i} = a_{4i} = 0,$$

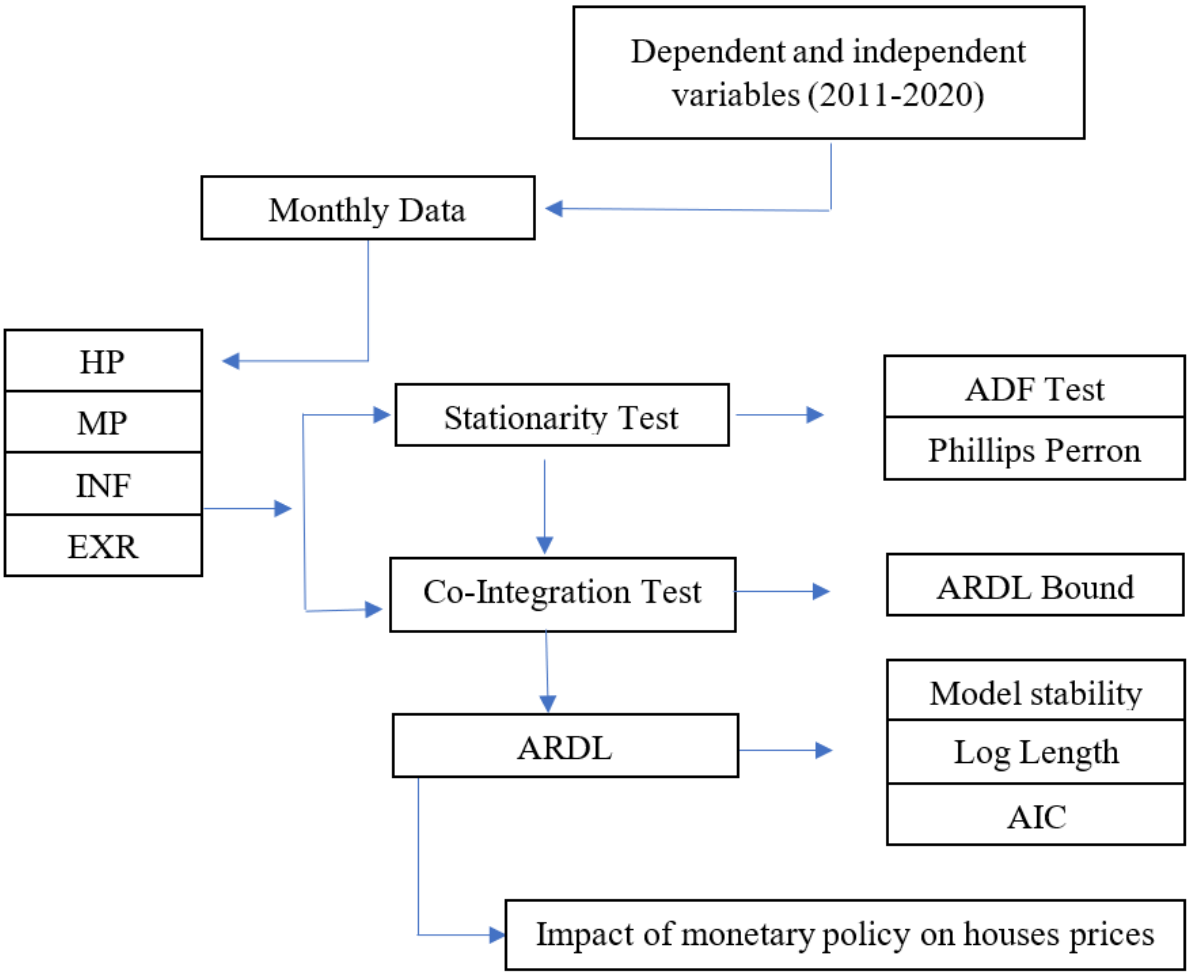

Fig. 4. **A conceptual framework**

Source: Naikoo et al., 2021.

where $i = 1, 2, 3, 4$.

$H_1 : a_{1i} \neq a_{2i} \neq a_{3i} \neq a_{4i} \neq 0,$

$$\Delta HP_t = a_{01} + a_{11}\Delta HP_{t-i} + a_{21}\Delta KIBORE_{t-1} + a_{31}\Delta INF_{t-i} + a_{41}\,\Delta EXR_{t-i} + \\ + \sum_{i=1}^{p} a_{1i}\Delta HP_{t-i} + \sum_{i=1}^{q} a_{2i}\Delta KIBORE_{t-1} + \sum_{i=1}^{q} a_{3i}\Delta INF_{t-i} + \sum_{i=1}^{q} a_{4i}\,\Delta EXR_{t-i} + e_{1t}, \quad (3)$$

$$\Delta KIBORE_t = a_{02} + a_{12}\Delta HP_{t-i} + a_{22}\Delta KIBOR_{t-1} + a_{32}\Delta INF_{t-i} + a_{42}\,\Delta EXR_{t-i} + \\ + \sum_{i=1}^{p} a_{1i}\Delta HP_{t-i} + \sum_{i=1}^{q} a_{2i}\Delta KIBORE_{t-1} + \sum_{i=1}^{q} a_{3i}\Delta INF_{t-i} + \sum_{i=1}^{q} a_{4i}\,\Delta EXR_{t-i} + e_{2t}, \quad (4)$$

$$\Delta INF_t = a_{03} + a_{13}\Delta HP_{t-i} + a_{23}\,\Delta KIBORE_{t-1} + a_{33}\Delta INF_{t-i} + a_{43}\,\Delta EXR_{t-i} + \\ + \sum_{i=1}^{p} a_{1i}\Delta HP_{t-i} + \sum_{i=1}^{q} a_{2i}\Delta KIBORE_{t-1} + \sum_{i=1}^{q} a_{3i}\Delta INF_{t-i} + \sum_{i=1}^{q} a_{4i}\,\Delta EXR_{t-i} + e_{3t}, \quad (5)$$

$$\Delta EXR_t = a_{04} + a_{14}\Delta HP_{t-i} + a_{24}\Delta KIBORE_{t-1} + a_{34}\Delta INF_{t-i} + a_{44}\,\Delta EXR_{t-i} + \\ + \sum_{i=1}^{p} a_{1i}\Delta HP_{t-i} + \sum_{i=1}^{q} a_{2i}\Delta KIBORE_{t-1} + \sum_{i=1}^{q} a_{3i}\Delta INF_{t-i} + \sum_{i=1}^{q} a_{4i}\,\Delta EXR_{t-i} + e_{4t}. \quad (6)$$

If there is no cointegration, the model of ARDL (p, q_1, q_2, q_3) specified as:

$$\Delta HP_t = a_{01} + \sum_{i=1}^{p} a_{1i}\Delta HP_{t-i} + \sum_{i=1}^{q} a_{2i}\Delta KIBORE_{t-1} + \sum_{i=1}^{q} a_{3i}\Delta INF_{t-i} + \sum_{i=1}^{q} a_{4i}\,\Delta EXR_{t-i} + e_{1t}, \quad (7)$$

where the difference operator Δ is used. The F-test and the coefficient of lagged variables are included in the test to ensure that the variables have a long-term relationship. The null hypothesis is "no long-term relationship between the variables" [27]. The following requirements must be met before the conclusion on *H0* can be accepted or rejected. If the value of the "F" test is larger (>) than the upper critical bound (UCB), then *H0* will be rejected, which implies that the study variables are moving together or cointegrated. Similarly, if the value of the "F" statistic test is lower (<) than the lower critical bound (LCB), then accept *H0,* and this condition signifies that the study variables are not cointegrated. Though, if the value of F-test < UCB and greater (>) from LCB, this condition's result will be unsatisfying. If there is cointegration, the error correction model (ECM) representation is specified as:

$$\Delta HP_t = a_0 + \sum_{i=1}^{p} a_{1i}\Delta HP_{t-i} + \sum_{i=1}^{p} a_{2i}\Delta KIBORE_{t-1} + \\ + \sum_{i=1}^{p} a_{3i}\Delta INF_{t-i} + \sum_{i=1}^{p} a_{4i}\,\Delta EXR_{t-i} + \lambda ECT_{t-1} + e_t. \quad (8)$$

The ECM, called the error correction term, indicates the speed adjustment required to regain equilibrium in the model. It must have a significant value and a negative sign so that the coefficient of ECM will correctly measure how soon variables regain equilibrium. The relatively significant error correction term demonstrates the presence of healthy long-run relationships.

Unit root testing

We used Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests to check if the series data of KIBOR and housing prices are stationary in time. The ADF test employed through augmenting equation and form lagged difference of dependent variables ΔY_{t-1} is included as independent variables to detect serial correlation [29]. Below is the equational form of the ADF tests.

$$\Delta Y_t = y_1 Y_{t-1} \sum_{i=1}^{m} a_i \Delta Y_{t-i} + \mu_t, \quad (9)$$

$$\Delta Y_t = y_0 + y_1 Y_{t-1} \sum_{i=1}^{m} a_i \Delta Y_{t-i} + \mu_t, \quad (10)$$

$$\Delta Y_t = y_0 + Y_1 Y_{t-1} + Y_2 t + \sum_{i=1}^{m} a_i \Delta Y_{t-i} + \mu_t. \quad (11)$$

The error term is μ_t and first difference is ΔY_t of the dependent variable. It is necessary to run a model to check the pattern of the data series, especially in time series data. If the data are without drift and trend, then it is better to use equation one. Equation two will be used if the data series have drift but no trend, and if the data have both drift and trend, then apply equation three.

Phillips-Perron test

$$Y_t = c + \delta t + a y_t + a y_{t-1} + e(t). \quad (12)$$

In the above equation, $e(t)$ is the innovation process. The test assesses the null hypothesis under the model variant appropriate for series with different growth characteristics $c = 0$ or $\delta = 0$.

5. Empirical results and discussion

Descriptive statistics

The summary of descriptive statistics results shows that the average value of HP is 11.25275 and KIBOR average value is 9.090370. The maximum values of HP and KIBOR during the study period were 32.77500 and 13.56000, and the minimum values were –0.123649 and 5.970000. The standard deviations of HP and KIBOR during the study period were 8.794751 and 2.589566. The skewness values of HP and KIBOR and all other variables were zero, that depicts that the data is normally skewed. Similarly, the Kurtosis values of all variables were less the 3, showing platykurtic distribution (*Table 2*).

Unit root analysis

The unit root process, or unit root, is the stochastic trend, especially in time series data, which is also known as "random walk with drift". It is said that if the data have a unit root, the supporting results of any analysis are unpredictable. Therefore, to obtain predictable results, it is important to check the unit root process, and that is possible with the help of ADF and PP tests. These tests are well known for the purpose of determining the unit root. The ADF test also avoids the issue of serial correlation. Furthermore, PP is the modified form of the ADF test, and the main advantage of the ADF test is that it corrects the problems of heteroscedasticity and autocorrelation [29, 30].

Table 2
Descriptive Statistics

Variables	HP_t	EXR_t	KIBORt	INFt
Mean	11.25275	7.538458	9.090370	6.919444
Median	8.839951	5.782852	9.210000	6.700000
Maximum	32.77500	30.52106	13.56000	13.90000
Minimum	–0.123649	–5.732753	5.970000	1.300000
Std. Dev.	8.794751	8.418928	2.589566	3.354123
Skewness	0.972346	1.039268	0.237356	0.313585
Kurtosis	2.853990	3.415812	1.740033	1.905506

Source: Developed by the author.

Table 3
Unit root test results

Variables	Augmented Dickey-Fuller		Phillips-Perron	
	Level	First Diff.	Level	First Diff.
HP	–1.292014	–3.222470*	–1.456204	–6.214008*
KIBOR	–1.661850	–3.429310*	–1.169064	–10.92534*
INF	–1.619339	–8.374408*	–1.668041	–9.157815*
EXR	–1.768843	–7.399178*	–1.620154	–7.399178*

**Level* of significance is 5%.

Source: Developed by the author.

The current study focuses on checking the effectiveness of the policy rate impact on housing prices in Pakistan. Before using ARDL, the initial step is to run the process of unit root. If the condition is mixed order or "at level I(0)" and "first difference I(1)," then the results of the ARDL model will be accurate and supporting. But it failed in the order of I(2) (second difference of order). The results of the unit root are given in *Table 3*.

The criteria of lag length

After examining the unit root process, the next step is to use the method of ARDL to examine the series' long-term relationship. When using the ARDL, one must choose the right lag length for the bounds test. Furthermore, the ideal lag length should be kept in mind when conducting policy analysis; an incorrect lag length can influence the results and cannot be accepted. It is necessary to ensure that the lag selection is appropriate. The Akaike information criterion (AIC) produces reliable outcomes and has excellent performance. *Table 4* summarizes the findings. Lag 11 was found to be appropriate for the sample.

The polynomial graph in *Fig. 5* confirms an acceptable lag selection with the help of VAR approach. All the blue dots in *Fig. 5* are in the circle that authorizes the lag 11, and estimations would be adequate to obtain satisfactory results.

Approach to bound testing

The Akaike information criterion was employed to choose the proper length of lags for the ARDL approach in [27]. *Table 5* summarizes the current study findings on the basis of the ARDL Bounds Test. When housing prices were set as a dependent variable, the F-statistics were found 6.486870, which is larger than UCB at 1 and 5 percent significance levels. The results of the bounds test confirm that there are cointegrating vectors, indicating the long-run connection between housing prices and the monetary policy rate in Pakistan.

Table 4
The lag selection criteria by VAR

Lag	LogL	LR	FPE	AIC	SC	HQ
0	−1075.84	NA	54895.11	22.26468	22.37086	22.30762
1	−502.874	1086.859	0.565387	10.78090	11.31177*	10.99555
2	−469.71	60.17334	0.397579	10.42701	11.38257	10.81339*
3	−455.14	25.23429	0.411262	10.45650	11.83675	11.01460
4	−436.316	31.04944	0.391172	10.39827	12.20323	11.12811
5	−423.104	20.70402	0.419827	10.45575	12.68540	11.35731
6	−417.696	8.028061	0.532699	10.67415	13.32849	11.74743
7	−404.017	19.17867	0.574554	10.72200	13.80104	11.96701
8	−371.614	42.75835	0.425389	10.38380	13.88753	11.80054
9	−355.329	20.14684	0.444344	10.37792	14.30634	11.96638
10	−343.89	13.20825	0.520279	10.47195	14.82507	12.23214
11	−289.792	58.00150*	0.257154*	9.686436*	14.46425	11.61835

Source: Developed by the author.

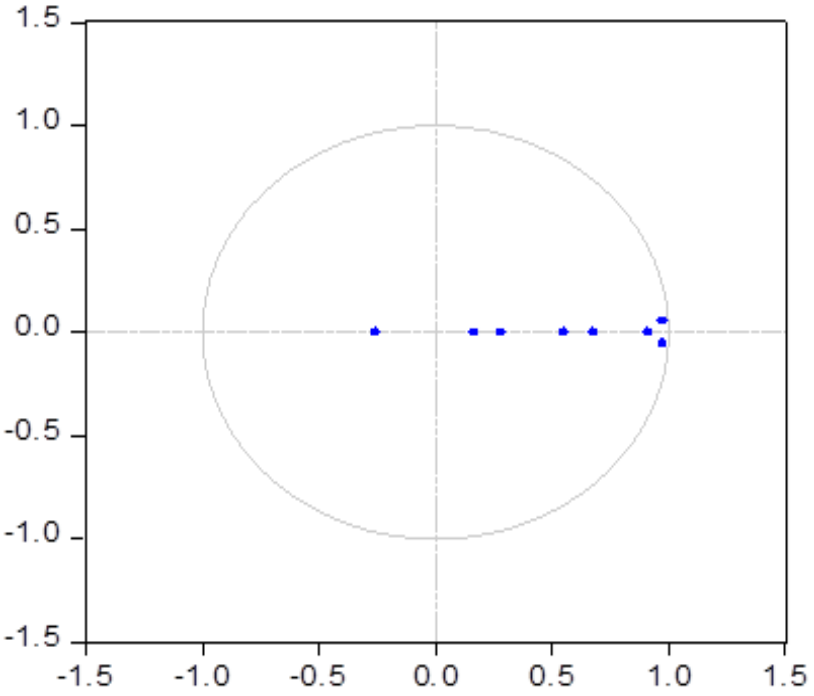

Fig. 5. **Inverse roots of AR characteristic polynomial**

Source: Developed by the author.

Long-term and short-term analysis

After the confirmation of long-run cointegration between housing prices and monetary policy, this study also examines short-run association. The short-run and long-run results are shown in *Tables 6*, *7*, and *8*. All explanatory factors were significantly affected by different angles on housing prices for the long-run findings (see *Table 6*). In the long run, the impact of KIBOR, according to the outcomes show-

Table 5
F-Bounds test

Test Statistic	Value	Signif.	I(0)	I(1)
F statistic	6.486870	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Source: Developed by the author.

Table 6
Long-run results

Variable	Coefficient	Std. Error	T-Statistic	Prob.
EXR	0.50544	0.13486	3.747869	0.0005
INF	4.610777	0.68902	6.691759	0.0000
KIBOR	–3.340232	1.02079	–3.27221	0.0020
C	6.703044	5.24497	1.277994	0.2073

Source: Developed by the author.

ing negative and highly significant impact on housing prices, means that if the KIBOR rate increases HP will decrease and vice versa. Furthermore, a one percent increase in KIBOR will reduce HP by –3.340232 percent. Likewise, EXR and INF also have a highly significant and positive impact on housing prices. It is clear from the following result that 1 percent change occurring in EXR and INF will cause 0.505440 and 4.610777 percent increase in housing prices.

The short-run results (*Table 7*) reveal that monetary policy has a highly significant effect on housing values. It is stated that, if a 1% change occurs in KIBOR, that will cut housing prices by –0.598269 percent at lag 11. Meanwhile, the influence of monetary policy on housing prices is negative and quite significant in the case of the short run. The study shows that a 1% rise in the KIBOR has resulted in –3.34022 percent decrease in property values. The observed findings of the current paper are similar to the previous study, such as [6] in Pakistan and with general studies, e.g., [21, 31].

According to the current study hypothesis and the ARDL model, which has been tested for the purpose of investigating co-integration, the R square and adjusted R square values were found to be 99%. These values indicate that the model is well fitted and has a strong relationship.

The error correction term (ECT_{t-1}) is significantly negative at 1%, indicating that the imbalance can be corrected in the long-run with better speed, even if the explanatory variables have any prior-year shock (see *Table 8*).

We conducted a model stability test using a combination of diagnostic tests, and the current study's findings show that the ARDL model passed all the diagnostic tests. For the confirmation of high order serial correlation, the study conducted a serial correlation LM test, that validated the ARDL model having no partial correlation or autocorrelation (*Table 9*).

An unequal scatter of error term or residuals occurs due to heteroscedasticity. According to [32], the problem of heteroscedasticity occurs in time series data when the dependent variable series fluctuates significantly from beginning to end. The residuals in ordinary least squares (OLS) regression are assumed to come from a population with homoscedasticity, or constant variance. The outcomes of a regression analysis are difficult to trust when heteroscedasticity is present. Heteroscedasticity is a natural occurrence in datasets with a wide range of observed data values. The current study also tests this issue through the

Table 7
Short-run result

[Variable]	[Coefficient]	[St. Error]	[t-Statistic]	[Prob.*]
HP (–1)	1.264209	0.106974	11.81787	0.0000
HP (–3)	–1.028812	0.197515	–5.208787	0.0000
HP (–4)	1.063256	0.204837	5.190728	0.0000
HP (–7)	0.566724	0.226407	2.503127	0.0157
HP (–10)	–0.341078	0.156598	–2.178043	0.0342
HP (–11)	0.211173	0.087548	2.412089	0.0197
EXR (–3)	–0.150245	0.061554	–2.440882	0.0183
EXR (–11)	0.1242	0.051959	2.390349	0.0207
INF	–0.293544	0.100569	–2.918848	0.0053
INF (–11)	–0.237523	0.108373	–2.191717	0.0332
KIBOR	–0.969189	0.234792	–4.127861	0.0001
KIBOR (–3)	–0.598269	0.273155	–2.190221	0.0333
KIBOR (–4)	0.579684	0.274094	2.114909	0.0395
KIBOR (–11)	0.50624	0.211442	2.39422	0.0205
C	0.825856	0.702025	1.176391	0.2451
R square 0.998204, Adjusted R square 0.996481				

Source: Developed by the author.

Breusch-Pagen-Godfrey test and concludes that there is no issue of hetero the observed value of R-squared is 0.8205 in *Table 10*, which is greater than 5 percent, and we reject H0.

Testing normality is a key step in data analysis. Many statistical tools rely on the assumption of normality. If the assumption is incorrect, the study may need to switch to a different statistical tool or methodology. The current study employs several different normality tests. The normality test tells us whether the sample data were taken from a normally distributed population or not, and it also checks whether the data set is well-modeled by a normal distribution. According to *Table 11,* the normality test, the data are normal, and the probability value is more than 5%, so we reject H0 and accept H1. H0 denotes that the data are not normal.

Meanwhile, to evaluate the stability of the long- and short-run parameters, this study used two stability tests, CUSUMSQ and CUSUM (see *Fig. 6* and *7*), these stability tests were proposed by [33]. The blue lines of *Fig. 6* and *7* are significantly between critical borders at the level of 5%, as shown in the graphs of both stability tests over the period 2011M1–2020M6, indicating the accuracy of long- and short-run characteristics that influence housing prices.

6. Conclusions and recommendations

An effective financial system is essential to a country's economic growth and development. Savings are turned into investments through the financial system. It provides a safe environment for doing economic transactions while also assisting in a seamless and timely manner. The rapid increase in population is creating a different level of demand in any economy. A similar pattern can also be observed in demand for housing, which has been found to be directly related to the increase in population and changes in monetary policy.

Monetary policy has been a major tool at the central bank's disposal to stabilize demand. In Pakistan, there has been a significant imbalance between supply and demand in the housing mar-

Table 8
The error correction model (ECM) results

[Variable]	[Coefficient]	[Std. Error]	[t-Statistic]	[Prob.]
D (HP (−1))	0.387416	0.095486	4.057288	0.0002
D (HP (−2))	0.384964	0.114435	3.364051	0.0015
D (HP (−3))	−0.64385	0.115737	−5.56302	0.0000
D (HP (−4))	0.419408	0.111678	3.755516	0.0005
D (HP (−6))	−0.30499	0.122229	−2.49524	0.0160
D (HP (−7))	0.261733	0.124512	2.102076	0.0407
D (HP (−10))	−0.21117	0.079347	−2.6614	0.0105
D (EXR (−1))	−0.09794	0.037128	−2.6378	0.0112
D (EXR (−3))	−0.16994	0.040822	−4.16298	0.0001
D (EXR (−5))	−0.08869	0.043089	−2.05834	0.0449
D (EXR (−7))	−0.09237	0.037821	−2.44231	0.0182
D (EXR (−8))	−0.13328	0.042175	−3.16018	0.0027
D (EXR (−10))	−0.1242	0.045016	−2.75903	0.0081
D (CPI)	−0.29354	0.092374	−3.17777	0.0026
D (CPI (−1))	−0.65399	0.138326	−4.72791	0.0000
D (CPI (−2))	−0.49289	0.14296	−3.4477	0.0012
D (CPI (−3))	−0.5237	0.141263	−3.70726	0.0005
D (CPI (−4))	−0.3434	0.123647	−2.77721	0.0077
D (CPI (−5))	−0.43079	0.123931	−3.47601	0.0011
D (CPI (−6))	−0.25863	0.124725	−2.07359	0.0434
D (CPI (−7))	−0.28422	0.118564	−2.39717	0.0204
D (CPI (−10))	0.237523	0.100446	2.364689	0.0221
D (KIBOR)	−0.96919	0.206947	−4.68327	0.0000
D (KIBOR (−3))	−0.41535	0.21029	−1.97513	0.0539
D (KIBOR (−8))	−0.67318	0.217527	−3.09468	0.0033
D (KIBOR (−10))	−0.50624	0.194792	−2.59887	0.0123
Coint Eq (−1) *	−0.12321	0.020801	−5.92301	0.0000

Source: Developed by the author.

Table 9
Diagnostic tests: the serial correlation LM test

F-statistic 0.291297 Prob. F (2,47) 0.7486
Obs*R-squared 1.187652 Prob. Chi-Square (2) 0.5522

Source: Developed by the author.

Table 10
The heteroskedasticity test

F-statistic 0.673371 Prob. F (47,49) 0.9122
Obs*R-squared 38.06519 Prob. Chi-Square (47) 0.8205

Source: Developed by the author.

Table 11
Diagnostic tests: normality test

Mean 8.28e-6 Skewness 0.436528
Median –0.014149 Kurtosis 3.731487
Maximum 1.140859 Jarque-Bera 5.243250
Minimum –0.897990 Probability 0.072685
S.D. 0.387469

Source: Developed by the author.

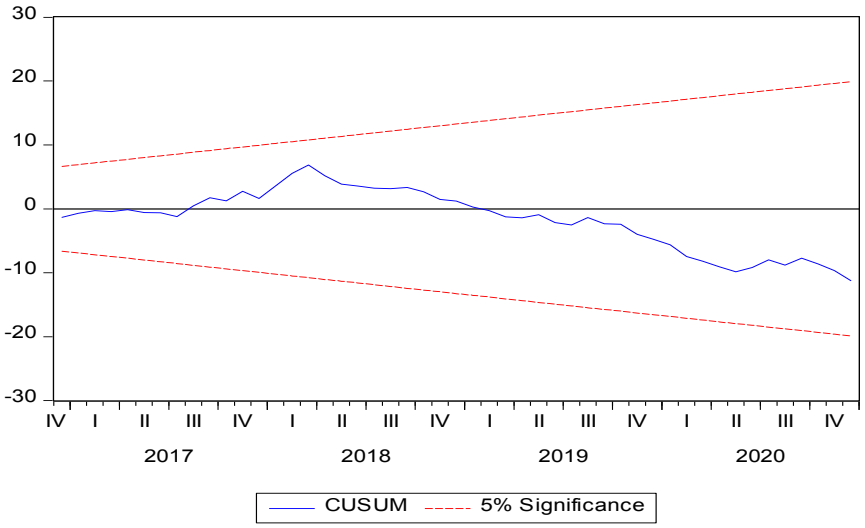

Fig. 6. **The CUSUM Test**

Source: Developed by the author.

ket. The current government, with an aim to boost economic growth and provide employment, used monetary policy, aka interest rates, to achieve its twofold objective. This objective will also influence house prices. This study analyzes time series data to study the influence of monetary policy on housing prices in Pakistan.

We used monthly time series data from 2011M1 to 2020M12 obtained from different websites, like housing prices data from zameen.com, KIBOR (Karachi interbank offered rate) from the State bank of Pakistan as a proxy for monetary policy, the exchange rate from the State bank of Pakistan and (CPI) the consumer price index obtained from international monetary funds. Based on the model identification strategy, we used ARDL (Auto Regressive Distributed Lag) method proposed by [26] to examine the drivers of houses prices in Pakistan. Before using the ARDL technique, we

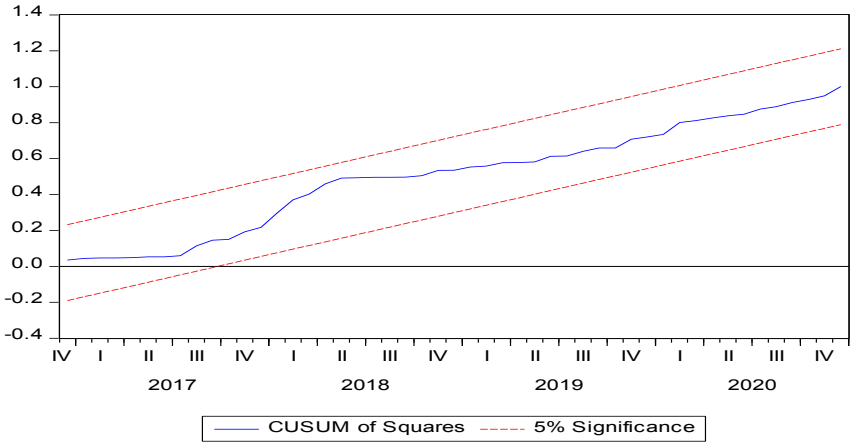

Fig. 7. **The CUSUM Squares Test**

Source: Developed by the author.

selected a proper lag length, which turned out to be 11 months. Various diagnostic tests indicated model stability with no autocorrelation or structural breaks. After using the ARDL bound test, we found that the F statistic value is greater than upper critical bound (UCB) at one and five percent of significance levels. Our analysis found that the KIBOR rate negatively affected house prices. Meaning that monetary policy is affecting house prices, and contractionary policy rate negatively affects housing prices, but a loose policy rate has a favorable impact. The current study's findings also match those of prior studies, such as [2, 4, 6, 18, 25]. Inflation and exchange rates affected house prices positively.

Recommendations. Apart from the authorities' decisions, there were strong expectations for this sector to grow rapidly in the future. The findings of the current study suggest that there should be a well-structured, transparent, and centralized framework, and that the central bank should provide a separate platform where the loans are being used for their intended use in productive investment instead of dead investment (like property investment). This will lead to higher employment and investment as well as a reduction in housing prices.

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