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ANALYSIS OF BUBBLES ASSETS FOR WEIGHTED AVERAGE INTEREST RATES APPLIED TO BANK LOANS

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ABSTRACT

This study investigates banks' bubble assets, and the average interest rates applied to the consumer, housing, vehicle, and commercial loan types. Bubble formations by Phillips et al. are examined using the GSADF unit root test developed by (2015). The study period consists of weekly data for June 2019–March 2023. The Monte Carlo simulation obtained critical values for the GSADF unit root test. The findings show that the existence of a bubble effect in housing loan interest rates was found to be statistically significant at the 0.05 level. Against this, although a bubble effect in consumer, vehicle, and commercial loan interest rates has been determined, these bubbles are statistically insignificant. These findings indicate that the existence of bubbles in interest rates on housing loans is closely related to the demand for housing and the relevance of bubble financing to the basis of the bubble process.

Keywords: *GSADF, Bubble Effect, Bubble Assets, Bank Loans, Home Loan Interest Rates.*

Jel Classification: *C22, E43, G21.*

1.INTRODUCTION

The concept of a bubble is described as the consistent and systematic departure of the market value of an economic asset from its fundamental (or ideal) value in the literature on finance. According to another definition the bubble effect is defined as buying an asset and subsequent collapses (Brunnermeier, 2016: 2). According to another definition, the bubble effect is a prolonged upward price movement followed by an internal collapse (Aliber and Kindleberger 2015). According to another definition, the bubble effect is defined as buying an asset with the expectation of being able to sell it at a higher price rather than the rate of return it provides (Kindleberger and Aliber 2005).

Some important bubble examples known in history can be stated as follows: 1634-1637 Tulip mania bubble, 1719-1720 Mississippi bubble, 1720 South Sea bubble mania, while some bubbles in the recent past are the 1986-1991 Japan asset price bubble, the 1995-2001 Dot-Bubble.com bubble, and the

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2006-2008 American real estate bubble (Kılıç, 2020:12). Although there are not many bubbles that are important to note in history today, it can be said that with the effect of globalization and the activity in financial markets, bubble effects that have or will have different effects in the coming periods have been or will be experienced.

In cases where investors hold an asset, even if bubbles occur when the asset's fundamental value exceeds its value, the holding investors believe they can sell the asset at a higher price than other investors. Undoubtedly, it can be said that speculative bubbles fit this definition. Also another type of bubble that occurs in the asset market is the rational price bubble (Varlık, 2021: 1126). Rational price bubbles imply rational deviations from their fundamental value. Although rational price bubbles are similar to speculative bubbles, the most distinctive feature between them is that when they occur, investors are aware of the bubble between the underlying values of this asset. At the same time, they are not aware of the bubble in speculative bubbles (Çağlı and Mandacı 2017: 64). Therefore, unusual price movements are constantly examined to evaluate bubble trends in the markets. In this case, if the related asset exceeds its basic value, the probability of the bubble bursting strengthens. In other words, continuous and systematic increases in asset prices can lead to great financial instability in the future. This situation may cause distrust in the relevant market that concerns national economies, consumers, and national and international investors.

Sudden changes (deviations) that may occur in the markets may cause the effect to deepen by being perceived as asymmetric information in the financial markets. Undoubtedly, changes in price dynamics bring about fluctuations in the cost of credit resources and exchange rate markets (Lyashenko, 2020). Conversely, consumer loans are important macro-variable sub-factors, such as economic growth and demand inflation (Ibicioğlu and Karan, 2009: 13).

With this, in commercial banking, savers may prefer to keep their savings in banks as deposits (İşcan, 2003). These deposits collected by commercial banks are channeled as loans to those needing funds after the relevant reserves are set aside. In the exchange of funds, the bank converts the deposit, a financial instrument, into a loan, another instrument. In other words, when the savers (individual and/or corporate) are defined as the group with surplus funds, and the company and the public sector group are defined as the group with fund deficit, there is a fund transfer between these two groups from those with surplus funds to those with fund deficit under certain conditions (Nalın and Taşdelen, 2016: 67). No doubt, those with surplus funds demand a return, such as interest, when they lend their funds. Those with a fund deficit are expected to be willing to pay interest for the funds they borrow (İşcan, 2003: 1). In addition, the increase in loan interest rates favors investments with lower risk, which excludes more reliable borrowers from the market. Loans may be directed to projects with a higher bankruptcy risk, as borrowers remaining in the market tend to engage in high-risk projects to obtain higher returns (İşcan, 2003: 26).

Credit contraction is closely related to the economic environment of the relevant country. In periods of economic depression, crisis, etc., high-interest loans cause a decrease in the loan demands of consumers and businesses. Chain effects that develop in response to shocks, economic depression, crises, etc., tend to create systemic risks by affecting the real sector and the financial system.

The studies examined in the literature have focused on identifying the bubbles that investors may encounter in financial markets. In addition, studies on banks' loan interest rates have developed in parallel with the effects of macroeconomic variables. This research paper investigates the existence of the bubble effect in the interest rates applied to various loans (consumption, housing, vehicle, and commercial loans) and in the average interest rates of different loans used by consumers through banks.

It is useful to mention the motivation of this study. As is well known, while investors profit from price movements, banks earn income from interest rates. In this case, the banks' distribution of their investments as loans enables them to earn interest income. Banks make it difficult to access loans by raising interest rates on all loans due to insecurity in the market during crisis periods. This leads to a bubble effect in loan rates. The existence of the bubble effect means that the prices in the subject of interest have reached continuous and systematic deviations from the fundamental value. In other words, bubbles in the said interest rates (for investment instruments and commodities) mean that prices rise more than they should for a certain period, and then these bubbles collapse or burst. Most of the studies in the literature have focused on the bubbles that investors may encounter. The topics researched in the literature are mostly focused on financial instruments. It focuses specifically on bubble assets at "prices." In this study, the investigation of the possibility that bubble financing may be at the basis of the bubble process, as bubble assets are closely related to the demand for the relevant product, shows the originality of this study. On the other hand, in this study, which investigates the bubble effect in the weighted average interest rates applied to the loans extended by the banks, the effect of the loan interest bubbles created by the banks is examined. At the same time, it tries to show that consumers face inflated or very high loan interest rates.

In the following sections of the study, the literature on various applications regarding balloon assets is mentioned. After the methodology of the GSADF test, which is the application method, was mentioned in the third section, the application was carried out in the fourth section.

2. LITERATURE REVIEW

Under this heading, various applications discussed in the academic literature are mentioned. As a result of a comprehensive literature review, studies investigating bubble assets are common. They focus on investigating the existence of bubble effects in cryptocurrencies, exchange rates, housing prices, food prices, precious metal prices, and the stock markets of countries. Since there are no bubble studies on loan interest rates, the literature summary is summarized according to the subjects to which they are applied.

There is no doubt that in the literature, it is possible to find many studies on Bitcoin and altcoins, which are cryptocurrencies. In studies on cryptocurrencies, it has been demonstrated by various studies that the bubble effect is encountered in this market in almost every period (Corbet, Lucey, and Yarovaya, 2018; Da Costa De Souza et al., 2017; Demmler and Fernández Dominguez, 2022; Göçmen, 2022; Güleç and Aktaş, 2019; Işıldak, 2022; Kyriazis et al., 2020; Li et al., 2019, 2021; Malhotra and Maloo, 2014; Şahin 2020; Songur, 2019; Yılmaz, 2022).

Studies examining the existence of bubbles in exchange rates can be summarized as follows: In most of the various indices within BIST, they have obtained findings that the index is priced differently (Çağlı and Mandacı, 2017). In another study conducted for the sectors and indices traded in the Turkish stock market, the existence of a speculative bubble was determined (Çıtak, 2019). In addition, the existence of speculative bubbles in the US stock markets has been examined (Mulla et al., 2018). Another study deals with speculative bubbles in spot and futures prices (Pavlidis et al., 2017). An April 2000 study focused on speculative bubbles in the Nasdaq collapse (Johansen and Sornette, 2000). A study on the existence of bubbles in the stock markets of BIRCS-T countries reveals the presence of three bubbles in the Chinese stock market in different periods (Kılıç 2020). The study, which examines the stock market of MIST countries, finds the existence of a bubble (Yurtoğlu, 2022). A study focusing on the COVID-19 period for the Dow Jones stock market, determines the bubble effect on 02/26/2020 (Chang et al., 2021). Addresses the existence of bubbles in emerging markets with the GSADF method (Liaqat et al., 2019). The other research focuses on speculative bubbles in African stock markets (Almudhaf 2017) and Chinese stock prices (Pavlidis and Vasilopoulos, 2020).

Studies examining the existence of bubbles in exchange rates can be summarized as follows: In the study, which examines the existence of bubble effects in the Chinese RMB-dollar exchange rate, he finds the presence of bubbles in the 2005–2006 period and in the 2008 global crisis period (Jiang et al., 2015). Obtains evidence of the existence of GBP/USD currency bubbles (Bettendorf and Chen, 2013). Provides evidence of asset price bubbles for Japan's 1980-90 periods (Hu and Oxley 2018a). While another study examines the bubbles in the exchange rates of Turkey and the BRICS countries (Yildirim et al., 2022), another study focuses on identifying the bubbles in the art market (Assaf 2018).

It is possible to come across studies examining the presence of bubbles in precious metals and commodities in the literature. A study on the presence of bubbles in the silver market finds that there were multiple bubbles in the last quarter of 2020 (Öncü, 2021). In one study, the existence of bubbles in fuel prices in developing economies was determined (Ahmed et al., 2022), while in another study, the presence of bubbles in the behavior of oil futures was examined with weekly data (Khan et al., 2021; Perifanis, 2019; Tsvetanov et al., 2016). In another study, speculative bubbles in metal prices are tried to be determined by GSADF and machine learning approaches (Ozgur et al., 2021). In one study, bubbles between oil and stocks and the contagion effect are discussed with data from China (Zhao et al., 2021), while another study investigates the presence of bubbles in the European Union Emissions

Trading Program. In a study carried out to identify bubbles in copper prices, the presence of more than one bubble was found (Su et al., 2020). Another important study examines market expectations and bubble assets in order to identify speculative bubbles in the crude oil market (Pavlidis et al., 2018).

In a study examining the bubble dates in food prices in the 2008 American real estate bubble crisis and the COVID-19 pandemic periods, the Fragile Eight (Brazil, Indonesia, South Africa, India, Turkey, Argentina, Russia, and Chile) countries were examined. It was determined that bubbles existed in food prices during the 2008 crisis period in Argentina, Chile, and Brazil, and during the COVID-19 period in countries other than Indonesia and Argentina (Varlık, 2021). In another study, Pu-erh examines the measurement of the bubble in tea prices (Dou et al., 2021). Another study tries to identify bubbles in agricultural commodity markets (Areal et al., 2016). Karcıoğlu and Özcan (2023) investigated bubble assets in various investment instruments as well as CDS and deposit interest rates.

In a study investigating the effects of bubbles in the housing market in Turkey, the presence of bubbles in housing prices throughout Turkey and in the TR71 region (Aksaray, Kırıkkale, Nevşehir, Kırşehir, Niğde) is obtained (Kartal, 2022). Another study investigating the existence of bubbles in Turkey and three major cities with the housing market reveals the effects of bubbles in the housing market along the western coastline of Anatolia (Mandacı and Çağlı, 2018). Another study on the housing market reveals a bubble in the real house price index for Ankara (Güler and Gökçe, 2020). In the housing market for the TRA1 region (North Anatolia: Erzurum, Erzincan, Bayburt), multiple bubbles reveal their presence (Çadırcı and Güner, 2021). Another study examining the bubbles in the housing market in Turkey finds the existence of the bubble effect (Abioğlu, 2020). The bubble effect in house sales to foreigners is examined at the level of Turkey in general and Istanbul and Antalya provinces (Çadırcı and Güner, 2021). Identifying US regional home price bubbles is addressed within the states (Hu and Oxley, 2018b). The bubble's existence for December 2013 is shown in the study that looks at whether the bubble's impact exists on Chinese house prices (Liu et al., 2016). The main evidence supporting the existence of bubbles is poor, according to a study on speculative booms in Chinese home prices (Chen and Funke, 2013a). The GSADF method is applied in a study that examines the data on real estate investment trusts in the USA for the bubble effect (Escobari and Jafarinejad, 2016). The existence of housing bubbles in Australian cities was the subject of another study (Shi et al., 2016). One study examines the existence of bubbles in the Swedish housing market (Asal, 2019), while another study examines the presence of bubbles in housing prices in Germany (Chen and Funke, 2013b). One study applies to the real estate market to examine speculative bubbles (Naoui and Bassem, 2015). Significant crisis phases in real estate investment trusts' speculative bubbles were looked at in a different study (Joyeux and Milunovich, 2015).

The uniqueness of this study lies in the fact that while the existing literature generally focuses on the bubble effects in investment instruments, this study focuses on the bubble effect in consumer, housing, vehicle, and commercial loan interest rates offered by banks. While studies mainly focus on

bubbles that investors may face, this study focuses on an area that directly affects consumers, such as loan interest rates. This is one of the few studies to identify the effects of interest rate bubbles on consumers during times of crisis when banks raise interest rates, making it more difficult to access credit. Therefore, this study provides a broader perspective on loan interest rate bubbles, which have been neglected in the existing literature, and fills an important gap.

3.APPLICATION METHOD

In the study, The Generalized Supremum Augmented Dickey-Fuller Test (GSADF) method, which was proposed by Phillips, Shi, and Yu (2015) to test the existence of bubbles due to multiple flooding and collapse breakdowns, is examined with the weighted interest rates applied according to the loan types of the banks in Turkey. The start and end dates of the bubble are employed in recursive backward regression along with the right-tailed unit root test in this approach (PSY, 2015: 1045).

This test uses adjustable window widths in applications but is based on recursive right-tailed ADF testing using newer processes such as PWY (see Phillips et al., 2011). GSADF test widens the sample coverage by modifying both the start point and the end point of the iteration within an appropriate flexible window range, as opposed to fixing the starting point of the recursion at the first observation.

This method was developed to test and date bubble formations when one or more bubbles occur in the data. This test is built on the foundation of the recursive and iterative ADF unit root test and uses right-tailed ADF test statistics with an expanding window structure. The GSADF test was preferred in this study because it can determine the formation and termination points of a bubble in the relevant variable and can detect the presence of many bubbles instead of SADF, which determines the presence of a single bubble.

3.1. GSADF Test Specification

Equation 1 yields the ADF test regressions repeated over subsamples of the data for the GSADF test (Phillips et al., 2015: 1047):

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

Equation 1 is followed by repeated ADF test regressions on subsamples specified recursively in the proposed test. This test permits the starting point of r_1 to vary within an appropriate range, from 0 to $r_2 - r_0$, in addition to adjusting the endpoint of the r_2 regression from r_0 (the minimum window width) to 1. The greatest ADF statistic in this double recursion over all relevant r_1 and r_2 ranges is hence known as the GSADF statistic. The GSADF statistic r_0 is shown in Equation 2:

$$GSADF(r_0) = \sup_{\substack{r_2 \in [r_0,1] \\ r_1 \in [0, r_2 - r_1]}} \left\{ \frac{\frac{1}{2} r_w [W(r_2)^2 - W(r_1)^2 - r_w] - \int_{r_1}^{r_2} W(r) dr [W(r_2) - W(r_1)]}{r_w^{1/2} \left\{ r_w \int_{r_1}^{r_2} W(r)^2 dr - \left[\int_{r_1}^{r_2} W(r) dr \right]^2 \right\}^{1/2}} \right\} \quad (2)$$

In this equation, $r_w = r_2 - r_1$, and W is a standard Wiener process (Phillips et al., 2015: 1049). While the related hypotheses are formed as $H_0: \delta = 1$ and $H_1: \delta < 1$ in the left-tailed ADF test, the hypotheses are expressed as follows in the right-tailed ADF test:

$H_0: \delta = 1$ (has a unit root)

$H_1: \delta > 1$ (contains an explosive unit root)

On the other hand, the GSADF in Equation 2 is briefly defined as (Phillips et al., 2015:1049):

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

Because it permits the various window sizes to vary from 0 to $r_2 - r_0$, as they emphasized in the SADF statistic presented by Phillips et al. (2011), this test enables the discovery of many bubbles (Phillips et al., 2015).

3.2. Empirical Findings

The existence of a bubble regarding weighted average interest rates applied by banks to the consumer, housing, vehicle, and commercial loans obtained from the CBRT was examined with weekly data consisting of 196 observations for the period 07.06.2019–03.03.2023. The initial window size in the study,

$$\left(r_0 = 0.01 + 1.8\sqrt{T}\right) \quad (4)$$

it is obtained by the equation. In this equation, T represents the observation values. Therefore, the window size (r_0) has been determined to be approximately 25. In the application made over Eviews 12, critical values were obtained by performing 1000 replications through Monte Carlo simulation in a Matlab program. Descriptive statistics on loan interest rates applied to related loan types are as follows:

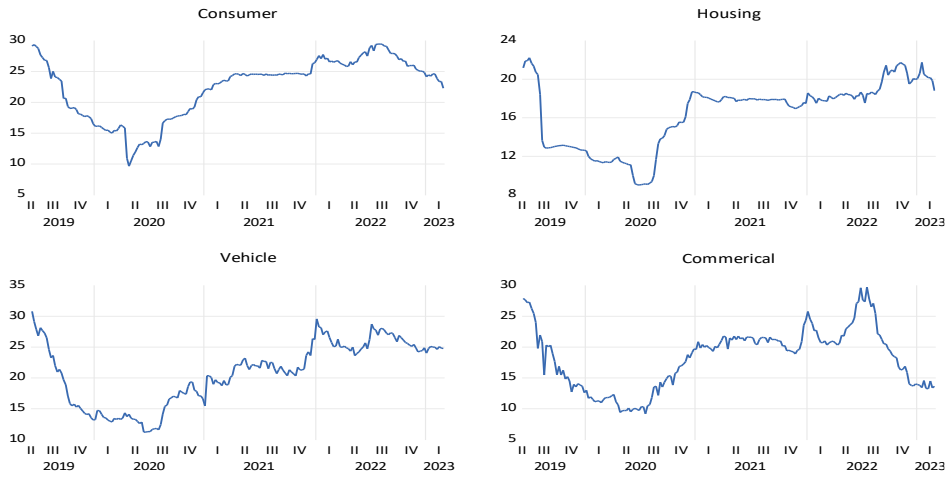
Tablo 1. Descriptive Statistics

	Consumer	Housing	Vehicle	Commercial
Mean	22.46199	16.47474	20.83128	18.25255
Median	24.39500	17.88000	21.49000	19.62500
Maximum	29.47000	22.23000	30.81000	29.74000
Minimum	9.660000	9.010000	11.20000	9.170000
Std. Dev.	4.906558	3.450165	5.116661	4.949234
Skewness	-0.689548	-0.568706	-0.280797	-0.015003
Kurtosis	2.388272	2.252721	1.882761	2.240643
Jarque-Bera	18.58830	15.12573	12.76948	4.716437
Probability	0.000092	0.000519	0.001687	0.094589

According to the descriptive statistics on interest rates applied to the related loan types and the Jarque-Bera statistics, it can be said that the series does not exhibit a normal distribution due to $p<0.05$. The fact that the kurtosis value is below 3 indicates that interest rates are not leptokurtic in structure. Therefore, it can be said that there is no volatility in the interest rates of different loan types. The

skewness value means that all interest rates are negative. In other words, it can be said that the interest rates applied by banks to loan types are higher than average in some periods. After the descriptive statistics, the time path graphs of the interest rates applied to the related loan types for the period under consideration are shown in Figure 1.

Figure 1. Time Path Charts of Interest Rates Applied by Loan Types



According to the graphs in Figure 1, consumer, housing, vehicle, and commercial loan rates, which were high in mid-2019, showed significant decreases during the pandemic (throughout 2020). With the decrease in the effect of the pandemic and the normalization, the interests of the four loans in the figure showed a similar tendency to increase. As can be seen from the findings in Table 1, the lowest loan interest rate average is in the housing loan interest rate, followed by commercial, vehicle, and consumer loan interest rates, respectively. After descriptive statistics and time path graphs for the four specified loan rates, Phillips et al. (2015) present the test statistics of the right-tailed GSADF unit root test and the critical values obtained by Monte Carlo simulation, which are given in Table 2.

Table 2. Test Statistics and Critical Values

	Consumer	**Housing**	**Vehicle**	**Commercial**
GSADF test.stat.	1.704459	2.207701	1.260310	1.206111
Prob.*	0.1470	0.0420	0.3780	0.4020
Test Criticial Values**	99% level	2.648442		
	95% level	2.114352		
	90% level	1.850800		

Note: * Right-Tailed Test; ** Critical values are based on a Monte Carlo simulation (run with MATLAB)

According to the findings in Table 2, the null hypothesis was rejected, and the opposite hypothesis was accepted since the p-value was less than 0.05 for the housing loan interest rate. In other words, the GSADF test statistics for housing loan interest rates were determined to be smaller than the critical values (0.90 and 0.95) obtained with the Monte Carlo simulation. This finding means an explosive unit root bubble ($\delta>1$) in housing loan interest rates at the 5% significance level. Moreover, it was concluded that there was no explosive unit root bubble in the interest rates of consumer, vehicle, and commercial

loans at the 5% significance level. In other words, it is obtained that there is a unit root (δ=1) at the three loan interest rates.

Figure 2 shows the formation of bubble periods related to loan interest rates. In each chart, the top chart shows the actual values, the middle chart shows the critical values and the bottom chart shows the GSADF bubble assets (charts). Peak structures above the critical value graphs represent bubbles. According to the findings in Table 2, the presence of an explosive unit root bubble in housing loan interest rates was statistically significant at the 5% level. Therefore, only the findings on housing loan interest rates will be interpreted. On the other hand, it was also stated that an explosive unit root bubble in consumer, vehicle, and commercial loan interest rates was found to be statistically insignificant at the 5% level. For this reason, the findings regarding the other three loan interest rates will not be interpreted; their visuals are given in Figure 2, and their important dates are given in Table 3 for the sole purpose of presenting them for the information of the readers

Figure 2. Formation of Bubbles in Interest Rates for Different Loan Types

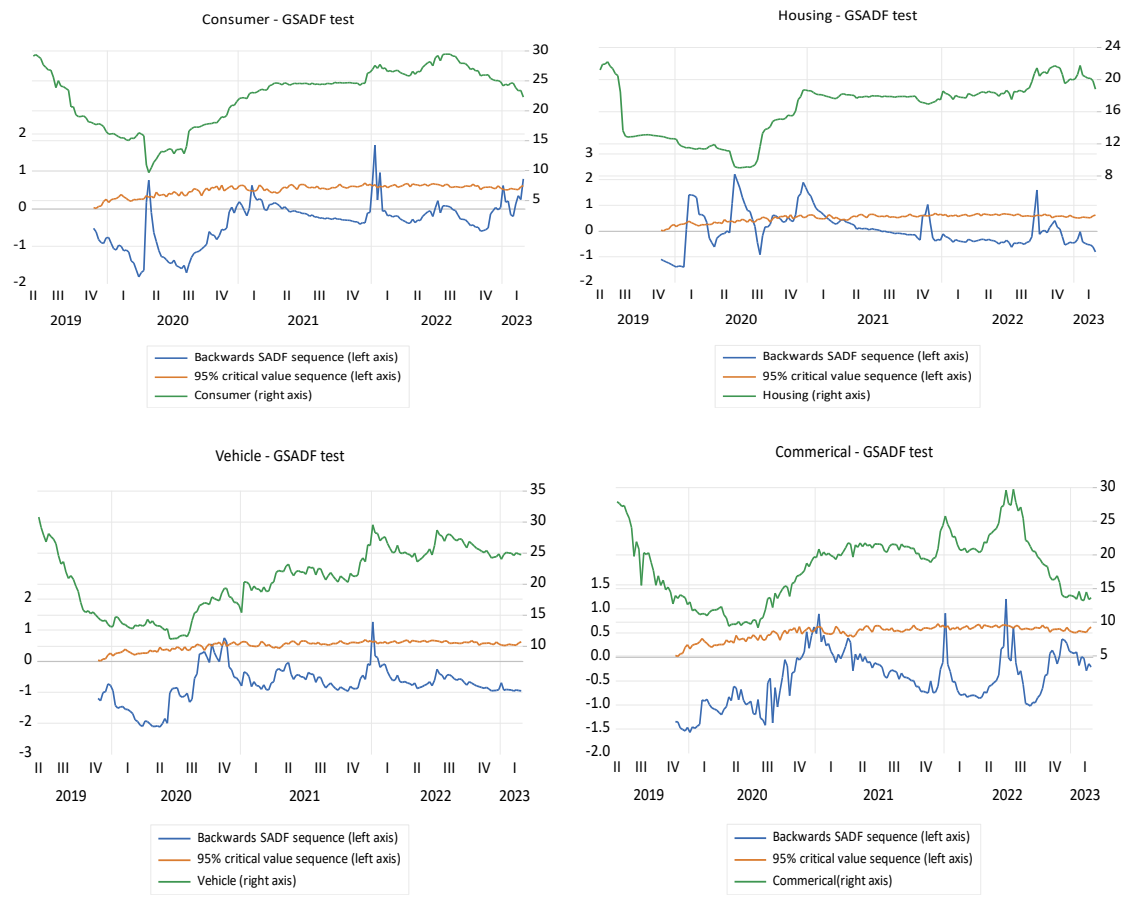


Figure 2 shows the bubbles in interest rates for four loan types, and Table 3 shows the formation dates of these bubbles. There are six bubbles in consumer loans, eight in housing loans, three in vehicle loans, and five in commercial loans. Let's just add that it was stated above that the bubbles in housing

loan interest rates, except for the eight bubbles, are statistically insignificant. Also, insignificant bubbles are included for information only.

Table 3. Beginning and Ending Dates of Bubbles Regarding Loan Types and Interest Rates

Consumer			**Housing**		
Start Date	Expiry Date	Duration	Start Date	Expiry Date	Duration
24.04.2020	24.04.2020	1 week	7.02.2020	27.03.2020	8 weeks
5.02.2021	5.02.2021	1 week	5.06.2020	31.07.2020	9 weeks
7.01.2022	14.01.2022	3 weeks	25.09.2020	9.10.2020	3 weeks
28.01.2022	28.01.2022	1 week	6.11.2020	6.11.2020	1 week
6.01.2023	6.01.2023	1 week	27.11.2020	19.02.2021	13 weeks
3.03.2023	Continues		2.04.2021	2.04.2021	1 week
Commercial			19.11.2021	26.11.2021	2 weeks
Start Date	Expiry Date	Duration	16.06.2022	23.09.2022	15 weeks
25.12.2020	25.12.2020	1 week	**Vehicle**		
8.01.2020	8.01.2020	1 week	Start Date	Expiry Date	Duration
7.01.2022	7.01.2022	1 week	9.10.2020	9.10.2020	1 week
1.07.2022	1.07.2022	1 week	13.11.2020	20.11.2020	3 weeks
22.07.2022	22.07.2022	1 week	7.01.2022	7.01.2022	1 week

In the GSADF test findings, since the existence of bubbles in housing loan interest rates caused one of the loan interest rates opened by banks for the examined period to be found to be statistically significant, the null hypothesis of $H_0: \delta = 1$, which claims that bubbles did not occur, was rejected for housing loans and the $H_1: \delta > 1$ alternative hypothesis was accepted.

The bubble dates and durations in the interest rates on the housing loans in Table 3 lasted eight weeks in the period of 07.02.2020–27.03.2020, respectively, nine weeks in the period of 05.06.2020–31.07.2020, and 3 weeks in the period of 25.09.2020–09.10.2020, one week in 06.11.2020, 13 weeks in 27.11.2020-19.02.2021, one week in 02.04.2021, 2 weeks in 19.11.2021-26.11.2021 and 15 weeks in 16.06.2022-23.09.2022 eight bubble periods determine the period (07.06.2019–03.03.2023) in question. Among the bubbles that started with the emergence of COVID-19 in the world, the one that lasted the longest was formed for 13 weeks from 27.11.2020–02.02.2021. This situation can be interpreted as the negative effects of our country's economic conditions and banks keep the housing loan interest rates higher than they should be, eight times according to these conditions, and for a maximum of approximately 3.5 months. These findings are in line with studies conducted on bubble assets in real estate prices (Escobari & Jafarinejad, 2016; Hu & Oxley, 2018b; Mandacı & Çağlı, 2018; Kartal, 2022). The fact that housing sales are closely related to loan interest rates shows that the bubble process is accompanied by financing in the background (loan interest rates).

The real estate bubble that occurred in 2008 and the FED's increase in interest rates brought about an increase in housing loan interest rates, as in other types of loans. Therefore, low-income consumers using housing loans could not pay their loans, and the houses were confiscated due to mortgages (Çınar

2022:297). This situation caused the fund balances of banks to be deeply shaken and led to a global crisis.

According to the findings, the existence of a housing loan interest rate bubble has important economic and social implications. One of the main reasons for the bubble in mortgage interest rates is the tendency of banks to raise interest rates to minimize credit risk during uncertainties in financial markets and economic crises. This suppresses demand in the housing market, making it difficult for low- and middle-income consumers, in particular, to purchase housing and leading to market imbalances. The social consequences of a mortgage interest rate bubble cannot be ignored; high interest rates can increase the cost of acquiring housing, deepening property inequality in society and leading to a decline in home ownership rates. Moreover, such bubbles can contribute to exacerbating economic crises and pushing large segments of society into financial insecurity. In this context, examining the mortgage interest rate bubble in a broader economic and social context can provide valuable insights for policymakers and regulators to prevent future crises.

4.CONCLUSION

When the studies on the existence of bubbles in the literature are examined, the bubbles related to the investment instruments for the benefit of the investors have been mostly studied. In this study, which has a separate structure for the application subjects in the literature, the existence of the bubble has been reduced from the investor dimension to the consumer dimension, and the existence of the bubbles has been investigated for the average interest rates of consumer, housing, vehicle, and commercial loans opened by banks. It is extremely important to examine the existence of the bubble effect regarding loan rates, which constitute one of the most important income items for the banking sector.

In financial studies, a bubble is defined as the continuous and systematic deviation of the market value of an economic asset from its fundamental value. Undoubtedly, a "bubble effect" that may occur in various investment items in the financial market can be seen as an upward price movement and attract new investors to the relevant investment instrument. However, the most recent proof that internal collapses are inevitable after the bubble effect is the real estate bubble that took place in the USA from 2006 to 2008.

As an application method, analysis is carried out with the right-tailed GSADF unit root test. Critical values for this test were obtained by Monte Carlo simulation. In the study, we used the average interest rates for consumer, housing, vehicle, and commercial loans for 196 weeks between June 2019 and March 2023. It has been concluded that there is no bubble containing an explosive unit root at the 5% significance level in the interest rates of consumer, vehicle, and commercial loans. The presence of a bubble containing an explosive unit root at the 5% significance level for the housing loan interest rate is also significant.

As an application method, analysis is carried out with the right-tailed GSADF unit root test. Critical values for this test were obtained by Monte Carlo simulation. The study used the average interest rates for consumer, housing, vehicle, and commercial loans for 196 weeks between June 2019 and March 2023. It has been concluded that no bubble contains an explosive unit root at the 5% significance level in the interest rates of consumer, vehicle, and commercial loans. The presence of a bubble containing an explosive unit root at the 5% significance level for the housing loan interest rate is also significant. According to the findings, the closest bubble period, 07.02.2020–27.03.2020, is from 13.01.2020, when COVID-19 was announced. Bubble assets in housing loan interest rates started forming in various working periods, and eight bubbles were obtained. While the loan increase rate was approximately 18.1% during the pandemic process in Turkey, the housing price increase rates (TUIK) were the first type of loan at 13.19%.

The most critical finding obtained from the study is that the existence of a bubble in housing loan interest rates is statistically significant in eight different periods. The bubble periods and periods regarding the housing loan interest rates are chronologically eight weeks 07.02.2020–27.03.2020, 9 weeks with 05.06.2020–31.07.2020, 3 weeks with 25.09.2020–06.90.2020, and 1 week with 06.11.2020 were found as the periods of 27.11.2020–19.02.2021 with 13 weeks, 02.04.2021 with one week, 19.11.2021-26.11.2021 with 15 weeks, and 16.06.2022-23.09.2022 with two weeks. In addition, one of the longest-lasting bubbles was the one in the period 27.11.2020–19.02.2021, lasting 13 weeks. It is an important finding that this period coincides with the period after the declaration of COVID-19 in the world and the negative economic conditions of our country. Thus, under the uncertainty conditions mentioned above, the fact that banks keep the housing loan interest rates higher than the required values can be interpreted as causing the formation of these bubbles. When interest rates rise, a decrease in housing purchases is expected. In this respect, it can be said that interest rates are one of the most critical indicators when making investment decisions. Since the housing market in Turkey is seen as an instrument of economic growth policy, all factors related to the housing market are analyzed separately to prevent a situation similar to the 2008 real estate bubble due to its high share in the Turkish economy and the components of this market, that is, the sub-sectors and the domino effect they can create in the economy. It is essential to investigate the existence of a bubble. In this study, bubble entities in mortgage loan interest rates were discussed, and bubble formations were encountered in different periods during the study period.

The theoretical framework focuses on the economic and financial dynamics that cause asset prices to deviate from their fundamental values and suggests that these deviations may lead to market instabilities. Accordingly, the study's hypotheses are based on the assumption that banks' tendency to raise loan interest rates, especially during periods of economic uncertainty, may contribute to a bubble in the mortgage market. Empirical evidence confirms these hypotheses by revealing the existence of

bubbles in mortgage interest rates and their relationship with periods of crisis and uncertainty based on the results of the GSADF test.

In the theoretical framework, bubbles are defined as persistent and systematic deviations of market values from assets' fundamental values. Sudden price increases followed by crashes characterize them. In the empirical section, we use the GSADF unit root test to identify a bubble effect in mortgage interest rates. Theoretically, it is predicted that banks' tendency to raise interest rates to manage increased credit risk during economic crises may lead to a bubble in mortgage interest rates. Empirical evidence supports these predictions and shows that bubbles in mortgage interest rates are strongly associated with uncertainty and crisis conditions in financial markets. In this context, the study makes an important contribution to the existing gaps in the literature by establishing a more consistent link between theoretical and empirical findings

In future studies, investigating the bubble assets in sub-sectors that are closely related to the housing market and investigating whether not only the bubble caused by housing prices but also the bubble assets in different sectors cause the bubbles in housing prices will contribute to preventing possible crises that may occur in the housing market.

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