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## EXPLOSIVE PRICE CHARACTERISTIC IN HOUSING MARKET: A COMPARATIVE ANALYSIS ON EMERGING ECONOMIES

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### Abstract

Housing price changes can be driven by both fundamental factors and speculative dynamics. This study examines explosive price movements in the housing markets of the “Fragile Five” economies—Türkiye, Brazil, South Africa, Indonesia, and India—under recent global shocks such as the pandemic and energy crises. The analysis covers quarterly data from Q1 2010 to Q4 2024, allowing the study to capture both pre- and post-pandemic market period. Although these countries share similar structural vulnerabilities, they adopt different macroeconomic and structural policies. Therefore, a comparative analysis of asset prices across selected countries can provide useful insights for both policymakers and market participants. By applying the generalized supremum augmented Dickey-Fuller (GSADF) test in a comparative framework, the paper contributes to the literature as one of the first studies to provide a systematic comparative GSADF analysis across major emerging markets. Unlike earlier research that focused on single countries or advanced economies, it provides updated comparative evidence on major emerging economies. The results indicate that housing price bubbles emerged in one period in Brazil and South Africa, and in three distinct episodes in Türkiye. Comparative evidence reveals a divergent pattern across countries: Türkiye’s accommodative monetary stance in the post-pandemic period fueled exuberant increases in real estate prices, Brazil’s relatively tighter policy framework contained speculative pressures and kept price dynamics more moderate, while South Africa’s contractionary conditions signaled early signs of a downward adjustment in the housing market. The findings suggest that the divergence in housing price dynamics across emerging markets is shaped not only by monetary policy responses but also by broader structural and regulatory frameworks that influence speculative pressures. A broader mix of macroprudential tools, strengthened regulatory oversight, and structural measures aimed at expanding housing supply and improving market transparency is essential to mitigate bubble risks and support sustainable housing market stability.

**Keywords:** Housing Market, Explosive price behavior, Emerging economies

## GAYRİMENKUL FİYATLARINDA PATLAYICI FİYAT DAVRANIŞLARI: GELİŞMEKTE OLAN EKONOMİLER ÜZERİNDE KARŞILAŞTIRMALI BİR ARAŞTIRMA

### Öz

Konut fiyatlarındaki değişimler hem temel faktörlerden hem de spekülasyon dinamiklerinden kaynaklanabilir. Bu çalışma, “Kırılgan Beşli” ekonomilerinde —Türkiye, Brezilya, Güney Afrika, Endonezya ve Hindistan— pandemi ve enerji krizleri gibi son küresel şoklar altında konut piyasalarındaki patlayıcı fiyat hareketlerini incelemektedir. Analiz, 2010 1. çeyrekte 2024 4. çeyreğe kadar uzanan verileri kapsamakta olup, pandemi öncesi ve sonrası dönemi birlikte değerlendirmeye imkân tanımaktadır. Bu ülkeler benzer yapısal kırılganlıklara sahip olmasına rağmen, farklı makroekonomik ve yapısal politikalar benimsemektedirler. Bu nedenle, varlık fiyatları üzerinde yapılacak karşılaştırmalı bir analiz, hem politika yapımcılar hem de piyasa katılımcıları için faydalı bilgiler sunabilir. Karşılaştırmalı bir çerçevede genelleştirilmiş supremum artırılmış Dickey-Fuller (GSADF) testi uygulanarak, çalışma literatüre büyük gelişmekte olan ekonomiler arasında karşılaştırmalı GSADF analizini sistematik biçimde

sunan ilk çalışmalardan biri olarak katkı sağlamaktadır. Tek bir ülkeye veya gelişmiş ekonomilere odaklanan önceki araştırmalardan farklı olarak, bu araştırma büyük gelişmekte olan ekonomiler hakkında güncel karşılaştırmalı veriler sunmaktadır. Bulgular, Brezilya ve Güney Afrika'da birer dönemde, Türkiye'de ise üç farklı dönemde konut fiyat balonlarının ortaya çıktığını göstermektedir. Karşılaştırmalı bulgular, ülkeler arasında pandemi sonrasında farklılaşan bir desen ortaya koymaktadır: Türkiye'nin gevşek para politikası gayrimenkul fiyatlarında büyük artışlara yol açarken, Brezilya'nın görece daha sıkı politika çerçevesi spekülasyon baskıları sınırlamış ve fiyat dinamiklerini daha ılımlı tutmuştur. Buna karşılık, Güney Afrika'daki daraltıcı koşullar konut piyasasında aşağı yönlü bir düzeltmenin erken işaretlerini vermektedir. Bulgular, yükselen piyasalarda konut fiyat dinamiklerindeki ayrışmanın yalnızca para politikası tepkileriyle değil, aynı zamanda spekülasyon baskıları şekillendiren daha geniş yapısal ve düzenleyici çerçevelerle belirlendiğini göstermektedir. Balon risklerini azaltmak ve konut piyasasında sürdürülebilir istikrarı desteklemek için daha geniş bir makro-ihtiyati politika seti, güçlendirilmiş düzenleyici denetim ve konut arzı ile piyasa şeffaflığını artıracak yapısal önlemler gerekmektedir.

**Anahtar kelimeler:** Konut piyasası, Patlayıcı fiyat davranışları, Gelişen ekonomiler

## 1. INTRODUCTION

In recent years, speculative pressures in housing markets have become particularly visible in emerging economies, where fragile financial structures, policy-driven credit growth, and inflation volatility amplify price dynamics. While the literature on housing bubbles in advanced economies is extensive, comparatively little is known about how such exuberance unfolds in developing country contexts. In particular, there is a lack of cross-country evidence that systematically captures explosive housing price episodes under different macroeconomic and policy environments. This research seeks to explore the dynamics of housing price exuberance in selected emerging markets, taking into account their distinct institutional frameworks and macroeconomic conditions.

Academic finance identifies two factors that influence real estate prices. These factors can be categorized as changes in fundamental value and price bubbles. The concept of fundamental value represents the value an asset should hold based on market conditions, while a bubble explains speculative price movements not grounded in fundamentals. Real estate prices fluctuate in line with economic conditions, such as supply-demand balance, and changes in indicators, such as energy prices, although in certain instances, they may deviate from market fundamentals. In such cases, changes in prices are attributed to price bubbles. One of the primary benchmarks for real estate is rental income (Engsted et al., 2016). Over the past several decades, real estate prices have exhibited significant deviations on a global scale. Zhao et al. (2017) assert that these deviations considerably impact the real economy. Price bubbles in real estate markets can disrupt economic stability. Furthermore, the 2008 crisis, often regarded as one of the most significant global crises in recent history, originated from the burst of a real estate bubble (Yıldırım, 2020). Hence, research related to price bubbles holds importance as a guiding tool for economic decision-makers in implementing necessary precautions.

The formation of real estate bubbles is a multidimensional phenomenon resulting from the interplay of economic, spatial, and institutional factors. From an economic perspective, speculative investments cause prices to diverge from their fundamental values, as investors prioritize expectations of future price increases over the use value of real estate (Liang, 2024). Credit expansion and lenient lending practices by financial institutions increase borrowing, inject substantial liquidity into the market, and fuel rapid price growth (Liang, 2024). Excessively optimistic expectations among market participants reinforce the belief that prices will continue to rise, thereby creating a self-fulfilling cycle (Defusco et al., 2022). Key macroeconomic drivers, such as expansionary monetary policies and global saving gluts, also exert significant effects on housing markets (Evgenidis and Malliaris, 2023). On the spatial dimension, imbalances between supply and demand accelerate price increases in regions with limited housing availability (Navickas et al., 2022). Moreover, shock events, such as natural disasters, can disrupt supply-demand dynamics and trigger bubble formation. For instance, Kartal (2024) demonstrates that significant bubble episodes emerged in Türkiye's housing market following the February 6, 2023 earthquakes. The COVID-19 pandemic also generated unique bubble patterns, with low-density metropolitan areas experiencing stronger bubble formations than high-density areas (Hansen et al., 2024). Additionally, government interventions, including land-use regulations and

broader institutional frameworks, directly shape market dynamics (Zhang, 2023). Nonetheless, not every price increase should be interpreted as a bubble; some may be driven by robust fundamentals, such as demographic shifts, sustained economic growth, or infrastructure investments. Distinguishing between healthy market expansion and speculative excess therefore remains essential for both policymakers and market participants.

Kartal (2024) provides an integrated theoretical framework that brings together key insights from various studies on speculative price formation, including Minsky's Financial Instability Hypothesis. This framework emphasizes that housing price exuberance often results from the interaction of psychological factors such as herding behavior, investor overconfidence, and anchoring bias; market inefficiencies including short-sale constraints, information asymmetries, and liquidity frictions; and external shocks such as accommodative monetary policy, expansionary fiscal actions, and global financial volatility. Within this context, speculative price surges in housing markets cannot be fully explained by monetary policy alone but should be interpreted within the broader interplay of financial, behavioral, and institutional factors.

Real estate markets have paramount impacts on the overall economy. Case et al. (2005) state that real estate markets substantially influence consumption more than stock markets. Hirano et al. (2015) argue that asset bubbles can lead to excluding other profitable investments since sudden surges in one market make other alternatives less appealing. This situation can lead to mismanagement of limited resources and result in economic disruptions or crises. Similarly, Graczyk and Phan (2016) state that housing bubbles have substantial effects on income distribution. Price bubbles in real estate worsen imbalances between individuals, favoring wealth transfer towards individuals in higher income brackets. Hence, price bubbles in the housing market remarkably affect income distribution.

In addition to their economic impacts, real estate bubbles also have negative social and environmental consequences. Munoz and Cueto (2017) assert that bubbles in real estate markets lead to unplanned land use and environmental issues. The lack of proper planning when converting areas into housing projects leads to habitat degradation, reduced agricultural production and yields, and water resource contamination in the region. Furthermore, Romero et al. (2012) state that real estate market bubbles can give rise to societal disruptions such as corruption and bribery.

In recent years, concerns over speculative housing prices have grown in emerging economies, where fragile financial structures, inflationary pressures, and policy-driven credit expansions have amplified price volatility. Despite the growing literature on asset bubbles, relatively limited attention has been paid to how speculative pricing manifests across developing economies with diverse macroeconomic and institutional conditions. Although numerous studies have examined housing price dynamics in advanced economies, there remains a lack of comparative empirical evidence on speculative price behaviors in the housing markets of major emerging economies. This study addresses this gap by employing a GSADF approach to identify and interpret explosive price episodes across five emerging markets. Investigating the pricing behavior in real estate markets, which have significant social, economic, and environmental impacts, can provide valuable insights for both market participants and regulatory institutions. Additionally, it aims to observe the effects of monetary and macro prudential policies of governments on explosive price movements in the market, considering both upward and downward market phases.

Within this framework, the analysis is structured around four key questions: (i) Do emerging housing markets show signs of explosive price behavior? (ii) If present, how do the duration and timing of such episodes differ across countries and across pre- and post-pandemic periods? (iii) How far can monetary policy conditions account for these patterns? (iv) To what extent do prudential policies help explain cross-country differences in pricing behavior? By exploring these questions, the paper contributes to a deeper understanding of speculative price dynamics in fragile five economies and offers policy-relevant insights.

## 2. LITERATURE REVIEW

Real estate markets are shaped by a combination of fundamental factors and speculative dynamics. Key variables such as housing supply and demand, construction costs, credit availability, and macroeconomic expectations all contribute to price formation. Arshanapalli and Nelson (2008), Mikhed and Zemčík (2009), Balcilar et al. (2016), Evgenidis and Malliaris (2023) and Hansen et al. (2024) provided substantial evidence of housing price bubbles in the U.S. market. These works, which span from the 19th century to 2021, emphasize the recurring nature of unsustainable price increases in real estate. Extending the analysis to OECD countries, Engsted et al. (2016) and Gomez-Gonzalez et al. (2018) confirmed the presence of bubbles in most member states, with the exception of Germany and Italy. In European countries, short-term bubbles were observed in France, Ireland, and Spain, indicating efficient housing markets where rational behavior quickly corrects market divergence (Tsai & Lin, 2022). These findings emphasize the importance of monitoring and regulating real estate markets to maintain economic stability (Asadov et al., 2023) and highlight the role of interest rates in controlling housing markets (Tsai & Lin, 2022).

Studies on real estate price bubbles in the Fragile Five countries are quite limited. Moreover, no comparative research has been found in the literature regarding the real estate price movements in these countries. Research on real estate bubbles in the Fragile Five economies—Brazil, India, Indonesia, South Africa, and Türkiye—has identified significant links between housing price dynamics and macroeconomic indicators. In the Fragile Five, the main common mechanism behind housing market exuberance lies in the interaction between credit cycles and monetary/exchange rate regimes. In Türkiye, the rapid expansion of housing loans during the pandemic, low-interest campaigns by state banks, and the depreciation of the lira significantly increased the likelihood of bubbles, while persistent exuberance dynamics were observed across districts in Istanbul (Doruk, 2026; Ayan and Eken, 2021). In South Africa, bubble episodes coincided with the mid-2000s credit expansion at both the national and metropolitan levels; moreover, house price shocks were shown to have asymmetric effects on consumption and to follow a contagion pattern across cities (Das, Gupta and Kanda, 2011; Muzindutsi et al., 2024). In India, long-term income and credit dynamics were found to drive housing prices, while macroprudential instruments (e.g., LTV/DSTI limits, credit growth restrictions) effectively constrained both credit and housing price surges, with tightening having a stronger impact on prices (Mahalik, Mallick, 2011; Kumar, Prabheesh and Bashir, 2022). Nevertheless, Singh (2023) state that loan-to-value (LTV) ratios are the most effective countercyclical measure for controlling housing price increases. In Brazil, lax credit standards, high intermediation costs, and aggressive financing supported by fiscal incentives during 2004–2014 fueled market excesses, creating “income transfers” through payment defaults and widespread foreclosures (Bertran and Ribeiro, 2018; Mendonça and Sachsidá, 2014). In Indonesia, speculative components were detected between 2003 and 2013, with GDP growth and credit/interest rate conditions emerging as the key determinants (Haryani and Wibowo, 2020). That said, Kurniawan and Purwono (2017) state that price movements in Indonesia are triggered both on the demand side by economic growth and inflation, and on the supply side by an imbalance arising from contractors’ increasing expected returns. Taken together, the literature suggests that (i) aggressive credit expansion and heterodox/loose monetary stances, (ii) exchange rate shocks and financial dollarization tendencies, and (iii) demand-side incentives and weak credit screening processes feed exuberance, while (iv) robust macroprudential frameworks and cautious monetary policy help mitigate these dynamics. Cross-country differences are largely explained by institutional capacity and regulatory effectiveness.

Monetary policy plays a crucial role in housing market dynamics, particularly during periods of economic uncertainty. While early-pandemic lockdowns initially caused real estate slowdowns, expansionary monetary policies later contributed to upward price pressures. McDonald and Stokes (2011) suggest that the low interest rate environment of 2001–2004 was instrumental in fueling the 2007–2009 U.S. housing crisis. Similarly, Darıcı (2018) found that Türkiye’s monetary expansion between 2010 and 2016 amplified housing price volatility and financial instability. Recent studies have

expanded the scope to international spillovers. Kolasa and Wesolowski (2023) argue that U.S. monetary expansion destabilizes housing markets in emerging economies through capital flow channels. Nguyen, Le, and Nguyen (2026) further demonstrate that expansionary U.S. monetary signals stimulate housing markets across nine major emerging economies, while contractionary signals trigger price corrections. Dawood (2024) emphasizes the strong link between credit market activity and real estate prices in emerging markets, highlighting the role of credit regulation in stabilizing housing prices. These findings align with Beraldi and Zhao (2023), who note that post-pandemic monetary expansion inflated housing prices and exacerbated inequalities, particularly for first-time buyers. Broader macroeconomic disruptions also shape real estate dynamics. Lim (2024) shows that housing markets in emerging economies are more sensitive to external shocks compared to their developed counterparts. Zhong et al. (2023) argue that lack of coordination between monetary and fiscal policies reduces the effectiveness of measures aimed at curbing real estate bubbles.

The COVID-19 pandemic profoundly disrupted real estate markets worldwide. Hansen et al. (2024) identified significant housing bubbles in the U.S. during the pandemic, with notable differences between low- and high-density areas. In Türkiye, Aliefendioğlu et al. (2022) documented both short- and long-term asymmetries between COVID-19 effects and housing prices, arguing that the pandemic exerted a positive long-term impact on housing values. Doruk (2026) examines housing price bubbles in Türkiye during the COVID-19 pandemic. The study finds that mortgage credit expansion and currency depreciation fueled bubbles, while foreign investor activity had minimal influence on prices. These studies highlight the importance of examining post-pandemic price behavior, especially in developing countries where economic responses and policy tools differ substantially from those in advanced economies.

When considered collectively, recent studies indicate that housing market exuberance in emerging economies is primarily driven by credit expansion, macroeconomic instability, and policy-induced liquidity growth. However, the magnitude and persistence of these effects differ markedly across countries due to variations in institutional quality, regulatory capacity, and macroprudential policy frameworks. This synthesis underscores the need for comparative analyses that capture how similar shocks generate distinct pricing outcomes across emerging markets—an empirical gap this study directly addresses.

Despite the growing body of research on housing market bubbles, there remains a noticeable lack of comparative studies focusing specifically on developing countries — especially the Fragile Five: Türkiye, Brazil, India, Indonesia, and South Africa. While many prior studies investigate individual markets or advanced economies, few examine how expansionary monetary policies in the post-COVID era have differentially impacted housing price dynamics across these key emerging markets. Furthermore, literature lacks comparative applications of formal testing procedures such as the GSADF test to simultaneously detect bubble episodes in multiple developing economies.

This study aims to fill this gap by conducting a cross-country analysis of explosive price behavior in the real estate markets of the Fragile Five. By examining both the timing and intensity of these price surges, the study provides insights into the effectiveness and consequences of monetary expansion in different institutional contexts. In particular, it contributes to the literature by highlighting the heterogeneity of bubble dynamics in emerging markets and offering policy-relevant implications for stabilizing real estate prices.

### **3. DATA AND METHODOLOGY**

#### **3.1. Methodology**

Various econometric techniques have been proposed to detect asset price bubbles. The traditional Phillips, Wu, and Yu (2011) (PWY) test applies a forward-recursive right-tailed Augmented Dickey-Fuller (ADF) framework to identify episodes of explosiveness. To enhance power and robustness under serial correlation and deterministic trends, subsequent adaptations have introduced Generalized Least Squares (GLS) detrending methods (Whitehouse, 2019). However, the PWY test's performance is

sensitive to initial conditions and the duration of the explosive episodes. The Time-Varying Parameter Model (TVPM) offers a nuanced approach to understanding explosive price changes, particularly in financial markets. However, it also presents several drawbacks that can complicate its application. These drawbacks include estimation bias, model complexity, and possible overfitting, which can reduce effectiveness in real-world applications (Blasques et al., 2018). Extreme Value Theory (EVT) and Quantile Regression (QR) are both utilized for detecting financial bubbles, yet they present notable drawbacks. EVT focuses on low-probability, high-impact events but can be limited by its reliance on Gaussian assumptions, which may lead to misestimations in tail events (Andreou et al., 2023). Conversely, QR, while effective in monitoring bubbles, can suffer from data sparsity issues, particularly in extreme quantiles, which complicates accurate estimation (Hou et al., 2024). The GSADF (Generalized Sup Augmented Dickey-Fuller) method offers several advantages for detecting explosive price changes. The GSADF test is more sensitive than traditional methods, allowing for the detection of subtle explosive patterns in asset prices (Montasser et al., 2018). It effectively identifies multiple bubbles within a single time frame, which is crucial for markets characterized by frequent price fluctuations. GSADF provides real-time date-stamping of bubble emergence and collapse, enabling timely intervention and risk management strategies (Long et al., 2016).

The study will employ the Generalized Supremum Augmented Dickey Fuller (GSADF) method to detect multi-period bubble formation, which was developed by Phillips et al. (2011) and expanded by Phillips et al. (2015a). This method is actually built upon the right-tailed Augmented Dickey Fuller (ADF) test. According to Evans (1991), the presence of recurrent bubbles renders conventional techniques inconsistent. Therefore, Phillips et al. (2011) devised the Supremum Augmented Dickey Fuller (SADF) test to detect explosive price behaviors. This approach relies on recursive regressions associated with sequential right-tailed unit root tests. Evidence against explosive behavior are obtained through sequential tests. Homm and Breitung (2012) observed that this method is more effective compared to conventional alternatives. The SADF method is built upon the repeated estimation of the ADF test on an advancing subsample.

If  $y_t$  is a time series with starting and ending points  $r_1$  and  $r_2$ , and a total of T observations, the window count for the time series will be  $r_2 - r_1 = r_w$ . In this case, the standard ADF equation;

$$\Delta y_t = \hat{c}_{r_1, r_2} + \hat{\beta}_{r_1, r_2} y_{t-1} + \sum_{i=1}^k \hat{\phi}_{r_1, r_2}^i \Delta y_{t-i} + \hat{\varepsilon}_t \quad (1)$$

With  $c$ ,  $\beta$ , and  $\phi$  representing the estimated parameters, the error term  $\varepsilon_t \sim N(0, \sigma^2)$ , and  $k$  denoting the lag preferred by the information criterion, this equation models the Standard Augmented Dickey Fuller (ADF) process, assuming the null hypothesis that  $y_t$  contains a unit root. Phillips et al. (2011) extended the ADF methodology to accommodate extreme behavior (Zhang et al., 2018). Through right-tailed ADF tests, explosive price behaviors can be detected, and employing the date stamp function allows the identification of the start and end points of explosive period. Within the Phillips et al. (2011) model, multiple recursive regressions are calculated over distinct sub-samples.  $r_1$  and  $r_2$  symbolize the starting and ending points, with the total number of observations ( $0 < r_1 < r_2 < 1$ ) being represented.  $r_w$  denotes the window size ( $r_w = r_2 - r_1$ ). The following equation can be used for SADF tests computed using windows expanding forward.

$$SADF(r_0) = \sup_{r_2 = [r_0, 1]} ADF_0^{r_2} \quad (2)$$

Phillips et al. (2015a, 2015b) developed the Generalized Supremum Augmented Dickey Fuller (GSADF) model based on the SADF practice. While the SADF technique employs an expanding forward window to sequentially compute explosive behaviors, its extension, GSADF, evaluates explosive price behaviors using all possible sub-samples of a time series provided by the user-defined minimum window size. Li et al. (2020) demonstrate that the GSADF approach is more likely to distinguish multiple bubbles. Classical models of exuberance, such as the fundamental model or cluster analysis, detect bubbles by referencing other price dynamics. In contrast, the GSADF method tests for the presence of a bubble using the series' own dynamics. This approach is considered a useful technique even for low observation (Gharib et al., 2021). Since the GSADF method is more effective than SADF at identifying

multiple bubbles, it is considered appropriate for the study. The following equation can be used to represent the GSADF test.

$$GSADF(r_0) = \sup_{r_2=[r_0,1], r_1=[0,r_2-r_0]} ADF_{r_1}^{r_2} \quad (3)$$

GSADF test is an extension of the conventional ADF unit root test, designed specifically to detect speculative bubbles in time series data. The test iteratively applies the ADF regression over a series of expanding and rolling windows to identify the emergence and collapse of explosive behavior in asset prices or other economic indicators. The GSADF test is constructed by iterating through  $r_2 \in [r_0, 1]$  until completion for each individual SADF. In the first step, to create the date stamp function, the estimation of equation (4) is conducted with the null hypothesis being  $\rho = 0$ .

$$\Delta y_t = \mu + \rho y_{t-1} + \sum_{j=1}^p \phi_j \Delta y_{t-j} + \mu_t \quad (4)$$

This equation represents the standard Augmented Dickey-Fuller (ADF) regression used to test for a unit root.  $\Delta y_t$  refers first difference of the time series  $y_t$  capturing short-term changes.  $\mu$  is the constant term (intercept).  $\phi_j$  indicates coefficients of lagged first differences, included to correct for serial correlation.  $\mu_t$  is the error term assumed to be white noise. In the GSADF framework, this regression is repeatedly estimated over different subsample intervals to identify periods of explosive behavior. The ADF regression is estimated repeatedly over different rolling and expanding windows. In the GSADF approach, both the starting point ( $r_1$ ) and ending point ( $r_2$ ) of the sample window vary, rather than just fixing one endpoint as in SADF. This flexibility allows GSADF to adapt to structural changes and detect multiple bubble episodes.

$$\Delta y_t^b = \sum_{j=1}^p \hat{\phi}_j \Delta y_{t-j}^b + \varepsilon_t^b \quad (5)$$

This equation illustrates the bootstrapping mechanism used to simulate critical values for inference.  $\Delta y_t^b$  is the first difference of the bootstrapped series.  $\hat{\phi}_j$  indicates coefficients estimated from the original ADF regression in Equation (4).  $\varepsilon_t^b$  is the bootstrapped residuals randomly drawn from the empirical distribution of regression residuals. This step is crucial for constructing empirical distributions under the null hypothesis and determining test thresholds.

$$M_t^b = \max_{t \in [\tau_0, \tau_0 + \tau b - 1]} (PSY_t^b) \quad (6)$$

This notation defines how the test statistic is extracted from the bootstrap samples.  $(PSY_t^b)$  test statistic computed for a bootstrapped sample at time  $t$ .  $\tau_0$  demonstrates the starting point of the rolling window.  $\tau b$  indicates number of observations in the selected subsample window.  $M_t^b$  maximum test statistic over the bootstrap sample, used for determining critical values. By collecting these maximum values across numerous bootstrapped paths, a reference distribution for the GSADF test statistic is formed.

The GSADF test is designed to enhance the flexibility and power of bubble detection by allowing both the start and end points of subsamples to vary. Unlike traditional tests, which assume a fixed window or a fixed endpoint, GSADF systematically scans through all possible windows, making it highly effective at identifying multiple bubble episodes in a time series. This method not only detects the existence of speculative bubbles but also helps in identifying their time of emergence and collapse—critical for policy response and risk management.

The study employs GSADF test with a minimum window size of 20% of the total sample size, which corresponds to the recommendations of Phillips et al. (2015a). Given the sample of approximately 60 quarterly observations (2010Q1–2024Q4), the minimum window size corresponds to roughly 12 periods. The lag length in the ADF regressions was chosen based on the Akaike Information Criterion (AIC). To ensure the robustness of the critical values, Monte Carlo simulations with 2000 replications were performed. Although the GSADF test offers advantages in identifying multiple bubbles, it may still be sensitive to small sample biases and high serial correlation. Nevertheless, its endogenous, data-

driven nature makes it more appropriate for bubble detection than traditional model-based or fundamental comparison approaches.

The dataset consists of quarterly real house price indices for the Fragile Five countries, covering the period from 2010Q1 to 2024Q4, yielding approximately 60 observations per country. This sample size is deemed sufficient for reliable recursive estimation. In line with the GSADF framework, the BSADF sequence was computed by recursively estimating the ADF statistic over all windows with lengths greater than or equal to the minimum window size. Accordingly, with a sample size of 60 and a minimum window of 12 periods, the effective BSADF sequence spans 48 recursive observations ( $60 - 12 = 48$ ). Bubble start and end dates were identified by comparing the test statistic sequence with the simulated 95% critical values. Periods where the GSADF statistic exceeded the critical value were interpreted as episodes of explosive behavior.

### 3.2. Data

The study encompasses real estate market data from the group of countries known as the "Fragile Five" namely Brazil, India, South Africa, Indonesia, and Türkiye. The reason for selecting these countries is because they share similar structural characteristics. The data is sourced from the Bank of International Settlements (BIS). The study employs the real quarterly housing index of the BIS. The data covers price movements from Q1 2010 to Q4 2024, including the pandemic period.

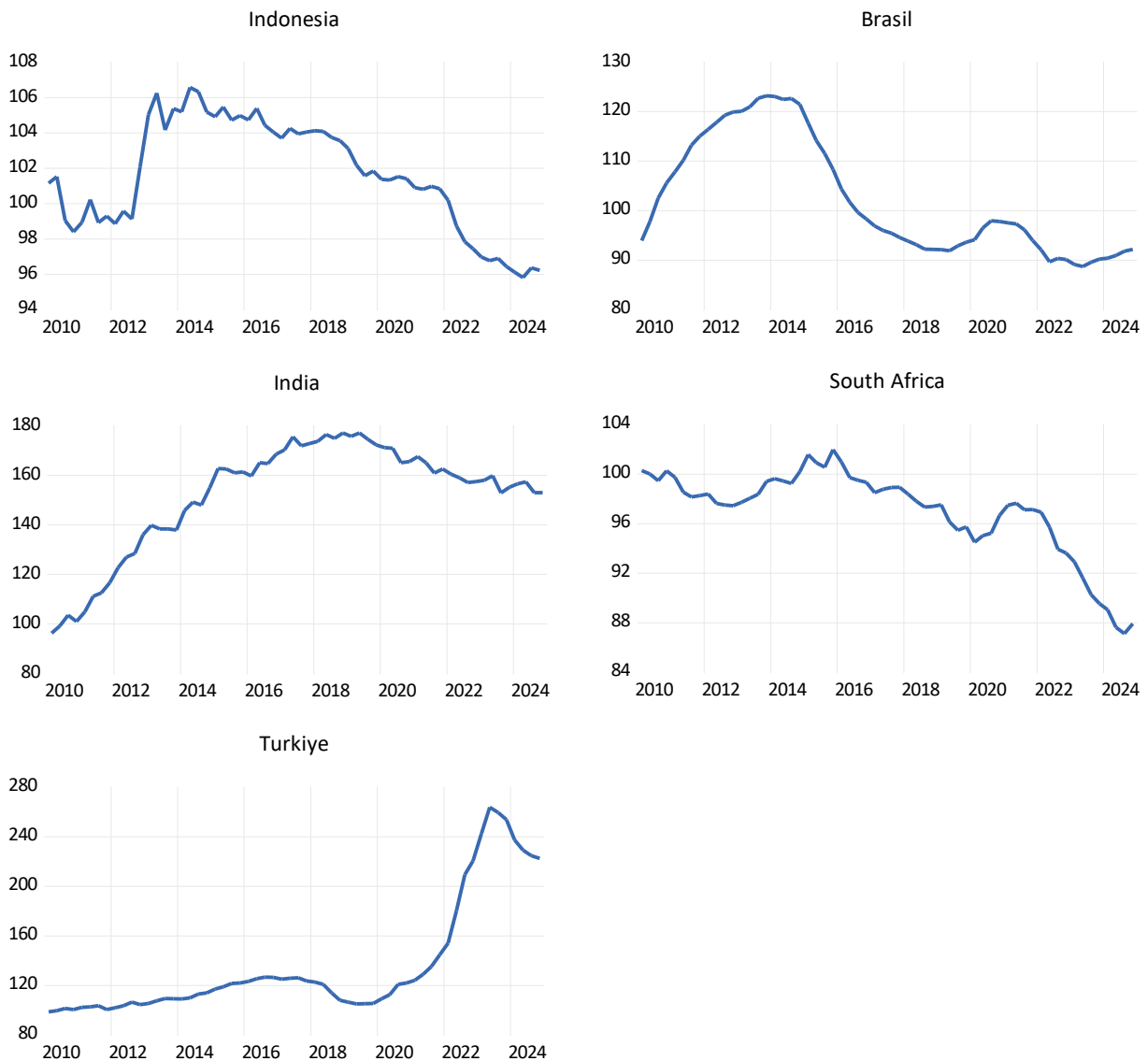
Descriptive statistical values regarding the data are presented in Table 1. The series demonstrate a considerable right-skewed and leptokurtic distribution. Nevertheless, the Jarque-Bera statistic at a 5% significance level indicates that, except for Indonesia, all countries follow a normal distribution. Figure 1 below displays graphs of all the series. Notably, in the figure, apart from Türkiye, all other countries exhibit stationarity in recent periods, whereas Türkiye experiences a marked boost following the pandemic.

**Table 1.** Descriptive statistics.

	BRASIL	INDIA	SOUTH AFRICA	INDONESIA	TÜRKİYE
Mean	102.2174	151.9269	97.00356	101.5813	136.0853
Median	97.44305	159.3018	97.76025	101.5189	119.8212
Maximum	123.1759	177.0669	101.9799	106.5637	263.7019
Minimum	88.7253	96.2271	87.1218	95.8124	98.667
Std. Dev.	11.70808	22.45907	3.523889	3.113488	47.77134
Skewness	0.639107	-1.102924	-1.32526	-0.257669	1.600083
Kurtosis	1.848566	3.167049	4.152191	1.879602	4.05064
Jarque-Bera	7.399077	12.23418	20.882	3.802166	28.36228
Probability	0.024735	0.002205	0.000029	0.149407	0.000001
Observations	60	60	60	60	60

Source: BIS

Figure 1. Graphs of series.



#### 4. RESULTS

The study applies the GSADF method to test for explosive price movements in the real estate markets of the "Fragile Five" countries. The findings indicate that although there are partially explosive price movements sign in India (IN), Indonesia (IDN), these are not statistically significant at %5 level. Figure 2 illustrates regions where the GSADF test statistic for these countries exceeds the critical value. On the other hand, explosive price movements at 1% significance level are evident in Brazil (BR), Türkiye (TR) and %5 level in South Africa. The results suggest that, despite the structural similarity among these countries, real estate prices do not exhibit similar characteristic pricing behaviors. In other words, ineffective market pricings due to explosive price movements, alongside the fundamental dynamics of the market, are evident in the markets of Brazil and Türkiye and South Africa. Nevertheless, Indonesia also exhibits episodes that can be characterized as explosive price movements at the 10% significance level. However, since a 5% significance level is commonly adopted in studies employing this methodology, these episodes are not deemed statistically significant.

**Table 2.** GSADF test statistics.

Test		BR	IN	ID	ZA	TR
GSADF		2.803073***	0.396666	1.681236*	2.029848**	8.296724***
Prob.		0.005	0.63	0.08	0.036	0.00
GSADF Critical Value	99%	2.664496	2.664496	2.664496	2.664496	2.664496
	95%	1.865078	1.865078	1.865078	1.865078	1.865078
	90%	1.560398	1.560398	1.560398	1.560398	1.560398

Notes: (\*\*\*, \*\*, \*) indicates significant series at %1, %5, %10 level respectively. The minimum window size was set at 12 observations, corresponding to 20% of the total sample. Accordingly, the BSADF sequence was computed over 48 recursive observations, obtained by subtracting the minimum window size from the full sample of 60 observations.

Table 3 presents the periods characterized by explosive price movements. Specifically, a single period spanning 16 quarters, from 2015Q4 to 2019Q3, reveals significant price fluctuations in the context of Brazil's financial market. In contrast, South Africa exhibits one collapsing episodes of explosive price behavior, spanning a total of seven quarters. Compared to other countries, this represents a relatively short duration of explosive episodes. On the other hand, Türkiye experienced three distinct episodes of explosive price behavior, encompassing either upward, downward, or combined movements. These episodes occurred during the periods 2015Q1–2016Q4, 2018Q4–2019Q3, and 2021Q4–2024Q2, collectively spanning 23 quarters. This duration is distinctly longer than in other countries, highlighting a key difference that merits attention.

Furthermore, Figure 2 includes a graphical representation illustrating the historical GSADF critical values. Instances where the GSADF value surpasses the critical threshold signify the presence of explosive price movements. Consequently, while the GSADF test statistic exceeds the critical value for Indonesia and India these instances are not statistically significant enough to be labelled as explosive price movements.

In Figure 3, the key monetary policy mechanisms employed by countries' central banks are depicted, focusing on the inflation-adjusted policy interest rates. A negative value in this rate can be interpreted as a signal of monetary expansion. When viewed in the context of market price movements, it is observed that the collapse in price bubbles in both Brazil and Türkiye and South Africa occurred during periods of contractionary monetary policy. On the other hand, the explosive behavior stemming from rising market movements in Türkiye during the other two periods occurred during an expansionary monetary policy phase. Appendix 1 shows credit growth in non-financial sectors. From Turkey's perspective, it can be seen that in 2020, the year the pandemic began, the credit-to-GDP ratio increased by 17%. Throughout the pandemic, there is a notable prevalence of explosive price movements in the Turkish financial market, while no extreme fluctuations were witnessed in other countries. In comparison to other countries, this situation may stem from Türkiye's historical record of a remarkably widened gap between its policy interest rate and inflation. However, attributing such significant price exuberance solely to monetary policy would be an oversimplification.

Another factor contributing to the divergent housing pricing behavior between Türkiye and other countries is inflation and the depreciation of the local currency. In recent years, Türkiye has experienced a continuous rise in price levels, leading individuals to prioritize housing investments as a means of preserving value (Doruk, 2026). All countries within the Fragile Five exhibit sensitivity to exchange rate volatility; however, Türkiye stands out distinctly among other emerging economies due to its substantial depreciation of the national currency. Consequently, a significant portion of recent housing investments in Türkiye can be considered value-preserving endeavors due to the ongoing depreciation of the Turkish lira. Implementing monetary and fiscal policies to protect the value of the Turkish lira could help control inflation and stabilize housing prices, thereby preventing explosive price movements (Berk et al., 2022).

Additionally, foreign purchases have recently been identified as factors contributing to the increase in house prices in Türkiye (Salami et al., 2023). As can be seen in Appendix 2, according to TUIK data, residential property sales to foreigners in Turkey in 2022 accounted for nearly 5% of total sales. Over the past decade, the facilities and incentives provided for foreigners to purchase houses have significantly increased the number of foreign nationals acquiring property in Türkiye (Ghaedrahmati & Rezaei, 2024). While these incentives were designed to invigorate the market, they have the potential to create pricing dynamics that could upset the balance of housing prices. Therefore, imposing restrictions on international capital flows in housing purchases, especially during periods of market upturns, could be beneficial in ensuring price stability. Moreover, international migration and refugee crises have also significantly increased the demand for housing in recent years (Sunata et al., 2024).

Nevertheless, attributing the recent explosive price movements in Türkiye solely to monetary policy or any other factor would be a reductionist approach. Ignoring the adverse effects of recent natural disasters, regional conflicts, and large-scale migration flows would hinder a proper understanding of the issue. The severe imbalances observed in Türkiye are not the outcome of a single factor, but rather the combined effect of multiple adverse components and policy choices.

In contrast, the explosive price behavior in Brazil seemed to have resulted from the uncontrolled growth of home loans and the issuance of excessive and careless credit to individuals lacking repayment capacity. Between 2005 and 2008, Brazil's housing sector experienced significant activity due to credit expansion and government support (Besarria et al., 2021). However, the 2008 global economic crisis strained the economy, leading to reduced government subsidies and resulting in sudden declines (Bertran & Ribeiro, 2018).

Since 2022, the South African housing market has undergone a sharp decline in real property prices, signaling a potential correction driven by macroeconomic imbalances and the effects of monetary tightening. According to Lekhuleni and Ndlovu (2023), while house prices in South Africa generally exhibit a stable long-run relationship with fundamental macroeconomic variables such as GDP, interest rates, and inflation, temporary deviations are expected to self-correct over time. However, the magnitude and persistence of the recent downturn suggest a deeper structural shift rather than a routine market fluctuation. This aligns with the findings of Mwanypedza and Mishi (2024), who highlight the contractionary effects of South Africa's inflation-targeting regime, where rising interest rates significantly reduce housing demand and investment appetite. Additionally, Marire (2024) identifies regime-switching dynamics between high-interest/low-price and low-interest/high-price environments, emphasizing the interactive role of house prices and policy rates in household debt behavior. The convergence of these factors likely triggered an explosive adjustment phase in the market, indicative of broader financial fragilities and the housing sector's sensitivity to policy shocks.

The relatively low volatility observed in Indonesia's housing market can be attributed to a multifaceted combination of structural and policy-driven factors, as evidenced by recent studies. The structural VAR model by Dąbrowski and Widiartoro (2023) demonstrates that macroprudential Loan-to-Value (LTV) restrictions have effectively curtailed credit expansion, thereby limiting the formation of housing price bubbles. Similarly, Khoirudin and Kurniawan (2023) show that the sensitivity of housing prices to inflation-targeting policy has helped stabilize price fluctuations in the residential sector. In addition, the study by Igamo et al. (2022) highlights the dominant role of fundamental economic variables such as income and population over speculative dynamics, indicating a demand structure grounded in real economic activity. Besides, Karlina et al. (2024) underscore the role of institutional and local government interventions in planning and supply regulation, which contribute to broader market stability. Taken together, these findings suggest that Indonesia's stable housing market is supported by the effectiveness of financial regulation, responsiveness to monetary policy, a fundamentals-based demand structure, and institutional capacity.

Recent empirical evidence suggests that India's residential housing market exhibits relatively lower price volatility compared to other Fragile Five economies, a stability that can be attributed to the

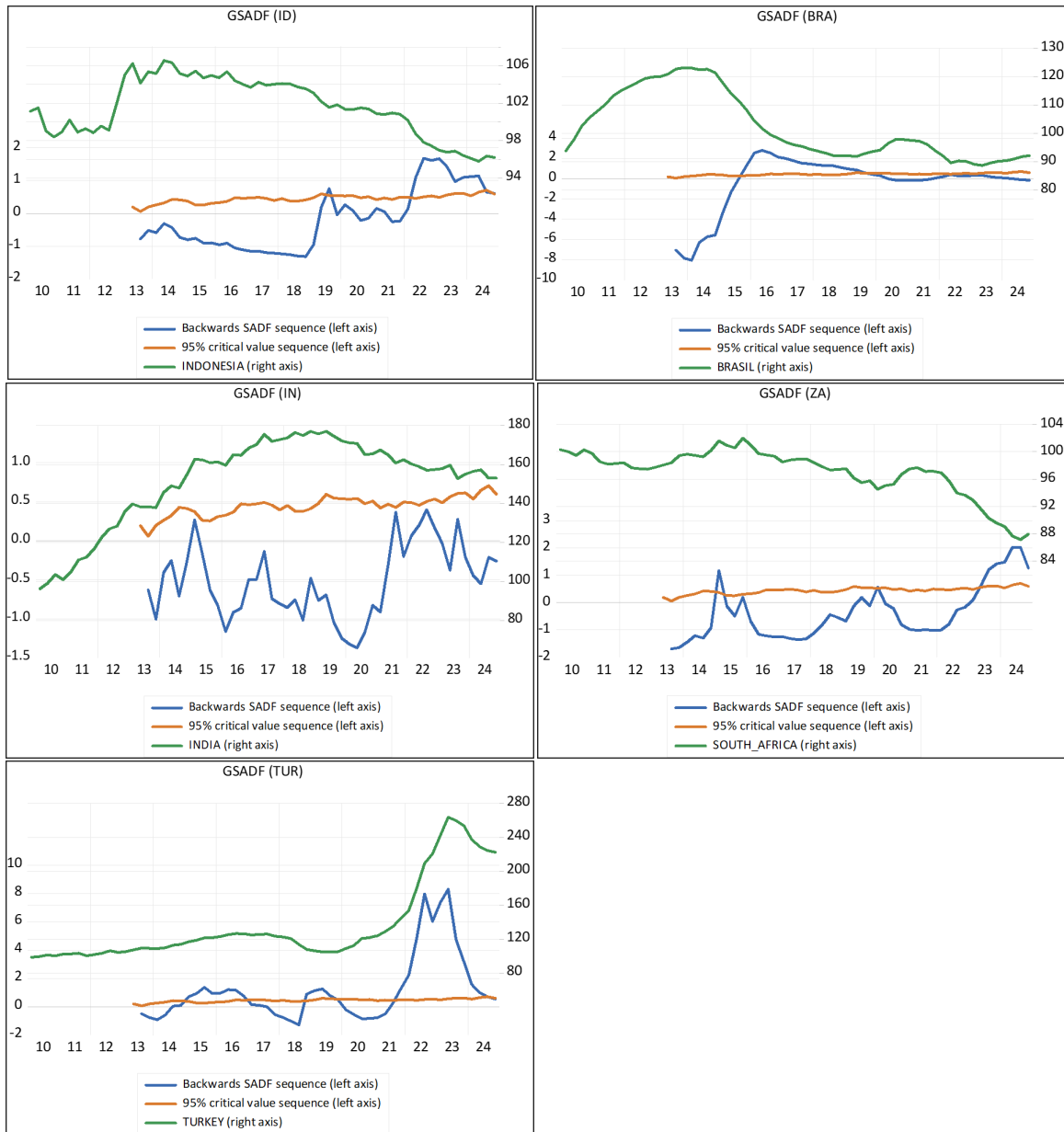
effective deployment of macroprudential policies and structural market characteristics. Singh (2023) identifies loan-to-value (LTV) ratios as the most potent countercyclical tool in moderating housing price growth, especially for large-sized, investment-driven mortgages, thus limiting speculative excesses. Complementing this, Kumar, Prabheesh, and Bashar (2022) affirm that macroprudential policy tightening significantly curbs housing credit and price appreciations across Indian cities, highlighting the policy's asymmetric efficiency. Additionally, Pani (2024) underscores the dominance of long-term fundamentals such as household wealth over speculative drivers in metropolitan housing dynamics, reinforced by India's low-leverage market structure. This institutional design, marked by higher buyer equity contributions and regulatory constraints, serves as a buffer against bubble formation. Furthermore, Dugar et al. (2024) demonstrate that smaller cities in India show relative resilience to structural shocks post-COVID-19, suggesting localized market stability. Mehta, Gupta, and Maitra (2023) reveal that although COVID-19 induced asymmetries in price adjustments, the long-term housing price response remained subdued due to swift government interventions and macroeconomic controls. Together, these studies indicate that India's housing market volatility is dampened not by absence of shocks, but by the presence of robust, policy-driven stabilizers and market fundamentals.

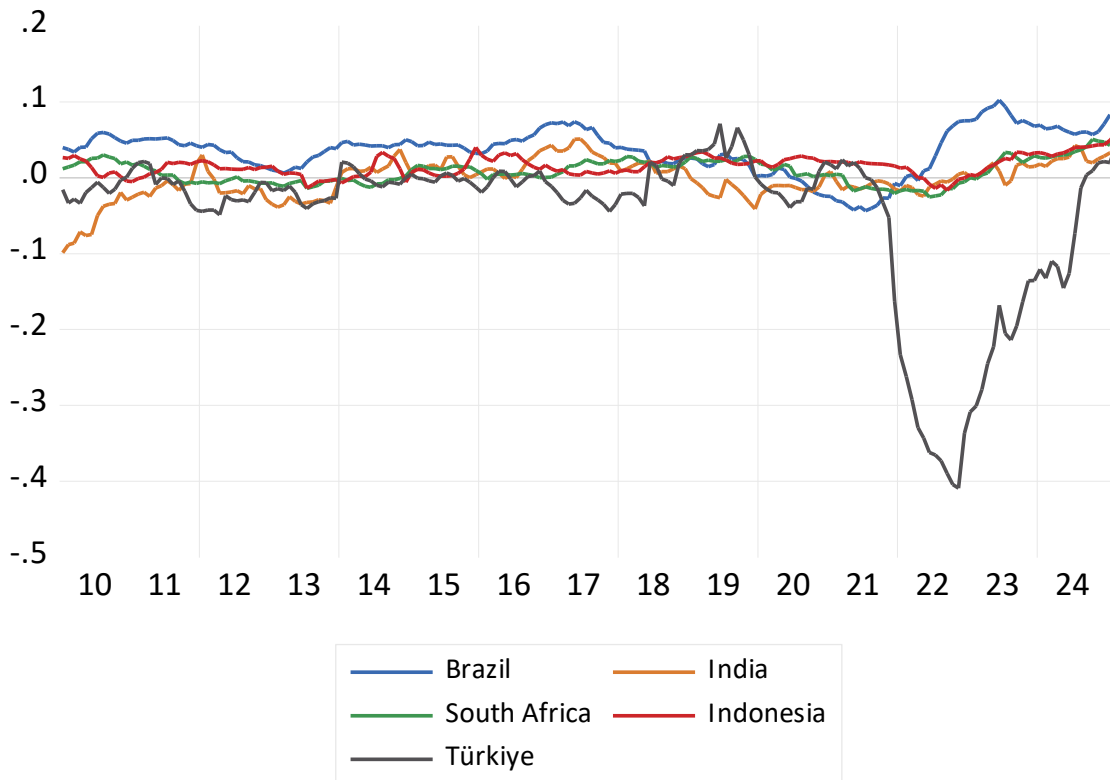
Even though the results indicate that monetary policy has a considerable influence on explosive price movements in housing markets, attributing such dynamics solely to monetary policy would be overly simplistic. As demonstrated in the cases of Indonesia and India, the destabilizing effects of monetary policy can be mitigated when complemented by prudential measures such as LTV and DSTI limits, or by structural reforms aimed at increasing housing supply. Implementing such a comprehensive policy mix is likely to provide the most effective framework for keeping housing prices under control. While our findings emphasize the stabilizing role of macroprudential and monetary policies, it is important to acknowledge that housing bubbles and explosive price dynamics are rarely the outcome of a single driver.

**Table 3.** *Bubble periods.*

Country	Period	Duration (Quarter)
BRA	2015Q4-2019Q3	16
Total		16
TR	2015Q1-2016Q4	8
	2018Q4-2019Q3	4
	2021Q4-2024Q2	11
Total		23
ZA	2023Q2-2024Q4	7
Total		7

Figure 2. GSADF test and critical values.



**Figure 3.** Degree of monetary easing by countries.

#### 4. CONCLUSION

In this study, explosive price movements in the real estate markets of developing countries have been comparatively analyzed. The study covers quarterly data from 2010Q1 to 2024Q4 for the fragile five countries classified as Brazil, Indonesia, South Africa, India, and Türkiye. These countries are referred to as the "fragile five" due to shared structural vulnerabilities such as current account deficits, inflation, and dependence on foreign investments. Therefore, comparing the characteristic features of real estate prices in these countries provides valuable insights both for the literature and the market. The findings of the study indicate that there were no statistically significant signs of explosive price movements in the real estate markets of Indonesia and India during the examined periods. In contrast, Brazil and South Africa each experienced one instance of such pricing behavior, while Türkiye showed several occurrences across three separate timeframes. These differing quarterly intervals suggest that, despite sharing similar structural features, the real estate markets in these countries display notable differences. On the other hand, in the pandemic period, while other countries outside of Türkiye experienced a relatively stable trend in their real estate markets, Türkiye saw a significant upward movement. This situation has led to a pronounced level of explosive pricing behavior. As a result, it is observed that the real estate market pricing characteristics of the Fragile Five countries diverge from Türkiye. One possible reason for this divergence could be the credit incentives and monetary expansion, particularly during the pandemic period.

The results of this study align with and expand upon a broad set of international evidence. Doruk (2026) and Ayan and Eken (2021) document persistent exuberance episodes in Türkiye, in line with our detection of repeated explosive dynamics. Similarly, Das, Gupta, and Kanda (2011) and Muzindutsi et al. (2024) show that housing price bubbles in South Africa's housing market are triggered by demand-side factors, such as credit expansion, and are sustained by supply-side rigidities. In contrast, the absence of significant explosive behavior in India echoes Mahalik and Mallick (2011) and Kumar, Prabheesh, and Bashar (2022), who attribute stability to effective macroprudential interventions. The single bubble episode found in Brazil is compatible with Bertran and Ribeiro (2018) and Mendonça and Sachsida (2014), who emphasize lax credit standards and fiscal incentives. Beyond country-specific

studies, global factors reinforce these patterns: U.S. quantitative easing amplified mortgage credit and housing prices in Latin America (Kolasa & Wesołowski, 2023), while Fed tightening shocks created heterogeneous spillovers across emerging markets, with capital controls mitigating the impact (Nguyen, Le, & Nguyen, 2026). On the structural side, bank credit and housing prices display a mutually reinforcing relationship in emerging markets (Dawood, 2024). Finally, the literature stresses the importance of institutional strength: the alignment of macroprudential and monetary policy enhances the effectiveness of regulatory measures in curbing house price booms (Zhong et al., 2023). Taken together, these findings suggest that both global shocks and domestic institutional responses are decisive in shaping the heterogeneous bubble dynamics observed across the Fragile Five.

When evaluating real estate prices from the multinational perspective, investigating the destabilizing effects on real estate prices that directly impact all other goods and services prices could be useful in preventing disruptive price formations. Indeed, the 2008 crisis originated primarily from the real estate sector, transitioned to the financial sector, and subsequently encompassed the entire economy. Putting an end to policies that destabilize the market would yield benefits in terms of both price and financial stability. Stable housing prices are crucial for economic stability and overall market health. Fluctuations in housing prices can lead to significant economic repercussions, including increased delinquency rates and reduced consumer confidence. Substantial fluctuations in Türkiye's exchange rates and inflation prompt individuals to view housing investments as a means of value preservation and speculative opportunity. Stabilizing the general price level can indirectly stabilize housing prices, mitigating abrupt market fluctuations. Additionally, initiatives such as citizenship or visa liberalization for foreign nationals in exchange for real estate investment have recently gained popularity; however, they may disrupt the supply-demand balance and lead to price surges. Temporarily suspending or adjusting these policy requirements could help maintain price stability. Policies addressing international migration and refugee crises may also contribute to market stabilization. In Brazil, government incentives and reduced loan costs have stimulated the housing market, resulting in significant price increases and heightened economic vulnerabilities. Notably, extending substantial loans to individuals lacking repayment capacity can destabilize housing prices. Financial institutions must exercise caution in credit allocation to manage market fluctuations and maintain stability. Previously implemented expansionary credit policies, political uncertainty, and income inequality have contributed to explosive housing price behavior. In South Africa, high household indebtedness and social vulnerability have triggered abrupt fluctuations in real estate prices. In all three countries, the observed disconnect between housing price dynamics and fundamental economic indicators highlights underlying structural fragilities in their housing markets.

Drawing on the successful experiences of India and Indonesia, several policy recommendations emerge for countries exhibiting speculative housing price behavior. These include the dynamic use of macroprudential tools such as adjustable loan-to-value (LTV) limits, tighter control over housing credit growth, and regulatory frameworks that ensure demand is driven by genuine housing needs rather than speculative motives. Furthermore, stronger coordination between central and local governments in urban planning and housing supply can help stabilize prices. Limiting foreign demand during periods of exuberance and providing targeted housing subsidies only for primary residence purchases may also curb price distortions.

The policy implications can be organized across complementary time horizons. Short-term measures should prioritize the prompt containment of speculative pressures through the dynamic tightening of LTV and DTI limits, stricter mortgage eligibility criteria, and temporary adjustments to risk weights and capital buffers to restrain excessive credit growth. Medium-term measures require strengthening monetary–fiscal coordination, refining macroprudential frameworks, and recalibrating housing-related tax incentives and foreign-investment programs to ensure that credit, interest rate policies, and fiscal interventions operate coherently. Long-term measures should focus on enhancing housing supply elasticity by reforming land-use regulations, streamlining zoning and permitting processes, and improving institutional capacity so that structural rigidities do not amplify future price

cycles. Collectively, these short-, medium-, and long-term actions offer a comprehensive policy framework to mitigate speculative housing dynamics observed in several Fragile Five economies.

This study also has certain limitations. The first of these is that the countries selected in this research represent the so-called 'Fragile Five' group, which is a specific cluster of emerging economies characterized by structural vulnerabilities such as dependence on international capital flows and current account deficits. Therefore, generalizing the findings of this study to all emerging markets may lead to misleading conclusions. Moreover, due to limitations in the availability of international data, quarterly data have been used. A study based on monthly data could allow for a clearer observation of bubble formation periods. Additionally, the time span of the study covers not only tranquil periods but also extraordinary phases such as wars, natural disasters, and energy shortages, the impacts of which are not homogeneous across countries. An additional methodological limitation relates to the GSADF test itself: as widely documented in the literature, GSADF statistics are sensitive to sample size, window selection, and the presence of structural breaks. This sample-dependence implies that bubble detection outcomes may vary under alternative specifications or with higher-frequency data, and therefore the results should be interpreted with appropriate caution.

Future research could expand upon this study in several directions. First, extending the sample to a broader set of emerging and frontier markets would enable a more comprehensive evaluation of explosive price dynamics across diverse institutional settings. Second, novel structural break models or structural VAR frameworks could be employed to test the robustness of the present findings while offering deeper insights into causality and dynamic responses. Third, a comprehensive panel study that examines the relationship between macroeconomic indicators and housing prices in countries experiencing explosive price movements would provide a deeper understanding of the results presented here. Moreover, cross-country comparative studies that explicitly incorporate institutional dimensions—such as land-use regulations, housing supply elasticity, and macroprudential alignment with monetary policy—would further enrich our understanding of heterogeneous housing market outcomes. Collectively, such avenues of inquiry would strengthen the external validity of current findings and provide valuable guidance for policymakers in emerging market economies.

### Disclosure Statements

1. The author of this article confirm that their work complies with the principles of research and publication ethics.
2. No potential conflict of interest was reported by the author.
3. This article was screened for potential plagiarism using a plagiarism screening program.

### REFERENCES

- Aliefendioğlu, Y., Tanrıvermiş, H., & Salami, M. A. (2022). House price index (HPI) and Covid-19 pandemic shocks: Evidence from Türkiye and Kazakhstan. *International Journal of Housing Markets and Analysis*, 15(1), 108-125. <https://doi.org/10.1108/IJHMA-10-2020-0126>
- Andreou, P. C., Anyfantaki, S., Maasoumi, E., & Sala, C. (2023). Extremal quantiles and stock price crashes. *Econometric Reviews*, 42(9- 10), 703- 724. <https://doi.org/10.1080/07474938.2023.2241223>
- Asadov, A. I., Ibrahim, M. H., & Yildirim, R. (2023). Impact of house price on economic stability: Some lessons from OECD countries. *The Journal of Real Estate Finance and Economics*, 2023, 1-31. <https://doi.org/10.1007/s11146-023-09945-0>
- Ayan, E., & Eken, S. (2021). Detection of price bubbles in Istanbul housing market using LSTM autoencoders: a district-based approach. *Soft Computing*, 25(12), 7957-7973. <https://doi.org/10.1007/s00500-021-05677-6>
- Balcilar, M., Katzke, M. N., & Gupta, R. (2018). Date-stamping US housing market explosivity. *Economics*, 12, 1-34. <http://dx.doi.org/10.5018/economics-ejournal.ja.2018-18>

- Beraldi, F., & Zhao, M. Y. (2023). The pricing-out phenomenon in the US housing market. *International Monetary Fund Working Paper*, 2023/001, <https://doi.org/10.5089/9798400229039.001>
- Berk, N., Biçen, S., & Seyidov, N. (2022). Study on measuring of real estate speculative bubble: Evidence from Türkiye. *European Journal of Multidisciplinary Studies*, 7(1), 18- 25. <https://doi.org/10.26417/ejms.v5i1.p334-338>
- Bertran, M. P. C., & Ribeiro, I. P. (2018). Brazilian housing bubble: Overpriced homes, subprime credit and overwhelming income transfer. *Revista de Direito da Cidade*, 10(3), 1521–1541. <https://doi.org/10.12957/rdc.2018.33060>
- Besarria, C., Silva, M., & Jesus, D. (2021). News shocks, government subsidies and housing prices in Brazil. *International Journal of Housing Markets and Analysis*, 14(1), 157-177. <https://doi.org/10.1108/IJHMA-02-2020-0011>
- Blasques, F., Koopman, S. J., & Nientker, M. (2022). A time-varying parameter model for local explosions. *Journal of Econometrics*, 227(1), 65-84. <https://doi.org/10.1016/j.jeconom.2021.05.008>
- Case, K. E., Quigley, J. M., & Shiller, R. J. (2005). Comparing wealth effects: The stock market versus the housing market. *Advances in Macroeconomics*, 5(1), 1–32. <https://doi.org/10.2202/1534-6013.1235>
- Dağbrowski, M. A., & Widianoro, D. M. (2023). Effectiveness and conduct of macroprudential policy in Indonesia in 2003–2020: Evidence from the structural VAR models. *Eurasian Economic Review*, 13, 703–731. <https://doi.org/10.1007/s40822-023-00244-w>
- Darıcı, B. (2018). Para politikası ve konut fiyatları ilişkisi: Türkiye ekonomisi için ampirik bir analiz. *Anemon Muş Alpaslan Üniversitesi Sosyal Bilimler Dergisi*, 6(18), 221-228. <https://dergipark.org.tr/tr/pub/anemon/issue/39147/452706>
- Das, S., Gupta, R., & Kanda, P. T. (2011). Bubbles in south African house prices and their impact on consumption. *Journal of Real Estate Literature*, 19(1), 69- 91. <https://doi.org/10.1080/10835547.2011.12090282>
- Dawood, T. C. (2024). The short-and long-run relationship between house prices and bank credit in developed and emerging market economies: A comparative study. *Panoeconomicus*, 71(2), 163-190. <https://doi.org/10.2298/PAN181004012D>
- DeFusco, A. A., Nathanson, C. G., & Zwick, E. (2022). Speculative dynamics of prices and volume. *Journal of Financial Economics*, 146(1), 205-229. <https://doi.org/10.1016/j.jfineco.2022.07.002>
- Doruk, Ö. T. (2026). Exploring the determinants of housing price bubbles in the Turkish economy: a COVID-related framework. *International Journal of Housing Markets and Analysis*, 19(1), 23–42. <https://doi.org/10.1108/IJHMA-05-2024-0073>
- Dugar, M., Humnekar, T. D., & Moovendhan, V. (2024). Analyzing pre- and post-pandemic housing market trends in India: A quasi-experimental approach using ITS and panel data analysis. *International Real Estate Review*, 27(3), 393–411. <https://doi.org/10.53383/100388>
- Engsted, T., Hviid, S. J., & Pedersen, T. Q. (2016). Explosive bubbles in house prices? Evidence from the OECD countries. *Journal of International Financial Markets, Institutions & Money*, 40, 14-25. <https://doi.org/10.1016/j.intfin.2015.07.006>
- Evans, G.W. (1991). Pitfalls in testing for explosive bubbles in asset prices. *The American Economic Review*, 81(4), 922–930. <https://www.jstor.org/stable/2006651>
- Evgenidis, A., & Malliaris, A. (2023). House Bubbles, global imbalances and monetary policy in the US. *Journal of International Money and Finance*, 138. <https://doi.org/10.1016/j.jimonfin.2023.102919>
- Ghaedrahmati, S., & Rezaei, E. (2024). Türkiye, the second home for Iranians: push and pull motivations in Turkish housing market. *Journal of European Real Estate Research*, 17(1), 123-136. <https://doi.org/10.1108/JERER-06-2023-0019>

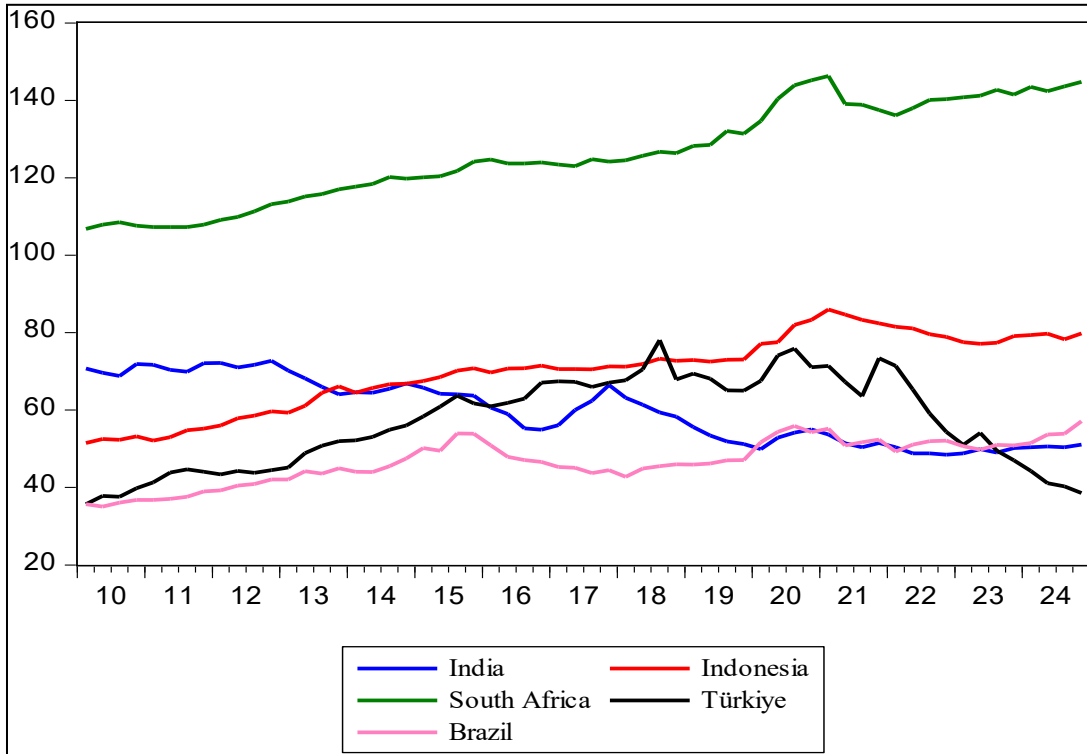
- Gharib, C., Mefteh-Wali, S., Serret, V., & Jabeur, S. B. (2021). Impact of COVID-19 pandemic on crude oil prices: Evidence from Econophysics approach. *Resources Policy*, 74, 1-17. <https://doi.org/10.1016/j.resourpol.2021.102392>
- Gomez- Gonzalez, J. E., Gamboa-Arbeláez, J., Hirs-Garzón, J., & Pinchao-Rosero, A. (2016). When bubble meets bubble: Contagion in OECD countries. *The Journal of Real Estate, Finance and Economics*, 56, 546-566. <https://doi.org/10.1007/s11146-017-9605-4>
- Graczyk, A., & Phan, T. (2021). Regressive welfare effects of housing bubbles. *Macroeconomic Dynamics*, 25(8), 2102-2127. <https://doi.org/10.1017/S1365100519000981>
- Hansen, J. H., Møller, S. V., Pedersen, T. Q., & Schütte, C. M. (2024). House price bubbles under the Covid- 19 pandemic. *Journal of Empirical Finance*. 75, <https://doi.org/10.1016/j.jempfin.2023.101462>
- Haryani, R., & Wibowo, A. (2020). Identification of Real Estate Bubbles in Indonesia. *International Journal of Innovation, Creativity and Change*, 11(9), 165-179.
- Hirano, T., Inaba, M., & Yanagawa, N. (2015). Asset bubbles and bailouts. *Journal of Monetary Economics*, 76, 71–89. <https://doi.org/10.1016/j.jmoneco.2015.09.008>
- Homm, U., & Breitung, J. (2012). Testing for speculative bubbles in stock markets: A comparison of alternative methods. *Journal of Financial Econometrics*. 10(1), 198- 231. <https://doi.org/10.1093/jfinec/nbr009>
- Hou, Y., Leng, X., Peng, L., & Zhou, Y. (2024). Panel quantile regression for extreme risk. *Journal of Econometrics*, 240(1). <https://doi.org/10.1016/j.jeconom.2024.105674>
- Igamo, A. M., Azwardi, A., Saputra, A., Ismail, R. G., & Melliny, V. D. (2022). Monetary policy and demographics: Empirical evidence for housing prices in Indonesia. *Sriwijaya International Journal of Dynamic Economics and Business*, 6(4), 371–384. <https://doi.org/10.29259/sijdeb.v6i4.371-384>
- Karlina, N., Rusli, B., & Muharam, R. S. (2024). Institutional housing and residential development: Lesson learning from Indonesia. *International Journal of Religion*, 5(11), 8647–8654. <https://doi.org/10.61707/dprkfd11>
- Kartal, G. (2024). Did the February 6-7 Türkiye Earthquake Trigger a Housing Market Bubble? Empirical Insights from Right-tailed Unit-root Tests. *İstanbul İktisat Dergisi*, 74(2), 461-489. <https://doi.org/10.26650/ISTJECON2024-1465715>
- Khoirudin, R., & Kurniawan, M. L. A. (2023). A time-varying of property residential price in Indonesia: A VAR approach. *Jurnal Ekonomi & Studi Pembangunan*, 24(1), 69- 80. <https://doi.org/10.18196/jesp.v24i1.17750>
- Kolasa, M., & Wesolowski, G. (2023). Quantitative easing in the US and financial cycles in emerging markets. *Journal of Economic Dynamics and Control*, 149. <https://doi.org/10.1016/j.jedc.2023.104631>
- Kumar, S., Prabheesh, K. P., & Bashar, O. (2022). Examining the effectiveness of macroprudential policy in India. *Economic Analysis and Policy*, 75, 91–113. <https://doi.org/10.1016/j.eap.2022.04.011>
- Kurniawan, A., & Purwono, R. (2017). Property Price Bubble: Regional Analysis in Indonesia. *Journal of Developing Economies*, 2(1), 1–15. <https://doi.org/10.20473/jde.v2i1.5707>
- Lekhuleni TI, Ndlovu G (2023) The dynamic effect of macroeconomic factors on housing prices: Evidence from South Africa. *PLOS ONE* 18(11). <https://doi.org/10.1371/journal.pone.0290552>
- Li, Y., Chevallier, J., Wei, Y., & Li, J. (2020). Identifying price bubbles in the US, European and Asian natural gas market: Evidence from a GSADF test approach. *Energy Economics*, 87, 1-9. <https://doi.org/10.1016/j.eneco.2020.104740>
- Liang, Y. (2024). Bubble in the real estate market and its risks to macroeconomy: A case study of the United States. *Advances in Economics, Management and Political Sciences*, 125(1), 72–76. <https://doi.org/10.54254/2754-1169/2024.17788>

- Lim, H. (2024). Debt vulnerabilities and house price responses to external shocks. *Finance Research Letters*, 63. <https://doi.org/10.1016/j.frl.2024.105389>
- Long, W., Li, D., & Li, Q. (2016). Testing explosive behavior in the gold market. *Empirical Economics*, 51, 1151-1164. <https://doi.org/10.1007/s00181-015-1030-z>
- Mahalik, M. K., & Mallick, H. (2011). What Causes Asset Price Bubble in an Emerging Economy? Some Empirical Evidence in the Housing Sector of India. *International Economic Journal*, 25(2), 215–237. <https://doi.org/10.1080/10168737.2011.586806>
- Marire, J. (2024). Interactive influence of house prices and the repo rate on household debt in South Africa. *Journal of Economic Analysis*, 3(1), 58–78. <https://doi.org/10.58567/jea03010003>
- McDonald, J. F., & Stokes, H. H. (2011). Monetary policy and the housing bubble. *Journal of Real Estate Finance and Economics*, 46, 437-451. <https://doi.org/10.1007/s11146-011-9329-9>
- Mehta, N., Gupta, S., & Maitra, S. (2023). House prices and COVID-19 pandemic shocks in India: A nonlinear ARDL analysis. *International Journal of Housing Markets and Analysis*, 16(3), 513–534. <https://doi.org/10.1108/IJHMA-02-2022-0026>
- Mendonça, M. J., & Sachida, A. (2014). Is there a bubble in Brazilian real estate market? *MISES: Interdisciplinary Journal of Philosophy, Law and Economics*, 2(1), 109- 138. <https://doi.org/10.30800/mises.2014.v2.585>
- Mikhed, V., & Zemčík, P. (2009). Testing for bubbles in housing markets: A panel data approach. *The Journal of Real Estate Finance and Economics*, 38, 366-386. <https://doi.org/10.1007/s11146-007-9090-2>
- Montasser, G., Naoui, K., & Fry, J. (2018). Speculative bubbles or explosive fundamentals in stock prices? New evidence from SADF and GSADF tests. *Journal of Statistics and Management Systems*, 21(1), 93-106. <https://doi.org/10.1080/09720510.2017.1401799>
- Muñoz, S. F., & Cueto, L. C. (2017). What has happened in Spain? The real estate bubble, corruption and housing development: A view from the local level. *Geoforum*, 85, 206-213
- Muzindutsi, P.-F., Mbhele, N., Gopal, T., Rambaran, N., Mthembu, T., Ramjiyavan, P. J., & Dube, F. (2024). A comparative analysis of housing price bubbles in the South African major cities. *International Journal of Economic Policy in Emerging Economies*, 20(3-4), 265–277. <https://doi.org/10.1504/IJEPEE.2024.142492>
- Mwanyepedza, R. & Mishi, S. (2024), Short-run dynamics and long-run effects of monetary policy on residential property prices in South Africa. *International Journal of Housing Markets and Analysis*, 17(7), 1-26. <https://doi.org/10.1108/IJHMA-09-2023-0126>
- Navickas, V., Skripkiunas, T., & Vida, I. (2022). The identification of spatial bubbles in a real estate market. *Journal of International Students*, 15(1), 197–210. <https://doi.org/10.14254/2071-8330.2022/5-1/13>
- Nguyen, T. B., Le, C. V., & Nguyen, T. A. D. (2026). Spillovers of US monetary policy shocks on housing prices in nine emerging economies and their stabilizing capital controls. *International Journal of Housing Markets and Analysis*, 19(1), 131–149. <https://doi.org/10.1108/ijhma-06-2024-0089>
- Pani, S. S. (2024). House price dynamics under lower leverage: The case of metropolitan cities in India. *International Journal of Housing Markets and Analysis*, 17(3), 814–836. <https://doi.org/10.1108/IJHMA-10-2022-0161>
- Phillips, P. C. B., Shi, S., & Yu, J. (2015a). 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>
- Phillips, P. C. B., Shi, S., & Yu, J. (2015b). Testing for multiple bubbles: Limit theory of realtime detectors. *International Economic Review*, 56(4), 1079–1134. <https://doi.org/10.1111/iere.12131>

- Phillips, P. C. B., Wu, Y., & Yu, J. (2011). Explosive behavior in the 1990s Nasdaq: When did exuberance escalate asset values? *International Economic Review*, 52(1), 201- 226. <https://doi.org/10.1111/j.1468-2354.2010.00625.x>
- Romero, J., Jiménez, F., & Villoria, M. (2012). (Un)sustainable territories: Causes of the speculative bubble in Spain (1996–2010) and its territorial, environmental, and sociopolitical consequences. *Environmental and Planning C: Politics and Space*, 30(3), 467–486. <https://doi.org/10.1068/c11193r>
- Salami, M. A., Tanrivermis, H., & Aliefendioğlu, Y. (2023). Interdependence between foreigner housing acquisitions and housing price increase in Türkiye during the COVID-19 pandemic era. *International Journal of Housing Markets and Analysis*, 16(3), 575-597. <https://doi.org/10.1108/IJHMA-08-2022-0109>
- Singh, B. (2023). Housing prices and macroprudential policies: Evidence from microdata. *Economic Systems*, 47. <https://doi.org/10.1016/j.ecosys.2022.101008>
- Sunata, U., & Güngördü, F. N. (2024). (Non-state) actors in internal bordering and differential inclusion: Syrian refugees' housing experience in Türkiye. *Ethnic and Racial Studies*, 47(12), 2587–2608. <https://doi.org/10.1080/01419870.2024.2344684>
- Tsai, I. C., & Lin, C. C. (2022). A re-examination of housing bubbles: Evidence from European countries. *Economic Systems*, 46(2). <https://doi.org/10.1016/j.ecosys.2022.100971>
- Whitehouse, E. J. (2019). Explosive asset price bubble detection with unknown bubble length and initial condition. *Oxford Bulletin of Economics and Statistics*, 81(1), 20- 41. <https://doi.org/10.1111/obes.12270>
- Yıldırım, H. (2020). Testing bubbles formation at real-time commodity prices. *Public Affairs*, 21(3), 1-10. <https://doi.org/10.1002/pa.2243>
- Zhang, D., Shi, M., & Shi, X. (2018). Oil indexation, market fundamentals, and natural gas prices: An investigation of the Asian premium in natural gas trade. *Energy Economics*, 69, 33–41. <https://doi.org/10.1016/j.eneco.2017.11.001>
- Zhang, S. (2023). Discussion on the key factors of real estate bubble formation in the process of urbanization. *Frontiers in Business, Economics and Management*, 12(2), 40- 43. <https://doi.org/10.54097/fbem.v12i2.14592>
- Zhao, S. X. B., Zhan, H., Jiang, Y., & Pan, W. (2017). How big is China's real estate bubble and why hasn't it burst yet? *Land Use Policy*, 64, 153-162. <https://doi.org/10.1016/j.landusepol.2017.02.024>
- Zhong, C., Xie, L., Shi, Y., & Xu, X. (2023). Macro-prudential policy, its alignment with monetary policy and house price growth: A cross-country study. *The Quarterly Review of Economics and Finance*, 90, 51-62. <https://doi.org/10.1016/j.qref.2023.05.003>

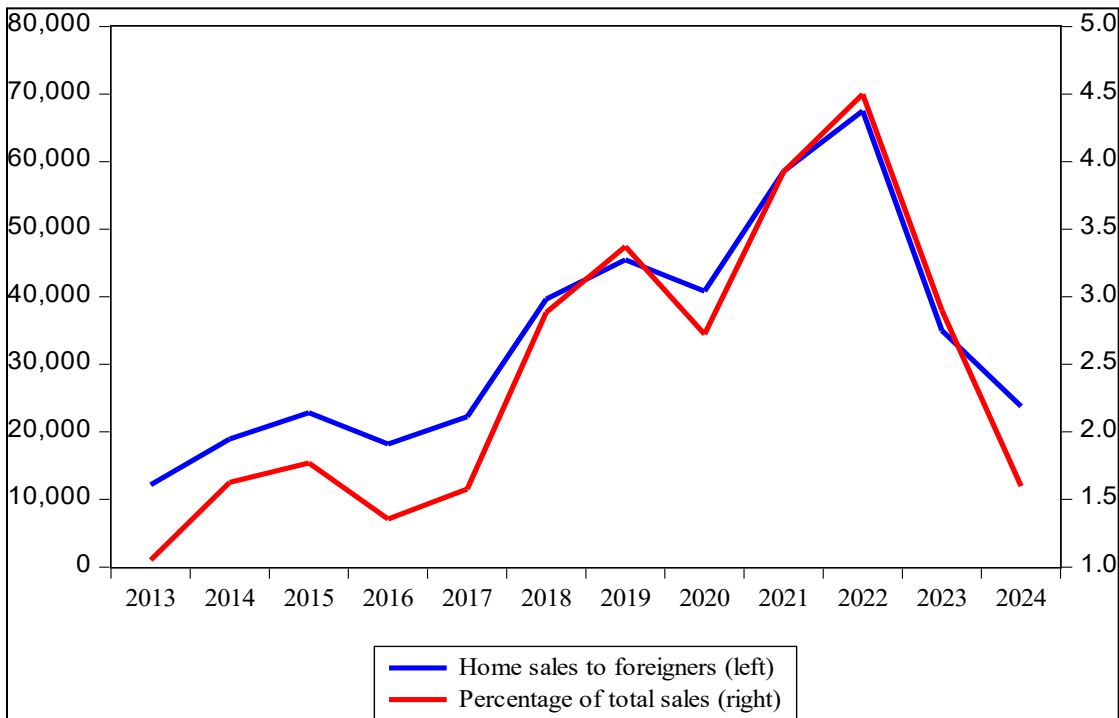
**APPENDIXES**

**Appendix 1.** Total credit to the non-financial sectors.



Sources: BIS

**Appendix 2.** Home sales to foreigners in Türkiye.



Sources: TUIK