Received Date: 12 February 2025 | Accepted Date: 7 October 2025

RESEARCH ARTICLE

OPUS Journal of Society Research

Speculative House Price Bubble Dynamics and Bursting Mechanisms in Türkiye: A Threshold Regression Model Proposal

Mehmet Kuzu[1]

[1] Asst.Prof.Dr., Bayburt University, Vocational School of Social Sciences, Finance, Banking and Insurance Department, Bayburt/Türkiye
ROR ID: https://ror.org/050ed7z50
ORCID: 0000-0001-5354-4368
E-Mail: kurbanigeyik1@gmail.com

November 2025
Volume:22
Issue:6
DOI: 10.26466/opusjsr.1638632

Citation: Kuzu, M. (2025). Speculative house price bubble dynamics and bursting mechanisms in Türkiye: A threshold regression model proposal. *OPUS– Journal of Society Research*, 22(6), 1165-1182.

Abstract

One of the most current social and socio-economic problems in Türkiye is the speculative bubbles that have formed in the housing markets due to the current economic and financial crisis, making it difficult for households to own a house. This study analyzes the dynamics and bursting mechanisms of speculative price bubbles in the Turkish housing market. The GSADF test was applied using monthly data for 2012-2024 to identify bubble periods in the housing market. In the determined bubble periods, robust regression analysis was performed to determine the main factors affecting these price formations. In addition, the Kalman filtering method was used to examine the dynamic coefficients of housing price bubbles that change over time. The findings show that falling interest rates trigger housing price bubbles in Turkey in an inflationary process; the bursting of the bubbles is associated with increasing domestic and foreign risk premiums, interest rate expectations, and realized interest rate increases. In addition, it investigated how the current housing bubble can burst in a controlled manner through the threshold regression model. The study results reveal that maintaining the interest rate difference between Türkiye and the US within 10% to 17% is critical in preventing financial and economic instabilities regarding housing prices. In addition, it can be argued that the current inflation rate and risk premiums should be managed effectively to ensure stability in housing prices.

Keywords: *Housing Market, Speculative Price Bubbles, Threshold Regression.*

Öz

Türkiye'nin en güncel toplumsal ve sosyo-ekonomik problemlerinden biri, mevcut ekonomik ve finansal kriz nedeniyle konut piyasalarında oluşan spekülatif balonların hane halkının konut sahibi olmasını zorlaştırmasıdır. Bu çalışma, Türkiye konut piyasasındaki spekülatif fiyat balonlarının dinamiklerini ve patlama mekanizmalarını analiz etmeyi amaçlamaktadır. Konut piyasasındaki balon dönemlerini tespit etmek için 2012-2024 dönemine ait aylık veriler kullanılarak GSADF testi uygulanmıştır. Belirlenen balon dönemlerinde, bu fiyat oluşumlarını etkileyen temel faktörleri belirlemek amacıyla robust regresyon analizi gerçekleştirilmiştir. Ayrıca, konut fiyat balonlarının zaman içinde değişen dinamik katsayılarını incelemek için Kalman filtreleme yöntemi kullanılmıştır. Bulgular, Türkiye'deki konut fiyat balonlarının enflasyonist bir süreçte düşen faiz oranlarıyla tetiklendiğini; balonların patlamasının ise artan yurtiçi ve yabancı risk primleri, faiz oranı beklentileri ve gerçekleşen faiz artışlarıyla ilişkilendirildiğini göstermektedir. Buna ek olarak, eşik regresyon modeli aracılığıyla mevcut konut balonunun kontrollü bir şekilde nasıl patlatılabileceği araştırılmıştır. Çalışmanın sonuçları, Türkiye ile ABD arasındaki faiz oranı farkının %10 ila %17 aralığında korunmasının konut fiyatları açısından finansal ve ekonomik istikrarsızlıkları önlemek açısından kritik olduğunu ortaya koymaktadır. Bunun yanı sıra, konut fiyatlarında istikrar sağlamak amacıyla mevcut enflasyon oranının ve risk primlerinin etkin bir şekilde yönetilmesi gerektiği ileri sürülebilir.

Anahtar Kelimeler: *Konut Piyasası, Spekülatif Fiyat Balonları, Eşik Regresyon.*

Review Note: *Evaluated by Double-Blind Peer Review*
Ethical Statement: *Ethical matters may be addressed via editorialoffice@opusjournal.net*

Introduction

One of Türkiye's most critical social and socio-economic issues is the speculative bubbles in property markets, exacerbated by the ongoing economic and financial crisis, which hampers homeownership for people. Increasing property prices, high inflation, and interest rates have reduced house accessibility and caused a housing crisis for low and middle-income demographics. Housing markets bring together buyers and sellers to exchange properties and their values, but prices do not always reflect real value. Especially in housing markets, imbalances in supply and demand or speculative behavior can lead to price bubbles that threaten financial stability.

Pioneering studies like Case and Shiller (2003) show that housing bubbles often emerge when investor expectations and low interest rates push prices beyond real economic fundamentals. In Türkiye, rapid and lasting increases in housing prices can similarly be explained by credit growth, speculative behavior, and herd mentality or group behaviour, rather than just supply and demand (Case & Shiller, 2003; Glaeser et al., 2008; Agnello & Schuknecht, 2011; Engsted et al., 2015).

The housing market is closely tied to the rest of the financial system, primarily through complicated tools like securitized derivatives. This makes it very sensitive to changes in price. When bubbles emerge and then burst, they can cause a lack of liquidity and impact the real economy, slowing growth and lowering business profits.

The 2007–2008 global financial crisis showed the dangers and risks of relatively early rate hikes. Unlike other emerging market economies, Türkiye's post-2013 unorthodox monetary policies, with low interest rates, led to persistent inflation, exchange rate volatility, and rising financial risks. So, there is a constant cycle of high interest rates, high exchange rates, high inflation, rising financial risks, and a current account deficit. In the summer of 2018, US President Donald Trump's trade restrictions and sanctions worsened the problems of the Turkish economy.

The post-2023 interest rate hikes amid rapidly rising house prices in Türkiye have sparked concerns about a potential housing bubble and an impending market correction, making the identification and prediction of such bubbles economically and academically significant.

This study has two problems: identifying the periods of housing price bubbles in Türkiye from 2012 to 2024 and establishing a framework for projecting the bursting timeframe and mechanism of the current bubble for Türkiye.

The GSADF (Generalised Supremum Augmented Dickey-Fuller) test determines the durations of house price bubbles in Türkiye. Next, the Kalman filter has been used to determine what factors impact these intervals by looking at time-varying coefficients. Ultimately, we give a framework for the house price bubble to burst. This framework uses threshold regression and Kalman filter analysis to examine how the Türkiye–U.S. bond rate spread influences risk expectations that may trigger a housing bubble collapse.

Literature Review

Academic studies examine the complex causes and consequences of the formation, persistence, and collapse of housing price bubbles from different perspectives. Kaufman, Malliaris, and Nelson (2018) emphasized that monetary policy plays a critical role in preventing the destructive effects of such bubbles and stated that innovative policies are needed for financial stability. Bansak and Starr (2015) emphasized that bubbles create disproportionate burdens, especially on low-income households, and increase social inequality.

From an econometric perspective, researchers such as Engsted, Hviid, and Pedersen (2015) have empirically proven the existence of explosive bubbles in the housing market, highlighting the value of such models as early warning systems. In contrast, Helbling (2005) emphasized the distinction between structural growth in prices and bubbles, arguing that not every price increase indicates a speculative bubble.

Zainuddin, Jali, and Gan (2012) shed light on the underlying causes of speculative behavior by analyzing the psychological tendencies of market actors. Malkiel (2012) directly linked the 2008 crisis

to housing bubbles. Similarly, Bolt et al. (2014) argued that financial liberalization and macroeconomic fluctuations exacerbated bubbles. Iancu, Croicu, and Rogojan (2023) highlighted the need for strict monitoring and control over the price mechanism by revealing speculative bubbles in both stock and real estate markets. Agnello and Schuknecht (2009) stated that housing bubbles historically have long-term and serious effects, while Xiao (2010) associated this process with excessive borrowing and speculative demand. Englund and Ioannides (1992) similarly stated that inadequate intervention by policymakers paved the way for bubbles. Lind (2009) defined bubbles as serious deviations of market values from fundamental values and noted that these deviations can lead to instability. Kocherlakota (2009) also points out that borrowing constraints increase systemic risks, while Glaeser, Gyourko, and Saiz (2008) argue that supply constraints directly affect the persistence and size of bubbles.

Jordà, Schularick, and Taylor (2015) have historically shown how credit-driven bubbles trigger financial instability. Hanweck (2017) points out that the US housing market has entered a new bubble phase as of 2016. Evanoff, Kaufman, and Malliaris (2011) emphasize the need for new perspectives and policy frameworks in responding to bubbles in the face of changing market conditions.

Wong (2001) states that Thailand's rapid growth led to housing bubbles at the regional level, while Owsinski (1988) examines the systemic effects of housing bubbles at the urban and regional levels. Miao (2014) explains how bubbles form, persist, and eventually collapse using economic theory, while Flood and Hodrick (1990) have developed practical methods to detect speculative pricing. Case and Shiller (2003) have emphasized that housing bubbles are repeated in many markets and require regular monitoring. Carson and Dastrup (2009) have shown that some local housing markets affect national trends. In conclusion, the literature provides a strong theoretical and practical framework for stable housing markets by addressing the causes of housing price bubbles, their economic and social impacts, and early intervention methods in a multidimensional manner.

The literature review section examined the studies conducted for Türkiye in the next stage because comparing the results obtained with the results of the studies undertaken for Türkiye will better emphasize the importance of the research.

Eraslan and Bayraktar (2013) analysed the impact of the low-interest monetary policy enacted in the United States before the global financial crisis, which resulted in a housing market bubble. The low-interest-rate environment from 2001 to 2005 prompted American banks to issue excessive mortgage loans; by 2006, as prices began to decline, these problematic loans were securitized and disseminated globally, precipitating the 2008 catastrophe. This study exemplifies the global ramifications of housing market bubbles on macroeconomic stability.

Numerous empirical data indicating the existence of bubble formations have been obtained from examinations undertaken in Türkiye. Vergili (2023) detected several bubble forms across Türkiye, particularly in the provinces of Istanbul, Ankara, and Izmir, during the 2010–2022 timeframe, utilising SADF and GSADF tests; he demonstrated that these bubbles intensified, especially in the post-2020 period. Based on actual pricing, Ankara exhibits the lowest danger of a bubble, whilst İzmir demonstrates the highest risk. Abioğlu (2020) examined price-rent ratios in 10 provinces around Türkiye from 2007 to 2018, revealing examples of bubble forms in provinces beyond Bursa and İzmir during the post-2010 period. It was established that the bubbles in Istanbul, Adana, and Mersin persisted for almost a year.

Comparable outcomes have been achieved in investigations performed at the regional level. Gökçe and Güler (2020) demonstrated that the volatile home price fluctuations in Ankara from 2010 to 2019 suggested the presence of rational bubble formations, as evidenced by SADF and GSADF tests applied to real pricing data. Kartal (2022) found multiple housing bubbles in Türkiye and the TR71 Region between 2010 and 2021 using GSADF and BSADF tests, noting that

while falling mortgage sales indicate some rational behavior, delayed reactions still leave the economy vulnerable to financial crises.

Akkaya (2024) identified substantial bubble trends in the housing market from June 2019 to June 2022. The initial research identified vertical price bubbles with GSADF tests, while the subsequent examination of home prices per square metre in TL uncovered a bubble structure throughout two distinct periods (2014–2016 and 2020–2022). The VAR model findings demonstrate that housing prices are influenced by supply-demand dynamics and macro-financial factors, including CPI, credit sales, capacity utilisation rate, and credit volume.

Akkuş (2021) asserted that housing bubbles in Türkiye and the TR22 Region from 2010 to 2020 were affected by macroeconomic variables, including credit volume, interest rates, BIST-100, CPI, and industrial production, and underscored the necessity for regulatory institutions to oversee this risk and implement safeguards.

Nonetheless, results suggest that the housing market in certain places does not exhibit bubble risk. Ece (2022) studied the TRA1 Region (Erzurum, Erzincan, Bayburt) over 2013–2020, utilising ARDL tests, demonstrating that no price bubble emerged and that market conditions influenced housing prices.

Tursun (2024) examined the structural aspects of the housing supply chain and showed that, relative to other sectors, the supply time, product attributes, and number of participants in the housing sector display distinct variations. He asserted that these attributes inhibit the bullwhip effect in the housing supply chain, attributing price variations more to external economic situations than internal chaotic dynamics.

Methodology

The research utilized multiple analytical techniques, such as the GSADF test, robust regression, Kalman filtering, and threshold regression. The GSADF test is an effective instrument for detecting phases of price bubbles in real estate values. The robust regression technique computes the static coefficients of the factors that elucidate these price bubbles. The Kalman filtering method computes time-varying dynamic coefficients with a rigorous test. Threshold regression explicitly designates the interest rate spread variable as a threshold variable, enabling the computation of thresholds that initiate and terminate the bubble.

Threshold regression is a method that delineates the link between the dependent variable and the independent variables using a specified threshold value. This framework characterizes nonlinear dynamics by defining separate regimes below and above a threshold value. Tong (1983) and Hansen (1999) performed a seminal study that laid the foundation for this method, which is widely employed in macroeconomics, finance, and environmental sciences (See Equation 1).

$$y_t = \begin{cases} \beta_1' \cdot x_t + \varepsilon_t & \text{if } q_t \le \gamma \\ \beta_2' \cdot x_t + \varepsilon_t & \text{if } q_t > \gamma \end{cases} \quad (1)$$

- *y_t: Dependent variable at time tx_t: Vector of explanatory variables (can include a constant)*
- *q_t: Threshold variable (can be one of the regressors or another variable)*
- *γ: Threshold value to be estimated*
- *β_1, β_2: Regression coefficients for the regimes below and above the threshold*
- *ε_t: Error term, typically assumed to be i.i.d. with mean 0*

The subsequent phase of the study involves the implementation of the GSADF (Generalised Supremum Augmented Dickey-Fuller) test, which, as formulated by Phillips, Shi, and Yu (2015), improves the conventional ADF test by permitting adaptable time intervals to identify speculative bubbles via stationarity analysis and peak statistics identification.

$$GSADF(r_0) = \sup \{ \hat{\rho}(r_1,r_2) / \hat{se}[\hat{\rho}(r_1,r_2)] \} \quad (2)$$
$$\text{where } r_2 \in [r_0, 1], \text{ and } r_1 \in [0, r_2 - r_0]$$

- *$GSADF_(r_0)$: The generalized sup ADF test statistic using minimum window size r_0*
- *r_0: The minimum fraction of the total sample used as the rolling window size*
- *r_1, r_2: Start and end points of the ADF regression window (subsample)*
- *$\hat{\rho}_(r_1,r_2)$: Estimated autoregressive coefficient from the ADF regression over $[r_1, r_2]$*
- *$\hat{se}(\hat{\rho}_(r_1,r_2))$: Standard error of that coefficient*

This study also uses robust regression with M-estimation to find static coefficients that can be used as a base for time-varying Kalman coefficients. Huber's M-estimator minimizes a modified loss function to reduce the effect of outliers. Other robust methods, such as the LAD and Theil-Sen estimators, are also used.(Huber, 1981:109) (See Equation 3).

$$\beta_{hat} = argmin \sum[\rho(y_i - X_{i\beta})] \quad (3)$$

- $Argmin = Argument\ of\ the\ Minimum.$
- $\beta_{hat} = Estimated\ Regression\ Coefficents$
- y_i =*Observed Value of Dependent Variable*
- $X_i = İndependent\ Variables.$

The fourth test in the study utilizes the Kalman filtering method. The Kalman filter is a recursive technique employed to estimate the state of a dynamic system using a series of noisy data. It is widely employed in signal processing, control systems, econometrics, and navigation (Kalman, 1960). The Kalman filter assumes a linear system founded on two fundamental equations: one that describes state evolution and another that relates to observation (measurement) (See Equations 4 and 5).

State Equation:

$$xt = At \cdot xt_{-1} + Bt \cdot ut + wt \quad (4)$$

- *xt: the hidden (latent) state vector at time t*
- *At: state transition matrix*
- *Bt·ut: effect of control variables*
- *wt: state noise (disturbance), typically wt ~ (0, Qt)*

Observation Equation:

$$yt = Ht \cdot xt + vt \quad (5)$$

- *yt: observed data at time t*
- *Ht: observation matrix*
- *vt: measurement error, typically vt ~ N(0, Rt)*

The key variable in this study is the house price index, which underpins the examination of housing market bubbles. The interest rate spread is a significant variable designated as the dependent variable in the threshold regression analysis. The differential between the 10-year bond yields of Türkiye and the United States determines the spread. The main aim of developing the spread variable is to include domestic interest rate expectations and the overall global interest rate levels in the model framework.

The interest rate differential variable has been chosen by examining the foundational literature on nominal interest rates and interest rate differentials in asset pricing. In this perspective, evaluating nominal local interest rates and the differential between local and US or global interest rates provides a more significant method for calculating home prices in economies with high financial integration. Interest rate differentials are critical factors that directly influence foreign capital flows, lending expenses, and housing demand. Capital flows, particularly in emerging nations with advantageous interest rate differentials, can channel into the property market and pressure prices. Moreover, fluctuations in global interest rates might indirectly influence housing demand by impacting local currency values and financing conditions. This scenario demonstrates that the housing market is responsive to international monetary conditions, rendering local interest rates inadequate. The literature consistently highlights the influence of interest rate differentials on credit expansion, asset prices, and investment behaviour (Obstfeld & Taylor, 2004; Bernanke, Gertler, & Gilchrist, 1999; Kim & Yang, 2011; Borio & Zhu, 2012; Taylor, 2009).

Data are collected weekly, covering January 2012 to November 2024. Additionally, interest rates are provided to analyze the outcomes (See Table 1).

The stationarity of the series is investigated through the implementation of the Phillips-Perron test. In the GSADF test, the absence of a very long period in the data set precludes the existence of a stationarity condition for the series. When applying the test, the analysis is performed with raw data (Phillips & Yu, 2011).

The Eviews 12 program has done the research. The Eviews package does not employ the Variance Inflation Factor (VIF) test for robust regression, as robust regression is inherently less susceptible to multicollinearity (Huber, 1964; Huber, 1973; Huber, 1981; Hampel et al., 1986; Maronna et al., 2006).

Table 1. Data Set

VARIABLES	CODE	Explanation	Source
Housing Price İndex	housing_price_index	İndex	TCMB, EVDS
Us Dollar	dollar	Parity	investing.com
Euro	euro	Parity	investing.com
Currency Basket	Currency_Basket	(Dollar*0.5)+(Euro*0.5)	investing.com
Gold	ALTIN	Derivative Parity (XAU/TRY)	investing.com
Türkiye 2-Year Government Bond Interest	tr_two_year_bond	Bond Yields	investing.com
Türkiye 10-Year Government Bond Interest	tr_ten_year_bond	Bond Yields	investing.com
İnflation	cpi	Change as a year %	TCMB, EVDS
Risk Appetite	VIX	İndex	investing.com
Türkiye 5-year CDS	turkiye_cds_5_year	Basis Points	investing.com
U.S. 2-Year Government Bond Interest	us_10_year	Bond Yields	investing.com
U.S. 10-Year Government Bond Interest	us_2_year_yields	Bond Yields	investing.com
İnterest Spread	İnterest_Spread	Spread Yields (TR 10-Year Bond- US 10-Year Bond)	Investing.com and Calculated by Author
GSADF Test for Bubble Terms as Dummy	Bubble	Test Results for Bubble Terms	Calculated by Author

The modified objective function in robust regression diminishes the influence of excess residual parameter estimations, facilitating the generation of less sensitive estimates. As a result, non-stationary series can be examined using robust regression and Kalman filtering, which is based on robust regression (Huber, 1964; Huber, 1973; Huber, 1981; Hampel et al., 1986; Maronna et al., 2006).

threshold variable, utilizing raw data yields more accurate results. Because threshold regression methods can address specific forms of non-stationarity by permitting distinct regression equations for various regimes, this adaptability ensures that even with unit root variables, the model can yield accurate findings by capturing the diverse implications across various regimes (Hansen, 2000; Enders & Siklos, 2001).

Table 2. Phillips-Perron Unit Root Test Results

UNIT ROOT TEST RESULTS TABLE (PP)
Null Hypothesis: The variable has a unit root
Lag Length based AIC

	With Constant		With Constant & Trend		Without Constant & Trend	
At Level	**t-Statistic**	**Prob.**	**t-Statistic**	**Prob.**	**t-Statistic**	**Prob.**
CPI	-13931,00	0,58	-24897,00	0,33	-0,60	0,45
GOLD	154036,00	1,00	73023,00	1,00	174358,00	1,00
CURRENCY_BASKET	41,404	1,00	0,7818	0,9997	61,234	1,00
BUBBLE_GSADF	-14824,00	0,54	-20166,00	0,59	-12023,00	0,21
HOUSING_PRICE_INDEX	54707,00	1,00	25715,00	1,00	71350,00	1,00
INTEREST_SPREAD	-13603,00	0,60	-31105,00	0,11	0,17	0,73
TURKIYE_CDS_5_YEAR	-21759,00	0,22	-27801,00	0,21	-0,86	0,34
VIX	-54175,00	0,00	-55982,00	0,00	-13453,00	0,16
	With Constant		**With Constant & Trend**		**Without Constant & Trend**	
At First Difference	**t-Statistic**	**Prob,**	**t-Statistic**	**Prob,**	**t-Statistic**	**Prob,**
d(CPI)	-66764,00	0,00	-66589,00	0,00	-66775,00	0,00
d(GOLD)	-94942,00	0,00	-103751,00	0,00	-88261,00	0,00
d(CURRENCY_BASKET)	-98,550	0,00	-107,620	0,00	-93,229	0,00
d(BUBBLE_GSADF)	-74802,00	0,00	-74531,00	0,00	-75025,00	0,00
d(HOUSING_PRICE_INDEX)	-32682,00	0,02	-49746,00	0,00	-26576,00	0,01
d(INTEREST_SPREAD)	-130721,00	0,00	-130766,00	0,00	-130695,00	0,00
d(TURKIYE_CDS_5_YEAR)	-123749,00	0,00	-123607,00	0,00	-124239,00	0,00
d(VIX)	-280094,00	0,00	-279540,00	0,00	-281482,00	0,00

The Phillips-Perron stationarity test was utilized within the methodological framework. As threshold regression requires parameter estimates across several regimes influenced by the

Findings

In the initial phase of the research, the GSADF test utilizes the time series of the Turkish house price

index to ascertain the periods during which housing bubbles exist. The test results, denoted by values beyond the crucial threshold of "0," indicate the presence of price bubbles. The graph depicts the onset and culmination phases of residential property price bubbles. The GSADF test results show that the Central Bank of the Republic of Türkiye (CBRT) has controlled housing bubbles by slowly changing interest rates and stepping in to make the market more stable. This has prevented the bubbles from significantly deflating, which may have led to financial instability (see Figure 1).

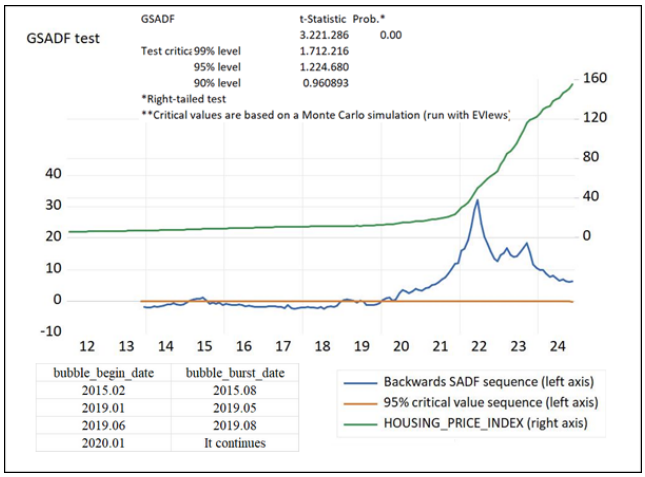


Figure 1. GSADF Test Results

selecting the dependent variable that indicates the presence of housing bubbles is crucial.

The chosen dependent variable is the time series of GSADF test output data. If these test results generate a dummy variable, it will provide a poor model fit. Moreover, utilizing the GSADF as the dependent variable is better suited for assessing bubbles' emergence and expansion rates. The test results indicate that the gold and VIX indices are insignificant at 5% and 10%, while the other variables are at 5%. The results reveal that gold, interest rate spread, housing prices, VIX, and a constant term negatively impact housing bubbles, but inflation, currency basket, and CDS positively impact them (See Equation 6, Table 3).

$$BUBBLE_{GSADF} = \beta 1 \cdot CPI + \beta 2 \cdot CURRENCY_{BASKET} + \beta 3 \cdot GOLD + \beta 4 \cdot HOUSING_{PRICE_{INDEX}} + \beta 5 \cdot INTEREST_{SPREAD} + \beta 6 \cdot TURKIYE_{CDS_{5_{YEAR}}} + \beta 7 \cdot VIX + C \quad (6)$$

In the third step of the study, the time-varying dynamic coefficients of the independent variables explaining the dependent variables of the GSADF test results that detect price bubbles are calculated with the help of the Kalman filtering method. Kalman filtering estimates time-varying dynamic coefficients. To ensure the analysis of these variables was meaningful, we also drew individual graphs of the variables as raw data. To better understand the Kalman filtering results, we should look at the variables' coefficients and raw data values during the bubbless' onset and burst periods (see Figures 2, 3, and Table 4).

Table 3. Robust Regression Results

Dependent Variable: BUBBLE_GSADF				
Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
CPI	3,025929	0,209623	14,43512	0.0000
CURRENCY_BASKET	1,507041	0,024005	62,78119	0.0000
GOLD	-0,000262	6,88E-06	-38,09553	0.0000
HOUSING_PRICE_INDEX	-0,097748	0,004428	-22,07647	0.0000
INTEREST_SPREAD	-44,44198	0,712720	-62,35549	0.0000
TURKIYE_CDS_5_YEAR	0,011169	0,000238	46,90489	0.0000
VIX	-0,003766	0,003566	-1,055862	0.2910
C	-3,379869	0,078252	-43,19184	0.0000
Robust Statistics				
R-squared	0,462428	**Adjusted R-squared**		0,436830
Rw-squared	0,897674	**Adjust Rw-squared**		0,897674
Akaike info criterion	261,2246	**Schwarz criterion**		299,4962
Deviance	545,1240	**Scale**		1,450351
Rn-squared statistic	102461,5	**Prob(Rn-squared stat,)**		0,000000
Non-robust Statistics				
Mean dependent var	3,264452	**S, D, dependent var**		7,215951
S.E. of regression	3,482012	**Sum squared resid**		1782,288

Kalman filtering was used to calculate time-varying coefficients; it is essential to estimate static coefficients first. Consequently, a robust regression model has been developed, and the static coefficients have been computed. In model construction,

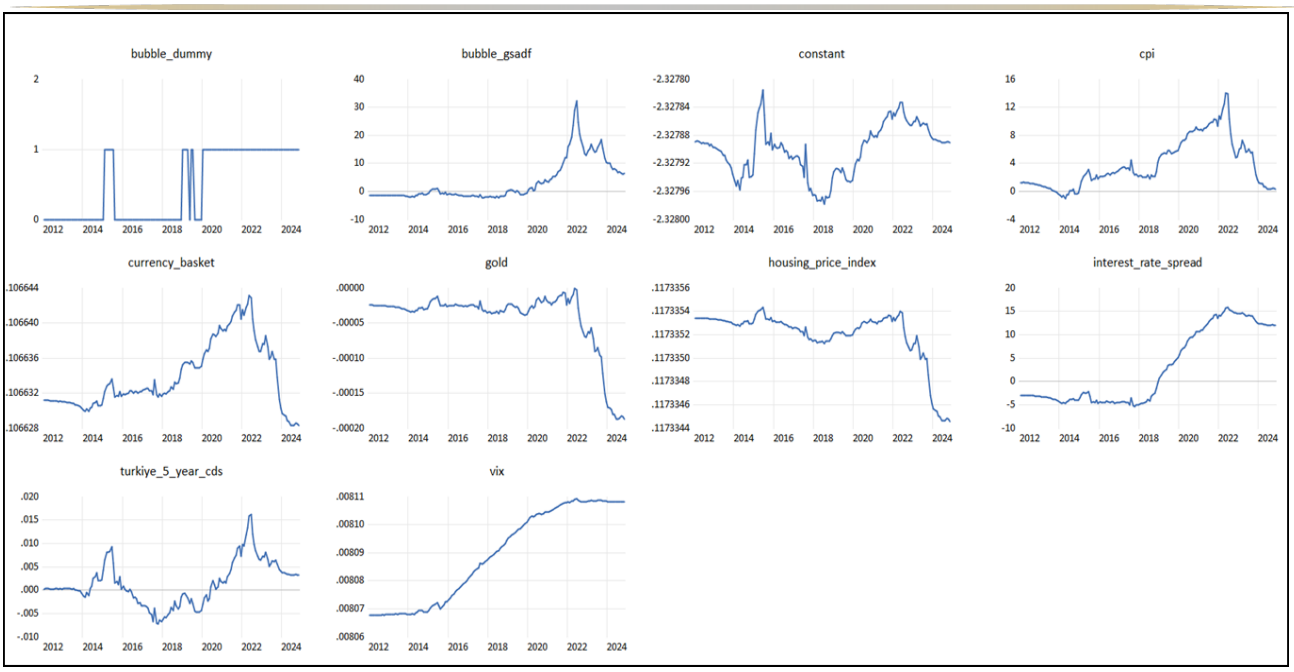


Figure 2. Kalman Filtering Results

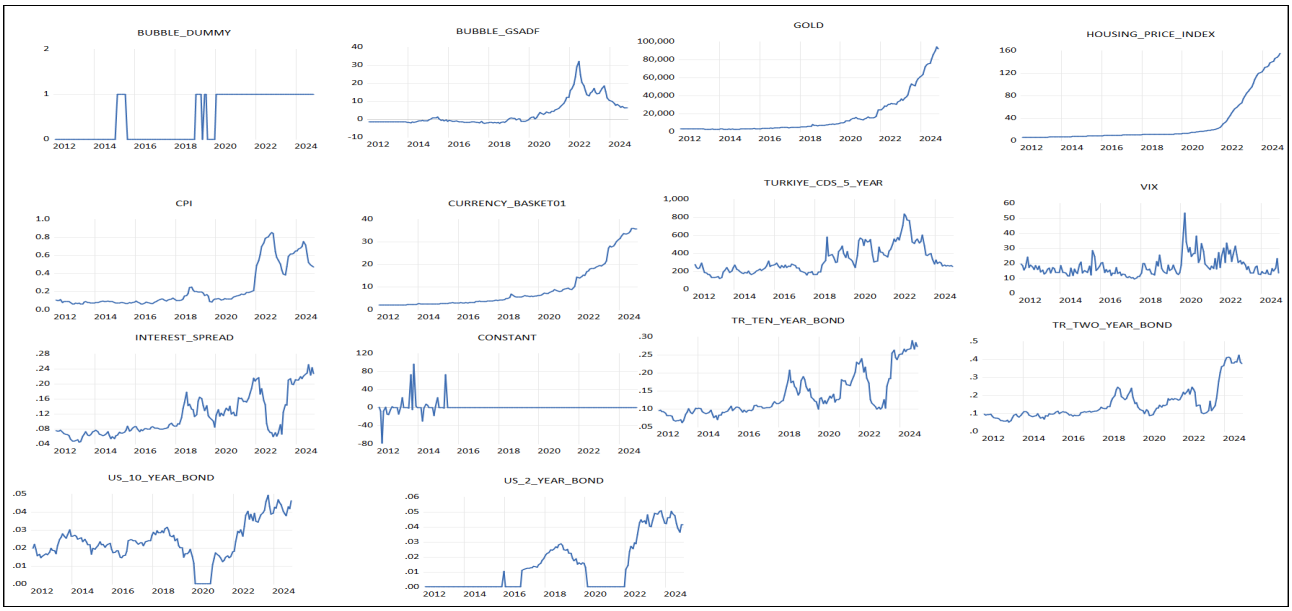


Figure 3. Graphs of The Variables

- **2015.02-The Beginning of the Bubble:** The low interest rate spread and low inflation made it easier to get a loan, and the exchange rate stayed fairly stable. This increased demand for housing led to the bubble.
- **2015.08-The Burst of the Bubble**: The rise in CDS premiums and interest rate spreads made investments more expensive, which lowered demand and caused the housing bubble to burst.
- **2019.01 - The Beginning of the Bubble**: The housing market became more popular because of rising inflation, high exchange rates, and low interest spreads. This made the bubble grow again.
- **2019.05-The Bubble Burst:** The housing market's bubble burst because interest rate spreads went up and financing conditions got stricter.

Table 4. Bubble Begin and Bursting Dates, Raw Data, and Their Time-Varying Coefficients

RAW DATA Bubble_Begin_Date	CONSTANT	CPI	CURRENCY_ BASKET	GOLD	HOUSING_ PRICE_INDEX	INTEREST_ SPREAD	TURKIYE_CDS_ 5_YEAR	VIX
2015.02	0,00123	0,0754	2,66	3041,700	7,78	0,062830	201,52	13,34
2019.01	0,00000	0,2035	5,54	6822,790	11,18	0,117530	299,78	16,57
2019.06	0,00000	0,1572	6,19	8155,750	11,4	0,129030	394,71	15,08
2020.01	0,00000	0,1215	6,31	9509,000	12,61	0,116370	239,82	18,84
Bubble_Burst_Date								
2015.08	0,00000	0,0714	3,09	3304,210	8,32	0,087250	260,67	28,43
2019.05	0,00000	0,1871	6,18	7621,970	11,46	0,141930	480,47	18,71
2019.08	0,00000	0,1500	6,12	8861,960	11,78	0,115320	421,61	18,98
It continues-LAST	0,00000	0,4709	35,69	92054,96	155,37	0,227230	251,12	13,51
KALMAN COEFFICIENTS **Bubble_Begin_Date**	**CONSTANT**	**CPI**	**CURRENCY_ BASKET**	**GOLD**	**HOUSING_ PRICE_INDEX**	**INTEREST_ SPREAD**	**TURKIYE_ CDS_5_YEAR**	**VIX**
2015.02	-2,327873	1,4059	0,106632	-0,000020	0,117335	-2,846201	0,006498	0,008070
2019.01	-2,327932	4,8729	0,106635	-0,000023	0,117335	0,671441	-0,000830	0,008095
2019.06	-2,327927	5,8849	0,106636	-0,000026	0,117335	3,318923	-0,001893	0,008098
2020.01	-2,327932	6,4184	0,106636	-0,000033	0,117335	5,831440	-0,002988	0,008102
Bubble_Burst_Date								
2015.08	-2,327892	1,6040	0,106632	-0,000025	0,117335	-4,524766	0,001603	0,008070
2019.05	-2,327933	5,3789	0,106635	-0,000028	0,117335	2,539273	-0,002763	0,008097
2019.08	-2,327943	5,4354	0,106635	-0,000035	0,117335	3,498588	-0,004499	0,008099
It continues-LAST	-2,327890	0,2926	0,106628	-0,000187	0,117334	12,018124	0,003242	0,008108

- **2019.06-The Bubble Begins to Grow**: The exchange rate was relatively stable, interest rate spreads fell in the short term, and inflation was high. Thus, a new bubble came out.
- **2019.08-The Burst of the Bubble:** CDS premiums increased. Because investors lost confidence due to interest rate spreads.
- **2020.01: "The Bubble's Rise":** Low interest rate spreads, rising gold prices, strong demand, and high inflation caused a new housing bubble post-2020. Rising CDS premiums signal increasing risk.

Changes in inflation, interest rates, and exchange rates are significant for starting and ending housing bubbles in Türkiye. Bubbles usually happen when inflation and interest rates are low, but they collapse quickly when interest rates and spreads increase sharply. This shows how important the Central Bank is for keeping the market balanced.

Conversely, the mechanisms that led to the bursting of these bubbles were sudden fluctuations in inflation, interest rate spreads, and exchange rate increases. Consequently, the effective management of housing bubbles necessitates a balanced approach to price stability, exchange rate policy, and interest rate spreads.

The threshold regression model has been estimated in the research's final stage. The house price index has been selected as the dependent variable in the model. The threshold variable is the interest rate spread between Türkiye and the USA, which is the 10-year benchmark interest rate. Therefore, we determine the thresholds using the sequential L + 1 thresholds vs. L method as follows (See Equation 10):

Thresholds Intervals

INTEREST_SPREAD < 0.09433999 -- 83 obs
0.09433999 <= INTEREST_SPREAD < 0.13143999 -- 23 obs
0.13143999 <= INTEREST_SPREAD < 0.17331999 -- 24 obs
0.17331999 <= INTEREST_SPREAD -- 25 obs

$$HOUSING\_PRICE\_INDEX = (INTEREST\_SPREAD < 0.09433999) * (\beta 1 * BUBBLE\_GSADF + \beta 2 * CPI + \beta 3 * CURRENCY\_BASKET + \beta 4 * GOLD + \beta 5 * TURKIYE\_CDS\_5\_YEAR + \beta 6 * VIX + \beta 7) + (0.09433999 \leq INTEREST\_SPREAD < 0.13143999) * (\beta 8 * BUBBLE\_GSADF + \beta 9 * CPI + \beta 10 * CURRENCY\_BASKET + \beta 11 * GOLD + \beta 12 * TURKIYE\_CDS\_5\_YEAR + \beta 13 * VIX + \beta 14) + (0.13143999 \leq INTEREST\_SPREAD < 0.17331999) * (\beta 15 * BUBBLE\_GSADF + \beta 16 * CPI + \beta 17 * CURRENCY\_BASKET + \beta 18 * GOLD + \beta 19 * TURKIYE\_CDS\_5\_YEAR + \beta 20 * VIX + \beta 21) + (0.17331999 \leq INTEREST\_SPREAD) * (\beta 22 * BUBBLE\_GSADF + \beta 23 * CPI + \beta 24 * CURRENCY\_BASKET + \beta 25 * GOLD + \beta 26 * TURKIYE\_CDS\_5\_YEAR + \beta 27 * VIX + \beta 28) \quad (10)$$

Table 5. Threshold Regression Results

Dependent Variable: HOUSING_PRICE_INDEX Method: Discrete Threshold				
Variable	**Coefficient**	**Std, Error**	**t-Statistic**	**Prob,**
INTEREST_SPREAD < 0,09433999 -- 83 obs				
BUBBLE_GSADF	0,470351	0,286409	1,642237	0,1030
CPI	-25,63918	5,923982	-4,328032	0,0000
CURRENCY_BASKET01	1,101170	0,887320	1,241006	0,2169
GOLD	0,001738	0,000443	3,919127	0,0001
TURKIYE_CDS_5_YEAR	-0,004524	0,007205	-0,627913	0,5312
VIX	-0,023564	0,096961	-0,243028	0,8084
C	2,930312	2,077578	1,410446	0,1609
0,09433999 <= INTEREST_SPREAD < 0,13143999 -- 23 obs				
BUBBLE_GSADF	-3,236906	0,599372	-5,400498	0,0000
CPI	76,85258	21,71498	3,539150	0,0006
CURRENCY_BASKET01	3,357151	2,959357	1,134419	0,2588
GOLD	0,001798	0,001436	1,251869	0,2129
TURKIYE_CDS_5_YEAR	-0,026067	0,006311	-4,130574	0,0001
VIX	0,069893	0,072928	0,958383	0,3397
C	-26,59767	5,213448	-5,101742	0,0000
0,13143999 <= INTEREST_SPREAD < 0,17331999 -- 24 obs				
BUBBLE_GSADF	-0,931825	0,270860	-3,440249	0,0008
CPI	39,47521	12,55272	3,144754	0,0021
CURRENCY_BASKET01	1,150280	2,006737	0,573209	0,5675
GOLD	0,001526	0,000994	1,535589	0,1271
TURKIYE_CDS_5_YEAR	-0,011780	0,006573	-1,792188	0,0755
VIX	-0,044274	0,172629	-0,256471	0,7980
C	-9,799455	5,354082	-1,830277	0,0696
0,17331999 <= INTEREST_SPREAD -- 25 obs				
BUBBLE_GSADF	1,449695	0,275743	5,257420	0,0000
CPI	1,411950	5,717437	0,246955	0,8053
CURRENCY_BASKET01	3,098317	0,417534	7,420522	0,0000
GOLD	0,000332	0,000130	2,552736	0,0119
TURKIYE_CDS_5_YEAR	-0,149808	0,018226	-8,219347	0,0000
VIX	-0,085873	0,168359	-0,510059	0,6109
C	38,87310	7,861174	4,944949	0,0000
R-squared	0,996729	Mean dependent var		29,53135
Adjusted R-squared	0,996034	S, D, dependent var		40,34637
S, E, of regression	2,540868	Akaike info criterion		4,864941
Sum squared resid	819,9135	Schwarz criterion		5,414721
Log-likelihood	-349,0329	Hannan-Quinn criteria,		5,088249
F-statistic	1433,438	Durbin-Watson stat		1,765694
Prob(F-statistic)	0,000000			

To accurately interpret the results, it is essential to consider the political economy cycles of Türkiye between 2012 and 2024, during which the country diverged from the monetary strategies of advanced and emerging economies following the U.S. Federal Reserve's May 2013 announcement to taper its bond-purchasing program. Because the Turkish economy depends so much on imported goods, the delay in interest rate hikes caused interest rate shocks that drove up exchange rates. This, in turn, made inflationary pressures worse in the economy. Consequently, the sustainability of housing bubbles tends to rise during inflationary periods.

The results suggest that Bubble_GSADF is significantly negative in the mid-range interest spread brackets (0.094 to 0.173), indicating a deflationary tendency of housing bubbles when inflation-adjusted interest rates remain moderate. However, in the highest interest spread bracket (above 0.173), Bubble_GSADF becomes positive and significant, reaffirming the observation that housing bubbles are more likely to emerge in such environments.

Interest rate spreads between 0.094 and 0.173 contributed to the decline of housing bubbles. However, spreads below 0.094 coincide with inflationary pressures, which can foster the formation of new bubbles. When interest rate spreads surpass 0.173, speculative increases in house prices become more evident, requiring proactive macroprudential measures.

The results point out that inflation is central in shaping housing prices when interest rate spreads stay within the 0.094–0.173 range. To provide a stable market, it is essential to fine-tune interest rates,

control inflation, and support financial stability with well-rounded policies.

Comparison of Findings with Literature for Türkiye

This study's results point out that the cycle of low interest rates, high inflation, and risk premiums causes house price bubbles in Türkiye. Rising interest rate spreads, CDS premiums, and exchange rate volatility cause these bubbles to burst. These results parallel the Akkuş (2021) and Akkaya (2024) research. This study uses Kalman filtering and threshold regression models to analyse the impact of interest and credit variables on bubble development, further exploring the bubble phases from 2019 to 2022 as identified by Akkaya using the GSADF test. Building on Kartal's (2022) finding that a drop in mortgage sales, modelled by macro-financial conditions, influences irrational price behaviour in the housing market, this study suggests an interest rate differential threshold of 9.4–17.3%. On the other hand, the timeframes determined by the GSADF test in this study closely match the many bubble forms discovered by Vergili (2023) and Abioğlu (2020) in locations like Istanbul and Izmir. This study aims to methodologically and empirically support and improve the findings already published in the Turkish literature.

Analysis of Findings in Terms of the COVID-19 Pandemic and the February 6 Earthquakes

Türkiye has two notable phases regarding the timeframe of the research undertaken. The eras include the COVID-19 pandemic commencing in 2020 and the earthquakes concentrated in Kahramanmaraş on February 6, 2023. Consequently, the research findings must be analysed considering these timeframes. During these two decades, external factors influencing housing supply and demand and the asset pricing dynamics that dictate home prices have shocked macroeconomic variables.

The low-interest rate policies, ample liquidity, and credit expansion enacted during the COVID-19 epidemic have fostered conditions conducive to the emergence of speculative bubbles in the Turkish housing sector. The results of Kalman filtering and the GSADF test suggest that a new house price bubble has emerged since early 2020 and continues to persist. Notwithstanding the inflation surge during the pandemic, maintaining low interest rates has augmented investors' appetite for real estate. This circumstance has resulted in speculative escalations in real estate prices. The volatile nature of exchange rates and rising risk premiums have augmented house demand due to its perceived as a safe haven. During the pandemic, the low-interest rate disparity, elevated inflation, and heightened risk premium collectively contributed to the upward fluctuation of house values.

The earthquakes in Kahramanmaraş in 2023 messed up Türkiye's housing market by making people want safer homes, which made prices go up quickly in low-risk areas and made the bubble dynamics even stronger. The rise in public borrowing and CDS premiums has made things even more uncertain, signalling the start of a new and different way for bubbles to burst.

Housing Price Index and Construction Cost Index Relationship

Examining house price dynamics through time-varying Kalman coefficients indicates a variable relationship with the building cost index, responsive to temporal variations. The first graph shows that home prices increased faster than costs at times, even though rising construction costs after 2021 were the main reason for this (See Figure 5).

This example shows that both cost factors and speculative expectations affect house prices. The Kalman coefficients show that building costs greatly affected prices after 2021, peaking in 2022. After 2023, the stabilisation of these coefficients shows that cost-driven pricing has reached a plateau. At the same time, macroeconomic factors like inflation, low interest spreads, and high-risk premiums are increasing bubble dynamics (see Figures 5 and 6). In this context, Kalman filtering results show that the costs of building homes have become a significant factor in home prices. However, their interaction with speculative demand has led to the formation of bubbles. So, to make

sure the housing market stays stable, we need comprehensive policy frameworks that deal with rising costs and macroeconomic factors that affect financial stability and how investors act (See Figure 5, Figure 6).

Figure 5. Housing Price Index and Construction Cost Index Relationship (Raw Data)

Source: Housing price endeks Central Bank EVDS Database, Construction Cost index in TÜİK Database

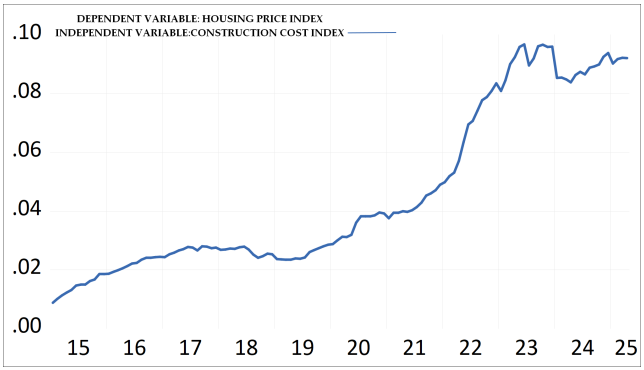


Figure 6. Housing Price Index and Construction Cost Index Relationship, Kalman Filtering Results

Analysis of Findings in Terms of Housing and Land Rent Indexes

The findings presented in the article, when assessed alongside the housing, real estate, and land graphs in the appendices, demonstrate that the theoretical modelling of the emergence and collapse of housing price bubbles is corroborated by empirical evidence. The price surges observed in the post-2020 period in Appendix 5: Türkiye Residential Property Price Index, Appendix 6: Türkiye Residential Land Price Index, and Appendix 7: Türkiye Field, Vineyard, Garden, and Land Price Index graphs are qualitatively aligned with the bubble formations identified in the study utilising the GSADF test and Kalman filtering method. These increases correspond with investors' shift towards home and land investments, perceived as a safe haven amid low-interest rates and increasing inflation. Moreover, the Rent Indices in Appendices 3 and 4 indicate that the escalation in property prices is mirrored in rental costs, resulting in social consequences. This condition reinforces the notion articulated in the research that low and middle-income demographics are being propelled towards a housing crisis.

Real Estate Price and Rent Indices in Appendices 8 and 9 show a more stable trend than the residential market. This supports the idea that speculative bubbles are primarily found in the housing sector because of investment-driven behaviour and unrealistic financial expectations. Also, the Demand and Supply Indicators in Appendices 1 and 2 show that when supply does not change quickly enough to keep up with rising prices, it worsens bubbles. This aligns with the threshold regression results and Kalman filter analyses, which show how economic uncertainty, interest rate policy, and supply-side constraints make Türkiye's housing market less stable.

Policy Recommendations

Based on the research findings, policy recommendations can be formulated for institutions like the

central bank, which is crucial in shaping and executing housing policies within Türkiye's economic bureaucracy. In this context, the central bank can monitor the emergence and collapse dynamics of the housing bubble daily, weekly, and monthly through models utilising dynamic threshold regression algorithms. The results indicate that the influence of model outcomes concerning housing bubbles on the adjustment of the policy interest rate and interest rate corridor in the monetary policy committee's decisions will enhance the overall coherence of monetary policy with other economic policies.

From the viewpoint of the Banking Regulation and Supervision Agency, the dynamic monitoring of housing bubbles daily, weekly, and monthly can significantly enhance the management of risks associated with housing loans. Updating house loan interest rates around the bubble's peak will facilitate improved management of existing bubbles, their regulated deflation, and effective mitigation of their repercussions on the financial system post-burst. Dynamic threshold regression models will serve as a crucial metric for assessing housing supply from the viewpoint of the Housing Development Administration. Optimally assessing housing supply during stagnation, devoid of a housing bubble, and during speculative periods characterised by bubbles will improve the coherence of housing and economic policies and the efficacy of the financial system. Given that an early increase in interest rates precipitated the 2008 global financial crisis in housing markets, analysing the interest rate differential between Türkiye and foreign markets through dynamic threshold regression models will be an early warning system during significant financial crises.

Discussion and Conclusion

One of the most significant socio-economic issues is that housing bubbles and economic unrest have made homeownership more unaffordable, which has increased rents and exacerbated inequality for low-income families in Türkiye. This study provides theoretical and practical insights into the mechanism and burst of housing bubbles in Türkiye by literature review, data analysis, and econometric modeling. It also evaluates the impact of financial and economic shocks on housing prices from the supply and demand standpoint.

To make the research design more effective, the relevant literature is reviewed. The analysis reveals that housing bubbles in Türkiye are predominantly driven by supply-demand imbalances, financing costs, and speculative investor asset pricing behavior influenced by domestic and international risk premiums. It is contended that particularly low interest rates and credit facilities have facilitated speculative investments. It can be posited that the escalation in housing financing costs precipitated the bursting of housing bubbles due to the rise in interest rates. A comprehensive review of the extant literature and the formulation of research objectives and variables enabled the determination of research methods for Türkiye.

The selected variables of study consist of the house price index, consumer inflation, Türkiye's gold prices, Türkiye's 5-year CDS premium, the VIX risk appetite index, the equally weighted basket exchange rate of the dollar and the euro, and the Türkiye-US 10-year bond rate spread. The data set was observed from 2012:01 to 2024:11 at a monthly frequency. The GSADF test was applied to identify housing price bubble periods for Türkiye within the estimation interval. The outcomes of this test indicate the following periods as housing price bubbles in Türkiye: February 2015 to August 2015, January 2019 to August 2019, June 2019 to August 2019, and the present period (2020 to the present). However, Türkiye's current housing price bubble exhibits signs of a controlled bursting. The econometric analysis demonstrates that price bubbles in house prices are driven by supply-side rigidities and cost increases rather than demand shocks.

In Türkiye, housing bubbles usually happen when inflation, foreign exchange, and gold prices go up, interest rates are low, and a lot of money is in the market. As the bubble grows, easy access to credit and investment incentives make house prices rise even faster. However, outside events, like more economic uncertainty, higher CDS premiums, and tighter financial conditions, can cause

the market to lose confidence, which leads to the bursting phase.

Conversely, housing bubbles in Türkiye have a tendency to burst when economic uncertainties escalate, financing conditions become more stringent, and the rise in exchange rates and risk premiums gives rise to a loss of confidence. The threshold regression results indicate that when the current interest rate spread exceeds 17.3%, the housing bubble dynamics will likely escalate due to rising interest rate expectations, which can precipitate exchange rate and inflation shocks.

To provide an optimal housing market adjustment and balancing, the domestic and foreign interest rate spread must remain within an optimal range of 9.4% to 17.3% under current conditions. The study's findings contribute not only significantly to the understanding of housing bubble dynamics but also bring out several critical points.

This study suggested that effectively managing speculative bubbles in Türkiye's housing market needs a critical balance of interest rates, inflation, and exchange rate dynamics, when interest spreads exceed 0.17%. The study's results pay attention to the importance of transparent data and comprehensive macroprudential policies for ensuring long-term stability beyond mere rate adjustments.

Declarations

Funding: No funding was received for conducting this study.

Conflicts of Interest: The author declares no conflict of interest.

Ethical Approval: This article does not involve any studies with human participants or animals performed by the author; therefore, ethical approval was not required.

Informed Consent: Not applicable.

Data Availability: All variables used in the analyses are based on publicly available macro time-series (e.g., the Central Bank of the Republic of Türkiye's EVDS database and Investing.com). The cleaned datasets compiled from these sources and the derived analysis outputs (e.g., model specifications and result tables) are available from the corresponding author upon reasonable request.

AI Disclosure: No artificial intelligence–based tools or applications were used in the conception, analysis, writing, or figure preparation of this study. All content was produced by the author in accordance with scientific research methods and academic ethical principles.

References

Abioğlu, V. (2020). Türkiye konut piyasasinda balon oluşumları: Bölgesel inceleme. *Finansal Araştırmalar ve Çalışmalar Dergisi, 12*(22), 1-14. https://doi.org/10.14784/marufacd.688444

Agnello, L., & Schuknecht, L. (2011). Booms and busts in housing markets: Determinants and implications. *Journal of Housing Economics, 20*(3), 171–190. https://doi.org/10.1016/j.jhe.2011.04.001

Akkaya, M. (2024). Konut birim fiyat balonu ve balonu etkileyen ekonomik değişkenlerin analizi. *Van Yüzüncü Yıl Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 63*, 72-85.

Akkaya, M. (2024). Konut fiyat balonu ve konut fiyatını etkileyen faktörlerin analizi: Türkiye uygulaması. *Gazi İktisat ve İşletme Dergisi, 10*(1), 33-45. https://doi.org/10.30855/gjeb.2024.10.1.003

Akkuş, H. T. (2021). Housing price bubbles and factors affecting the formation of bubbles: The Turkish case. *Pamukkale Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 46*, 271-292. https://doi.org/10.30794/pausbed.835374

Bahçeşehir Üniversitesi Ekonomik ve Toplumsal Araştırmalar Merkezi (BETAM). (2025). *Sahibindex kiralık konut piyasası görünümü: Mayıs 2025*. https://betam.bahcesehir.edu.tr/2025/05/sahibindex-kiralik-konut-piyasasi-gorunumu-mayis-2025/

Bansak, C., & Starr, M. A. (2015). Distributional costs of housing-price bubbles: Who pays the price when bubbles deflate? *Review of Social Economy, 73*(3), 255–273. https://doi.org/10.1080/00346764.2015.1089108

Bernanke, B. S., Gertler, M., & Gilchrist, S. (1999). The financial accelerator in a quantitative business cycle framework. In J. B. Taylor & M.

Woodford (Eds.), *Handbook of macroeconomics* (Vol. 1C, pp. 1341–1393). Elsevier.

Bolt, W., Demertzis, M., Diks, C., Hommes, C., & van der Leij, M. (2014). Identifying booms and busts in house prices under heterogeneous expectations. *Journal of Economic Dynamics and Control, 48*, 150–165. https://doi.org/10.1016/j.jedc.2014.07.005

Borio, C., & Zhu, H. (2012). Capital regulation, risk-taking and monetary policy: A missing link in the transmission mechanism? *Journal of Financial Stability, 8*(4), 236–251. https://doi.org/10.1016/j.jfs.2011.12.003

Carson, R. T., & Dastrup, S. R. (2009). After the fall: An ex-post characterization of housing price declines across metropolitan areas. *Journal of Housing Economics, 18*(1), 48–61. https://doi.org/10.1016/j.jhe.2009.02.002

Case, K. E., & Shiller, R. J. (2003). Is there a bubble in the housing market? *Brookings Papers on Economic Activity, 2003*(2), 299–362. https://doi.org/10.1353/eca.2004.0004

Central Bank of the Republic of Türkiye (CBRT). (2025). Electronic data delivery system (EVDS) [Database].

Central Bank of the Republic of Türkiye. Retrieved October 7, 2025, from https://evds2.tcmb.gov.tr/

Ece, O. (2022). Default riskine dayalı olarak Türkiye'de konut fiyat köpüklerinin varlığının analizi: TRA 1 bölgesinden kanıtlar. *Erzincan Binali Yıldırım Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 4*(1), 1-22. https://doi.org/10.46482/ebyuiibfdergi.1055441

Endeksa. (2025). *Konut ve emlak verileri*. https://www.endeksa.com/tr/

Enders, W., & Siklos, P. L. (2001). Cointegration and threshold adjustment. *Journal of Business & Economic Statistics, 19*(2), 166–176.

Englund, P., & Ioannides, Y. M. (1997). House price dynamics: An international empirical perspective. *Journal of Housing Economics, 6*(2), 119–136. https://doi.org/10.1006/jhec.1997.0219

Engsted, T., Hviid, S. J., & Pedersen, T. Q. (2015). Explosive bubbles in house prices? Evidence from the OECD countries. *Journal of International Financial Markets, Institutions and Money, 40*, 14–25. https://doi.org/10.1016/j.intfin.2015.07.001

Eraslan, C., & Bayraktar, Y. (2013). Konut balonlarının oluşumunda Fed'in rolü ve küresel krizden çıkarılacak bazı dersler. *İstanbul Üniversitesi İktisat Fakültesi Mecmuası, 62*(2), 38-59.

Evanoff, D. D., Kaufman, G. G., & Malliaris, A. G. (2012). *New perspectives on asset price bubbles: Theory, evidence, and policy*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199859492.001.0001

Flood, R. P., & Hodrick, R. J. (1990). On testing for speculative bubbles. *Journal of Economic Perspectives, 4*(2), 85–101.

Glaeser, E. L., Gyourko, J., & Saiz, A. (2008). Housing supply and housing bubbles. *Journal of Urban Economics, 64*(2), 198–217. https://doi.org/10.1016/j.jue.2008.07.007

Gökçe, A., & Güler, İ. (2020). Sağ-yönlü ADF sınamaları ile Ankara ilinde konut balonu araştırması. *Ankara Hacı Bayram Veli Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 94-116.

Hampel, F. R., Ronchetti, E. M., Rousseeuw, P. J., & Stahel, W. A. (1986). *Robust statistics: The approach based on influence functions*. Wiley Series in Probability and Statistics.

Hansen, B. E. (1999). Threshold effects in non-dynamic panels: Estimation, testing, and inference. *Journal of Econometrics, 93*(2), 345–368. https://doi.org/10.1016/S0304-4076(99)00025-1

Hansen, B. E. (2000). Sample splitting and threshold estimation. *Econometrica, 68*(3), 575–603.

Hanweck, G. A. (2017). Identifying house price booms, bubbles, and busts: A disequilibrium analysis from chaos theory. *Journal of Real Estate Research, 39*(4), 521–556. https://www.jstor.org/stable/26328213

Helbling, T. (2005). Housing price bubbles—a tale based on housing price booms and busts. *BIS Papers, 21*, 30–41. https://www.bis.org/publ/bppdf/bispap21.pdf

Huber, P. J. (1964). Robust estimation of a location parameter. *The Annals of Mathematical Statistics, 35*(1), 73–101. https://doi.org/10.1214/aoms/1177703732

Huber, P. J. (1973). Robust regression: Asymptotics, conjectures, and Monte Carlo. *The Annals of Statistics, 1*(5), 799–821. https://doi.org/10.1214/aos/1176342582

Huber, P. J. (1981). *Robust statistics*. John Wiley & Sons.

Iancu, L., Croicu, A., & Rogojan, L. C. (2023). An investigation on real estate market dynamics and bubble formation modeling. *Journal of Risk and Financial Management, 16*(2), 85. https://doi.org/10.3390/jrfm16020085

Investing.com. (2025). Retrieved January 10, 2025, from https://www.investing.com

Jordà, Ò., Schularick, M., & Taylor, A. M. (2015). Leveraged bubbles. *Journal of Monetary Economics, 76*, S1–S20. https://doi.org/10.1016/j.jmoneco.2015.08.005

Kalman, R. E. (1960). A new approach to linear filtering and prediction problems. *Journal of Basic Engineering, 82*(1), 35–45. https://doi.org/10.1115/1.3662552

Kartal, G. (2022). Konut piyasasında çoklu balon oluşumu: Türkiye geneli ve TR71 bölgesinden ampirik deliller. *Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 15*(2), 343-360. https://doi.org/10.25287/ohuiibf.1002825

Kaufman, G., Malliaris, A., & Nelson, R. W. (2018). Housing and other price bubbles: The buildup, the burst, and the impact. In *Innovative Federal Reserve Policies During the Great Financial Crisis* (pp. 157–178). World Scientific Publishing. https://doi.org/10.1142/97898132365-92_0008

Kim, S., & Yang, D. Y. (2011). What makes housing prices move: A study of the housing market in Seoul, South Korea. *Journal of Housing Economics, 20*(4), 267–273. https://doi.org/10.1016/j.jhe.2011.08.001

Kocherlakota, N. R. (2009). *Bursting bubbles: Consequences and cures* (Economic Policy Paper). Federal Reserve Bank of Minneapolis. https://www.minneapolisfed.org/research/economic-policy-papers/bursting-bubbles-consequences-and-cures

Lind, H. (2009). Price bubbles in housing markets: Concept, theory, and indicators. *International Journal of Housing Markets and Analysis, 2*(1), 78–90. https://doi.org/10.1108/17538270910939548

Malkiel, B. G. (2012). Bubbles in asset prices. In *The New Palgrave Dictionary of Economics* (2nd ed.). Palgrave Macmillan. https://doi.org/10.1057/9780230226203.0136

Maronna, R. A., Martin, R. D., & Yohai, V. J. (2006). *Robust statistics: Theory and methods*. John Wiley & Sons.

Miao, J. (2014). Introduction to the economic theory of bubbles. *Journal of Mathematical Economics, 53*, 130–136. https://doi.org/10.1016/j.jmateco.2014.03.001

Obstfeld, M., & Taylor, A. M. (2004). *Global capital markets: Integration, crisis, and growth*. Cambridge University Press.

Owsinski, J. W. (1988). [Review of the book *Handbook of regional and urban economics: Volume I, regional economics*, by P. Nijkamp (Ed.)]. *European Journal of Operational Research, 37*(2), 268–269. https://doi.org/10.1016/0377-2217(88)90420-0

Phillips, P. C. B., & Yu, J. (2011). Dating the timeline of financial bubbles. *Quantitative Economics, 2*(3), 455–491.

Phillips, P. C. B., Shi, S., & Yu, J. (2015). Testing for multiple bubbles: Historical episodes of exuberance and collapse in the S&P 500. *International Economic Review, 56*(4), 1043–1078. https://doi.org/10.1111/iere.12132

Taylor, J. B. (2009). *The financial crisis and the policy responses: An empirical analysis of what went wrong* (NBER Working Paper No. 14631). National Bureau of Economic Research. https://doi.org/10.3386/w14631

Türkiye Cumhuriyet Merkez Bankası (TCMB). (2025). *Elektronik veri dağıtım sistemi (EVDS)*. Retrieved January 10, 2025, from https://evds2.tcmb.gov.tr

Turkish Statistical Institute (TUIK). (2025). TurkStat data portal [Database]. Turkish Statistical Institute. Retrieved October 7, 2025, from https://data.tuik.gov.tr/

Tong, H. (1983). *Threshold models in non-linear time series analysis*. Springer.

Tursun, A. (2024). Konut tedarik zincirinde kamçı etkisinin araştırılması. *Bulletin of Economic Theory and Analysis, 9*(2), 475-492.

Vergili, G. (2023). Reel konut fiyatlarında balon analizi: Türkiye geneli, İstanbul, Ankara ve İzmir uygulaması. *Mehmet Akif Ersoy Üniversitesi Uygulamalı Bilimler Dergisi, 7*(1), 44-66. https://doi.org/10.31200/makuubd.1243107

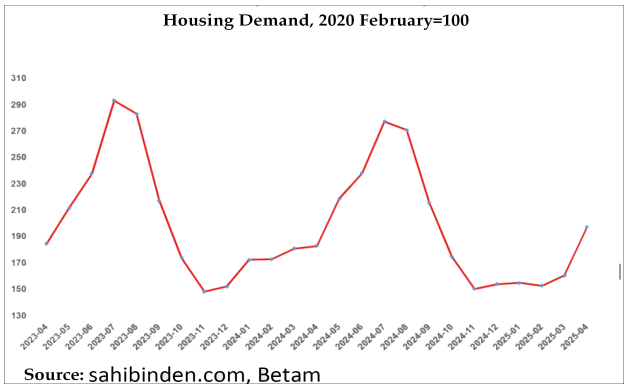
Wang, P., & Wen, Y. (2012). Speculative bubbles and financial crises. *American Economic Journal: Macroeconomics, 4*(3), 184–221. https://doi.org/10.1257/mac.4.3.184

Wong, K.-Y. (2001). Housing market bubbles and the currency crisis: The case of Thailand. *Asian Economic Journal, 15*(4), 393–416. https://doi.org/10.1111/1467-8381.00145

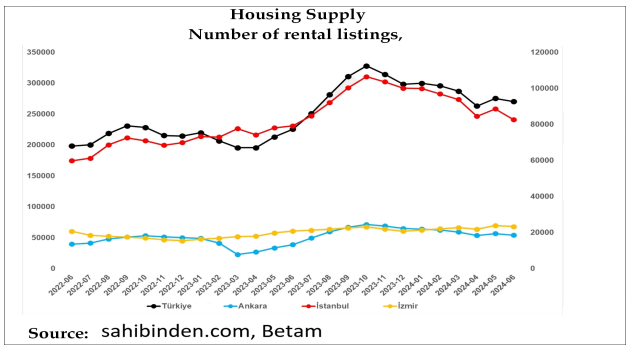
Xiao, Q. (2010). Crashes in real estate prices: Causes and predictability. *Journal of Real Estate Research, 32*(4), 399–424. https://www.jstor.org/stable/24888282

Zainuddin, Z., Jali, M. N., Gan, C., & Ward, B. (2012). Revitalizing the issues, theories, and concept of house price bubbles. *International Journal of Economics and Finance Studies, 4*(2), 123–133. https://dergipark.org.tr/en/pub/ijefs/issue/26125/275195

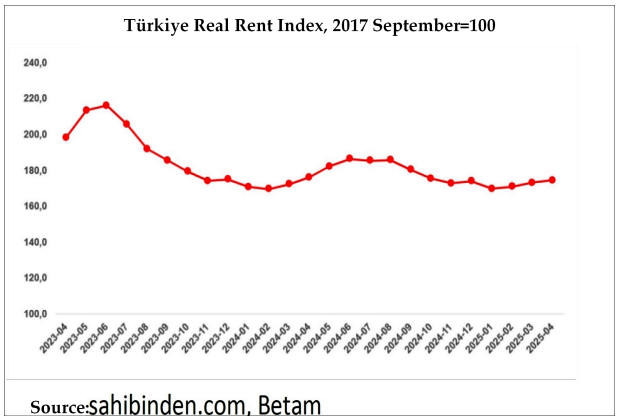
Appendixes



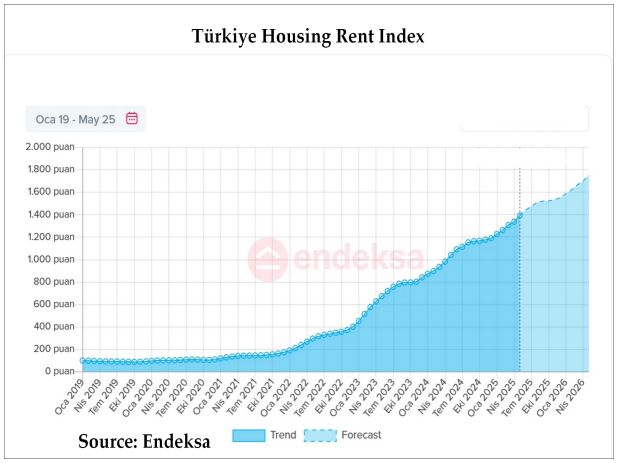
Appendix 1. Housing Demand



Appendix 2. Housing Supply

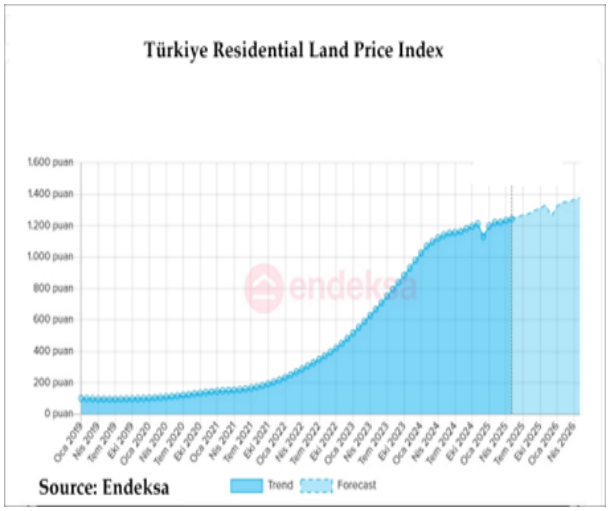


Appendix 3. Türkiye Real Rent Index

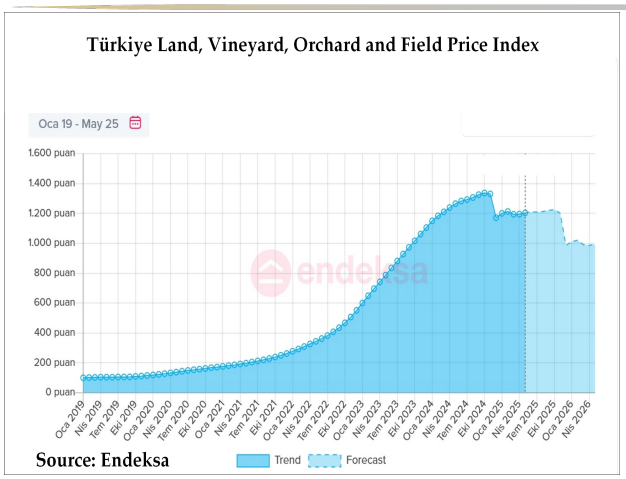


Appendix 4. Türkiye Housing Rent Index

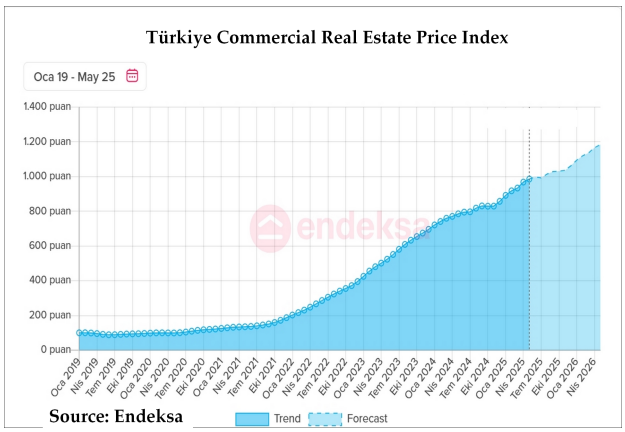
Appendix 5. Türkiye Sale Housing Price Index



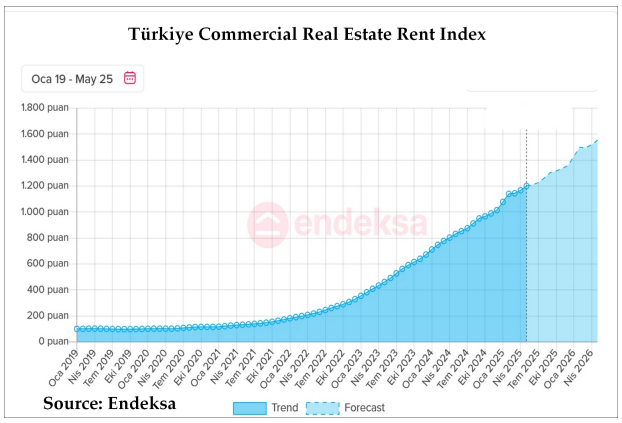
Appendix 6. Türkiye Residential Land Price Index



Appendix 7. Türkiye Land, Vineyard, Orchard, and Field Price Index



Appendix 8. Türkiye Commercial Real Estate Price Index



Appendix 9. Türkiye Commercial Real Estate Rent Index