How the consequences of the COVID-19 pandemic affected housing sector? Empirical evidence from Turkey

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Abstract

Purpose – This study aims to analyze the relationship between the consequences of the pandemic and the housing sector with econometric tests that allow for structural breaks.

Design/methodology/approach – Study data were collected weekly between March 9, 2020, and February 4, 2022, and analyzed for Turkey. In the model of the study, housing loans were used as a housing market indicator, and the number of new deaths and new cases were used as data related to the pandemic. The exchange rate, which affects the use of housing loans, was added to the model as a control variable. This study was analyzed to examine the relationship between the pandemic and the housing sector, time series analysis techniques that allow structural breaks were used.

Findings – Based on the result of the analyses, it was concluded that there is a long-run relationship between the pandemic stages and housing markets along with structural breaks. As a result of the time-varying causality test developed to determine the causality relationship between the variables and its direction, a bidirectional causality relationship was identified between all variables at certain dates.

Research limitations/implications – Study data were collected weekly between March 9, 2020, and February 4, 2022, and analyzed in the case of Turkey.

Practical implications – Based on results of the study, it is recommended that policy makers and market actors take into account extraordinary situations such as pandemics and create a budget allocation that is always ready to use for this purpose.

Originality/value – The empirical examination of the relationship between the pandemic and the housing sector in Turkey provides originality to this study in terms of its topic, sample, methodology, contribution to the literature and potential policy recommendations.

Keywords Housing sector, COVID-19 pandemic, Housing loans, Time-varying causality

Paper type Research paper

1. Introduction

Housing, which is a leading sector for the economy, plays a role in 250 different economic sectors. The main industries affected by the housing sector are iron and steel, cement or concrete and ceramics, wood and furniture, chemicals and dyes, weaving, carpets and glass. While these industries are directly affected by housing construction, the housing sector also has direct and indirect impacts on the economy. For example, supply and demand for housing affect the financial system because both the construction company and the person demanding housing use consumer and housing loan channels. Thus, the housing sector, which interacts with 250 subsectors and financial markets, has a structure with a multiplier effect for the economy (Kızıltepe, 2011, p. 54).

As in other sectors, the housing sector is also affected by natural disasters, terrorism, political events and pandemics. Among the abovementioned phenomena, the COVID-19 pandemic, which has recently swept the world, has had a significant impact on the housing sector while negatively affecting all life. The COVID-19 virus emerged in Hubei Province of Wuhan in China on December 1, 2019, and was declared a pandemic on March 11, 2020, by the World Health Organization (WHO) within the scope of the criteria for a disease to spread to a large area and mass in the world in a short time (WHO, 2021).

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The housing sector is an area that is constantly monitored all over the world because it contributes to the economy in Turkey and other countries. However, due to the structure of the sector, it both prepares the ground for economic crises and causes fluctuation in the construction market because of its fragile nature. The reason that the housing sector causes crises stems from monetary factors in the sector.

In Turkey, the housing sector started to develop in 2004 along with the impact of economic growth. In order to revitalize the sector, various measures were taken by the government. Within this context, the right to buy houses granted to foreigners, the construction of community buildings, Urban Planning Laws, and legal proceedings have mobilized the housing sector (Turkey Report, 2010, p. 11).

Table 1 shows the share of the housing sector in GDP in Turkey over seven years from 2015 to 2021. GDP has been calculated using the production method. The sector in question increased from 2015 to 2017; however, the currency crisis in Turkey in 2018 disrupted the sector and led to its decline. The COVID-19 pandemic, which began in 2019, negatively influenced the housing industry and made its impact felt in the following year. In 2021, due to the partial control of the virus, the housing sector improved compared to the previous year.

The housing sector is associated with factors such as the increase in credit utilization rates, the rise in house prices and overall house sales, both nationally and globally. In the Turkish economy, loan rates increased by 18.10% and house prices increased by 13.19% in 2019 (Usanmaz, 2021, p. 1356). With this statistic, Turkey led the ranking when compared with European countries. Also in 2019, the IMF Global House Price Index reached the highest peak in its history, hovering around 169.77 in the third quarter of 2020. Table 2 shows the amount of loans utilized by individuals in the Turkish economy according to quarterly data.

This study examines the economic impact of the pandemic on the housing sector by taking the Turkish economy as a sample. This is the first study to analyze the impact of the pandemic on the housing sector with structural breaks over the Turkish economy. The literature review has shown that previous studies on the housing sector during the pandemic and similar crisis situations are insufficient. In this context, the aim of this study is to identify and reveal the relationship between the pandemic and the housing sector. To achieve this objective, the impact of the pandemic on the housing sector was evaluated using econometric analyses that allow for structural breaks. Based on the findings obtained, policy recommendations are presented to strengthen the housing sector and make it more resilient to economic crises, and the study will shed light on future studies. The main problem addressed in the study has been determined as "the change in the

Table 1.
The share of the housing sector in gross domestic product (GDP) in Turkey

2015	2016	2017	2018	2019	2020	2021
8.1	8.5	8.5	7.1	5.4	5.2	5.5

Source(s): GYODER Third Quarter Report (2021, p. 18)

Table 2.
Loans extended in the Turkish economy (Turkish lira)

Period	Q1-2019	Q2-2019	Q3-2019	Q4-2019	Q1-2020	Q2-2020	Q3-2020
Total loans extended	5,920	6,790	18,216	25,075	24,089	33,230	55,001
Number of loans extended	42,379	46,789	113,120	147,731	127,574	151,445	230,193

Source(s): GYÖDER, Fourth Quarter Report (2020, p. 34)

housing sector during the pandemic." Regarding the stated problem, the performance of the housing sector has been investigated during the pandemic. The main reason for choosing the Turkish economy as the sample country is the size of the sector in the country's economy and the total multiplier effect it creates.

Due to its characteristics in the Turkish economy, the housing sector creates employment, contributes to economic growth and is preferred by individuals as an investment instrument, which is why it acts as a leading sector in the economy.

Studies on the pandemic and the housing sector have focused on countries with strong housing markets such as the United States (US). However, the number of studies examining the impact of global pandemics such as COVID-19 on housing markets is extremely limited, and no study discussing Turkey in this respect has been found. Regarding Turkey, there is no empirical evidence beyond basic statistics on the fluctuations in the housing market during the pandemic. In this context, the empirical examination of the relationship between the pandemic and the housing sector in Turkey provides originality to this study in terms of its topic, sample, methodology, contribution to the literature and potential policy recommendations. Based on these considerations, the study first explains the theoretical and conceptual framework regarding the pandemic and the housing sector; then, the relevant literature review is reported and interpreted. Following the literature review, the econometric analysis of the study is performed, policy recommendations are presented from the findings, and finally the study is concluded.

2. Literature review

A review of the literature on the housing sector reveals that there are studies addressing topics such as macroeconomic factors, supply-demand balance, real and effective exchange rates and capital markets. This study investigates the relationship between the pandemic and the housing sector. In this context, the study discusses a topic that has not been studied in the literature much within the context of the housing sector and is original and quantitative research. It is seen that previous studies have generally done due diligence and made statistical inferences using limited data. The literature review of the study is discussed under two headings: (1) the relationship between the housing sector and macroeconomic indicators and (2) the relationship between the pandemic and the housing sector.

There is a close relationship between the housing sector and macroeconomic indicators. A change in these indicators has an impact on all areas, particularly on the housing sector. Studies in the literature examining the relationship between the housing sector and macroeconomic magnitudes can be summarized as follows: There are numerous theoretical and empirical studies on the housing sector. When the studies conducted in Turkey are examined, it is seen that some findings confirm the relationship between the housing sector and macroeconomic variables, while others contradict economic expectations. In this regard, it is possible to find many studies that show the existence of a relationship between the housing sector and selected macroeconomic indicators such as interest rates, inflation, exchange rates, money supply and real GDP Badurlar, 2008; İbicioğlu and Karan, 2012; Çankaya, 2013; Akkaş and Sayılgan, 2015; Dilber and Sertkaya, 2016; Kolcu and Yamak, 2018; Ozcan and Tormuş, 2018; Afşar and Karpuz, 2019; Bayır *et al.*, 2019; Eryüzlü and Ekici, 2020; Karadağ, 2021). Studies conducted outside Turkey have generally discussed the housing sector in terms of macroeconomic indicators and the relationship between housing supply and demand. When these studies are compared with those in Turkey, theoretical differences stand out. The findings obtained from previous studies (Kennedy and Andersen, 1994; Englaund and Ioannides, 1997; Green, 1997; Baffoe-Bonnie, 1998; Zhu, 2006; Egert and Mihaljek, 2007; Beltratti and Morana, 2010; Gasparėnienė *et al.*, 2016) revealed that the housing sector was directly and indirectly affected by macroeconomic indicators.

The literature also includes studies having found that macroeconomic indicators have a negative impact on the housing sector, contrary to these abovementioned studies. There are also studies suggesting no relationship between macroeconomic indicators and the housing sector (Kearl, 1979; Follain, 1981; Schwab, 1983; Manchester, 1987; Haris 1989; Gallin, 2006; Mikhed and Zemcik, 2009). Studies conducted in recent years have shown that housing loans, exchange rates, household incomes, housing investments, and macroeconomic variables have positive and negative effects on the sector and stated that loans in the housing sector, investments made in the sector and the exchange rate, which is one of the leading indicators, caused a revival in the sector (Panagiotidis and Printzis, 2015; Kong *et al.*, 2016; Shaari *et al.*, 2016; Bahmani-Oskooee and Wu, 2018; Trofimov *et al.*, 2018).

Within the scope of the literature review, only one study on the Turkish economy was found in the literature on the pandemic and the housing sector, which forms the basis of this study. This aforementioned research, conducted by Usanmaz (2021), examined the impact of COVID-19 on the housing sector as a review study. Therefore, foreign studies examining economies other than the Turkish economy were reviewed to examine the impact of the pandemic on the housing sector.

The course of housing prices and rental prices during epidemics is not a research topic specific to the COVID-19 pandemic. For example, Francke and Korevaar (2021) examined the housing market using microdata from the periods of the plague that affected Amsterdam in the 17th century and the cholera outbreaks in Paris in the 19th century. The results of the study showed that these pandemics led to a large-scale decline in housing prices, while the decline in rental prices was relatively smaller.

The literature empirically discussing the impact of COVID-19 on housing prices has started to emerge as of late 2020 due to the technically sufficient level of data accumulation. At this point, it is seen that the few existing empirical studies generally have focused on the US, which has a strong housing market and mortgage system. For example, as one of the first studies on the subject, D'Lima *et al.* (2020) presented an analysis based on micro-level data for 31 states as well as the District of Columbia in the US. Based on the results of the study that used the difference-in-differences method, a one-unit increase in the COVID-19 transmission rate decreased the housing prices in the states affected by the pandemic by 5.1%. A study conducted by Liu and Su (2021) in the US took into account online housing search views and local characteristics to see housing sales, prices, and rental prices and housing demand. The study found that COVID-19 caused larger housing demand declines in areas with higher population density and emphasized that the advantage of working close to the workplace and the decrease in value of consumption facilities with COVID-19 played a role in this decline in demand. Moreover, prices fell more sharply in areas where housing prices were high before the pandemic. According to Liu and Su (2021), although the national housing market in the US has seen partial improvements as of June 2020, the pandemic has had a lasting effect on housing demand. On the other hand, as a contradictory result, Zhao (2020) states that housing demand in the US started to increase as the Federal Reserve (FED) launched a comprehensive monetary easing process during the pandemic, and at this point, consumers increased the level of demand by acting out of fear of missing the opportunity. In addition, the developments in housing prices and demand and supply have been close to each other in urban, rural and suburban areas since April 2020. The housing market in the US experienced the initial shutdowns on transactions and a surging housing market afterward. According to Redfin Data Center, the national transaction volume dropped by 42.2% at the end of April in 2020 but increased by 23.1% in September. Wang (2021) examined the impact of COVID-19 on housing prices in five cities in the US (Houston, Santa Clara, Honolulu, Irvine, Des Moines) using the difference-in-differences method. The study found that only Honolulu experienced a decline in housing prices, while the other four cities experienced price increases.

Moreover, housing prices decoupled positively and more strongly in cities with strong local facilities and less dependence on service industries. The results show that, after the outbreak, Honolulu is the only place that experienced declines in house prices with the largest decrease rate approaching 6.69% in April 2020. For the other four areas, which see increases in house prices, the largest increase rate of 9.97% appears in Santa Clara followed by Irvine with a growth rate of 5.80%. Del Giudice *et al.* (2020) conducted a study on the Campania region of Italy and presented the findings of the "Prey-Predator" model. The results of the study showed that COVID-19 reduced housing prices by 4.16% in the short term and 6.49% in the medium term. The findings related to Australia presented by Hu *et al.* (2021) also indicate a negative relationship between the number of cases and daily housing returns in the early stages of the pandemic and emphasize that the government's quarantine practices do not have a significant effect on housing returns.

The impression obtained from the emerging literature on the relationship between COVID-19 and the housing sector is that, in general, there has been a depreciation in the housing sector due to the spread of the pandemic. However, the aforementioned studies have supported that the decline in demand in the housing market is also a significant problem. On the other hand, interest rate cuts by decision-makers in the early stages of the pandemic brought about a revival in demand, albeit only to a certain extent and temporary in certain regions. However, the lack of sufficient empirical findings and comprehensive policy recommendations for the sector's response to the pandemic stands out as a serious shortcoming because the reviewed literature is still in its infancy. In this context, this study examines the pandemic adventure of the Turkish housing sector, which does not yet have any empirical evidence, from multiple perspectives. This study utilizes a wide range of data on housing loans and variables related to COVID-19. The lack of research on the effects of the pandemic on the housing sector for developing countries such as Turkey makes the findings and policy recommendations of this study very important. The empirical analysis of the study on the Turkish scale is also important in this respect.

Finally, the econometric analysis methods that the study presents are also important in terms of both the originality and consistency of the results of the study and its contributions to the existing literature. In this context, in order to reach consistent and meaningful empirical findings, structural break analyses are used for pandemic indicators and housing loans, which can consider possible breaks that may have occurred during the period under consideration. The findings and propositions obtained will shed light on both the related literature and the future of the housing sector.

3. Econometric methods and methodology

In the analysis part of the study, the relationship between the housing sector and the pandemic is tested through the Turkish economy. In this context, first, the data set and model of the variables to be used based on the hypothesis are introduced, and then the methodology is determined. Within the scope of the methodology, after presenting the theoretical and conceptual framework of the tests to be applied, the results obtained from the analyses are interpreted.

3.1 Data set and model

In the study, the hypothesis that "there is a long-run relationship between the pandemic and the housing sector" was tested with time series analysis methods that allow structural breaks on the Turkish economy. Due to the limited and common data problem, weekly data for the period March 9, 2020, to February 4, 2022, were used in the analysis. The variables of the model determined in accordance with the hypothesis are given in Table 2 below.

The variables included in the model are based on the literature on the housing sector and the pandemic. Macroeconomic variables are usually monthly and annual data. In the study, the data were included in the analysis on a weekly basis. Therefore, some variables in the literature could not be included in the model. In addition, the data constraint problem of the relevant periods was also effective in determining the selected variables. Within this context, the dependent variable of the model is housing loans (HL), while the independent variables are the number of new deaths (ND) and the number of new cases (NC) as pandemic data. In addition, the exchange rate (USD), which affects housing loan utilization, is added to the model as a control variable. In the analyses, logarithmic forms of all variables except the USD rate are used. Housing loans are calculated as the total amount of housing loans granted by banks under the Consumer Loans Title in the weekly reports of the BRSA. The number of new deaths and cases, which are pandemic data, is announced by the Ministry of Health.

Since the housing loan variable is published weekly in the model, the weekly total values of the independent variables were analyzed. As the factors affecting the housing loan are examined in the literature research, it is seen that many factors (housing prices, housing rents, household income level, interest rates, consumer confidence, gold prices and demographic factors) are effective. Since the relationship between the pandemic and the housing loan was examined in the study, the variables that could represent the pandemic were included in the model. However, the factors affecting the housing loan should also be included in the model as a control variable. However, since the range of variables included in the model is taken on a weekly basis, weekly data should be available for the variable included in the model as a control variable.

The model of the study was determined as follows:

$$LHL_t = \beta_0 + \beta_1 LND_t + \beta_2 LNC_t + \beta_3 USD_t + \varepsilon_t$$

Table 3 shows the variables included in the model and their sources. These variables were obtained from the databases of official institutions for easy accessibility and reliability of the data.

3.2 Econometric method

In this study, where weekly data for the period March 9, 2020 to February 4, 2022 were analyzed to examine the relationship between the pandemic and the housing sector, time series analysis techniques that allow structural breaks were used. The methodology is as follows:

(1) The Augmented Dickey and Fuller (1979) test (ADF), a unit of root test, the KPSS stationarity test developed by Kwiatkowski *et al.* (1992) and the CS stationarity test developed by Carrion-i Silvestre *et al.* (2009) were implemented to determine whether the variables included in the model contain unit roots.

Table 3. Variables and their sources

Variables	Description	Sources
HL	Amount of Housing Loans Used	BRSA
ND	Number of New Deaths	Our World in Data
NC	Number of New Cases	Our World in Data
USD	Exchange Rate	CBRT

(2) The Maki (2012) cointegration test, which allows five breaks to detect the existence of a cointegration relationship between the variables included in the model, was analyzed.

(3) For causality, analyses were carried out using the time-varying causality test, which was introduced to the literature by Hacker and Hatemi-J (2006).

3.2.1 Unit of root tests. In this study, the ADF unit root test, the KPSS unit root test and the CS unit root test, which allows five structural breaks, were used. The ADF unit root test is used to reveal whether there is a unit root in the observed series.

The KPSS unit root test is used as a complement to the ADF unit root test. In classical unit root tests, the null hypothesis usually states non-stationarity. KPSS tests the stationarity of the series evaluated under the null hypothesis. The ADF unit root test is weak and inadequate in finding the appropriate lag length (Schwert, 1989). However, the KPSS unit root test yields stronger results than other classical unit root tests. The hypothesis in the ADF unit root test is the opposite of the KPSS and contains the null hypothesis. Unlike the ADF, the KPSS states that the series are stationary under the null hypothesis. The KPSS statistic depends on the error terms obtained from regressing the time series on exogenous variables. Critical values are derived from the work of Kwiatkowski, Phillips, Schmidt and Shin in 1992 (see Table 4).

According to the ADF, the variables are unit rooted at the level value in the constant and stationary model when differenced except for the LNC variable. When the LNC variable was differenced, the stationarity level strengthened from 5% to 1%. In the constant and trend model, all variables were stationary at level values. However, the significance level strengthened when differenced. In sum, the variables are stationary at I(1).

In the KPSS analysis, all variables except the LVS variable in the constant model are unit rooted at level values and become stationary when differenced. In the model constant and trend model, while LHL, LND, LNC and USD variables are stationary at level, their significance levels increase when they are differenced. In addition, the null hypothesis is valid. The results are evaluated accordingly. Based on the stationarity analysis, since the variables are stationary at I(1) level, the precondition for the cointegration test is met.

In contrast to the classical unit root tests, Carrion-i Silvestre *et al.* (2009, pp. 1756–1757) developed a unit root test that allows five structural breaks and the breaks in the tests are endogenous. Thanks to Bai and Perron (2003) and Perron and Qu (2006), the time of structural breaks in the CS unit root test was created by transforming the programming form into a dynamic structure and turning it into an algorithm. According to an idea put forward by

	ADF test statistic		KPSS test statistic	
Variable	Constant model	Constant and trend model	Constant model	Constant and trend model
LHL	−2.44 [3] (0.13)	−3.23 [1]*** (0.08)	0.80 [8]	0.20 [8]**
ΔLHL	−2.94 [2]** (0.04)	−3.12 [2]*** (0.10)	0.25 [7]*	0.10 [7]*
LND	−2.35 [5] (0.15)	−3.34 [5] *** (0.06)	0.92 [7]	0.13 [6] ***
ΔLND	−4.83 [4]* (0.00)	−4.82 [4] * (0.00)	0.23 [5]*	0.08 [5]*
LNC	−3.11 [1] ** (0.02)	−6.48 [1]* (0.00)	1.07 [8]	0.13 [6]***
ΔLNC	−5.35[0]* (0.00)	−5.12 [0]* (0.00)	0.21 [5]*	0.09 [5]*
USD	0.16 [9] (0.96)	−3.71 [6]** (0.02)	0.86 [8]	0.18 [8]**
ΔUSD	−3.61 [8]* (0.00)	−3.76 [8]** (0.02)	0.24 [2]*	0.07[1]*

Note(s): *,** and *** indicate stationarity at 1%, 5% and 10% significance level, respectively; the values in parentheses indicate probability values. In the ADF, the values in brackets indicate the appropriate lag lengths determined according to the AIC (Akaike) information criterion. KPSS test critical values Constant Model: 1%: 0.73% 5%: 0.46% 10%: 0.34 Constant and Trend Model: 1%: 0.21% 5%: 0.14% 10%: 0.11

Table 4.
ADF and KPSS unit root test analysis

Elliott *et al.* (1996), with Quasi-Generalized Least Squares (Quasi-GLS) and detrending method, the error sum of squares is minimized and obtained by summing. Simulation experiments have developed methods that can be used for small samples (Carrion-i-Silvestre *et al.*, 2009, p. 1782).

Unlike other tests with structural breaks, the CS unit root test allows a maximum of five breaks (Carrion-i Silvestre *et al.*, 2009). In addition, in SC, stationarity is tested with five different test statistic values, which are MZt, MSb, MZα, MPt and Pt. The main hypothesis of CS is stated as "the series contains a unit root under a structural break." According to the hypothesis of CS, the null hypothesis is invalid if the test statistic values calculated in this case are less than the critical point; however, there is no unit root in the series in the presence of structural breaks. Therefore, the series are stationary (see Table 5).

According to the CS results, all variables were unit rooted at their level values. In order to make the series stationary, the differencing method was not applied as in the classical unit root tests (ADF–KPSS). The series were stationary at level in classical unit root tests, but their significance levels strengthened when they were differenced because the 5-fracture CS test takes into account structural breaks, and the reason for the non-stationarity in the series was not considered to be structural breaks and the difference was not taken. Since all variables

Variable	P_T^{GLS}	MP_T^{GLS}	MZ_α^{GLS}	MSB^{GLS}	MZ_t^{GLS}	Break dates
LHL	35.27 (8.81)	32.91 (8.81)	−12.26 (−45.42)	0.19 (0.10)	−2.45 (−4.76)	June 01–05, 2020 August 10–14, 2020 April 05–09, 2021 July 26–30, 2021 November 01–05, 2021
LND	42.50 (9.17)	35.90 (9.17)	−12.23 (−47.40)	0.20 (0.10)	−2.47 (−4.84)	May 11–15, 2020 July 27–31, 2020 December 21–25, 2020 March 15–19, 2021 July 26–30, 2021
LNC	42.48 (9.27)	35.40 (9.27)	−12.34 (−46.86)	0.20 (0.10)	−2.47 (−4.81)	May 11–15, 2020 November 09–13, 2020 January 25–29, 2021 April 19–23, 2021 July 05–09, 2021
USD	16.86 (8.73)	15.33 (8.73)	−30.67 (−45.86)	0.11 (0.10)	−3.65 (−4.79)	July 20–24, 2020 October 26–30, 2020 February 15–19, 2021 August 16–20, 2021 November 22–26, 2021)

Table 5.
CS unit root test results

Note(s): Values in parentheses are critical values at 5% significance level. Critical values are generated using bootstrap with 1,000 iterations

were I(I) in the classical unit root test results on the series with unit roots at their level values, the necessary condition for the cointegration test was met.

The break dates observed in the CS indicate that there have been significant social, political, economic, and structural developments in the Turkish economy, and these developments are likely to lead to new breaks.

3.2.2 Maki cointegration test. In this study, the Maki Cointegration test, which allows five breaks among the new generation tests, is used since the time interval is wide. In addition, this test was preferred since there will be more than two breaks due to the selected data interval and the fact that social, economic, health, and political fluctuations have an impact. Maki is a cointegration test that allows analysis of the multifractal relationship (Maki, 2012, p. 2013). The main feature of the Maki cointegration test is that it reveals the realized breaks internally. In this context, Maki (2012) has taken its place in the literature by using the cointegration test with structural breaks, which allows a maximum of five breaks, with four different models.

The algorithm of the Maki test works as follows: a possible break point is taken in each period, the *t* statistic is calculated, and the points where the *t* value is minimum are accepted as the break focus (Göçer *et al.*, 2013, p. 10). The results of the Maki cointegration test in the study are presented in Table 6.

According to the results of the Maki cointegration test, a long-run relationship was found in all models at the 1% level. In other words, it has been concluded that there is a long-run relationship between the number of cases and deaths, which are pandemic variables and housing loans with structural breaks. Considering the break dates, a total of eight breaks occurred in four models, and the reasons for these breaks are as follows:

First, on April 13–17, 2020, COVID-19 increased its course and impact and restrictions emerged. Another break in the following period occurred on April 20–24, 2020. Due to the measures implemented during this period, disruptions in the production and supply chain, and a slowdown in activities, sectors faced some difficulties in this period. On August 3–7, 2020, countries trying to combat COVID-19 embarked on vaccine development efforts. In addition, due to a number of developments in the world, the exchange rate in the country reached 7 Turkish lira, the highest in the history of the exchange rate. On November 16–20, 2020, another breakthrough date range, interesting developments occurred in the world and in the Turkish economy. During this period, the Turkish Central Bank governor changed. The impact of this change was felt in a week and a decline in the exchange rate emerged. Later in the period, the Istanbul Stock Exchange (BIST) renewed its record high and rose to 1,309 points. Finally, sales in the housing sector, which constitutes the main theme of this study, increased to 1.3 million in the last 10 months of 2020. These developments caused a break in

Models	Test statistic	Break dates	Critical values 1%	5%	10%
Model 0	−7.409*	April 13–17, 2020 February 01–05, 2021	−5.984	−5.517	−5.272
Model 1	−7.335*	April 13–17, 2020 November 16–20, 2020	−5.984	−5.517	−5.272
Model 2	−9.018*	April 20–24, 2020	−5.82	−5.341	−5.101
Model 3	−7.978*	April 13–17, 2020 August 03–07, 2020 March 08–12, 2021 November 22–26, 2021 December 27–31, 2021	−6.55	−6.038	−5.773

Note(s): Maximum five breaks are allowed in the analysis. * indicates significance at 1% significance level. Critical values have been taken from Table 1 in Maki (2012)

Table 6.
Maki cointegration test results

the analysis. February 1–5, 2021 emerged as another break date in the analysis. During this period, society got used to living with restrictions and adapted to the new order. However, total monthly house sales in the housing sector increased by 14,602 compared with the previous month (GYÖDER 3rd Quarter Report, 2021, p. 24). Another break occurred in March 8–12, 2021 when the governor of the Turkish Central Bank changed again. However, the pandemic entered a new phase, along with gradual normalization phases and easing of restrictions. November 22–26, 2021 is seen as another breaking date in the analysis. In this period, the Turkish economy changed its foreign policy and the Central Bank started to cut interest rates, which was announced as the third interest rate cut in 2021. The fall in interest rates put significant pressure on the exchange rate. The last break occurred December 27–31, 2021. During this period, interest rates were cut for the fourth time in 2021. In addition, while the exchange rate closed that year in the 14 band, decision-makers in Turkey stated that this situation should not cause anxiety. In addition, Omicron, the new variant of the virus that led to the pandemic, was first seen in Turkey during this period.

3.2.3 Time-varying causality test results. The time-varying causality test, introduced to the literature by Hacker and Hatemi-J (2006), involves "subdividing the samples and applying it to all of them individually." As any structural change may cause changes in the parameters, the direction of the causality relationship also changes over time. The relationships between variables may change over the period under consideration; therefore, in the second step, unlike traditional methods, the time-varying bootstrap causality test developed by Hacker and Hatemi-J (2006) based on the Toda (1995) causality test was performed and interpreted.

The relationships between variables, as mentioned by Tang (2008) and Arslantürk *et al.* (2011), change over time. In particular, political and economic events have an impact on the causality relationship. Therefore, it is useful to examine the relationships between the series using the time-varying causality method and examine the existence of different causality relationships in various periods. According to Hacker and Hatemi-J (2006) and causality analysis, and based on the Rolling Window method, the windows here refer to subperiods.

The main advantage of time-varying causality tests is that they focus on the intertemporal variation of the causality relationship between variables. Another strength is that it provides information about the stability of the ongoing causality relationship between variables.

The causality relationship between pandemic variables and the amount of housing loan utilization was analyzed using time-varying symmetric methods in this study. In Figure 1, the blue lines represent the periodically calculated test statistic value of the hypotheses and the

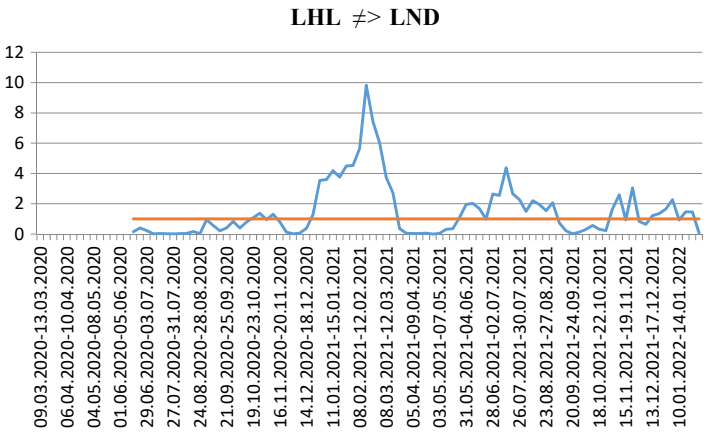

Figure 1.
Causality analysis from housing loans to number of deaths

red solid line represents the critical value of the test. It can be argued that there is a causality relationship between the variables in the intervals with the blue line above the red line.

A causality relationship is observed between housing loans and the number of deaths at the following dates:

In the study, a causal relationship was found between the specific dates in Table 7, between the housing loans, which is the dependent variable and the number of deaths, which is the independent variable. The quarantine measures taken on the relevant dates brought the housing sector to a standstill. Due to the easing of the measures in time and the summer season, the sector became active again. In addition to all these, the increase in the number of deaths on the relevant dates may have been financed by an expenditure allocated to health expenditures.

In Figure 2, a causal relationship is seen between the number of deaths and housing loans between the following dates:

A causality relationship between the number of deaths and housing loans was observed within the dates in Table 8. In particular, an increase in the number of deaths raises the risk perception in the country. Housing is used both as a shelter and an investment instrument. While an increase in the death rate causes uncertainty, individuals may turn to investment in the housing sector to protect their assets. In sum, there is a bidirectional causality relationship between the two variables at certain dates.

19.10.2020–23.10.2020	01.11.2021–05.11.2021	12.07.2021–16.07.2021	08.03.2021–12.03.2021
26.10.2020–30.10.2020	08.11.2021–12.11.2021	19.07.2021–23.07.2021	02.08.2021–06.08.2021
09.11.2020–13.11.2020	22.11.2021–26.11.2021	26.07.2021–30.07.2021	09.08.2021–13.08.2021
21.12.2020–25.12.2020	04.01.2021–08.01.2021	13.12.2021–17.12.2021	16.08.2021–20.08.2021
28.12.2020–01.02.2021	11.01.2021–15.01.2021	20.12.2021–24.12.2021	23.08.2021–27.08.2021
15.03.2021–19.03.2021	18.01.2021–22.01.2021	27.12.2021–31.12.2021	30.08.2021–03.09.2021
24.05.2021–28.05.2021	25.01.2021–29.01.2021	08.02.2021–12.02.2021	03.01.2022–07.01.2022
31.05.2021–04.06.2021	01.02.2021–05.02.2021	15.02.2021–19.02.2021	17.01.2022–21.01.2022
07.06.2021–11.06.2021	28.06.2021–02.07.2021	22.02.2021–26.02.2021	24.01.2022–28.01.2022
14.06.2021–18.06.2021	05.07.2021–09.07.2021	01.03.2021–05.03.2021	

Table 7.
Dates of causality from housing loans to number of deaths

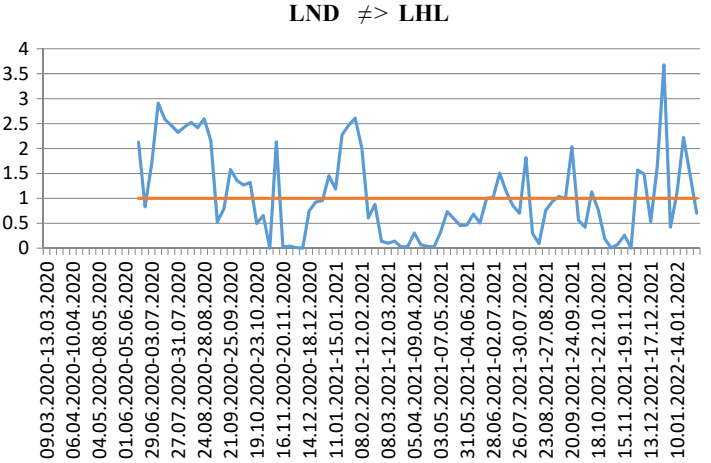

Figure 2.
Causality analysis from death numbers to housing loans

In Figure 3, a causality relationship is observed between housing loans and the number of cases between the following dates:

A causal relationship between housing loans and the number of cases on certain dates was determined in Table 9. In the relevant period, the fluctuations in COVID-19 variants, inflation and interest rates may have dominated the uncertainty. Therefore, the change in the sector was reflected in the number of cases. In addition, during the pandemic period, remote work (home office) began to occur all over the world, including in Turkey. Therefore, there would be an increase in the demand for housing. The increase in demand will result in the supply not being able to meet the demand in the current situation and will cause an increase in prices.

Table 8.
Dates of causality relationship from the number of deaths to housing loans

15.06.2020–19.06.2020	25.01.2021–29.01.2021	08.02.2021–12.02.2021	05.10.2020–09.10.2020
29.06.2020–03.07.2020	06.12.2021–10.12.2021	28.06.2021–02.07.2021	12.10.2020–16.10.2020
06.07.2020–10.07.2020	20.12.2021–24.12.2021	05.07.2021–09.07.2021	02.08.2021–06.08.2021
13.07.2020–17.07.2020	27.07.2020–31.07.2020	12.07.2021–16.07.2021	06.09.2021–10.09.2021
20.07.2020–24.07.2020	03.08.2020–07.08.2020	27.12.2021–31.12.2021	20.09.2021–24.09.2021
09.11.2020–13.11.2020	10.08.2020–14.08.2020	10.01.2022–14.01.2022	11.10.2021–15.10.2021
04.01.2021–08.01.2021	17.08.2020–21.08.2020	31.08.2020–04.09.2020	29.11.2021–03.12.2021
11.01.2021–15.01.2021	24.08.2020–28.08.2020	21.09.2020–25.09.2020	17.01.2022–21.01.2022
18.01.2021–22.01.2021	01.02.2021–05.02.2021	28.09.2020–02.10.2020	24.01.2022–28.01.2022

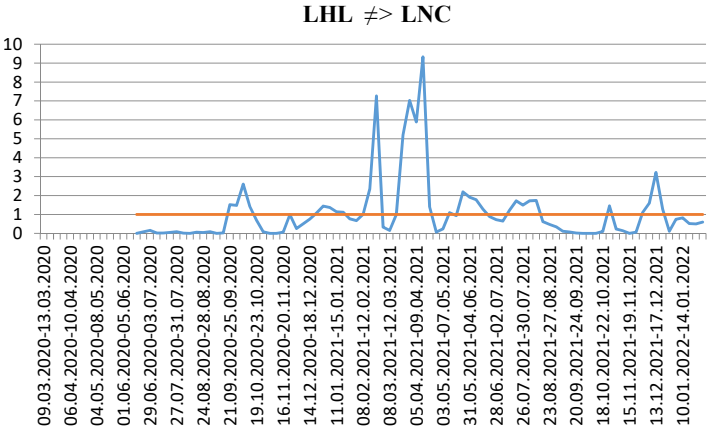

Figure 3.
Causality analysis from housing loans to number of cases

Table 9.
Dates of causality relationship from housing loans to number of cases

09.03.2020–13.03.2020	21.12.2020–25.12.2020	08.02.2021–12.02.2021
21.09.2020–25.09.2020	28.12.2020–01.02.2021	15.02.2021–19.02.2021
28.09.2020–02.10.2020	04.01.2021–08.01.2021	22.02.2021–26.02.2021
05.10.2020–09.10.2020	11.01.2021–15.01.2021	22.03.2021–26.03.2021
12.10.2020–16.10.2020	18.01.2021–22.01.2021	29.03.2021–02.04.2021
05.04.2021–09.04.2021	31.05.2021–04.06.2021	26.07.2021–30.07.2021
12.04.2021–16.04.2021	07.06.2021–11.06.2021	02.08.2021–06.08.2021
19.04.2021–23.04.2021	14.06.2021–18.06.2021	09.08.2021–13.08.2021
10.05.2021–14.05.2021	12.07.2021–16.07.2021	25.10.2021–29.10.2021
24.05.2021–28.05.2021	19.07.2021–23.07.2021	29.11.2021–03.12.2021
06.12.2021–10.12.2021	13.12.2021–17.12.2021	20.12.2021–24.12.2021

In Figure 4, a causality relationship is observed between the following ranges from the number of cases to housing loans:

A causality relationship between housing loans and the number of cases is identified for certain dates in Table 10. Any change in the number of cases on the dates in question had an impact on housing loans. As the number of cases increased or decreased, just like the number of deaths, the number of cases caused an upturn or a recession in the sector. According to the table, any change in the number of cases in the relevant period had an impact on housing loans. In sum, a bidirectional causality relationship was detected between the two variables at the mentioned dates.

In Figure 5, a causality relationship is observed between the following date ranges from housing loans to exchange rate:

The exchange rate is the control variable in the study and is estimated to have had an impact on housing loans. A change in the exchange rate has an impact not only on the housing sector but also on all other sectors. A causality relationship between housing loans and the exchange rate on certain dates is shown in Table 11. Housing loans are affected by many macroeconomic variables, primarily interest rates. The interest rate to which it is linked causes volatility in the exchange rate.

In Figure 6, there is a causality relationship between the exchange rate and housing loans between the following date ranges:

A causality relationship between exchange rates and housing loans on certain dates is observed in Table 12. Changes in exchange rates on these dates had a significant impact on

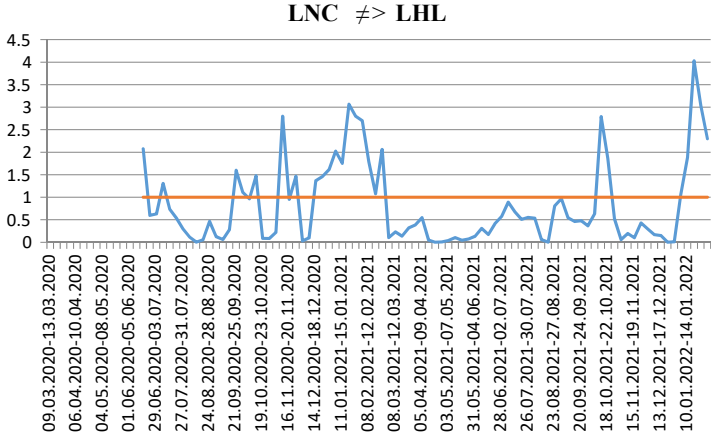

Figure 4.
Causality analysis from number of cases to housing loans

09.03.2020–13.03.2020	09.11.2020–13.11.2020	11.01.2021–15.01.2021
15.06.2020–19.06.2020	23.11.2020–27.11.2020	18.01.2021–22.01.2021
06.07.2020–10.07.2020	14.12.2020–18.12.2020	25.01.2021–29.01.2021
21.09.2020–25.09.2020	21.12.2020–25.12.2020	01.02.2021–05.02.2021
28.09.2020–02.10.2020	28.12.2020–01.02.2021	08.02.2021–12.02.2021
12.10.2020–16.10.2020	04.01.2021–08.01.2021	15.02.2021–19.02.2021
22.02.2021–26.02.2021	11.10.2021–15.10.2021	18.10.2021–22.10.2021
03.01.2022–07.01.2022	10.01.2022–14.01.2022	17.01.2022–21.01.2022
24.01.2022–28.01.2022	31.01.2022–04.01.2022	

Table 10.
Dates of causality from number of cases to housing loans

the housing sector. In particular, the causality from the housing sector to the exchange rate is less than the causality from the exchange rate to the housing sector. As seen in Table 11, a change in exchange rates had a greater impact on the housing sector. Interest rates and exchange rates have a significant impact on housing loans. In sum, there was a bidirectional causality relationship between the two parameters at certain dates.

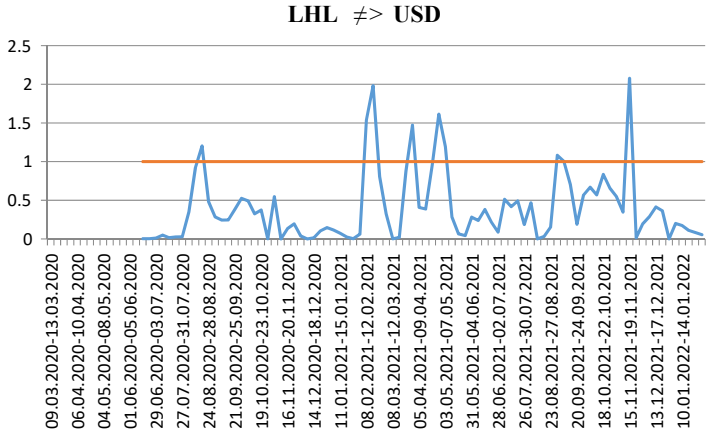

Figure 5.
Causality analysis from housing loans to exchange rate

17.08.2020–21.08.2020	03.05.2021–07.05.2021
08.02.2021–12.02.2021	30.08.2021–03.09.2021
15.02.2021–19.02.2021	06.09.2021–10.09.2021
29.03.2021–02.04.2021	15.11.2021–19.11.2021
26.04.2021–30.04.2021	

Table 11.
Dates of causality from housing loans to exchange rate

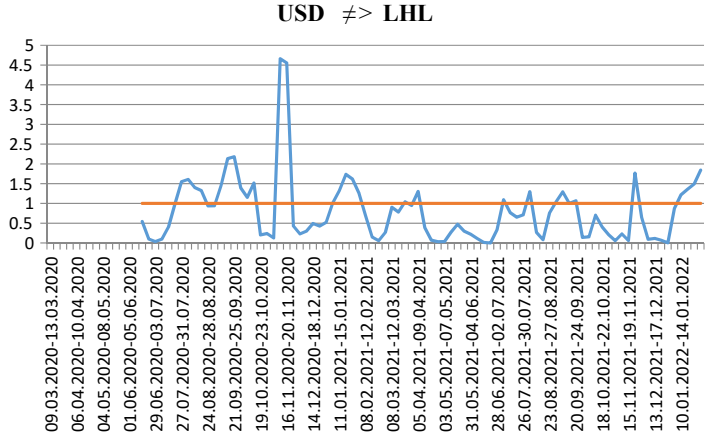

Figure 6.
Causality analysis from exchange rate to housing loans

4. Conclusion

In this study, the relationship between the housing sector and the pandemic was analyzed using weekly data from March 9, 2020 to February 4, 2022. Housing loans were used as a measure of the housing sector; the number of new deaths and the number of new cases were used to represent the pandemic, and the exchange rate was used as a control variable due to the effect of credit utilization on the housing sector. According to the results obtained, it was concluded that there was a long-run relationship between the variables with structural breaks. Finally, a time-varying causality test was used to determine the causality relationship between the variables and its direction. As a result of the analysis, a bidirectional causality relationship was found between all variables at certain dates.

The results of this study are generally consistent with other studies in the literature. Studies in the literature have indicated a positive or negative relationship between the pandemic and the housing market, especially when prices are taken into account. In this context, the results of this study are consistent with those obtained by Francke and Korevaar (2021), D'Lima *et al.* (2020), Liu and Su (2021), Zhao (2020), Wang (2021), and Del Giudice *et al.* (2020). However, the results partially contradict those found by Hu *et al.* (2021). The reason for this contradiction is that the quarantine practices implemented by the Australian government in the housing market were insufficient.

Based on the findings of the study, policymakers, market actors and new researchers were separately presented with recommendations. In this context, policymakers first of all should set a permanent budget allocation in the public budget for extraordinary situations such as pandemics. In addition, research and development (R/D) expenditures for the treatment of and solution for such a pandemic stage should be increased and necessary support should be provided for new treatment methods. The pandemic negatively affects social life and the real economy. Therefore, it is very important for decision-makers to support firms and citizens with financial measure packages. The housing sector, the main subject of this study, is also very important in terms of macroeconomics. Accordingly, measures and support packages should be continuously developed in both the housing sector and the subindustry related to this sector during pandemics. In addition to sectoral support, stable and successful management of macroeconomic indicators such as interest rates and exchange rates is of great importance for housing markets. Policymakers have many ways to do these recommendations. Some of these are expressed as lowering loan interest rates, providing tax support, revision in the public budget and providing budget allocations from international organizations.

The recommendations offered to market actors within the scope of the results of the study should be evaluated in terms of those who supply housing and demand it. For those who supply housing, construction costs should be reduced, innovative policies should be followed, and the houses built for this purpose should be introduced to individuals in an

Table 12. Dates of causality from exchange rate to housing loans

27.07.2020–31.07.2020	21.09.2020–25.09.2020	04.01.2021–08.01.2021
03.08.2020–07.08.2020	28.09.2020–02.10.2020	11.01.2021–15.01.2021
10.08.2020–14.08.2020	05.10.2020–09.10.2020	18.01.2021–22.01.2021
17.08.2020–21.08.2020	12.10.2020–16.10.2020	25.01.2021–29.01.2021
07.09.2020–11.09.2020	09.11.2020–13.11.2020	01.02.2021–05.02.2021
14.09.2020–18.09.2020	16.11.2020–20.11.2020	22.03.2021–26.03.2021
05.04.2021–09.04.2021	06.09.2021–10.09.2021	10.01.2022–14.01.2022
05.07.2021–09.07.2021	13.09.2021–17.09.2021	17.01.2022–21.01.2022
02.08.2021–06.08.2021	20.09.2021–24.09.2021	24.01.2022–28.01.2022
30.08.2021–03.09.2021	22.11.2021–26.11.2021	31.01.2022–04.01.2022

appropriate way by following a remarkable advertising policy. This will attract the interest of citizens and cause mobility within the sector. Building contractors following innovative policies and making production continuous will respond to the sector's demand and cause prices to fall. In addition, house builders can provide ease of payment in order to sell housing to citizens. Another suggestion is that digital marketing can be used since everything is technological in today's world. In this context, builders and real estate agents can promote houses by using 3D imaging to offer citizens the feeling that they are inside the house. However, to achieve this, infrastructure equipment must be very strong and the background must be solid. In other words, the ease of access to each company in the Internet environment should be at a high level. Therefore, the sector should attach importance to R/D activities. An increase in the potential of housing consumers may also have a positive impact on the financial markets in the economic process and may cause dynamism in the sector.

Finally, based on the results of the study, new researchers can expand the data range and analyze daily data in their studies of the pandemic. In addition, testing new studies using different methods, countries and country groups, and variables will contribute to the literature.

References

Afşar, A. and Karpuz, E. (2019), "Makroekonomik Değişkenlerle Borsa İstanbul Gayrimenkul Yatırım Ortaklıkları Endeksi Arasındaki İlişki", *Anadolu Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, Vol. 20 No. 1, pp. 52-64.

Akkaş, M. and Sayılgan, G. (2015), "Konut Fiyatları ve Konut Kredisi Faizi: Toda-Yamamoto Nedensellik Testi", *Finans Sempozyumu Çorum*, Vol. 19, pp. 367-378.

Arslantürk, Y., Balcılar, M. and Özdemir, Z.A. (2011), "Time-varying linkages between tourism receipts and economic growth in a small open economy", *Economic Modelling*, Vol. 28 No. 1, pp. 664-671.

Badurlar, İ. (2008), "Türkiye'de Konut Fiyatları ile Makro Ekonomik Değişkenler Arasındaki İlişkinin Araştırılması", *Anadolu Üniversitesi Sosyal Bilimler Dergisi*, Vol. 8 No. 1, pp. 223-238.

Baffoe-Bonnie, J. (1998), "The dynamic impact of macroeconomic aggregates on housing prices and stock of houses: a national and regional analysis", *Journal of Real Estate Finance and Economics*, Vol. 17 No. 2, pp. 179-197.

Bahmani-Oskooee, M. and Wu, T. (2018), "Housing prices and real effective exchange rates in 18 OECD countries: a bootstrap multivariate panel granger causality", *Economic Analysis and Policy*, Vol. 60, pp. 119-126.

Bai, J. and Perron, P. (2003), "Computation and analysis of multiple structural change models", *Journal of Applied Econometrics*, Vol. 18 No. 1, pp. 1-22.

Bayır, M., Güvenoğlu, H. and Kutlu, Ş. (2019), "Konut Fiyatlarının Belirleyicileri Üzerine Ampirik Bir Analiz", *İnternational Conference On Empirical Economics and Social Sciences*, Vol. 19, ICEESS, pp. 777-791.

Beltratti, A. and Morana, C. (2010), "International house price and macroeconomic fluctuations", *Journal of Banking and Finance*, Vol. 34 No. 3, pp. 533-545.

Çankaya, S. (2013), "Konut Fiyatları Ve Makroekonomik Faktörler Arası İlişkiye Global Bakış", *Maliye ve Finans Yazıları*, Vol. 1 No. 100, pp. 143-154.

Carrion-i-Silvestre, J.L., D. Kim, D. and Perron, P. (2009), "GLS-based unit root tests with multiple structural breaks under both the null and the alternative hypotheses", *Econometric Theory*, Vol. 25 No. 6, pp. 1754-1792.

D'Lima, W., Lopez, L.A. and Pradhan, A. (2020), "COVID-19 and housing market effects: evidence from US shutdown orders", *Real Estate Economics*, available at: SSRN 3647252.

Del Giudice, V., De Paola, P. and Del Giudice, F.P. (2020), "COVID-19 infects real estate markets: short and mid-run effects on housing prices in Campania region (Italy)", *Social Sciences*, Vol. 9 No. 7, pp. 114-131.

Dickey, D.A. and Fuller, W.A. (1979), "Distribution of the estimators for autoregressive time series with a unit root", *Journal of the American Statistical Association*, Vol. 74, pp. 427-431.

Dilber, İ. and Sertkaya, Y. (2016), "2008 Finansal Krizi Sonrası Türkiye'de Konut Fiyatlarının Belirleyicilerine Yönelik Analiz", *Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi*, Vol. 4 No. 1, pp. 11-29.

Egert, B. and Mihaljek, D. (2007), "Determinants of house prices in central and Eastern Europe", William Davidson Institute Working Paper No.894.

Elliott, G., Rothenberg, T.J. and Stock, J.H. (1996), "Efficient tests for an autoregressive unit root", *Econometrica*, Vol. 64, pp. 813-836.

Englaund, P. and Ioannides, Y.M. (1997), "House price dynamics: an international empirical perspective", *Journal of Housing Economic*, Vol. 6 No. 2, pp. 119-136.

Eryüzlü, H. and Ekici, S. (2020), "Konut Fiyat Endeksi ve Reel döviz Kuru İlişkisi: Türkiye Örneği", *İktisadi İdari ve Siyasal Araştırmalar Dergisi*, Vol. 5 No. 12, pp. 97-105.

Follain, J.R. (1981), "Does inflation affect real behavior? The case of housing", *Southern Economic Journal*, Vol. 48 No. 3, pp. 570-582.

Francke, M. and Korevaar, M. (2021), "Housing markets in a pandemic: evidence from historical outbreaks", *Journal of Urban Economics*, Vol. 123, 103333.

Gallin, J. (2006), "The long-run relationship between house prices and income: evidence from local housing markets", *Real Estate Economics*, Vol. 34 No. 3, pp. 417-438.

Gaspareniene, L., Remeikiene, R. and Skuka, A. (2016), "Assessment of the impact of macroeconomic factors on housing price level: Lithuanian case", *Intellectual Economics*, Vol. 10 No. 2, pp. 120-127.

Göçer, İ., Mercan, M. and Peker, O. (2013), "Kredi Hacmi Artışının Cari Açığa Etkisi: Çoklu Yapısal Kırılmalı Eşbütünleşme Analizi", *İstanbul Üniversitesi İktisat Fakültesi Ekonometri ve İstatistik Dergisi*, Vol. 18, pp. 1-17.

Green, R. (1997), "Follow the leader: how changes in residential and non-residential investment predict changes in GDP", *Real Estate Economics*, Vol. 25 No. 2, pp. 253-270.

GYODER (Gayrimenkul Yatırımcıları Derneği) (2020), *GYODER Third Quarter Report Türkiye'de 2020 Yılında Konut Satış Rakamları*, GYODER Yayınları, İstanbul.

Gayrimenkul Yatırımcıları Derneği (GYODER) (2021), *GYODER 3. Çeyrek Raporu Türkiye'de 2021 Yılı Konut Adedi*, GYODER Yayınları, İstanbul.

Hacker, R.S. and Hatemi-J, A. (2006), "Tests for causality between integrated variables using asymptotic and bootstrap distributions: theory and application", *Applied Economics*, Vol. 38 No. 13, pp. 1489-1500.

Haris, J. (1989), "The effect of real interest on housing prices", *Journal of Real Estate Finance and Economics*, Vol. 2 No. 1, pp. 47-60.

Hu, S., Xiong, C., Yang, M., Younes, H., Luo, W. and Zhang, L. (2021), "A big-data driven approach to analyzing and modeling human mobility trend under non-pharmaceutical interventions during COVID-19 pandemic", *Transportation Research Part C: Emerging Technologies*, Vol. 124, 102955.

İbicioğlu, M. and Karan, M. (2012), "Konut Kredisi Talebini Etkileyen Faktörler: Türkiye Üzerine bir Uygulama", *Ekonomi Bilimleri Dergisi*, Vol. 4 No. 1, pp. 65-75.

Karadağ, H. (2021), "COVİD-19 Pandemi Döneminde Türkiye Ekonomisinde Enerji Sektöründe Yaşanan Gelişmeler", *Turkish Business Journal*, Vol. 2 No. 3, pp. 11-23.

Kearl, J.H. (1979), "Inflation, mortgages and housing", *Journal of Political Economy*, Vol. 87 No. 5, pp. 1-29.

Kennedy, N. and Anderson, P. (1994), "Household saving and real house prices: an international perspective", BIS Working Paper, p. 20.

Kızıltepe, M. (2011), *Türkiye'de Konut Politikalarının Belirlenmesinde Kredilerin Etkisi ve Değişen Rolü*, Yayınlanmamış Yüksek Lisans Tezi, Ankara Üniversitesi, Ankara.

Kolcu, F. and Yamak, N. (2018), "Gelir ve Faiz Oranlarının Konut Fiyatları Üzerindeki Kısa ve Uzun Dönem Etkileri", *International Journal of Economic and Administrative Studies*, Prof. Dr. Harun Terzi Special Issue, pp. 141-152.

Kong, Y., Glascock, J.L. and Lu-Andrews, R. (2016), "An investigation into real estate investment and economic growth in China: a dynamic panel data approach", *Sustainability*, Vol. 8 No. 66, pp. 1-18.

Kwiatkowski, D., Phillips, P.C.B., Schmidt, P. and Shin, Y. (1992), "Testing the null hypothesis of stationarity against the alternative of a unit root: how sure are we that economic time series have a unit root?", *Journal of Econometrics*, Vol. 54, pp. 159-178.

Liu, S. and Su, Y. (2021), "The impact of the covid-19 pandemic on the demand for density: evidence from the US housing market", *Economics Letters*, Vol. 207, 110010.

Maki, D. (2012), "Tests for cointegration allowing for an unknown number of breaks", *Economic Modelling*, Vol. 29 No. 5, pp. 2011-2015.

Manchester, J. (1987), "Inflation and housing demand: a new perspective", *Journal of Urban Economic Literature*, Vol. 21 No. 1, pp. 105-125.

Mikhed, V. and Zemcik, P. (2009), "Do house prices reflect fundamentals? Aggregate and panel data evidence", *Journal of Housing Economics*, Vol. 18 No. 2, pp. 140-149.

Özcan, G. and Tormuş, N. (2018), "Konut Fiyat Endeksi Ve Döviz Kuru İlişkisi: Türkiye Üzerine Ampirik Bir Çalışma", *Icpess 2018 Proceedngs*, Vol. 2, Economic Studies, pp. 505-514.

Panagiotidis, T. and Printzis, P. (2015), *On the Macroeconomic Determinants of the Housing Market in Greece: A VECM Approach*, Hellenic Observatory European Institute, Hellenic Observatory Papers on Greece and Southeast Europe, No. 88, pp. 1-25.

Perron, P. and Qu, Z. (2006), "Estimating restricted structural change models", *Journal of Econometrics*, Vol. 134 No. 2, pp. 373-399.

Schwab, R. (1983), "Real and nominal interest rates and the demand for housing", *Journal of Urban Economics*, Vol. 13 No. 2, pp. 230-251.

Schwert, G.W. (1989), "Tests for unit root: a Monte Carlo investigation", *Journal of Business and Economic Statistics*, Vol. 7, pp. 147-160.

Shaari, N.H., Mahmood, W.M.W., Affandi, S. and Baharuddin, N.S. (2016), "Housing prices, macroeconomic variables and corruption Index in ASEAN", *Journal of Applied Environmental and Biological Sciences*, Vol. 6 No. 3S, pp. 67-71.

Tang, C.F. (2008), "Wagner's law versus Keynesian hypothesis: new evidence from recursive regression based causality approaches", *ICFAI Journal of Public Finance*, Vol. 6 No. 4, pp. 29-38.

Toda, H.Y. (1995), "Statistical inference in Vector autoregressions with possibly integrated processes", *Journal of Econometrics*, Vol. 66 Nos 1-2, pp. 225-250.

Trofimov, I.D., Aris, N. Md. and Xuan, D.C.D. (2018), "Macroeconomic and demographic determinants of residential proferty prices in Malaysia", available at: https://mpra.ub.uni-muenchen.de/85819/1/MPRA_paper_85819.pdf (accessed 7 June 2022).

Turkey Report (2010), *Europe's Best Residential Property Investment*, Global Propert Guide.

Usanmaz, D. (2021), "COVID-19 Pandemi Sürecinin Türkiye'de Konut Sektörü Üzerine Etkileri", *Nevşehir Hacı Bektaş Veli Üniversitesi SBE Dergisi*, Vol. 11 No. 3, pp. 1352-1365.

Wang, B. (2021), "How does COVID-19 affect house prices? A cross-city analysis", *Journal of Risk and Financial Management*, Vol. 14 No. 2, pp. 47-61.

WHO (World Health Organization) (2021), "Coronavirus disease (COVID-19)", available at: https://www.who.int/emergencies/diseases/novel-coronavirus-2019 (accessed 1 April 2021).

Zhao, Y. (2020), "US housing market during COVID-19: aggregate and distributional evidence", available at: SSRN 3744679.

Zhu, H. (2006), "The structure of housing finance markets and house prices in Asia", *BIS Quarterly Review*, Vol. 1, pp. 55-69.

Further reading

Bayır, M. (2020), "Konut Fiyatlarının Parasal Aktarım Mekanizmasındaki Rolü", *Sosyoekonomi*, Vol. 28 No. 45, pp. 63-86.

BRSA (2022), "Haftalık Bankacılık Sektörü Verileri", available at: https://www.bddk.org.tr//BultenHaftalik (accessed 4 February 2022).

Carrion-i-Silvestre, J.L. and Sansó, A. (2006), "Testing the null of cointegration with structural breaks", *Oxford Bulletin of Economics and Statistics*, Vol. 68 No. 5, pp. 623-646.

CBRT (2022), "Döviz Kuru", available at: https://evds2.tcmb.gov.tr/ (accessed 4 February 2022).

Our World in Data (2022), "Coronavirus pandemic", available at: https://ourworldindata.org/coronavirus (accessed 4 February 2022).

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