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Why Did House Prices Go Up During COVID-19 Pandemic? Policy-Driven or Market-Driven?

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During the spread of the COVID-19 virus, governments in many countries took temporary measures to mitigate and/or remove the cost of its negative effects on both society and the economy. In Türkiye, as in many countries, the deposit banks cut mortgage interest rates. Thus, Türkiye has experienced large increases in house prices, as have many countries. Türkiye has also become the country with the highest average annual rate of house price increase among the Organisation for Economic Co-operation and Development (OECD) countries during the pandemic period. However, despite an increase in the number of studies on house prices or mortgage loans during the pandemic period, there is a research gap in terms of a comparison of the relationship between house prices and mortgage loans in the pre-pandemic and the pandemic periods compared with that on other assets or in other sectors,. This study aims to rectify this gap. To achieve this, both the Fourier Granger and the Fourier Toda-Yamamoto causality tests are used. The results indicate that there are differences in both periods of time with respect to the relationship between mortgage loans and house prices in Türkiye, and that there is a causal relationship between both factors in the pre-pandemic period, but not during the pandemic period.

Keywords

Mortgage loan, House price, COVID-19 pandemic

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1. Introduction

Since the beginning of the 21st century, the world has witnessed two significant global crises for a short period of time: the 2007-2008 global financial crisis and the COVID-19 pandemic from 2019 to 2023. One of their common features is that both were initiated in two of the largest economies in the world (i.e., China and the United States (US)).[1] The COVID-19 pandemic started in China at the end of 2019 while the global financial crisis started in the US in the second half of 2007. Another common feature is that both crises have greatly influenced many economies in the world, and a final similarity is that governments quickly took temporary measures to prevent the negative impacts of the crisis on society and the economy (e.g. monetary instruments, loans and guarantees, foreign exchange operations, public spending and so on and so forth) (European Council and Council of European Union, 2022; Financial Stability Board, 2021; International Monetary Fund, 2010; International Monetary Fund, 2021; Jinjarak et al., 2021). However, there are also some differences between the crises. The first is that the pandemic crisis globalised in a shorter time than the other. The second relates to their starting point. Unlike the 2007-2008 global crisis which originated from developments in the housing sector and then the finance sector, the starting point of the pandemic crisis was the health sector. The third difference is that the consequences of the two crises differ. In addition to the economic problems which emerged, the COVID-19 crisis resulted in approximately 14.9 million deaths in the world at the end of 2021 (World Health Organisation, 2022). With administrative closures and rises in infection rates, domestic economies were severely affected in most countries by the pandemic shock due to reduction in labour supply, losses of labour income, reductions in household spending, and so on and so forth (International Monetary Fund, 2022; Pan and Yue, 2022). In addition, some sectors (e.g. travel and entertainment) were more greatly and negatively influenced during the pandemic than other sectors (e.g. information technology and communication services). There was also a large discrepancy between sector performance. Moreover, economic development worldwide (e.g. disruptions to international trade and decline in world demand) exacerbated these negativities in the economies.

As with previous economic crises, the COVID-19 pandemic has created many uncertainties. One of them is the effect of the economic shock on the housing markets. With government-implemented lockdowns around the world, economic commentators were warning about the possibility of extreme declines in house prices in many cities globally (Collinson, 2020; Janda, 2020). However, after the start of the pandemic, the mortgage rates decreased so a very different housing market story was experienced by many countries. Contrary to

[1] As of the end of 2021, China and the US ranked first and second in world GDP (purchasing power parity (PPP)-international dollar), respectively. The size of the total production of China and the US was 27.312 trillion US dollars and 22.997 trillion US dollars, respectively (The World Bank, 2022).

expectations, price increases emerged in the housing markets of many countries, except for few (e.g. India, Spain) (Adkins et al., 2021; Allen-Coghlan and Mcquinn, 2021; Duca and Murphy, 2021; Ha, 2021; Organisation for Economic Co-operation and Development, 2022; Wang, 2021). In addition, larger increases in house price than usual were recorded in 2020 in many countries, such as the US, Canada, South Korea, and most of the European countries (e.g. Estonia, Hungary, Iceland, Ireland, Luxembourg, the Netherlands, Norway, Slovakia, Sweden, and Türkiye) (European Mortgage Foundation, 2021; Knight Frank, 2021). The average increases in real house price across 56 national housing markets, which were 4.4% in 2019 annually, were 7.3 % and 10.2% in 2020 and 2021, respectively, as shown in Figure 1.

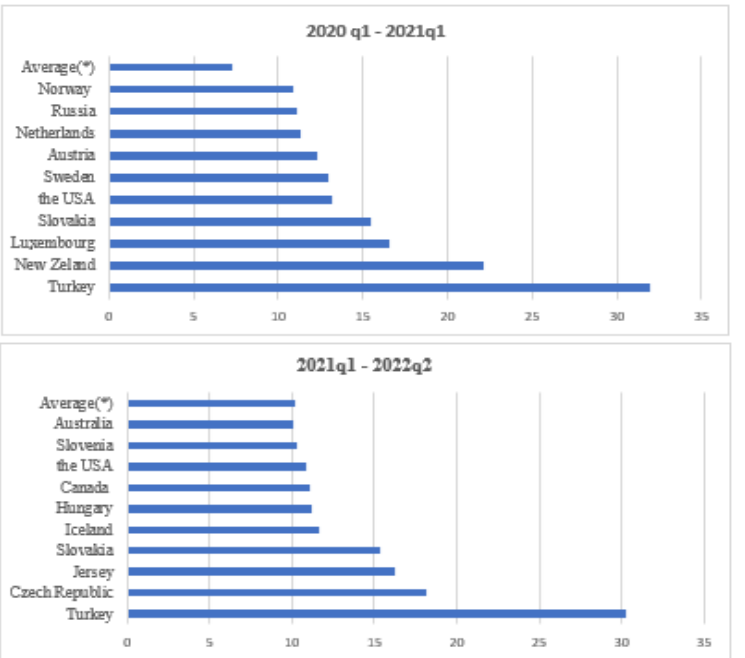
With an easy monetary policy implemented in most countries when the pandemic started, mortgage interest rates decreased and the size of the loan supply increased.[2] As expected, increasing the affordability of households resulted in an increase in the demand for housing as well as mortgage loans (European Mortgage Foundation, 2021). Real house prices also followed a similar trend, which is natural due to the close relationship between loans and house prices[3] (e.g. Gaganis et al. (2020); Hofmann (2004); and Öhman and Yazdanfar (2018)). This was also evidenced by the developments in the pre-2007-2008 global financial crisis period (Mody and Sandri, 2012; Shambaugh et al., 2012). However, during the pandemic, decreases in mortgage rates in Türkiye were much higher than those in many other countries (e.g. European countries), and were also at a record level historically for the Turkish mortgage markets (Figure 2). The existing literature shows that house prices responded to changes in mortgage rates in both the pre-COVID-19 period and during the COVID-19 period (Ferrero, 2015; Miles and Monro, 2021; Otto, 2021; Liu et al., 2021; Yiu, 2021). Studies that focus on the pre-pandemic period indicate that declines in real mortgage rates are consistent with rising house prices in many countries (e.g. the US and the UK) (Bhutta and Ringa, 2021; Ferrero, 2015; Miles and Monro, 2021). The findings of Otto (2021), Liu et al. (2021) and Yiu (2021) for the pandemic period align with pre-pandemic findings. For example, Yiu (2021) finds that a 1% decrease in real interest rates results in an increase of 1.5% in the housing markets of five countries/regions (Australia, Canada, the EU, New Zealand, and the US). The same was true for Türkiye. Moreover, as mortgage rates decreased at a record level during the pandemic period (Figure

[2] The financial accelerator mechanism based on the monetarist view suggests that the monetary policy affects the spending and investment decisions of households and firms by affecting the level of interest rates and the size of the loan supply (see Bernanke and Gertler (1995); Bordo et al., 2016; Kashyap & Stein, 1997). When the supply of loans with low-interest rates increases, households can choose to purchase durable goods, such as a house.

[3] Many studies on the relationship between loans and house prices confirm a causal relationship between both dynamics (e.g. Hofmann (2004); Fitzpatrick and McQuinn (2007); Greiber and Setzer (2007); Qi and Yang (2009); Gimeno and Martinez-Carrascal (2010); Öhman and Yazdanfar (2018); Gaganis et al. (2020); and Akcay et al. (2022)).

2), real house price increases in the Turkish housing markets were much higher than those in many other countries.[4] As with mortgage interest rates, both increasing house prices and the number of mortgage loans borrowed also broke the historical record in this period of time.

Figure 1 Global House Price Index (% - Ranked by Annual Real Price Change)



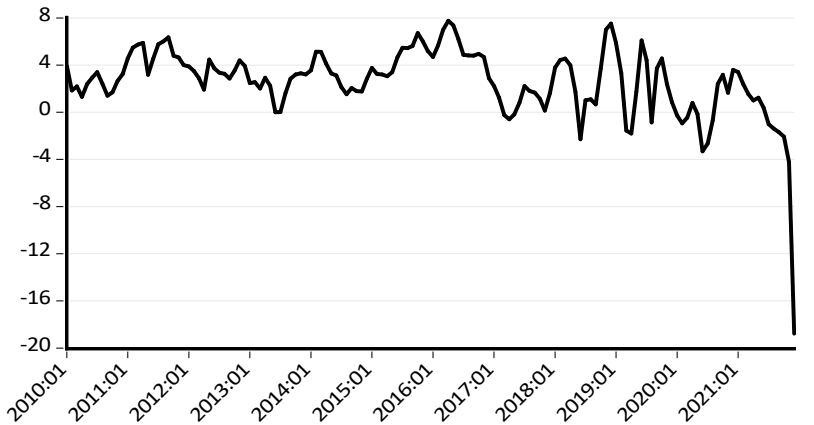
Notes: **(*)** Average annual price change across 56 countries. (**) Countries with the highest house price increases are considered.
Source:Knight Frank (2021, 2022).

As shown in Figure 1, the annual average increases in real house price reach double digits in Türkiye. Türkiye ranks first among 56 countries with an annual average increase in real house price of 32% in 2020**.** Indeed, house price increases decreased to single digits in the second year of the pandemic in some countries (e.g. New Zealand, Luxembourg) compared to the double-digit price increases in Türkiye in 2020. However, large increases in house price (30.3%) continued in Türkiye in 2021. At the time, it seemed that this would continue in 2022, if necessary measures were not taken.

[4] House price increases in New Zealand (22.1%) and the Czech Republic (25.9%), which experienced the highest price increases after Türkiye in 2020 and 2021 respectively were well below those experienced in Türkiye (32% and 30.3%). (Knight Frank, 2022).

In many economies (e.g. the US and EU), housing indicators are monitored regularly to protect macroeconomic stability. For example, in the EU, the threat limit for the member countries concerning real house price increases is 6% annually. [5] However, in Türkiye, which has had sustained accession negotiations with the EU, the house price increases that occurred during COVID-19 were five times as high as this threat limit.

Figure 2 Real Interest Rates in Turkish Mortgage Markets (% - Weighted Average Monthly)



Source: Türkiye Cumhuriyet Merkez Bankası İdare Merkezi (2022b)

On the other hand, a correlation between house prices and loan supply exists. Particularly, the subprime mortgage crisis in the US, which shows the strength of the linkage between house prices and loans, has caused many researchers to question whether a nexus between both factors exists. Thus, a large amount of literature on this relationship has been produced in the pre-pandemic period.[6] In general, their common features are based on country-level analyses, even when multiple countries are considered (e.g. Collyns and Sendhadji (2003) and Hofmann (2004)). This case may stem from the differences among the countries

[5] Following the sovereign debt crisis experience, the EU adopted the Macroeconomic Imbalances Procedure (MIP) Scoreboard for the surveillance of the external and internal aspects of macroeconomic imbalances in 2011 to identify potential macroeconomic risks early on, which would prevent the emergence of harmful macroeconomic imbalances, and correct the imbalances that are already in place. The MIP covers 14 headline economic indicators related to the most relevant areas of macroeconomic imbalances, competitiveness, and adjustment issues. These 14 indicators are complemented by 25 auxiliary indicators providing additional information. The main purpose of MIP is to prevent and, if necessary, correct macroeconomic imbalances that may occur in the future within the EU (European Commission, 2012).

[6] For a more detailed literature review, see Table 1 in Akcay (2022).

related to the development of the financial sector, economic structure, sensitivity to developments in the external markets, etc. Another feature of previous studies is that almost similar model specifications are used (e.g. Brissimis and Vlassopoulos (2009); Oikarinen (2009); Gimeno and Martinez-Carrascal (2010); Öhman and Yazdanfar (2018); and Gaganis et al. (2020)). However, as already established, no studies have been carried out on the causal relationship between house prices and loans during the COVID-19 pandemic along with a comparison between the pre-pandemic and the pandemic periods although there are some studies that have investigated the developments in only the housing or loan markets for this period of time (Allen-Coghlan and McQuinn, 2021; Brzozo-Brzezina et al., 2021; Wang, 2021). This is also the case for Türkiye (Ekinci and Kaya, 2021; Aksoy Khurami and Özdemir Sarı, 2022; and Kartal et al., 2023). Thus, there is a research gap on the comparison of the causal relationship between housing and credit before and during the pandemic periods in Türkiye.

The aim of this study is to explore the causal relationship between mortgage loans and house prices in Türkiye in order to see whether this relationship varied in the pandemic period by comparing it with the pre-pandemic period. To achieve this aim, the following hypotheses are proposed:

- H_1: There is a causal relationship between house prices and mortgage loans in Türkiye in the pre-COVID-19 pandemic period and during the pandemic.
- H_2: The relationship between these two factors increase in strength during the COVID-19 period compared to pre-COVID-19.

To test the hypotheses, we follow the vector autoregressive (VAR) approach and apply two different causality tests; the Fourier Granger (FG) and Fourier Toda-Yamamoto (FTY) causality tests. The findings of the empirical analysis show that there are differences in both periods with respect to the relationship between mortgage loans and house prices in Türkiye, and that there is a causal relationship between both factors in the pre-COVID-19 period, but not during COVID-19. The main reason that this relationship is not found during the pandemic largely stems from the measures taken by the government during that time. We find that this relationship is largely market-driven pre-pandemic but policy-driven during the pandemic.

This study makes various contributions that facilitates a better understanding of the relationship between house prices and mortgage loans at the country-level, and also serves as a resource for policy makers to reduce and remove the probability of risks to both the mortgage and housing markets and thus the economy in Türkiye. The main contribution of examining this relationship is to reveal whether there are any differences between the pre-pandemic and pandemic periods by applying two different causality tests. Another contribution is to provide the reasons for the difference in Türkiye and the role

of the monetary policy in price stability in the housing markets as well as the entire economy.

The rest of the paper includes the methodology in the following section, and a description of the data in the third section. The findings of the empirical analysis are provided in the fourth section, while a discussion is found in the fifth section. The last section is the conclusion.

2. Methodology

The main assumption is that there is a bi-directional causality between mortgage loans and house prices in Türkiye between 2018(month1 (m1)) and 2021(m12). We follow the VAR approach in the empirical analysis.

The approaches in Gerlach and Peng (2005) and Oikarinen (2009) are adopted to examine the causal relationship between mortgage loans and house prices. However, we also follow Sadorsky (1999), Papapetrou (2001), and Huang et al. (2005) to include an index of industrial production as a measure of the overall output in our VAR model specifications.[7] Additionally, instead of using a conventional causality test,[8] two different causality tests are used: the FTY and FG causality tests. Our VAR model is also estimated by considering two different periods of time: the pre-COVID period (2018-2019) and during the COVID-19 period (2020-2021). The causal relationship between mortgage loans and house prices is explored in the empirical analysis, instead of the cointegration relationship.

The FTY and FG causality tests are the extended versions of conventional causality tests, which do not consider the structural changes in VAR modelling.[9]

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[7] We regard the industrial production index as the total output due to the lack of monthly GDP data for Türkiye.

[8] The Fournier Granger and Toda and Yamamoto causality tests are called conventional causality tests in studies that apply time-series analyses in the economics literature. Granger (1969) developed the Granger causality test and Toda and Yamamoto (1995) developed the Toda and Yamamoto causality test.

[9] We use the Granger causality test after we estimate the following VAR model:

$$y_t = Z_t + A_1 y_{t-1} + \cdots + A_p y_{t-p} + \varepsilon_t \quad (1)$$

where Z_t is the deterministic term, which is $Z_t = \alpha_0$ for a constant model and $Z_t = \alpha_0 + \alpha_1 t$ for a constant and trend model, A indicate the coefficient matrices, p is the lag length and ε_t are independent and identically distributed errors. Thus, we call this the $VAR(p)$ model. Toda and Yamamoto (1995) extend the $VAR(p)$ model used in the Granger causality test in Equation (1) and adds the maximum integration order of variables (d) to the model. Hence, Toda and Yamamoto (1995) use the $VAR(p+d)$ model defined as:

$$y_t = Z_t + A_1 y_{t-1} + \cdots + A_p y_{t-p} + \cdots + A_{p+d} y_{t-(p+d)} + \varepsilon_t \quad (2)$$

In fact, most time series, such as mortgage loans and house prices, include sharp breaks. To overcome this problem, the FTY and FG causality tests are used, as proposed by Nazlıoğlu et al. (2016) and Enders and Jones (2016), respectively. Enders and Jones (2016) extend the Granger causality approach with Fourier approximation and developed the FG causality test. Then, the deterministic term, Z_t , is described in the following VAR model:

$$y_t = Z_t + A_1 y_{t-1} + \cdots + A_p y_{t-p} + \varepsilon_t \tag{2}$$

where Z_t is the deterministic term, which is $Z_t = \alpha_0$ for a constant model and $Z_t = \alpha_0 + \alpha_1 t$ for a constant and trend model, p is the lag length, A indicate the coefficient matrices, and ε_t are the independent and identically distributed errors. Z_t, is defined in Enders and Jones (2016) as:

$$Z_t \cong \alpha_0 + \sum_{k=1}^{n} \gamma_{1k} sin\left(\frac{2\pi kt}{T}\right) + \sum_{k=1}^{n} \gamma_{2k} cos\left(\frac{2\pi kt}{T}\right) \tag{3}$$

Nazlıoğlu et al. (2016) extend the Toda and Yamamoto approach for the same reason, which allows smooth structural breaks with the use of Fourier approximation. They estimate the VAR model of the FTY as follows:

$$y_t = \alpha_0 + \sum_{k=1}^{n} \gamma_{1k} sin\left(\frac{2\pi kt}{T}\right) + \sum_{k=1}^{n} \gamma_{2k} cos\left(\frac{2\pi kt}{T}\right) + By_{t-1} + \cdots + B_{p+d} y_{t-(p+d)} + \varepsilon_t \tag{1}$$

where p indicates the lag length; d is the maximum integration order of variables and ε_t are independent and identically distributed errors.

Both Nazlıoğlu et al. (2016) and Enders and Jones (2016) emphasise that the conventional causality tests are less powerful than Fourier based causality tests, which regard smooth shifts in time series. In addition, both the FG and FTY causality tests are based on the null hypothesis of Granger non-causality (H_0:B_1=…=B_p=0) and the alternative hypothesis of Granger causality (H_1: B_i≠0 for some i). Wald statistics are used to test the null hypothesis of Granger non-causality predicated on zero restrictions on the first *p* parameters in Nazlıoğlu et al. (2016). However, since the Wald test is based on Fourier frequencies, *k*, it need not be chi-square distributed. To overcome this drawback, the distribution of the bootstrapped Wald statistics in Nazlıoğlu et al. (2016) is used.

Applying the two different Fourier-based causality tests, we compare the results of the two tests and determine the direction of the causality between mortgage loans and house prices during the two concerned periods of time. Also, this enables us to examine the robustness of the results based on the empirical analysis.

After conducting the empirical analysis, we expect our results to confirm the theory for the two periods of interest, which suggests that there is a two-way causal relationship between house prices and credit, with the relationship between them being much stronger during the pandemic compared to the pre-pandemic period.

3. Data Description

Our dataset includes mortgage loans, house prices, the industrial production index, mortgage interest rates, and the consumer price index for the period of January 2018- December 2021. All of the data are available on a monthly basis. A description and the source of the monthly datasets are provided in Appendix 1.

Mortgage interest rates (*ir*) are the average interest rates of mortgage loans with a maturity of 10 years, and mortgage loans (*cre)* cover only loans lent to households by Turkish deposit banks.[10] We employ the industrial production index *(ip)* as an indicator for total output in the industry sectors (e.g. mining, manufacturing, gas, and electricity) and the nominal house price index is considered for the house price *(pri)* variable. The house price index is calculated by using the hedonic regression method, which removes the quality effect due to the observable characteristics of the houses. The house price index is available on a monthly basis.

By using the consumer price index (2015=100), mortgage loans and house prices are transformed into real terms. Except for the mortgage interest rates, all of the variables are also converted into their natural logarithms.

4. Findings

Before estimating the VAR model and the application of the causality tests, the stationarity of the data needs to be confirmed to increase the accuracy of the results. For this, unit root tests are implemented. Next, for the identification of the VAR structure, the lag length and maximum integration order should be determined. The maximum integration order of the variables required by the FTY causality test is determined. For both the lag length (*p)*, and Fourier frequency (*k*), the Akaike information criterion is used. By following Enders and Lee (2012), the maximum number of the Fourier frequency is set to three and the maximum number of lags is set to two.

[10] In Türkiye, deposit banks are dominant in the mortgage markets. The share of deposit banks in the total outstanding total mortgage loans is more than 99% as of the end of 2021.

Tables 1 and 2 show the Fourier augmented Dickey–Fuller (ADF) unit root test results for the pre-COVID-19 period and during the COVID-19 period respectively. The Fourier ADF statistics do not reject the null of the unit root for mortgage loans, house prices, and industrial production for the constant model, but reject the null hypothesis for interest rates at their level. After taking first differences, the Fourier ADF statistics reject the null hypothesis of the unit root for mortgage loans, house prices, and industrial production. Thus, the first difference form of mortgage loans, house prices, mortgage interest rates, and industrial production is used for the FG causality test and the order of integration is determined as one for the FTY causality test.

The Fourier ADF unit root test results of the COVID-19 period for a constant model are shown in Table 2. The table shows that the Fourier ADF test statistics do not reject the null hypothesis of the unit root for all of the variables. Yet, the null hypothesis of the unit root is rejected in their first differenced forms. The Fourier ADF test results indicate that all of the variables have unit roots at their level but take their first difference to make them stationary. Therefore, the first difference form of mortgage loans, house prices, mortgage interest rates, and industrial production is used for the FG and the maximum order of integration for FTY causality is determined to be one.

Table 1 Fourier ADF Unit Root Test Results: Pre-COVID-19

	Level		First Difference	
Variable	**FADF**	**Lag**	**FADF**	**Lag**
pri	-1.977	1	-4.824***	1
cre	-1.950	1	-4.578***	1
ir	-3.926**	1	-3.909***	0
ip	-2.986	1	-4.079***	1

Notes: ***, **, and * represent significance at 1, 5, and 10 percent, respectively. *k* represents Fourier frequency. The maximum number of Fourier frequencies is set to 3 and chosen by the minimization of the sum of squared residuals as in Enders and Lee (2012). The maximum number of lags is set to 1 and the optimal lag(s) is selected by the Akaike information criterion. The critical values for the constant model are -4.420 (1%), -3.810 (5%) and -3.490 (10%) for k=1; -3.770 (1%), -3.070 (5%), and -2.710 (10%) for k=3 (see Enders and Lee (2012), p.197).

After determining the structure of the VAR model and conducting a structural estimation of the model, the FG and FTY causality tests are conducted[11] to see

[11] Due to the stationarity properties of some of the variables in our data, the co-integration test in Johansen and Juselius (1990) is not applied to investigate the long-run co-integration relationship between the variables. According to Johansen and Juselius (1990), all variables are assumed to be non-stationary to test the co-integration relationship. However, the Fournier ADF (FADF) unit root test results show that interest rates have an order of integration of zero for its constant model in the pre-COVID-19 period while house prices and industrial production, both in the pre-COVID-19 and

whether there is a causal relationship between mortgage loans and house prices in the two periods of interest, and if so, to see its direction.[12] Table 3 shows the results of the causality tests for the constant model in the pre-COVID-19 pandemic period (i.e. 2018(m1) to 2019(m12)). The test results show that in the pre-pandemic period, the null hypothesis of no Granger causality from house prices to mortgage loans is rejected at the 5 percent level. Moreover, the FG test results show that the null hypothesis of no Granger causality which ranges from mortgage loans to house prices is rejected at the 5 percent level while the FTY test result shows the null hypothesis of no Granger causality from mortgage loans to house prices is rejected at the 10 percent level. In other words, the FG and FTY causality test results show that there is a strong bi-directional causality between mortgage loans and house prices in the pre-COVID-19 period in lag order two. Thus, the findings support the theory and, thus, H1; i.e., there is a bi-directional causal relationship between mortgage loans and house prices. In addition, both tests show that the causality from mortgage loans to house prices is more pronounced than from house prices to mortgage loans. That is, price movements in housing markets are driven by mortgage loans in this period of time. The results from the pre-COVID-19 period also align with previous studies for Türkiye which cover periods of different lengths.[13]

Table 2 Fourier ADF Unit Root Test Results: during COVID-19

Variable	Level		First Difference	
	FADF	Lag	FADF	Lag
pri	-1.051	1	-4.421***	0
cre	-3.472	1	-3.756**	0
ir	-2.510	1	-4.595***	1
ip	-2.713	0	-6.155***	1

Notes: ***, **, and * represent significance at 1, 5, and 10 percent, respectively. *k* represents Fourier frequency. The maximum number of Fourier frequencies is set to 3 and chosen by the minimization of the sum of squared residuals as in Enders and Lee (2012). The maximum number of lags is set to 1 and the optimal lag(s) is selected by the Akaike information criterion. The critical values for the model with constant are -4.420 (1%), -3.810 (5%), and -3.490 (10%) for k=1; -3.770 (1%), -3.070 (5%), and -2.710 (10%) for k=3 (see Enders and Lee (2012), p.197).

during the COVID-19 periods, have an integration of order of I(0). Therefore, we cannot examine the long run co-integration relationship between variables. Also, the vector error correction model (VECM) cannot be used in our study since interest rates in the pre-COVID-19 period and industrial production were stationary at their level form. Hence, causality tests are utilised to investigate the causal relationship between mortgage loans and house prices.

[12] We do not present the causality test results for mortgage interest rates and industrial production since the focus of this research is to explore the causal relationship between house prices and mortgage loans.

[13] Tunc (2020) examines the impact of exogenous loan shocks on house prices loan shocks by utilizing data from 2010q2 to 2017q4. Yıldırım and İvrendi (2017) focus on the dynamics that drive house price variations for the period of 2010q1 to 2019q3.

Table 3 Causality test results for model: pre-COVID-19

Direction	Test	Wald	Asym. p-val.	Boot. p-val.	Lag	Frequency
pri ≠> cre	FG	6.673*	0.036	0.018	2	3
	FTY	12.950***	0.000	0.031	2	3
cre ≠> pri	FG	11.407**	0.003	0.084	2	3
	FTY	14.268**	0.001	0.001	2	3

Notes: ≠> indicates null hypothesis of Granger non-causality. FG: Fourier Granger causality test with a single frequency. Single FTY: Fourier Toda-Yamamoto causality test with a single frequency. The maximum frequency is set to 3 and the optimal frequency is determined by the Akaike information criterion. The maximum lag(s) is set to 2 and the optimal lag(s) are determined by the Akaike information criterion. Bootstrap p-values are obtained from 1000 replications. ***, **, and * show significance at 1, 5, and 10 percent, respectively.

The results of both the FG and FTY causality tests during COVID-19 are listed in Table 4. The null hypothesis of no Granger causality is not rejected from mortgage loans to house prices. Both causality test results are similar and show no causal relationship between house prices and mortgage loans during COVID-19 from 2020(m1) to 2021(m12). That is, mortgage loans and house prices move independently in the lagged two-month during the pandemic. Thus, these findings do not support H1 for the pandemic period. They also do not validate H2 - the causal relationship between house prices and mortgage loans is much stronger during the pandemic than in the pre-pandemic period in spite of the increasing affordability of households caused by measures taken in the financial markets to revive the economy which was suffering due to the COVID-19 pandemic.

Table 4 Causality Test Results for Model: during COVID-19

Direction	Test	Wald	Asym. p-val.	Boot. p-val.	Lag	Frequency
pri ≠> cre	FGC	0.274	0.872	0.871	2	3
	FTY	0.418	0.811	0.830	2	1
cre ≠> pri	FGC	0.665	0.717	0.714	2	3
	FTY	1.800	0.407	0.467	2	1

Notes: ≠> indicates the null hypothesis of Granger non-causality. FG: Fourier Granger causality test with a single frequency. FTY: Fourier Toda-Yamamoto causality test with a single frequency. The maximum frequency is set to 3 and the optimal frequency is determined by the Akaike information criterion. Maximum lag(s) is set to 1 and optimal lag(s) are determined by the Akaike information criterion. Bootstrap p-values are obtained from 1000 replications. ***, **, and * show significance at 1, 5, and 10 percent, respectively.

In summary, both the FG and FTY causality tests have the same results for Türkiye for both the pre-pandemic and pandemic periods. However, the results are different between the two periods. The evidence provided by both causality tests shows that in the pre-COVID-19 period, a bi-directional causal relationship exists between mortgage loans and house prices in lag order two, and increasing the loan supply with low-interest rates in mortgage markets causes house price increases. Yet, the results indicate that there is no evidence that supports the causality between mortgage loans and house prices during the COVID-19 pandemic.

5. Discussion

As noted earlier, the results based on the empirical analysis indicate that in contrast to the pre-pandemic period, the loan-driven causality between house prices and mortgage loans disappeared during the pandemic. The movements of both house prices and loans occur independently, especially in the second year of the pandemic (i.e., 2021), not in its first year (i.e., 2020). This is supported by Figures 3 and 4. These figures show that house prices responded to mortgage loan supply with low-interest rates and they rose rapidly in 2020. The main reason for the upward movement of house prices largely stems from increasing housing demand (see Figure 5). Housing demand is triggered by the developments in the mortgage markets (e.g. mortgage supply with low interest rates and easy mortgage lending standards) when the pandemic started to spread in 2020.

As in many countries (e.g. Italy, Luxembourg, and the Netherlands), interest rates were cut in Türkiye in 2020 when the pandemic spread. Yet, unlike them, the mortgage rate cuts were at an unprecedented level in Türkiye and mortgage interest rates fell to their lowest level of the last three decades at the end of May 2020 (see Figure 2). Monthly mortgage rates were reduced to 0.64% for new homes and 0.74% for second-hand homes. The rate of reduction in mortgage rates was also much higher than the interest rates of other loans (e.g. commercial and car loans). Again, in contrast to many countries, the mortgage loan lending terms were also loosened in Türkiye. The loan-to-value (LTV) ratio was increased from 80% to 90% and the mortgage loan maturity was extended from 10 to 15 years. In addition, for the first time, home buyers were offered the option to have a mortgage loan with a one-year grace period. Thus, historical records were not only broken in terms of mortgage rates, but also in loan terms in the Turkish mortgage markets.

Such developments in the mortgage markets emerged due to the measures taken to increase the affordability of households with the aim of mitigating the negative effects on the Turkish economy of administrative closures in the second half of 2020. However, it can be argued that, unlike other countries, another reason for the record mortgage rate cuts may be to reduce the stock of

unsold new houses.[14] The supply of unsold new housing grew in the big cities, particularly in Ankara, İstanbul, and İzmir, and it is likely that this phenomenon was due to the economic problems caused by the currency crisis in the first quarter of 2018. Much of the stock consisted of luxury homes that were priced far above the purchasing power of the middle and middle-upper income groups. The builders of these homes were in financial trouble because they could not sell them in a reasonable length of time. In order to relieve the home builders, the government took measures to encourage home sales by increasing the affordability of households via state deposit banks.[15] They gave mortgage loans to new home buyers at lower interest rates than second-time home buyers during the pandemic, but private deposit banks did not. This lending practice of the state deposit banks was sustained even when the reserve requirement ratio was raised by the Central Bank of the Republic of Türkiye (Türkiye Cumhuriyet Merkez Bankası İdare Merkezi; CBRT) in August 2020.

In addition to the increase in domestic demand for housing due to the very advantageous loan conditions, it can be argued that the increase in foreign demand supported the upward movement of house prices during the COVID-19 pandemic. In 2009, the legislation on the sale of property to foreigners and in 2018 the legislation on granting citizenship to foreigners were amended, which facilitated sales of homes to foreigners. Thus, the share of foreigners in total house sales started to increase in 2009, but then accelerated, nearly tripling during the pandemic due to the high depreciation of the national currency in 2018 when the exchange rate crisis occurred (Turkish Statistical Institute, 2022).[16] With increase in both domestic and foreign demand, real house prices in 2020 quadrupled compared to 2019 (32%) and Türkiye ranked first among 56 countries in terms of large increases in housing price (see Figure 1).

[14] The stock of new housing was much more than in previous years. In Türkiye, the number of residences (flats) for which occupancy permits were issued until 2003 averaged between 90,000 and 160,000 annually. This number has increased rapidly, especially since 2005, and started to increase between 250,000 and 350,000 on average annually (Turkish Statistical Institute, 2022). In 2013-2019, the annual average housing produced reached 750,000- 850,000 units. The sale of municipal and treasury lands in greater numbers than previous years and the conversion of these lands into residential areas by changing the zoning were effective in increasing the units produced (see Milli Emlak Genel Müdürlüğü (2022) and Özelleştirme İdaresi Başkanliği (2022)).

[15] There are 26 deposit banks in the Turkish banking system; three of them are state banks and among the top four deposit banks in terms of asset size (Bankacılık Düzenleme ve Denetleme Kurumu, 2022).

[16] While the share of foreigners in the total house sales is between 1% and 1.5% in the period between 2009 and 2017, it has accelerated since 2018 when the government started to encourage home sales to foreigners by amending the legislation on granting citizenship to foreigners and increase 2.72% in 2020 and 3.93% in 2021 (TURKSTAT, 2022).

Moreover, the house price increases in 2020 were nearly three times higher than the inflation rate of the same year.[17]

In the second year of the pandemic, new developments in the economy (e.g. accelerated depreciation of the national currency, high inflation rates) along with declines in house sales by 0.49% compared to 2020, the real loan demand decreased at a much higher rate, or six times the total sales. However, the upward movement in real house prices continued (Figure 3). That is, the loan-driven causal relationship of mortgage loans with house prices in 2020 completely disappeared in 2021 (see Figures 3 and 4). In addition, inflation and appreciation of exchange rates started to rise rapidly in 2021, so the CBRT maintained the interest rate reduction policy by cutting interest rates four more times in 2021.[18] However, despite the continuation of low mortgage rates, home sales decreased, particularly due to a decline in the domestic demand for housing, although the demand of foreigners for housing continued to increase and reached 3.93% at the end of 2021 (Turkish Statistical Institute, 2022).

Large increases in producer costs in 2021, especially construction costs, also strengthened the upward movement of real house prices. Construction costs increased sixfold according to the 12-month averages, compared to 2020 (Turkish Statistical Institute, 2022) (see Figure 6). In 2021, this negative trend in construction costs was aggravated by increasing input prices (cement, iron, diesel, etc.) in 2021, and the increase in the material price annual index (85.77%) in December 2021 (Türkiye Cumhuriyet Merkez Bankası İdare Merkezi, 2022b).

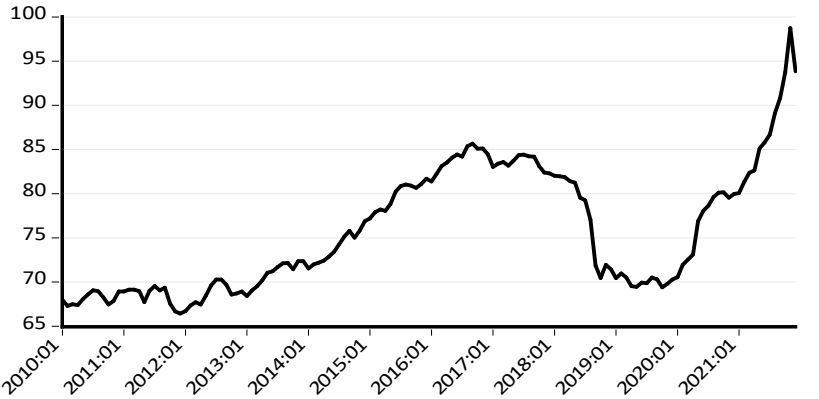
On the other hand, considering that approximately 68% of construction inputs are obtained through imports in the construction sector (Turkish Contractors Association, 2022), it can be argued that the rapidly rising exchange rate also played an important role in the increase in construction costs and house prices. Exchange rate increases, which began from March 2021 and accelerated in October 2021, nearly doubled at the end of the year.[19]

[17]In 2020, the consumer price index (CPI) and producer price index (PPI) were 12.28% and 12.18% respectively (TURKSTAT, 2022).

[18] State deposit banks continued to cut the mortgage rates in March, September, October and November in 2021.

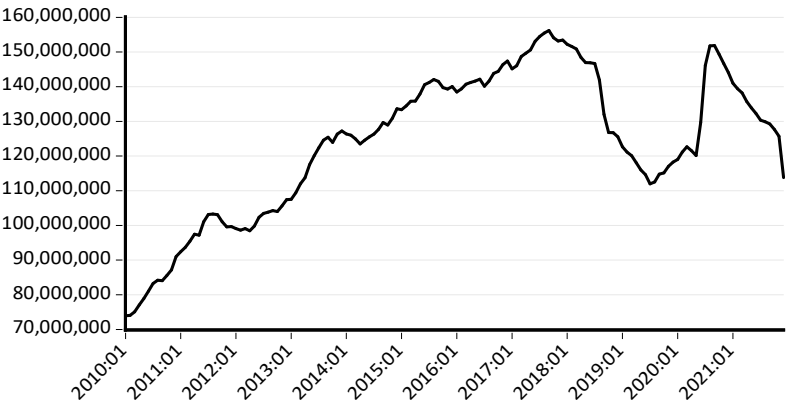
[19] While 1 USA and 1 Euro are 7.36 Turkish lira (TL) and 8.35 TL, respectively, at the beginning of January 2021, the dollar started to increase faster than the Euro, especially in March, and reached 13.35 TL and 15.15 TL, respectively, by the end of November of the same year. After peaking three times in mid-December, they completed 2021 at these levels (Türkiye Cumhuriyet Merkez Bankası İdare Merkezi, 2022a).

Figure 3 Real House Price Index (2015=100)



Source: Turkish Statistical Institute (2022).

Figure 4 Real Mortgage Loans (Volume, Turkish Lira) (2015=100)

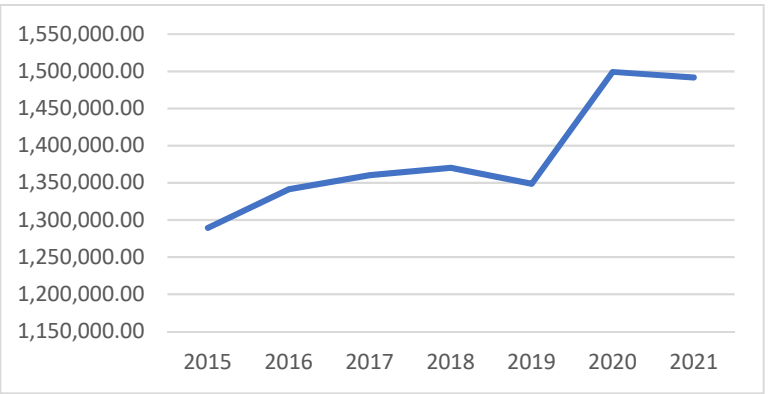


Source: Türkiye Cumhuriyet Merkez Bankası İdare Merkezi (2022b).

Moreover, home sales with investment purposes contributed to the double-digit house price increases. The record low mortgage interest rate environment during COVID-19 between 2020 and 2021 meant that total home sales rose by an average of 20% compared to the previous period between 2018 and 2019, but at the same time, there was a gradual decline in the home ownership rate which became 57.5% and 54.5% in 2020 and in 2021, respectively (Türkiye Cumhuriyet Merkez Bankası İdare Merkezi, 2022a). It appears that double-digit house price increases encouraged house purchases for investment purposes because the returns are higher than those of alternative investments (e.g. gold, equities, treasury bonds) in this period of time. Thus, property as a wealth accumulation tool came to the fore in such an environment.

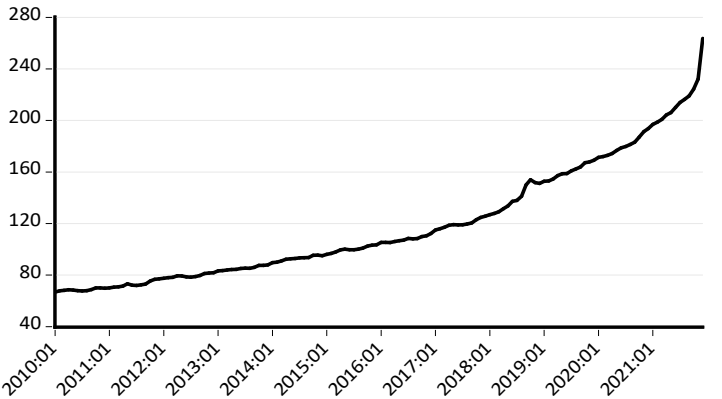
Furthermore, in spite of the increase in both inflation and exchange rates, they were strengthened by the insistence of the Central Bank through a monetary policy that maintained low indicative interest rates at the end of August 2021. The Central Bank has given up on supporting the price stability target implemented since 2002 by using policy tools based on short-term interest rates in spite of the environment, including both high deprecation of the national currency and increasing inflation in 2021.

Figure 5 Home Sales (unit-yearly)



Source: Turkish Statistical Institute (2022).

Figure 6 Construction Cost Index (2015=100)



Source: Turkish Statistical Institute (2022).

Consequently, it is observed that the causal relationship between house prices and mortgage loans no longer existed during the pandemic, particularly in the second year of the pandemic. Although loan demand decreased, double-digit house price increases continued in 2021. It seems that in a free market economy, the populist policies of the government (e.g. low indicative interest rates in a high inflation environment, encouragement of foreign house sales) have played an important role in these developments. In the other words, substantial increases in house price are largely policy-driven rather than market-driven during the pandemic. Thus, the populist policies implemented have greatly contributed to the elimination of the causal relationship between both factors in Türkiye during the pandemic.

6. Conclusion

This study compares the pre-COVID-19 period with the period during the COVID-19 pandemic with respect to the causal relationship between mortgage loans and house prices in Türkiye. To achieve this, the VAR approach is adopted and two different causality tests – the FG and FTY causality tests, are used. These two tests also enable us to determine the robustness of the empirical analysis results.

The results of both causality tests are the same for both periods of time and show that there is differentiation in both periods related to the causality between mortgage loans and house prices. In the pre-COVID-19 period, there is a causal relationship between both factors, and this relationship is loan-driven as well as market-driven. Yet, the same relationship is not found during COVID-19, especially in the second year of the pandemic. The findings for the pre-pandemic period are consistent with those of previous studies (e.g. Tunç (2020); Yıldırım and Ivrendi (2021)). These results also confirm H1 for the pre-pandemic period – i.e., there is causality between house prices and mortgage loans, but not during the pandemic. That is, in contrast to the pre-pandemic period, the causality between house prices and mortgage loans is not found during the pandemic and house prices and loans did not move dependently. Therefore, the results during the pandemic do not support H2 and show that house prices and loans moved independently despite increases in loan supply with record low mortgage rates.

There are many reasons why the causal relationship is not found during the pandemic, and why house prices continued to significantly increase. One reason is a loose monetary policy in a high inflation environment. As well, there was record demand for homes by foreigners, and record depreciation of the national currency. In this case, we suggest that double-digit house price increases during the pandemic were largely policy-driven, not market-driven, due to the actions of the Central Bank which were contrary to generally accepted monetary policy practices as a result of experience gained. The Central Bank insisted on a low

indicative rate policy in spite of the very high inflation environment, as well as high appreciation of exchange rates. Such a policy has also caused an increase in house sales for investment because of the greater increase in return on property than through alternative investment tools (e.g. gold, equities, and treasury bonds).

This phenomenon has once again demonstrated the importance of using economic policy instruments according to the changing conditions of the economy. As in the case of Türkiye, it has once again confirmed how a monetary policy, contrary to what should be done in a high inflation environment, can negatively affect price stability in the housing markets and the entire economy. Not only are economic problems increased and deepened (increasing inflation, decreasing purchasing power of households, depreciation of national currency, loss of confidence in the market and so on and so forth), but also social problems emerged (increasing poverty).

These findings also show that some factors (e.g. construction costs, sales of housing to foreigners, appreciation of exchange rates, and inflation) can affect price stability in the housing markets and the relationship of loans with house prices. However, the implementation of a monetary policy is much more important than other means to protect price stability in housing markets as well as the economy. The developments in the Turkish housing market and mortgage market as well as the Turkish economy during the pandemic show a situation that clearly emerged as a result of the follow-up of populist policies in the free market economy. This case confirms once again that the way that monetary policy tools are used contributes to price stability and a well-functioning economy at the micro and macro levels, and this can happen if the policies which are recommended for the economy (as a result of many years of experience) are implemented in a timely manner.

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References

Adkins, L., Bryant, G., and Konings, M. (2021). The asset economy during and after the Covid-19 crisis. *IPPR Progressive Review*, *28*(3), 242-252.

Akcay, S.B. (2022). Causality between Credit Lending and House Prices: Evidence from the Eurozone and the GIPS, *Real Estate Finance*, Fall, 26, 26-41.

Aksoy-Khurami, E. and Özdemir-Sarı, B. (2022). Trends in housing markets during the economic crisis and Covid-19 pandemic: Turkish case, *Asia-Pacific Journal of Regional Science, 6,* 1159–1175.

Allen-Coghlan, M. and McQuinn, K.M. (2021). The potential impact of Covid-19 on the Irish housing sector, *International Journal of Housing Markets and Analysis*, *14*(4), 636-651.

Bernanke, B. S., and Gertler, M. (1995). Inside the black box: the credit channel of monetary policy transmission. *Journal of Economic Perspectives*, *9*(4), 27-48.

Bordo, M. D., Duca, J. V., and Koch, C. (2016). Economic policy uncertainty and the credit channel: Aggregate and bank level US evidence over several decades. J*ournal of Financial Stability*, *26*, 90-106.

Bordo, M.D. and Duca, J. V. (2021). An overview of the Fed's new credit policy tools and their cushioning effect on the COVID-19 recession, *Journal of Government and Economics, 3*, 1-10.

Brissimis, S. N., and Vlassopoulos, T. (2009). The interaction between mortgage financing and housing prices in Greece. *The Journal of Real Estate Finance and Economics*, *39(*2), 146-164.

Bankacılık Düzenleme ve Denetleme Kurumu (Banking Regulation and Supervision Agency) (2022). Türk Bankacılık Sektörü Temel Göstergeleri-22 Mart, Available at: https://www.bddk.org.tr/Veri/Detay/162 (Accessed 14 May 2022).

Brzoza-Brzezina, M., Kolasa, M., and Makarski, K. (2021). Monetary policy and COVID-19. Working Paper No. 2021/274. Available at: https://www.imf.org/en/Publications/WP/Issues/2021/11/12/Monetary-Policy-and-COVID-19-506831 (Accessed 10 August 2022).

Türkiye Cumhuriyet Merkez Bankası İdare Merkezi [The Central Bank of the Republic of Turkey) (2022a). Gösterge Niteliğindeki Merkez Bankası Kurları [Central Bank Indicative Rates]. Available at:

https://www.tcmb.gov.tr/wps/wcm/connect/tr/tcmb+tr/main+menu/istatistikler/doviz+kurlari/gosterge+niteligindeki+merkez+bankasi+kurlarii (Accessed 10 December 2022).

European Council and Council of European Union (2022). COVID-19: the EU's response to the economic fallout. https://www.consilium.europa.eu/en/policies/coronavirus-pandemic/covid-19-economy/ (Accessed 6 November 2022).

Collinson P. (2020). UK property market could fall 13%, housing experts predict, The Guardian, 14 May 2020. Available at: https://www.theguardian.com/business/2020/may/13/uk-property-market-could-fall-13-housing-experts-predict2 (Accessed 9 April 2022).

Collyns, C. and Senhadji, A. (2003). Lending booms, real estate bubbles, and the Asian crisis. In Hunter, W.C., Kaufman, G.C. and Pomerleano, M. (Eds.), Asset price bubbles: the implication for monetary, regulatory and international policies, (pp. 101-25). MIT Press, Cambridge and London.

Duca, J. V. and Anthony Murphy, A. (2021). Why House Prices Surged as the COVID-19 Pandemic Took Hold, Working Paper. Available at: https://www.dallasfed.org/research/economics/2021/1228 (Accessed 12 September 2021).

European Commission (2012). Scoreboard for the surveillance of macroeconomic imbalances, Occasional Paper No.92, February, Brussels. Available at: https://ec.europa.eu/economy_finance/publications/occasional_paper/2012/op92_en.htm (Accessed 19 August 2022).

European Mortgage Foundation (2021). Hypostat 2021: Analysis of Latest Developments on European Housing and Mortgage Markets, 9 November, Brussels. Available at: https://hypo.org/app/uploads/sites/3/2021/11/HYPOSTAT-2021_vdef.pdf (Accessed 11 February 2022).

Enders, W., and Lee, J. (2012). The flexible Fourier form and Dickey–Fuller type unit root tests. *Economics Letters*, *117*(1), 196-199.

Enders, W., and Jones, P. (2016). Grain prices, oil prices, and multiple smooth breaks in a VAR. *Studies in Nonlinear Dynamics and Econometrics*, *20*(4), 399-419.

Ferrero, A. (2015). House price booms, current account deficits, and low interest rates. *Journal of Money, Credit and Banking*, 47(S1), 261-293.

Financial Stability Board (2021). COVID-19 support measures, Extending, amending and ending. Available at: https://www.fsb.org/wp-content/uploads/P060421-2.pdf (Accessed 02 January 2022).

Fitzpatrick, T. and McQuinn, K. (2007). House prices and mortgage credit: empirical evidence for Ireland. *The Manchester School, 75*(1), 82-103.

Gaganis, C., Hasan, I., and Pasiouras, F. (2020). National culture and housing credit. J*ournal of Empirical Finance*, *56*, 19-41.

Gerlach, S., and Peng, W. (2005). Bank lending and property prices in Hong Kong. *Journal of Banking and Finance*, *29*(2), 461-481.

Gimeno, R., and Martinez-Carrascal, C. (2010). The relationship between house prices and house purchase loans: The Spanish case. *Journal of Banking and Finance*, *34*(8), 1849-1855.

Granger, C. W. (1969). Investigating causal relations by econometric models and cross-spectral methods*. Econometrica, 37*(3), 424-438.

Greiber, C. and Setzer, R. (2007). Money and housing: Evidence for the euro area and the US. Deutsche Bundesbank Discussion Paper Series 1: Economic Studies No 12/2007.
https://www.econstor.eu/bitstream/10419/19691/1/200712dkp.pdf (Accessed 11 December 2021).

Ha, N. H. P. (2021). Factors affecting real estate prices during the COVID-19 pandemic: An empirical study in Vietnam. *The Journal of Asian Finance, Economics and Business*, *8*(10), 159-164.

Hofmann, B. (2004). The Determinants of Bank Credit in Industrialized Countries: Do Property Prices Matter? *International Finance*, *7*(2), 203–234.

Huang, B. N., Hwang, M. J., and Peng, H. P. (2005). The asymmetry of the impact of oil price shocks on economic activities: an application of the multivariate threshold model. *Energy Economics*, *27*(3), 455-476.

International Monetary Fund (2021). Policy Responses to the Covid-19, updated July 2, 2021. https://www.imf.org/en/Topics/imf-and-covid19/COVID-Lending-Tracker (Accessed 6 January 2022).

International Monetary Fund (2010). A Fair of Substantial Contribution by the Financial Sector; Final Report for the G-20, June, http://www.imf.org/external/np/g20/pdf/062710b.pdf (Accessed 14 August 2011).

International Monetary Fund (2022). World Economic Outlook, April 2022. Available at: https://www.imf.org/en/Publications/WEO/Issues/2022/04/19/world-economic-outlook-april-2022 (Accessed 19 November 2022).

Janda, M. (2020). CBA warns Australia risks 32 per cent house price crash in a "prolonged downturn", flags $1.5 billion coronavirus-hit to bank, ABC News, 13 May 2020. Available at: https://www.abc.net.au/news/2020-05-13/coronavirus-commonwealth-bank-house-prices-economy-unemployment/12241338 (Accessed 10 June 2021).

Jarque, C. M., and Bera, A. K. (1987). A Test for Normality of Observations and Regression Residuals. *International Statistical Review/Revue Internationale de Statistique*, *55*(2), 163-172.

Jinjarak, Y., Ahmed, R., Nair-Desai, S., Xin, W., and Aizenman, J. (2021). Pandemic shocks and fiscal-monetary policies in the Eurozone: COVID-19 dominance during January–June 2020. *Oxford Economic Papers*, *73*(4), 1557-1580.

Johansen, S., and Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. *Oxford Bulletin of Economics and Statistics, 52*(2), 169-210.

Kartal, M., Depren, T.and Depren, Ö. (2023). Housing prices in emerging countries during COVID-19: evidence from Turkey, *International Journal of Housing Markets and Analysis, 16*(3), 598-615.

Kashyap, A. K., and Stein, J. C. (1997). The role of banks in monetary policy: A survey with implications for the European monetary union. *Economic Perspectives-Federal Reserve Bank of Chicago*, 21, 2-18.

Kaynak, S., Ekinci, A. and Kaya, H.F. (2021). The effect of COVID-19 pandemic on residential real estate prices: Turkish case, *Quantitative Finance and Economics*, *5*(4), 623–639.

Knight Frank (2021). Global House Price Index Available at: https://content.knightfrank.com/research/84/documents/en/global-house-price-index-q1-2021-8146.pdf. (Accessed 05 June.2022)

Knight Frank (2022). Global House Price Index Available at: https://content.knightfrank.com/research/84/documents/en/global-house-price-index-q1-2022-9098.pdf (Accessed 05 June 2022)

Liu, H., Lucca, D. O., Parker, D., and Rays-Wahba, G. (2021). The Housing Boom and the Decline in Mortgage Rates (No. 20210907). Federal Reserve Bank of New York. Available at

https://libertystreeteconomics.newyorkfed.org/2021/09/the-housing-boom-and-the-decline-in-mortgage-rates/ (Accessed 11 February 2022).

Meen, G. (2001). *Modelling Spatial Housing Markets: Theory, Analysis and Policy*. New York: Springer Business Media.

Meltzer, A. H. (1995). Monetary, credit and (other) transmission processes: a monetarist perspective. *Journal of Economic Perspectives*, *9*(4), 49-72.

Miles, D., and Monro, V. (2021). UK house prices and three decades of decline in the risk-free real interest rate. *Economic Policy*, *36*(108), 627-684.

Milli Emlak Genel Müdürlüğü (Directorate-general for National Property) (2022). 2022 Yılı Milli Emlak Genel Müdürlüğü Faaliyet Raporu. Available at: https://milliemlak.csb.gov.tr/faaliyet-raporlari-i-93111 (Accessed 20 May 2022).

Mody, A., and Sandri, D. (2012). The eurozone crisis: how banks and sovereigns came to be joined at the hip. *Economic Policy*, *27*(70), 199-230.

Nazlıoğlu, S., (2019). GAUSS time series and panel data tests package (tspdlib), Available at: https://github.com/aptech/tspdlib. (Accessed November 2020).

Nazlıoğlu, S., Gormus, N. A., and Soytas, U. (2016). Oil prices and real estate investment trusts (REITs): Gradual-shift causality and volatility transmission analysis. *Energy Economics*, *60*, 168-175.

Organisation for Economic Cooperation and Development (2022). Data, Available at: https://data.oecd.org/ (Accessed 15 March 2022)

Oikarinen, E. (2009). Interaction between housing prices and household borrowing: The Finnish case. *Journal of Banking and Finance*, *33*(4), 747-756.

Otto, G. (2021). Accounting for Longer-Run Changes in Australian House Prices. *Australian Economic Review*, *54*(3), 362-374.

Öhman, P., and Yazdanfar, D. (2018). Bank lending and housing prices in Sweden. *International Journal of Housing Markets and Analysis, 11*(3), 498-519.

Özelleştirme İdaresi Başkanliği [Privatisation Administration Directorate] (2022), Faaliyet Raporları [Activity Reports]. Available at: https://www.oib.gov.tr/faaliyet-raporlari (Accessed 20 May 2022).

Pan, K., and Yue, X. G. (2022). Multidimensional effect of Covid-19 on the economy: Evidence from survey data. *Economic Research-Ekonomska Istraživanja*, *35*(1) 1658-1685.

Papapetrou, E. (2001). Oil price shocks, stock market, economic activity and employment in Greece. *Energy Economics*, *23*(5), 511-532.

Qi, M. and Yang., X. (2009). Loss given default of high loan-to-value residential mortgages. *Journal of Banking & Finance, 33*(5), 788-799.

Sadorsky, P. (1999). Oil price shocks and stock market activity. *Energy Economics*, *21*(5), 449-469.

Shambaugh, J. C. (2012). The Euro's Three Crises, *Brookings Papers on Economic Activity*, *43*(1), 157-231.

Turkish Contractors Association (2022). İnşaat Sektörü Analizi [Construction Industry Analysis], Available at: https://www.tmb.org.tr/uploads/publications/62551d35b98d7551ad940732/1649745199880-tmb-bulten-nisan-2022.pdf (Accessed 11 May 2023).

Türkiye Cumhuriyet Merkez Bankası İdare Merkezi (Central Bank of the Republic of Turkey) (2022b). Available at: https://evds2.tcmb.gov.tr/index.php?/evds/dashboard/1078 (Accessed 10 March 2022).

The World Bank (2022). World Bank Database, https://databank.worldbank.org/ (Accessed 10 December 2022).

Toda, H. Y., and Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of Econometrics, 66*(1-2), 225-250.

Tunc, C. (2020). The effect of credit supply on house prices: Evidence from Turkey. *Housing Policy Debate*, *30*(2), 228-242.

Turkish Statistical Institute (2022). Data Portal for Statistics, Available at: https://data.tuik.gov.tr/Kategori/GetKategori?p=Ulusal-Hesaplar-113 (Accessed 15 February 2022).

Wang, B. (2021). How does COVID-19 affect house prices? A cross-city analysis. *Journal of Risk and Financial Management, 14*(2), 47.

World Health Organisation (2022). WHO Coronavirus (COVID-19) Dashboard, Available at: https://covid19.who.int/ (Accessed 22 January 2022).

Yıldırım, M.O. and Ivrendi, M. (2021). Turkish Housing Market Dynamics: An Estimated DSGE Model. *The Journal of Applied Economic Research, 15*(2), 238–267.

Yıldırım, M.O. and Ivrendi, M. (2017). House prices and the macroeconomic environment in Turkey: the examination of a dynamic relationship. *Economic Annals*, *62*(215), 81-110.

Yiu, C. Y. (2021). Why house prices increase in the COVID-19 recession: A five-country empirical study on the real interest rate hypothesis. *Urban Science*, *5*(4), 77.

APPENDICES

Appendix 1 Data Description and Source

Notation	Variable	Source
cpi	Consumer Price Index (2015=100) (%)	Organisation for Economic Cooperation and Development (2022)
cre	Mortgage Loans (volume)	CBRT, Electronic Data Delivery System
pri	House Price Index (2017=100)	CBRT, Electronic Data Delivery System
ir	Mortgage Interest Rate (%)	CBRT, Electronic Data Delivery System
ip	Industrial Production Index (2015=100)	Organisation for Economic Cooperation and Development Database (2022)

Appendix 2 Descriptive Statistics

Variable	Mean	Max.	Min.	Std.	S	K	JB	p-val.
pri	7.474	7.694	7.248	0.137	-0.076	1.666	9.458	0.009
cre	9.526	12.672	6.385	1.592	0.057	2.289	2.721	0.257
ir	1.089	2.412	0.710	0.319	2.440	9.393	339.621	0.000
ip	4.558	4.793	4.152	0.162	-0.505	2.343	7.616	0.022

Notes: S is skewness, K is kurtosis, and JB is normality statistic in Jarque and Bera (1987). p-val is the probability of the JB test. p-val<0.10 (10%), p-val<0.05 (5%), and p-val<0.01 (1%). *pri*: house prices, *cre*: mortgage loans, *ir*: mortgage interest rates, and *ip*: industrial production index.