



The Effect of Macroeconomic Factors Affecting Housing Demand On Housing Sales In Turkey: Time Series Analysis

ABSTRACT

Housing has become an indispensable element in human life. The concept of 'housing,' a fundamental component of the basic need for shelter, has evolved from being a term solely related to the need for shelter to also serving as an indicator reflecting the social and economic status of individuals, coinciding with the transition to the information age driven by technological and communicative advancements. It has transformed into a core place where individuals can engage in cultural activities and feel secure. That's why caves, which were originally used only for shelter and protection in prehistoric times, have become a legally protected cultural heritage for modern, contemporary humans.

With advancing technology, the quantity of offered housing has shown a rapid increase, and as a result, the housing sector has become one of the cornerstone sectors determining the Turkish economy. In this context, it is crucial to accurately determine housing supply and demand, and stakeholders in the housing sector need to conduct thorough financial analyses during this process. This study will delve into the factors influencing housing demand. The dataset used in this study covers the period from 2007 to 2023. The selection of these time intervals is particularly influenced by the Mortgage Crisis that occurred in 2007, which had a significant impact on the entire world. The analysis of this study will be conducted using the econometric analysis program Gretl Lab Cloud Student Version.

Keywords: Mortgage Crisis, Housing , Financial Analysis

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INTRODUCTION

The advancement of technology leading to the transition into the information age has accelerated the process of globalization worldwide. Concurrently, it can be stated that the needs, expectations, and preferences of individuals have shaped alongside these developments. A portion of these newly shaped preferences and expectations in this period of change also emerges in the housing market. "In recent years, many studies have been conducted that relate housing to macroeconomic indicators. Standard macroeconomic textbooks consider housing as part of investment expenditures. However, there is also a dimension of housing related to consumption expenditures. Despite efforts to bridge the gap between macroeconomics and housing economics in recent years, the number of studies conducted is still quite limited. How do the housing market and macroeconomics influence each other? Should the housing market be included in macroeconomic analysis? What should be the scope of macro-housing research?" These questions form the basis of research (Öztürk, N., & Fitöz, E., 2012).

Housing, in addition to serving the function of meeting people's housing needs, has become a tool that determines their social status, facilitates their socio-cultural activities, and enables them to make economic investments. Housing is also legally protected. In the Universal Declaration of Human Rights published by the United Nations in 1948, housing is defined as a place that must be safeguarded. Indeed, within the framework of Jellinek's theory of rights, the concepts of housing security and non-interference in housing have been considered under Negative Status Rights (Dursun, 2009;8). Furthermore, Article 16 of the European Social Charter and Article 34 of the Charter of Fundamental Rights of the European Union have also been safeguarded. It is also included in the International Covenant on Economic, Social, and Cultural Rights dated 1966 (Aydın, 2014). Housing demand is associated with individuals' needs, socio-economic status, the region/place where the housing is located, and the characteristics of the housing. In this context, it is concluded that the primary factor determining housing demand is the location/region of the housing. Proximity to local transportation services, the level of infrastructure development, the presence of commercial establishments near the housing (cafeterias, shops, bank ATMs, etc.) constitute the essential elements of housing demand. Additionally, factors such as the size of the housing, its interior and exterior architecture, and

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its compatibility with technological advancements (smart home features, automatic fire extinguishing systems, security cameras, etc.) form the shape elements of housing demand.

Generally, when examined, the most crucial factor determining housing demand is price. Since housing prices directly affect individuals' budgets, they are also a direct determinant of housing demand. However, economic fluctuations, housing loans, and economic indicators such as the desired interest rates, term differences, down payment rates, along with the population growth rate, are indirect variables that affect housing demand. Population growth, coupled with technological advancements, has led to the construction of more housing. Especially in Turkey, the continuous increase in the number of houses, along with migrations to cities, and the resulting population growth, can meet housing supply but it should be remembered that housing demand is not unlimited.

The ideal point where housing demand is met occurs at the intersection of housing supply and demand. In other words, housing supply and demand play a significant role in determining the ideal housing demand. Therefore, key decision-makers in the construction sector need to read economic indicators carefully, follow the economic agenda, and make rational and prudent decisions. Otherwise, the housing sector may face an economic crisis.

This study aims to determine the direction of the impact of key macroeconomic factors affecting housing sales in Turkey. In the literature, various studies have been utilized to explore the relationship between the share of the housing sector in the GDP in Turkey, the index of building usage permits, and income. Additionally, studies have been considered on the impact of urban transformation on housing demand, the effect of income elasticity on housing demand, the relationship between housing demand and interest rates, the size of the requested housing based on family expansion, and the effects of demographic variables on housing demand.

The Least Squares Method (LSM) was employed in the model set and methodology of the study. To test the assumptions about the error terms of the model, the Jarque-Bera (J-B) normality test was conducted for normality, the White (W) test for changing variance, and the Breusch-Godfrey (B-G) serial correlation test for serial correlation. Moreover, since the variables used in the study are time series, their integration degrees were investigated using the Augmented Dickey-Fuller (ADF) unit root test developed by Dickey and Fuller (1979).

LITERATUR REVIEW

When examining the share of the housing sector in the GDP in Turkey, the ratio of the values of homeownership (current) and real estate, rental, and business activities (current) total to the GDP can be used as a measure. According to this measure, the share of the housing sector in the GDP in Turkey reached 7.5% in 1998 and increased to 16% in the first quarter of 2008. This indicates that the housing sector has a significant weight within the macroeconomy (CBRT, EVDS, 07.08.2008).

Bekmez and Özpolat (2013) investigated the relationship between the "Building Usage Permit Index" and "Income" as indicators of housing demand using data from the period between 2002:1 and 2012:3. They utilized the Vector Error Correction Model (VECM) as an econometric method. The impact of urban transformation on housing demand was also examined using a dummy variable, and it was found that urban transformation positively affected housing demand. However, according to the study, deviations occurring in the long-term balance of the housing market in Turkey are corrected by approximately 51% every quarter.

Carliner (1973), in a cross-sectional study based on survey data from 2107 tenants and 2458 homeowners in the United States, using the 'Panel Study of Income Dynamics' conducted by the University of Michigan Research and Survey Center (SRC), found that the income elasticity of housing demand for homeowners was in the range of 0.6 to 0.7, while for tenants, it was in the range of 0.4 to 0.5. On the other hand, he found that the price elasticity of housing demand varied between 0 and -0.8. In a study by Rosen (1979) involving 2150 American families, the price elasticity was found to be negative and approximately -1, while the income elasticity was positive and 0.76.

Demirhan and Kurul, in their research, have reached the following conclusion: In order to identify trends in housing demand, factors such as housing loans, interest rates, consumer confidence indices, exchange rates, gold prices, and demographic variables have been taken into consideration. In the early 2000s, inflation and interest rates, which have been on a declining trend, have made bank loans a significant financing tool in housing purchases. On the other hand, with the increase in credit-based housing purchases, the influence of credit conditions on individuals' decisions to buy a house has increased. Since 2008, the trend in housing loan interest rates has been found to be downward, showing cyclical fluctuations. Additionally, it is well-known

that demographic and socio-economic factors play a crucial role in housing demand. Factors such as a young population, increases in marriage and birth rates are expected to positively impact the demand for housing.

Dokko et al. (2011) and Kuttner (2014), in empirical studies conducted in the early 2000s in the United States and other countries, emphasize that the effect of interest rates on housing prices is quite modest.

Dornbusch and Fischer (1994) state that the demand in the housing market depends on both household income and wealth and on the market price of the housing as well as the real return on other assets outside of housing and the real net return the housing owner would obtain.

Dönmez (1997) conducted a study on 200 families in Eskişehir to determine the factors influencing families' decisions to change homes. The research revealed that as the number of family members increases, the desire to live in larger and more spacious homes also increases. The study also found that as the age of the male head of the household advances, the preference for larger and higher-quality homes becomes more prominent. The desire to live in a well-designed and quality residence is identified as a significant factor in housing demand.

Durkaya and Yamak (2004) investigated the dynamics influencing housing demand in Turkey using data from the years 1964-1997. The study calculated how housing demand responds to changes in income and prices.

According to the obtained results, it has been revealed that there is a positive relationship between income and housing demand. Accordingly, the income elasticity has taken positive values in the range of 1.9 to 3.8. The price elasticity of housing demand has taken values in the range of (0.03) to (-0.10).

Elder and Zumpano (1991), in a cross-sectional study based on survey data from 968 families, using the 'Panel Study of Income Dynamics' conducted by the University of Michigan Research and Survey Center (SRC), found a positive relationship between housing demand and household size, and a negative relationship between housing prices and housing demand. Accordingly, the price elasticity of housing demand for homeowners was -0.44, while for tenants, it was -0.32. The income elasticity of housing demand was found to be 0.42 for homeowners and 0.49 for tenants.

Ermisch et al. (1996), in their study for the United Kingdom, found a negative price elasticity of housing demand in the range of (-0.5) to (-0.8) and a positive income elasticity of housing demand in the range of 0.8 to 1.0. Tiwari et al. (1999), in their study examining factors influencing housing demand in Mumbai, used cross-sectional data. According to their findings, the income elasticity was 1.18 for homeowners and 1.07 for tenants. The price elasticity of housing demand for homeowners was -0.85, while for tenants, it was -1.02.

Ermisch et al. (1990) pointed out that one of the factors determining housing demand is related to the structure of the population. Factors such as population growth, age distribution, gender, marital status, education level, etc., influence housing demand. Population growth increases the demand for all goods and services, including housing. Therefore, an increase in population is expected to result in an increase in housing demand.

Fair et al. (1972) examined the effects of mortgage, interest rates, and mortgage rates on housing demand in their study. The variables used in the analysis are observed to affect the amount of housing investment. Consequently, it is concluded that an increase in mortgage rates increases the capital cost of housing investment, leading to long-term declines in the desired housing demand.

Halıcıoğlu (2007), in a study using data from 1964 to 2004 in Turkey and the ARDL approach, estimated the income elasticity of housing demand to be approximately 1 and the price elasticity to be (-0.2).

Hausman and Wise (1980) found the income elasticity of housing demand to be 0.6 and emphasized that the amount of money available to households significantly determines housing demand. According to the analysis based on survey data from 586 households in Phoenix and 799 households in Pittsburgh conducted by Hanushek and Quigley (1980), the price elasticity of housing demand was found to be -0.36 for Pittsburgh and -0.41 for Phoenix.

Gündoğdu (2011) investigated the marginal price and contribution to rent prices of variables influencing the determination of rental prices for houses located in central neighborhoods in Isparta province. In addition to housing characteristics, spatial factors affecting house rental prices were also examined. The neighborhood in which the house is located significantly influences the rent amount. Proximity to the market and schools increases rental prices, while factors such as high traffic and noise from businesses in the area and high crime rates in the location of the house were calculated as factors reducing the rent amount.

Güriş, Çağlayan, and Ün (2011) used logit, probit, and gompit models to determine the factors affecting housing demand in urban and suburban areas, comparing and determining the logit model as the best model.

Variables such as income, age, gender, education level, marital status, employment status of the head of the household, and housing type were found to be significant in determining housing demand.

Jin and Zeng (2007) examined the impact of interest rates on investment-oriented housing incentives in their study. According to the analysis in the study, an increase in incentives applied to investment-oriented housing purchases leads to an increase in such purchases. On the other hand, household demand for housing decreases, and employment increases. When incentive rates increase, housing prices also increase. A decrease in interest rates increases demand for investment-oriented housing, reduces household demand for housing, and ultimately increases housing prices.

MODEL AND DATA SET

The 2007 Mortgage Crisis, one of the most significant crises in the world financial sector, which also closely affected Turkey, and the Housing Loan developed and popularized by the banking sector from 2008 onwards form the essential elements of this study. Alongside these precursor changes, alterations have occurred in the indicators affecting housing demand. In this context, new elements such as interest rates applied by banks to housing loans, down payment requirements, and the determination of the amount that can be granted for credit have become among the indicators affecting housing demand.

The selected dataset for this study covers a 17-year time span from 2007 to 2023. The selection of this time interval particularly considers significant developments such as the 2007 Mortgage Crisis and the 2008 Housing Loan. In this context, the functional use of housing for investment purposes has been emphasized, thanks to the innovations made by the banking sector in the globalization process since 2008. Moreover, since 2011, with the transparency decision implemented by the Government of the Republic of Turkey in the public sector, including the Central Bank of the Republic of Turkey, crisis predictions in the banking and finance sector have become more foreseeable, facilitating intervention against possible crises in the sector. Simultaneously, efforts have been made to minimize the disadvantages of the results that may arise in case of intervention against sectoral crises. The aim of this structuring is to ensure that the new situation that will arise is effective and efficient at the most appropriate level.

In this context, the dataset used in our study covers the years 2007-2023. The dataset consists of 4 independent and 1 dependent variable. The data used in this study were obtained from the Electronic Data Distribution System of the Central Bank of the Republic of Turkey (CBRT EDDS) and the Turkish Statistical Institute (TurkStat). Accordingly, while creating our dependent variable, which is Housing Sales, the independent variables consist of the Consumer Price Index (CPI), Gross Domestic Product (GDP) calculated by the income method with current prices, the interest rates applied by banks to housing loans, and the population growth rate. Gretl Lab Cloud Student Version Econometric Analysis Program will be used for data analysis.

Since the values of the variables in the dataset are on an annual basis, no seasonal adjustment process has been applied. In addition, when analyzing the data, the Augmented Dickey Fuller (ADF) unit root test has been applied because it is the most widely used unit root test in the literature. Therefore, it has been accepted as the most valid test in the literature. When examining the data analysis processes, it is observed that the logarithms of TÜFE, housing sales, GDP, and population growth rate data have been taken for proportional analysis purposes. On the other hand, when analyzing the unit root tests of the data, it is determined that they are stationary with the first difference in the ADF test. In this context, the graphs of the series that have been proportioned and made stationary by taking the first difference in the Augmented Dickey Fuller test are given below.

In a study aiming to determine the factors influencing customers' decisions to purchase homes and to identify the profiles of those who intend to buy a house, Kaba (2008) conducted a survey with 157 individuals. When looking at the averages of factors influencing home purchase decisions, customers prioritize the reliability of the construction company, the security of the housing complex, and the presence of gardens, play areas, and parks within the complex. Tests conducted to examine the relationship between customers' demographic characteristics and the desired features of the house revealed that the type of house and the number of rooms desired by customers do not change according to their genders. However, a relationship was found between the marital status of customers and the size of the desired house, with married customers observed to prefer larger square meter houses. Significant relationships were found between customers' socioeconomic status and the type of house they prefer, indicating that individuals with higher economic status tend to prefer villa-type houses. There was no significant relationship between customers' income status and the payment method they considered for housing, with most customers observed to prefer installment payments and housing loans.

Karakurt (2006) stated that variables such as population growth, gender, age, and household size also guide social demand by changing the long-term socio-demographic structure.

Kargı (2013) examined the variables affecting the formation of housing loan interest rates in a study covering the period from 2000 to 2012. According to the estimates, the coefficients for GDP were (-4.97), housing expenditures were (-1.11), and housing loans were (-3.02). The expansion of credit volume in the banking system also has an increasing effect on housing loan interest rates (5.88).

Kunduracı (2013) pointed out that developed countries such as the UK, Germany, and the USA have been continuously experiencing this process of change at an increasing pace since the 20th century until today.

Lee (1963) investigated the effects of age, marital status, occupation, disposable income, and the social environment on housing demand. According to Lee's developed model for housing purchase decisions, disposable income plays a dominant role in housing purchase decisions, but it cannot explain everything. Changes in income significantly affect non-housing expenditures, while they do not have much impact on housing demand. The second most important variable influencing housing demand, apart from income, is the individual's age, as it is directly related to housing borrowing. When people are young, they tend not to borrow for homeownership and prefer renting. However, as age increases, this demand rises, and the borrowing rate for housing also increases. Lee's study concluded that variables such as marital status, occupation, education, gender, social environment, and whether the house is new or old are not effective in housing demand.

Maisel and others (1971) determined the income elasticity of housing demand as 0.5 and the price elasticity as -0.88 in their study conducted in 1971 using data from 100 observations each from 29 different regions in the United States, totaling 2900 observations. Accordingly, housing demand is positively influenced by income and negatively influenced by prices.

In Martin's (1966) housing demand model, variables such as the number of household members, the annual population growth rate, average life expectancy, the annual percentage increase in family income, the unemployment rate, marital status, and the number of individuals living in the family were found to determine housing demand. According to Gelfand (1966), one of the most important variables determining housing demand is credit conditions and mortgage interest rates. Loans that provide flexible payment terms, especially for the middle-income group, significantly affect housing demand. Ozturk and Fitoz (2009) investigated the factors affecting housing supply and demand in Turkey using regression analysis. The study found a positive relationship between per capita income, interest rates, housing prices, and housing demand, while there was no significant relationship between demographic factors and housing demand. Among the variables affecting housing supply, per capita income, liquidity expansion, and housing prices were found to have a positive relationship with housing supply. The income elasticity for housing demand ranges from 1 to 2 in different equations, while the price elasticity for housing demand is very small and negative, ranging from (-0.003) to (-0.004). The results obtained are similar to the study conducted by Painter and Redfearn (2002) for the United States, where it was concluded that interest rates are ineffective in the long-term housing demand.

In Özbek's study (2008), housing demand is influenced by individuals' income levels, or, in other words, individuals' current disposable income levels, as well as their expectations about future income and expenses. Factors such as the interest rates that individuals will pay for credit in case of using credit, which will determine the interest amount for credit, or options related to interest rates, the maturity of the housing loan, and the price of the property they will purchase, affect housing demand.

Painter and Redfearn (2002), while examining the factors that increase the homeownership rate for households in the United States, found that the short-term impact of interest rates on housing demand is weak and has little effect, and in the long term, interest rates are ineffective on housing demand.

Ridker and Henning (1967) conducted a study on the effects of air pollution on housing prices, which is the first study to address the factors influencing housing prices using the hedonic pricing model. The study, which used a linear functional model and included 167 observations related to housing sales, generally obtained results suitable for the respective regions and were statistically significant. Variables related to housing characteristics such as "average number of rooms per dwelling, the percentage of recently built homes, and the number of homes per capita in the regions" are important explanatory variables, and the coefficients of these variables are in line with expectations in economic theory. Variables such as "travel time to job centers and accessibility to main roads and underpasses" were found to be significant. The most accurately predicted characteristic from neighborhood characteristics is the "employment rate." There is a positive relationship between the variable of school quality and housing prices.

Selim (2009) analyzed factors determining housing prices in Turkey using the 2004 Household Budget Survey data. According to the research results, the most important variables affecting housing prices are the type of housing, building type, number of rooms, and the size of the dwelling, as well as having a pool and natural gas.

Winger (1968), in a cross-sectional analysis using survey data for transactions insured by the FHA under the regular homeownership program in the 1962-1964 period, found that housing demand in large cities relies on average income and home prices. In this study, the income elasticity of housing demand was approximately 1.05.

Yayar and Karaca (2014) attempted to determine the factors affecting housing prices in the TR83 region using a hedonic model. The most important variables positively influencing apartment prices were identified as the number of bathrooms, the number of elevators, the location of the residence on the boulevard, and having central heating. Negatively influencing factors were determined as the residence being in the city center of Çorum, the use of fuel oil as fuel, and being on the first floor.

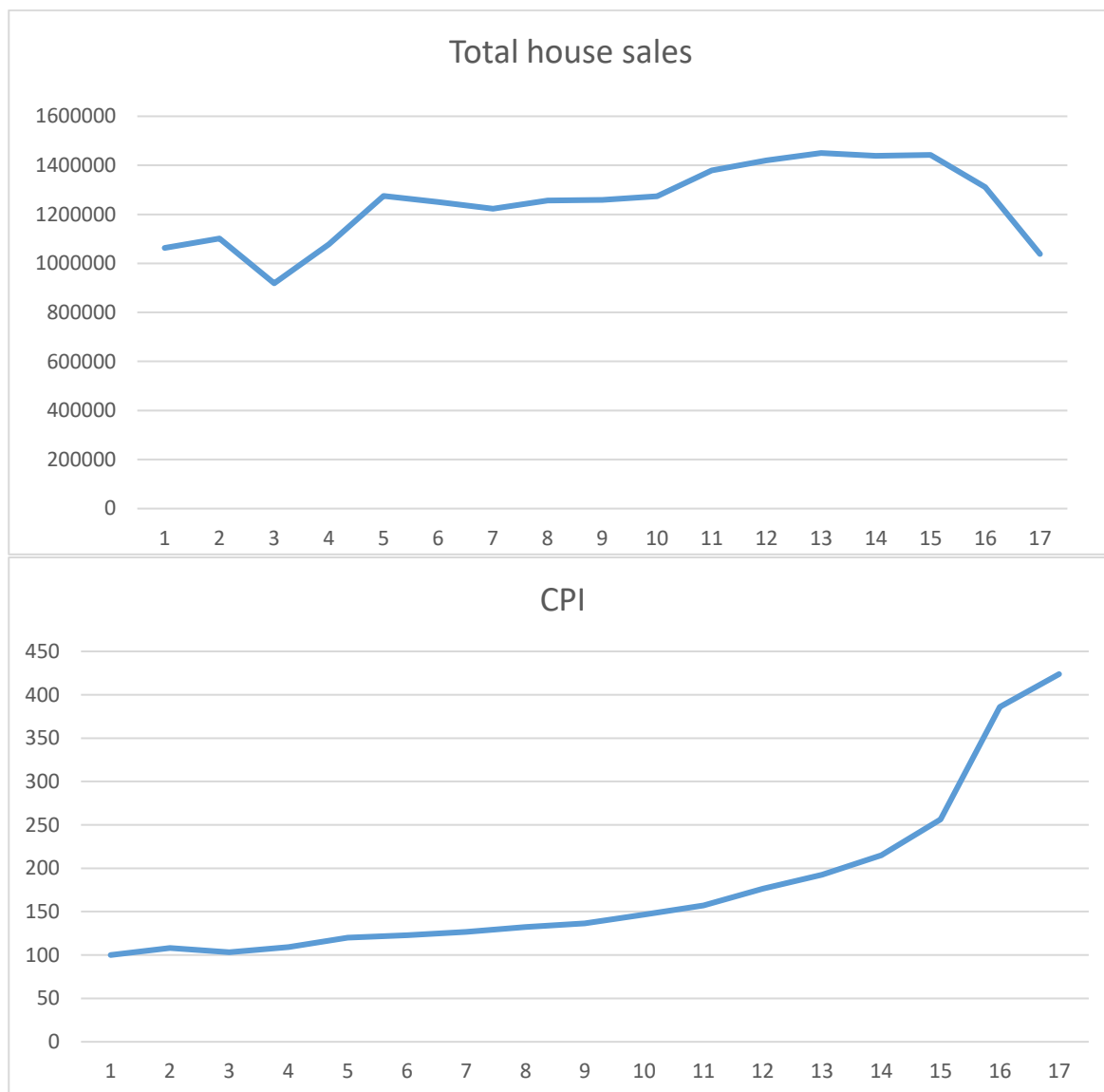




Figure 1: Separately Distributions of All Data

The ADF Unit Root Test is a statistical test used to test whether a time series has a unit root. A unit root means that a time series has non-constant mean and variance in the long run.

If the test value is greater than the critical value, the null hypothesis should be rejected and the alternative hypothesis should be accepted. In this case, the alternative hypothesis is that the series has a unit root.

In this study, the test value for all variables is greater than the critical value. Therefore, it can be concluded that all variables do not have a unit root and are stationary.

Table 1: Significance Values of The Data

Variable	Coefficient Values	T Stat Values	Probability Values	Test Values	Critical Value	Stationarity Hypothesis
Total house sales	0.002	-2.94	0.003	-3.47	-3.47	Stationarity
CPI	0.003	-3.33	0.001	-3.47	-3.47	Stationarity
GDP	0.001	-3.56	0.000	-3.47	-3.47	Stationarity
Housing loan interest rate	0.002	-3.72	0.000	-3.47	-3.47	Stationarity
Population growth rate	0.002	-3.56	0.000	-3.47	-3.47	Stationarity

Table 2: Significance ratios of the model

Variable	R ²	Adjusted R ²	F Stat Values	F Stat Probability Values
Total house sales	0.079	0.075	7687	0.000
CPI	0.085	0.081	8423	0.000
GDP	0.091	0.087	9159	0.000
Housing loan interest rate	0.097	0.093	9895	0.000
Population growth rate	0.091	0.087	9159	0.000

When the proportioned data, which was taken into consideration and subjected to the ADF Stationarity Test with a first difference, is examined, it is observed that the model is significant at a rate of 79%. On the other hand, Granger Causality Analysis has been applied to the dataset, and the results are shared in the table below. Since the Jarque-Bera values for each of them are greater than the 0.05 threshold, we can say that the errors are normally distributed, and the null hypothesis (H0) is accepted.

The correlation values of the data have been individually examined. According to the results obtained in the correlation test, since the Q Test value is greater than the critical value, it can be stated that there is no structural break in the Q Test. The Variance Inflation Factor (VIF) test was applied to the variables to assess multicollinearity, which quantifies the amount of non-shared variance between two variables on a scale from 1 to infinity. The results of the VIF test are as follows:

Table 3: Autocorrelation values of the model

Variables	Coefficient Variances	Central Non VIF	Central VIF
GNP	0.228806	2.236801	1.312393
Interest	0.171263	1.525657	1.431248
Population increase speed	0.334287	1.734660	1.689421
CPI	19.88699	43.05036	1.226624

Autocorrelation is a condition associated with the error term ut series of the main model. It implies a relationship between the successive values of the error term ut. In this context, the Breusch-Godfrey test has been applied, and the LM auxiliary correlation test has been conducted. The results are as follows:

Table 4: Breusch-Godfrey Test values of the model

Variables	Values
F-statistic	0.465015
R ²	0.481873
Organized R ²	-0.554380
Probe(F- statistics)	0.804902

According to the result of this test, there is autocorrelation since the F-statistic value is greater than the limit value of 0.10. In other words, H0 hypothesis is rejected and H1 hypothesis is accepted. As a result, the model is based on the following equation:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \epsilon$$

Y: Total House Sales

X1: CPI

X₂: Gross Domestic Product (GDP) (Trillion Turkish Liras)

X₃: Housing Loan Interest Rate (in %)

X₄: Population Growth Rate (in %)

Total House Sales = $\beta_0 + \beta_1 * CPI + \beta_2 * GDP + \beta_3 * \text{Housing Loan Interest Rate} + \beta_4 * \text{Population Growth Rate} + \varepsilon$

The numerical values for the coefficients:

$$\beta_0 = 0.173004$$

$$\beta_1 = 0.058047$$

$$\beta_2 = 0.647258$$

$$\beta_3 = -0.226400$$

$$\beta_4 = -0.168799$$

Total House Sales = 0.173004+ 0.058047* CPI + 0.647258 * GDP - 0.226400 * Housing Loan Interest Rate - 0.168799* Population Growth Rate + ε

CONCLUSION AND RECOMMENDATIONS

Economic investments stand out as one of the significant tools utilized in achieving economic growth. In Turkey, real estate investments have been a preferred investment vehicle for investors for many years, with residential investments constituting a crucial element of the real estate investment source. Moreover, the concept of housing has not only been classified by the state merely as a 'private space' but has also been identified as a symbol of economic investment power. In this context, residential investments are so crucial for the Turkish economy that they significantly influence the macro variables of the Turkish economy. State policies, such as housing acquisition subsidies, housing support for investors, and housing completion insurances for service providers, have positioned the government to play a protective and supportive role in the housing sector. However, in 2007, the Mortgage Crisis that erupted in the U.S. affected not only the U.S. but the entire world. In Turkey, in addition to state policies, the importance given to the housing sector through financial and economic policies helped limit the impact of the crisis in Turkey. When examining the data covered in this study, an increase in housing sales is found to have positive effects on the Consumer Price Index (CPI) and the population growth rate. Simultaneously, revitalization in the housing sector was achieved by reducing interest rates used in housing loans. However, contrary to expectations, it had a negative impact on the Gross Domestic Product (GDP). It can be suggested that this negative effect is attributed to the indirect costs incurred by housing investors and high tax rates they face.

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