Factors Affecting Demand and Supply in the Housing Market: A Study on Three Major Cities in Turkey

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Abstract: This paper aims to identify the economic factors that significantly affect the demand for and supply of housing in three major cities in Turkey, such as Istanbul, Ankara, and Izmir. This study uses monthly data ranges from January 2010 to December 2020 because of the limited housing price data from each city. For smooth measurement, the logarithm of all data except measurements of nominal interest rate, real interest rate and inflation is used. This research uses the Co-integration Analysis and Vector Error Correction Model (VECM) to investigate the macroeconomic variables' effects on the demand and supply. Mortgage credit volume, as a dependent variable, is influenced by real per capita GDP, real house prices, projected inflation, and nominal interest rates. On the contrary, the building site is used as a dependent variable on the supply side that is determined by the real housing price, the real interest rate, and the real cost of construction. In the VECM model, the mortgage credit volume and constriction cost were dominated by error correction variables, showing the adjustment of disequilibrium towards an equilibrium point. In the case of Ankara, supply-side variables have a long-term relationship. Both housing demand and supply-related factors have a long-term impact on the housing market in Istanbul and Izmir. Given a significant p-value, the coefficient of C1 derived from system equations is negative.

Keywords: housing demand; housing supply; housing market; economy of Turkey; housing price

1. Introduction

Accommodation and housing are considered fundamental human needs. To achieve this, it is a civil obligation of every community to assist people in managing adequate accommodation. Thus, the government tries to ensure a consumer-friendly approach to succeed in the housing market. To grow the economy in the right direction, it is important to strike a balance between the demand for and availability of housing [1–5].

In this paper, we attempt to point out the economic elements that significantly affect the demand or supply of housing within three important cities in Turkey. We chose the three largest cities in Turkey, so we conducted a town-specific analysis. The reason for our evaluation is to demonstrate the supply and demand side in the housing market. The study's findings show the significant impact of house prices, income levels, interest rates,

and inflation on housing demand. Likewise, the supply-side is affected by building costs, house prices, and actual interest rates.

The US housing market has been uncertain since the global recession of 2007–2008. In [6], the reason for this economic meltdown was described, which is related to excess housing supply due to tax relaxation, lack of institutional supervision, and regulatory and legal structures. Other studies have identified similar reasons as the cause of the recession, but these studies covered broader areas [7]. According to their research, the interplay between complex factors such as the lack of proper monetary policy guidelines and an unstable and unbalanced global economy coupled with the misconception of financial risk caused the economic crisis in 2007. More specifically, the monetary relaxation reflected in mortgage securitization and easy money policies of 2001–2005 adopted by Fed [8] contributed to the recession. Along the same lines of the study, the less restricted and more flexible credit market boom in the housing market contributed to the economic recession of 2008 [9]. Moreover, as an exogenous credit shock, the unregulated credit supply in the USA contributed to rising housing prices from 1994 to 2005 [10]. The volatility in the housing market and the unsold new housing stock are also factors responsible for the recession. According to Favara et al. (2015) [10], macroeconomic conditions dominate the imbalance triggered by the difference between housing demand and supply. He also studied the complex period of this incidence. Nevertheless, apart from these aforementioned reasons, labor market distortion and reduced labor supply were also primary causes of the 2008 recession [11,12].

2. Literature Review

There are several factors influencing demand and supply in the housing sector. Two issues are considered in the housing market: one is the housing price, and the other is demand and supply. Several important research studies have been carried out on the demand and supply of housing. In a cross-sectional analysis, a close relationship is shown between prices, household income, and housing demand [13–16]. The findings show that the demand for housing is positively affected by income elasticity. Furthermore, a study on the Malaysian housing market found the factors affecting housing prices include gross domestic product, population, and real property gain tax [17–19]. Moreover, the relationships between interest rates, prices, income elasticity, and demand are identified for the housing market using time-series data [20,21]. Price and interest rate elasticity have a negative effect, while the housing market's income elasticity has a positive relationship. Using recent panel data, the s authors studied the demand for housing in Turkey and used income levels, housing prices, and population as explanatory variables [22]. The findings reveal that income level is the most critical factor in determining the demand for housing in Turkey.

Some other reports are available on the supply side and the health of the housing market [23–27]. The debt-to-income ratio slows down household credit growth [28]. As a result, housing-related taxes place a 3–4 percentage point limit on housing credit and price growth. Another analysis stated that higher housing supply elasticity is pushing up the transitory price following the demand shock [29]. In addition, excess housing supply can impede other economic factors [30]. Suppose that the economy is not in balance due to the lack of housing availability. That's going to create another risk for the near future. Demand will need to be affected to reduce the difference. An analysis of growing Chinese cities found the links between geography and regulatory factors with the housing supply's price elasticity [31]. Likewise, a Shanghai-specific study identified two factors affecting housing prices: GDP and lending rates [32]. On the other hand, a Chinese-city level analysis, using the significant cities data of 2002–2008, found the population and income level, land supply in urban area, and construction cost as significant factors that can explain the rise in housing prices [33].

The purpose of our analysis was to demonstrate the supply and demand sides of the housing market. In this sense, housing credit is used to understand the housing market

demand and housing permit data for supply-side based variables. Details on the impact of the macroeconomic factors on housing credit and the number of building permits will be added to the existing body of literature.

3. Materials and Methods

This is a town-specific analysis. We selected the three largest cities—Istanbul, Ankara, and Izmir—the 1st, 2nd, and 3rd largest cities in Turkey. We used monthly data from January 2010 to December 2020. The data was acquired from the Turkish Statistical Institute and the Central Bank of the Republic of Turkey (CBRT). We use a range of data to restrict house price data for each city. The logarithm of all dates except the nominal interest rate, the actual interest rate, and inflation are used for the smoothness calculation.

The mortgage credit amount is designated as an indicator of demand in the housing market due to Turkey's inappropriate housing stock record. Such data is examined under the Banking Regulation and the Supervisory Agency (BDDK). On the other hand, construction permit numbers are known to be a contingent supply-side variable obtained from the Turkish Statistical Institute (TUIK). Interest rate and predicted inflation data are available from the Central Bank of the Republic of Turkey (CBRT). However, the real interest rate was calculated by subtracting the projected inflation from the mortgage rate.

The OLS, Ordinary Least Square, refers to the relationship between one or more regressors and the regressed. It is a common method that is used to predict linear relationships. In the case of nonstationary variables, the runn of OLS produces a spurious regression. Actually, in econometrics, the Ordinary Least Squares (OLS) approach is broadly chronic in accordance with the parameters of a linear regression model. OLS estimators minimize the quantity of squared errors (a distinction between celebrated values and expected values). VECM (Vector Error Correction Model) is suitable for this estimation to correct this default problem. When variables have one or more cointegrations, it is convenient to apply the VECM model, which can capture both long-run and short-run changes, and also adjust for any deviations from equilibrium. In this study, one lag is chosen by using the lag length criteria. Here, the coefficient of error correction term is a vital parameter in the analysis of VECM.

$$\Delta yt = \Pi 0 + \Gamma yt - 1 + \Pi 1 \Delta yt - 1 + ::::: + \Pi p \Delta yt - p + \Psi 0 xt + ::::: + \Psi q xt - q + \Phi Dt + ut$$

The demand of the Turkish housing market were influenced by HPI (Housing Price Index), industrial output as profits, the inflation rate, and the nominal interest rate. In our study, the association between these factors depends on city characteristics. While price hikes negatively influenced housing demand in Istanbul and Ankara, they positively affected demand in Izmir [34,35].

4. Results

To explain the VECM, we check the data to see whether the variables are integrated with order one. All variables are non-stationary at the stage using the Augmented Dicky-Fuller test. After the first difference is taken, the variables are stationary.

4.1. Cointegration Test

The Johansen Co-integration Test is used to estimate co-integration. We can see that at least one or two variables are co-integrated for each city. Therefore, housing credit is linked and influenced by HPI (Housing Price Index), industrial output as profits, the inflation rate, and the nominal Interest rate. On the contrary, construction permits on the supply side, coincides with construction price, costs, and real interest rates.

4.1.1. For Ankara

$Coint_{Ank1}$: $cr_{t-1} = 6.093443 + 0.031368 \ trend_{t-1} - 2.998063 p_{t-1} - 2.439748 Y_{t-1} + — + -0.029757 Inf_{t-1} + 0.033990 \ i_{t-1+}$

(0.23324) (Number in the parentheses denote standard deviation of the corresponding slope coefficient) *(0.02939) (0.01541) (1.00133)*

$Coint_{Ank2}$: $per_{t-1} = -49.65211 - 0.069898 trend_{t-1} + 8.790259 p_{t-1} + \underline{\quad} + 0.133555 cc_{t-1} - 0.051352\ ri_{t-1+}$

(0.25582)   (4.30937) (1.36039)

4.1.2. For Istanbul

$Coint_{Ist1}$: $cr_{t-1} = 15.89900 + 0.035020\ trend_{t-1} - 0.489705 p_{t-1} - 6.858388 Y_{t-1+} \underline{\quad} + -0.078628 Inf_{t-1} - 0.173496 i_{t-1}$

(0.17568) (0.08708) (1.19390) (0.96102)

$Coint_{Ist2}$: $per_{t-1} = -67681.758 - 6.877547 trend_{t-1} + 128.8552 p_{t-1} + \underline{\quad} + 74.65621 cc_{t-1} - 18.75822 ri_{t-1+}$

(38.9375)   (35.7706) (8.75295)

4.1.3. For Izmir

$Coint_{Izm1}$: $cr_{t-1} = -18.81736 - 0.875482 trend_{t-1} + 1.848414 P_{t-1} - 1.809652 Y_{t-1} + \underline{\quad} + 0.651734 Inf_{t-1} - 0.031275 i_{t-1+}$

(0.13404) (0.01247) (0.68941) (0.21628)

$Coint_{Izm2}$: $per_{t-1} = -24.33304 - 0.031342 trend_{t-1} + 2.242016 p_{t-1} + \underline{\quad} + 12.87856 cc_{t-1} - 2.828460 ri_{t-1}$

(3.27740)   (2.75862) (0.70352)

The effect of the co integration shows a distinct outcome for each city. Housing demand in Istanbul and Ankara is adversely affected by price hikes. But in Izmir, price and demand for housing are positively related, while house prices are growing, demand for housing is also increasing. For Izmir, in terms of price, housing can be considered as a Giffen good. On the other hand, wages, inflation, and nominal interest rates are inversely associated with housing demand, while in Ankara housing demand keeps pace with a mixed relationship.

In the case of a housing supply model, all variables' coefficient is based on a macroeconomic theoretical model for and particular city. An increase in price and building costs improve housing availability as the number of housing permits increases. The result is coherent and consistent across all cities.

4.2. Vector Error Correction Model

This model helps us to understand the relationship between variables in the short-term. The Vector Error Correction Models (VECM) are as follows.

4.2.1. VECM (for Ankara)

$\Delta Cr_t = 0.036884\ coint1_{t-1} + 0.327036\ \Delta Cr_{t-1}$
(0.00686) (0.10662)
$- 0.078950\ \Delta p_{t-1} + 0.000532\ \Delta \pi^e_{t-1} - 0.006481 \Delta i_{t-1}$
(0.13244)   (0.01395) (0.01151)
$\Delta per_t = -0.287036\ coint1_{t-2} + 6.824057\ \Delta Cr_{t-1}$
(0.07829)   (7.86077)
$+ 3.805676 \Delta p_{t-1} + 0.515986 \Delta \pi^e_{t-1} +$
(11.5516) (0.33609)
$-0.158822 \Delta r^i_{t-1} - 1.695224\ \Delta cc_{t-1} + 3.642315\ \Delta y$
(0.33609) (1.54594) (0.80705)

4.2.2. VECM (for Istanbul)

$\Delta Cr_t = -0.082047 coint1_{t-1} - 0.005776 \Delta Cr_{t-1} - 0.057404 \Delta p_{t-1}$
[−6.44598] [−0.06540] [0.67840]
$+ 0.002691 \Delta \pi^e_{t-1} - 0.004462 \Delta i_{t-1}$
[0.58970] [−1.83452]

$\Delta per_t = -0.515311 coint1_{t-2} + 16.60894 \Delta Cr_{t-1}$
[−3.54591]   [2.73874]
$+ 7.175901 \Delta p_{t-1} + 0.254613 \Delta \pi^e{}_{t-1} +$
[1.63895] [1.18088]
$+ 0.100005 \Delta r^i{}_{t-1} - 0.614807 \Delta cc_{t-1} + 0.275148 \Delta y$
[0.35865] [−0.52759]   [0.73149]

4.2.3. VECM (for Izmir)

$\Delta Crt = -0.042001 coint1_{t-1} + 0.055616 \Delta Cr_{t-1} + 0.057404 \Delta p_{t-1}$
[−5.93503] [0.52268] [1.31769]
$+ 0.001691 \Delta \pi^e{}_{t-1} - 0.003489 \Delta i_{t-1}$
[0.84435] [−2.42728]
$\Delta per_t = -0.076266\ coint1_{t-2} - 7.816945 \Delta Cr_{t-1}$
[−3.18474]   [−1.23252]
$+ 10.63084 \Delta p_{t-1} + 0.406175 \Delta \pi^e{}_{t-1} +$
[1.74342] [1.85674]
$+ 0.441631 \Delta r^i{}_{t-1} - 0.616981 \Delta cc_{t-1} + 1.648696 \Delta y$
[1.48162] [−0.85466]   [2.47188]

In the VECM of Ankara, Istanbul, and Izmir, variable mortgage credit volume and housing (Starts) construction permits are evaluated in various forms using a general-to-specific approach. The demand-side equation shows that price and projected inflation, nominal interest rate, and credit itself have a positive short-term effect on credit volume. However, the price positively influences Izmir's demand for housing, and the credit itself hurts Istanbul's demand for housing. In addition, a credit error of 2.689%, 7.21%, and 6.67% will be resolved consecutively by the demand equation for Ankara, Istanbul, and Izmir, respectively. Disequilibrium would shift towards an even-handed direction of housing demand at this pace per year.

In the second equation, credit, price, projected inflation, and income positively impact housing permits in all three cities, and real interest rates are also positively affected in Istanbul and Izmir. On the other hand, construction costs negatively affect housing availability for all three cities, but real interest rates negatively correlated with Ankara only. The correction of the error in the housing permit is corrected in the short-term, suggesting that its correction process is quicker than the actual housing market demand. This speedy correction method in the housing supply model rather than the demand model is measurable and valid for all cities. In addition, VECM residues are diagnosed for serial correlation, normality, Arch, Glejser Test, Harvey, and Jarque-Bera Test.

4.3. Impulse Response Analysis

The impulse response analysis refers to the shock of one variable to another variable's effect. It's an analysis of two variables. The following graphs display the response of a particular variable to shock or novelty and the impulse of a single standard deviation for each variable. As a result, we will evaluate the reactions of two variables: the amount of mortgage loans and the volume of housing permits, according to both variables' impulses.

The international financial collision highlighted the chances related to the real-estate boom. Before the crisis, mortgage booms were each fueled and supported by rising residence costs and financial activity. When that amount of circumflexion inverted, aberrat house expenses or tightened lending standards were received in accordance with widespread failures and an overhanging loan. The result used to be recessions and large increases in mass debt. However, at least until the crisis, insurance policies among aid about personal loan markets were common and were regarded as essential to raise domestic ownership, convivial stability, and pecuniary growth. Half of the housing pay-up characteristics associated with deeper personal loan markets are also associated with an elevated jeopardy of crisis. For example, higher LTVs are associated with excessively rapid

increases in house prices and credit growth for the duration of booms, or wholesale funding which is associated with worse results in the aftermath of housing booms [34,35].

4.3.1. Ankara (Housing Demand Model)

The shock to macro-economic variables, such as per capita GDP, projected inflation, and nominal interest rates, shows the response of mortgage credit volumes. Credit shock has a positive impact on credit itself. As income impulses arise, they positively impact demand in the short-term but are persistent in the long run. While a price-level shock is observed, the credit-volume response is temporarily rising but is constant over time. The credit response is inconsistent with macroeconomic theory due to the inflation and interest rate impulses. This scenario is provided by the following Figure 1.
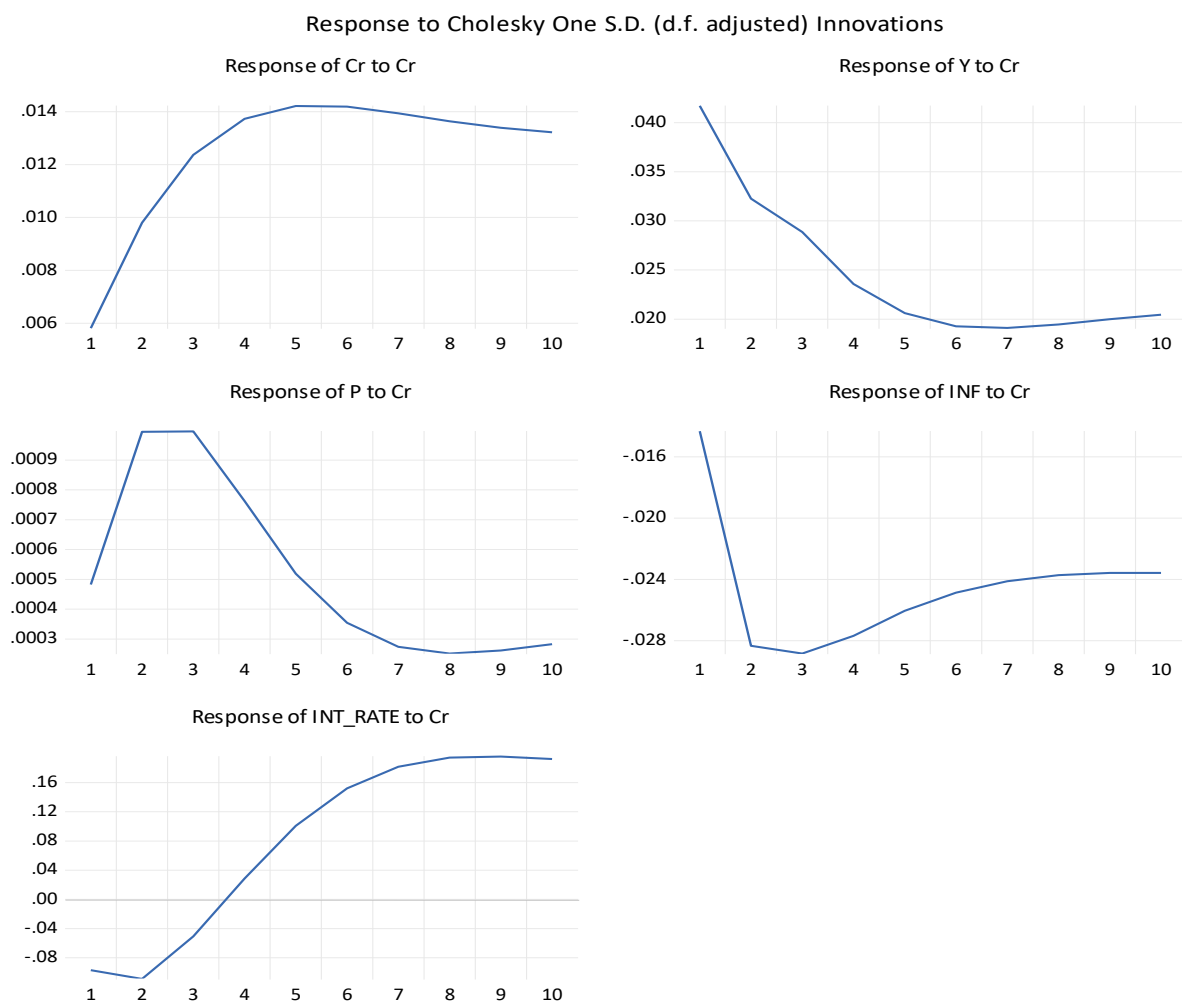

Figure 1. Mortgage credit volume response to housing demand in Ankara, Turkey.

4.3.2. Ankara (Housing Supply Model)

Income innovation positively affects housing supply in the short-term. However, its influence dies out over time. Impulses on building costs and real interest rates have adversely impacted housing availability in the short-term. It follows a positive pattern, according to Figure 2 below.
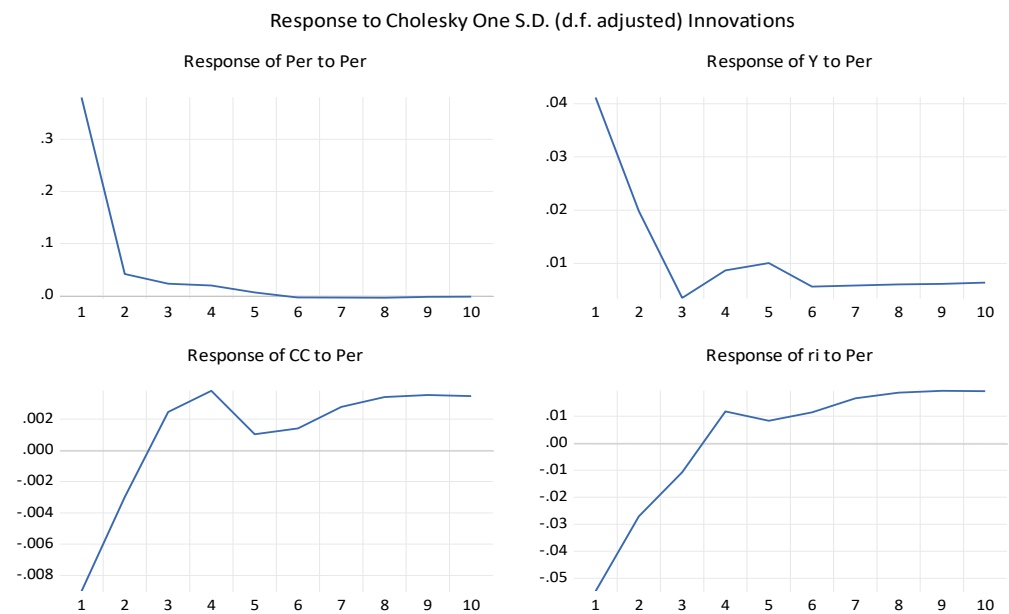
Response to Cholesky One S.D. (d.f. adjusted) Innovations

Figure 2. The response of housing permit to housing demand in Ankara, Turkey.

4.3.3. Istanbul (Housing Demand Model)

The expected inflation, shock on price, and nominal interest rate are inversely associated with demand in the short-term (see Figure 3).
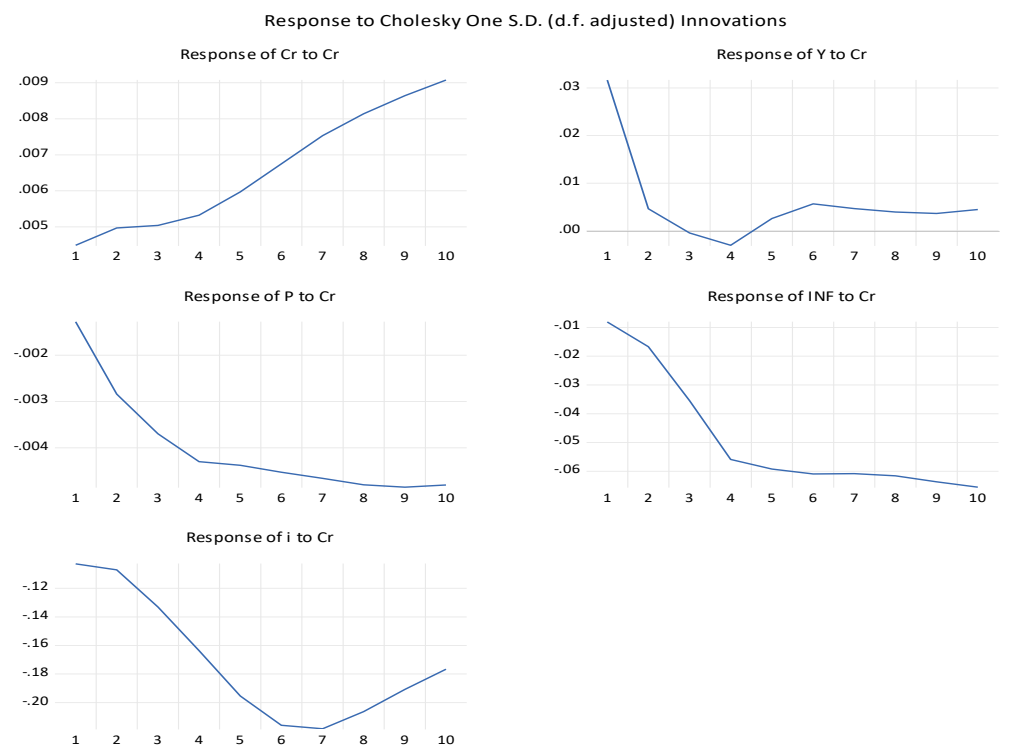
Response to Cholesky One S.D. (d.f. adjusted) Innovations

Figure 3. The response of mortgage credit volume to housing demand in Istanbul, Turkey.

4.3.4. Istanbul (Housing Supply Model)

Building cost and price shocks have negatively affected the housing supply response. As the construction cost index increases, it reduces the number of materials over time. There is volatility between these reactions and the shock. The negative pattern is followed by price pulses on the supply of housing. On the contrary, the increase in real interest

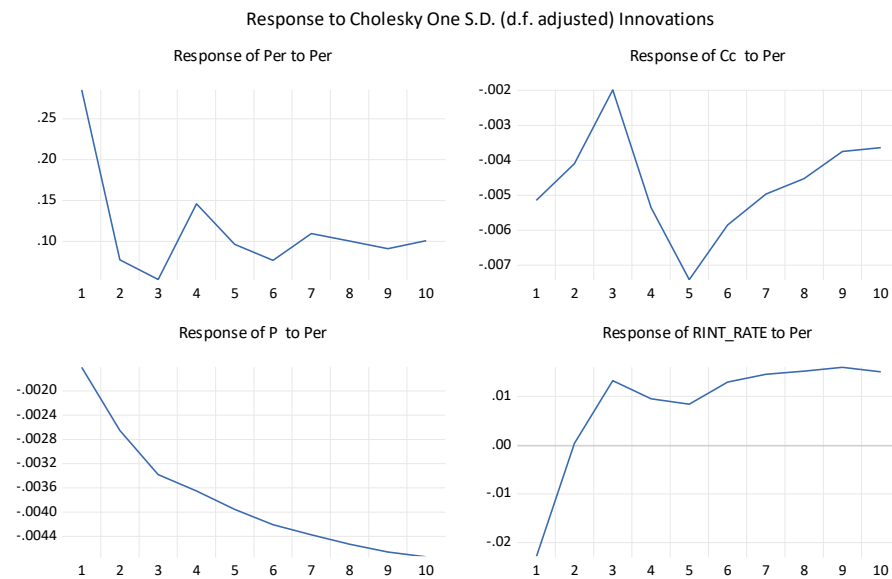rates has affected the supply side negatively, but it responds positively in the long run (see Figure 4).

Figure 4. The response of housing permit to housing demand in Istanbul, Turkey.

4.3.5. Izmir (Housing Demand Model)

Price shock and nominal interest rate shock negatively affect the demand of housing temporarily, followed by a positive influence. After a while, the response of mortgage credit volume or the housing demand to the innovation of inflation and income per capita is negative (see Figure 5).
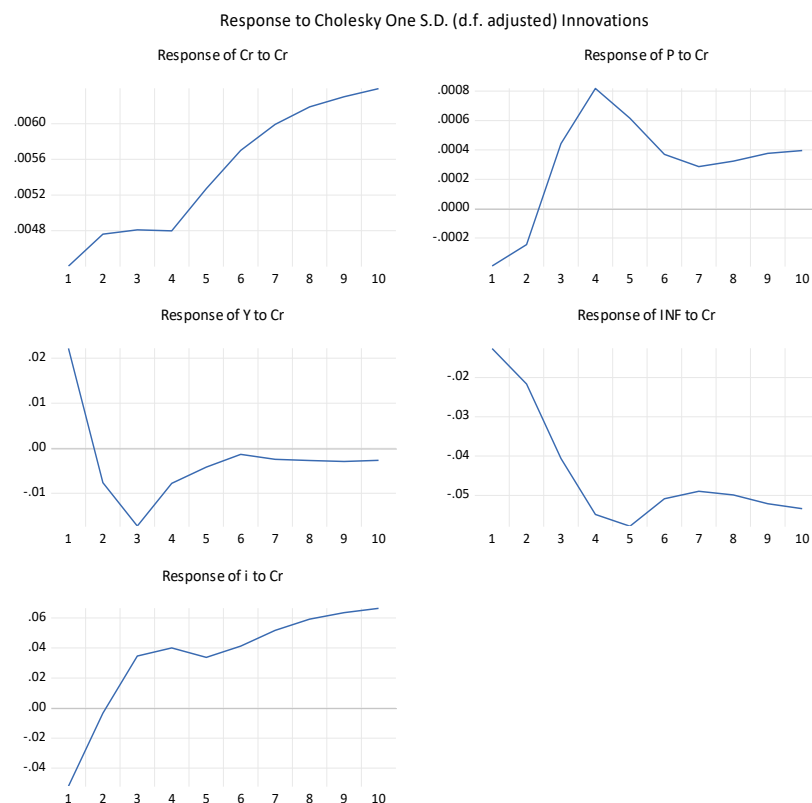

Figure 5. The response of mortgage credit volume to housing demand in Izmir, Turkey.

4.3.6. Izmir (Housing Supply Model)

The shock of price, construction cost, and real interest rate are connected to the response of the housing supply positively (see Figure 6).
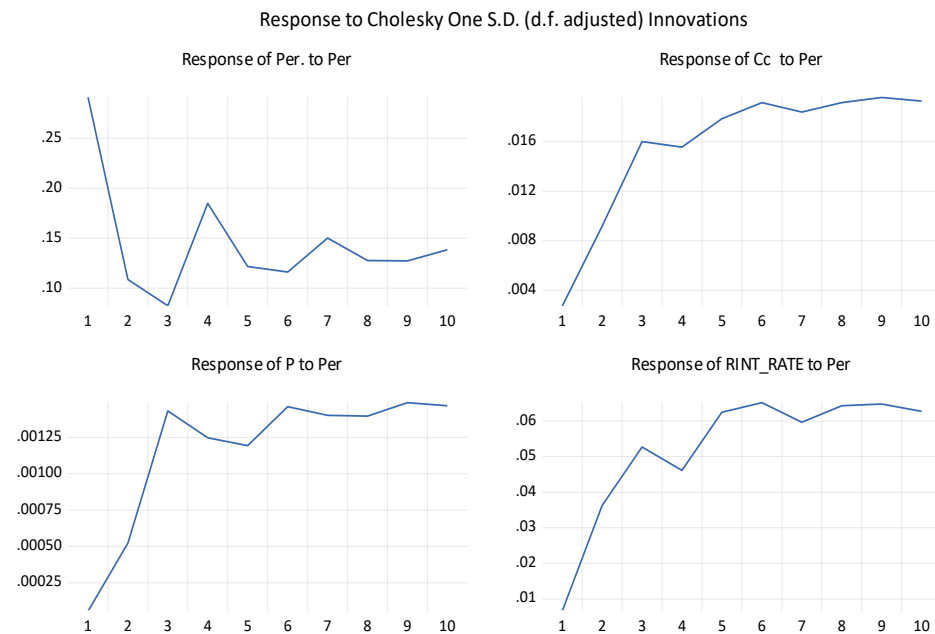

Figure 6. The response of housing permits to housing demand in Izmir, Turkey.

4.4. Forecast Variance Decomposition

One of the implications of structural variance decomposition is the variance decomposition. The result shows a forecast error variance caused by different macroeconomic variables which account for future variations.

5. Discussion and Conclusions

The COVID-19 pandemic has had a significant impact on both supply (goods and services manufacturing) and demand (consumption and investment), as stated by Zayed et al. [36]. In terms of intensity and scope, the pandemic's impact on financial activity [37] and financial performance [38] differs. When people from one nation are unable to enter another, the demand-supply cycle suffers [39]. The majority of early studies tended to be more concerned with real estate matters, placing emphasis on the buying and selling of commercial real estate, even when it was being rented [40]. The findings summarized here demonstrate the substantial effect of house prices, income levels, interest rates, and inflation on housing demand. Likewise, the supply-side is affected by building costs, house prices, and real interest rates. However, the report's important results can be divided into four major categories based on the housing market model and empirical research. Firstly, the amount of mortgage loans as a dependent variable is influenced by real house prices, real per capita GDP, projected inflation, and nominal interest rates. On the other hand, the building site is used as a supply-side indicator, determined by the price of real housing, the cost of real construction, and the rate of real interest. Secondly, in the VECM model, the correction factors for the amount of mortgage credit and the constriction cost prevailed, which indicates modification of the imbalance towards a balanced direction. Thirdly, the housing market in these three cities is vulnerable to economic shocks. Fourthly, supply-side variables have a long-term relationship with Ankara. But both housing demand and supply-related factors have a long-term effect on the housing market in Istanbul and Izmir. The p-value obtained in this study was positive and the C1-value derived from the device equations was negative. However, one of the study's major limitations is that it is based on only three major cities in Turkey. Nevertheless, the research findings can help policymakers

take appropriate measures to ensure that policies boost the housing market in Turkey. Future investigations can be conducted to include other relevant variables and other major cities. We sought to identify the economic factors that significantly affect the demand for and supply of housing in three major cities in Turkey—Istanbul, Ankara, and Izmir—with an appropriate econometric model. Here we selected those cities as they are the most crowded and because identifying the factor effecting housing demand and supply is best done in a crowded city. This study and the used models can easily be generalized and help analyze the housing conditions of any country. Indeed, in this model, it is feasible to increase the number of cities with no limit on the number.

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