Ekonomi, Politika & Finans Araştırmaları Dergisi, 2025, 10(1): 127-139
Journal of Research in Economics, Politics & Finance, 2025, 10(1): 127-139
Araştırma Makalesi / Research Article, https://doi.org/10.30784/epfad.1599083

DYNAMICS OF CAUSALITY BETWEEN REAL ESTATE AND STOCK PRICES: EVIDENCE FROM TÜRKİYE

Gayrimenkul ve Hisse Senedi Fiyatları Arasındaki Nedenselliğin Dinamikleri: Türkiye'den Kanıtlar

Evrim TURGUTLU* & **Pınar NARİN EMİRHAN****

Keywords:
Real Estate Prices, Stock Prices, Asymmetric Relationship, Nonlinear ARDL Models

JEL Codes:
C22, G11, R31

Abstract

This paper aims to examine the causal relationship between real estate and stock prices in Türkiye over the 2010-2023 period and uncover whether the wealth effect or the credit price effect has been dominant. This study investigates the association between real estate prices and stock prices in Türkiye using both linear and non-linear ARDL cointegration models. A recently developed non-linear ARDL technique by Shin, Yu, and Greenwood-Nimmo (2014) is employed to investigate possible asymmetric relationships between real estate and stock prices. Linear ARDL bounds test results indicate strong evidence of wealth effect for Türkiye. The findings of the non-linear ARDL technique reveal that there is a strong asymmetric association between real estate and stock prices in Türkiye and there is evidence of the existence of both wealth and credit price effects. The asymmetric association is more dominant in the credit price effect model. The findings of the study will help both investors and policymakers to establish effective policies for developing portfolios considering the asymmetric associations and provide a better understanding of the driving forces behind real estate prices.

Anahtar Kelimeler:
Gayrimenkul Fiyatları, Hisse Senedi Fiyatları, Asimetrik İlişki, Doğrusal Olmayan ARDL Modelleri

JEL Kodları:
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Öz

Bu makale, 2010-2023 döneminde Türkiye'deki gayrimenkul ve hisse senedi fiyatları arasındaki nedensellik ilişkisini incelemeyi ve servet etkisinin mi yoksa kredi fiyatı etkisinin mi baskın olduğunu ortaya çıkarmayı amaçlamaktadır. Çalışmada Türkiye'de gayrimenkul ve hisse senedi fiyatları arasındaki ilişki doğrusal ve doğrusal olmayan ARDL eş bütünleşme modelleri kullanılarak incelenmektedir. Bu çalışmada, gayrimenkul ve hisse senedi fiyatları arasındaki olası asimetrik ilişkileri araştırmak için Shin, Yu ve Greenwood-Nimmo (2014) tarafından yakın zamanda geliştirilen doğrusal olmayan bir ARDL tekniği kullanılmaktadır. Doğrusal ARLD sınır testi sonuçları Türkiye için servet etkisine dair güçlü kanıtlar sunmaktadır. Çalışmanın bulguları, Türkiye'de gayrimenkul ve hisse senedi fiyatları arasında güçlü asimetrik bir ilişki olduğunu ve hem servet hem de kredi fiyatı etkilerinin varlığını ortaya koymaktadır. Asimetrik ilişki kredi fiyatı modelinde daha baskındır. Çalışmanın bulguları hem yatırımcıların hem de politika yapıcıların asimetrik ilişkileri göz önünde bulundurarak portföy geliştirmeye yönelik etkili politikalar oluşturmasına ve gayrimenkul fiyatlarının arkasındaki itici güçlerin daha iyi anlaşılmasına yardımcı olacaktır.

* Prof. Dr., Dokuz Eylul University, Faculty of Business, Department of Economics, Türkiye, evrim.gursoy@deu.edu.tr
** Prof. Dr., Dokuz Eylul University, Faculty of Business, Department of Economics, Türkiye, pinar.emirhan@deu.edu.tr

Received Date (Makale Geliş Tarihi): 10.12.2024 Accepted Date (Makale Kabul Tarihi): 25.03.2025

1. Introduction

The vast growth of interest in financial markets has also brought about the importance of portfolio diversification possibilities. Besides the alternative financial instruments, investors have started to add real estate assets to their portfolios to improve the risk-returns performance. Investors increase their demand for assets in the stock market during the boom periods and balance their portfolios through investing in other assets, particularly real estate (Markowitz,1952). Traditionally, real estate assets, stocks, bonds, and similar instruments have been assumed to have low correlations (Kakes and Van Den End, 2004; Chan et al., 2011). Hence, these assets could be used together for portfolio diversification. However, recent experiences particularly during the COVID-19 pandemic period, indicate strong linkages between the real estate and stock markets (Al Refai et al., 2021; Chaudhry et al., 2021; Büyükkara et al., 2023; Kartal et al., 2023). Hence, clarifying the linkage between these markets, namely whether stock market performance leads the real estate market or real estate market performance leads the stock market provides crucial information.

In this study, we focus on Türkiye, an economy in which real estate has been a traditional investment instrument. There has been a rapid increase in the demand for housing in Türkiye particularly in the last decade. One of the reasons for this increase in demand is the aim of protecting the purchasing power of investors' savings in the face of high inflation. The rapid monetary expansion in the aftermath of the 2008 global financial crisis led to the rapid growth of the construction sector in Türkiye. Expansionary monetary policy over the 2018-2022 period eased the access to financial resources. This fostered an increase in commercial and residential projects. The increase in the number of immigrants, the increasing housing demand of foreigners due to the depreciation of the TL, and the granting of citizenship to foreigners also triggered the increase in housing demand. As of 2023, the homeownership ratio in Türkiye is 56.2 percent (TURKSTAT, 2024). The housing price index in Türkiye has increased from 154.90 in 2020 to 1273.30 in 2024 from 2020 to 2024 (CBRT, 2024). Preceding the global financial expansion after the 2008 crisis and expansionary monetary policy rules in Türkiye after 2018, interest in the Turkish stock market has also increased. As of mid of 2023, the demand for housing started to decline and this was also reflected in the lower real price index of housing in July 2023 for the first time after May 2020 (BETAM, 2023). In parallel, the Turkish economy has witnessed a 2.78 percent growth in stock market return in 2018 and this has reached 33.24 percent in 2021. In the meantime, despite the COVID-19 pandemic, Türkiye's economy grew by 1.9 percent in 2020 and achieved 11.4 percent growth in 2021, and 5.5 percent in 2022 (World Bank, 2024). In summary, the Turkish economy has experienced a period of dynamic and complex interactions among the real estate and financial sectors over the last decade. Hence, executing the link among them will provide valuable information for the policymakers and the investors.

There are two prominent approaches explaining the relationship between real estate and stock markets in the existing literature. The first is the "wealth effect" which reveals that households and investors tend to invest more in real estate due to the increase in their welfare caused by unexpected gains in the stock market. Second is the "credit-price effect". Credit-constrained firms use real estate as collateral. Hence, increases in real estate prices translate into lower costs of borrowing for credit-constrained firms and reduce their borrowing costs. This cost reduction will positively affect the profitability of the companies and consequently increase the stock prices of these companies.

The aim of this study is to examine the causal relationship between real estate and stock markets in Türkiye over the 2010-2023 period and uncover whether the wealth effect or the credit price effect has been dominant. The period of the study also includes the Covid-19 pandemic. Hence the findings will provide information about the dynamics of the relationship between real estate and stock markets in the shade of an unexperienced era. The study contributes to the literature in several ways. The majority of the previous papers on the relation between real estate and stock prices employ linear symmetric models, however, the direction and magnitude of the changes in real estate and stock prices may exhibit asymmetric patterns when the interaction among them is considered. For instance, increases and decreases in stock prices may not lead to equal and opposite effects on real estate prices. Few empirical studies applied the nonlinear autoregressive distributed lag (NARDL) model, considering this possible asymmetric relationship. To the authors' best knowledge this is the first study comprising the Turkish economy that uses the NARDL model developed by Shin et al. (2014) to analyze the dynamics among the real estate and stock prices. In that way, we aim to explore the possible asymmetric impact of positive and negative shocks on the series and their asymmetric adjustment patterns.

The remainder of the article is organized as follows. The literature is reviewed in Section 2. Section 3 describes the data and the estimation methodology. Estimation results are presented in Section 4. Section 5 concludes with the main findings and some concluding remarks.

2. Literature Review

The importance of the relationship between stock markets and real estate markets has gradually increased in the literature due to rapidly growing financial markets and volatility in real estate prices. However, the findings of these studies differ according to the countries and time periods examined and do not show a consensus. While the earliest of these studies find evidence of the wealth effect (E.g. Kapopoulos and Siokis, 2005; Kakes and Van Den End, 2004) more recent efforts based on a larger number of countries have not reached a concurrence. For example, in a study of 7 European countries, Irandoust (2021) found a wealth effect for the 1975-2017 period. However, Ali and Zaman (2017) found mixed effects for 22 European countries for the 1975-2017 period. Using panel cointegration and panel causality methods, this study found stock-led house prices in the short run and joint inter-dependence in the long run which confirms the feedback hypothesis for the stock and house prices. On the other hand, Gökmenoğlu and Hesami (2019) investigated the real estate and stock markets in Germany and found unidirectional causality from the real estate market to the stock market, which indicates the existence of a credit-price effect. In another study, Gil-Alana et al. (2020) analyzed the stock and real estate markets of BRICS countries by using daily values of real estate and stock indices. The findings of this study revealed a positive relationship between real estate and stock market indices for India and Russia, indicating a credit-price effect for these two countries. The study also discovered a two-way causal relationship between stock and real estate indices in South Africa.

Cultural factors are highly influential on individuals' investment decisions. Citizens of the Far East and Asian countries have more traditional investment behaviors like in Türkiye. In these countries, house ownership is very important and housing is seen as the main investment tool. In their study of Korea, where real estate is traditionally seen as an important investment tool, Sim and Chang (2006) examined different regional housing and land markets. The findings of the study revealed that stock prices in both national and regional markets are more strongly affected by the prices of industrial land, while the effects of commercial and residential land prices are more limited. A strong causal relation from the real estate markets to the stock market was found indicating a credit-price effect. Another country where home ownership is important is Hong Kong. In a study conducted for this country, Hui and Ng (2012) examined the relationship between property prices and stock index for three sub-periods and revealed that the credit-price effect was valid in the first two sub-periods. In the third sub-period, it was observed that capital gains in the stock market increased the investments in this market and the capital gains in the real estate market increased the investments in this market, creating a snowball effect within each market. In another study in Hong Kong, Lee (2017) examined the causality relationship between residential property prices and stock prices. The findings show that in the long run, changes in stock prices affect residential property prices; in other words, the wealth effect is valid in Hong Kong.

With the fast development of financial markets in the last decade the number of studies examining the relationship between real estate prices and stock prices in Türkiye increased. In one of these studies, Yüksel (2016) analyzed the relationship between real estate and house prices in Türkiye and investigated how the 2007 global economic crisis affected this relationship. The study's findings showed that in the pre-crisis period, both credit-price and wealth effects existed in Türkiye however, for the crisis period evidence was found only for the credit-price effect. In a similar study, Afşar and Karpuz (2019) examined the same relationship by using time series estimation methods but could not find a significant relationship between the two markets for the 2000-2017 period. More recently, Torun and Demireli (2022) analyzed the dynamic causality relationship between housing and stock markets for the 2010-2021 period for Türkiye. They concluded that the interaction between the two markets changes over time and both wealth and credit-price effects are observed periodically.

In addition to the above-mentioned studies using the time series and cointegration methods, studies considering the asymmetric relationships between the real estate and stock markets have recently begun to appear in the literature. These studies use the NARDL method which allows researchers to account for asymmetries in responses to positive and negative shocks. One of the first studies that used this method on the subject was Okunev et al. (2000). They employed both linear and nonlinear causality tests to analyze the relationship between stock and housing markets in the US. Their findings indicate that stock prices significantly lead to house prices, demonstrating a wealth effect for the US. Al Refai et al. (2021) also used the NARDL method to analyze the relationship between real estate and stock markets in Qatar and found support for the wealth effect both in the short run and long run. Similarly, Mahmoudinia and Mostolizadeh's (2023) findings using the NARDL method support the wealth effect for Iran.

The NARDL method has been used only for a limited number of countries and Türkiye is not among these countries. To the best of the authors' knowledge, this is the first study to examine the relationship between real estate and stock prices for Türkiye using the NARDL method, and it is expected to contribute to the literature in this respect.

3. Data and Methodology

We address the linkages between real estate and stock markets using the following data. We employ the Borsa Istanbul Index (XU100) (*lnBIST*) to establish the stock market data. To represent the real estate market we employ residential property indices, namely the general index (*lnhouse*). We also use the three-month deposit rate (*R*). Following Al Refai et al. (2021), we use the return series both for the real estate and stock market variables. All series are taken in monthly frequency for the period January 2010-March 2023.

The descriptive statistics for the real estate and stock market prices are presented in Table 1. We observe that the average monthly change in the stock market has been greater than the real estate market over the sample period. The higher standard deviation of the stock market prices is in conformity with our expectations. This finding may seem to contradict the risk-return relationship, however, it is not surprising when the dynamics of the Turkish economy are considered over the sample period.

Table 1. Descriptive Statistics for Real Estate and Stock Market Data Indicators

Variable	**lnBIST**	**lnhouse**	**R**
Mean	7.186	4.509	12.481
Median	6.965	4.490	10.440
Std Dev	0.713	0.536	4.199
Max	9.076	6.294	23.770
Min	6.303	3.815	7.530

To trace the dynamic relationship between real estate and stock markets and uncover whether the wealth effect or credit-price effect is dominant in the Turkish economy, we use both linear and nonlinear ARDL models. ARDL models are independent of the order of integration of the series perform well in small samples and produce consistent estimates of long-run coefficients. Recently, Shin et al. (2014) have introduced a nonlinear ARDL model, building further the well-known model of Pesaran et al. (2001). The conventional ARDL model assumes a symmetric relationship among the variables. However, the positive and negative changes in the explanatory variables may have an asymmetric impact on the dependent variable. This approach is valuable in the sense that many economic and financial variables respond to positive and negative shocks in different directions and magnitudes.

We will employ the following equations to investigate the wealth effect and credit-price effect:

Wealth effect:

$$\ln(house_t) = \theta_0 + \theta_1 \ln(BIST_t) + \theta_2 R_t + \mu_t \tag{1}$$

Credit-price effect:

$$\ln(BIST_t) = \alpha_0 + \alpha_1 \ln(house_t) + \alpha_2 R_t + \varepsilon_t \tag{2}$$

To estimate short-run coefficients, we estimate the following error correction models, respectively:

$$\begin{aligned}\Delta\ln(house_t) = \gamma_0 &+ \sum_{k=1}^{m} \gamma_{1k}\, \Delta\ln(house_{t-k}) + \sum_{k=1}^{m} \gamma_{2k}\, \Delta\ln(BIST_{t-k}) \\ &+ \sum_{k=1}^{m} \gamma_{3k}\, \Delta(R_{t-k}) + \delta_1 \ln(house_{t-1}) + \delta_2 \ln(BIST_{t-1}) + \delta_3 \mathrm{R}_{t-1} \\ &+ u_t\end{aligned} \tag{3}$$

$$\Delta \ln(BIST_t) = \rho_0 + \sum_{k=1}^{m} \rho_{1k}\, \Delta\ln(BIST_{t-k}) + \sum_{k=1}^{m} \rho_{2k}\, \Delta\ln(house_{t-k}) + \sum_{k=1}^{m} \rho_{3k}\, \Delta(R_{t-k}) + \vartheta_1 \ln(BIST_{t-1}) + \vartheta_2 \ln(house_{t-1}) + \vartheta_3 \mathrm{R}_{t-1} + v_t \tag{4}$$

In equations 3 and 4, short-run coefficients are represented by differenced variables and δ_i's. ϑ_i 's indicate long run coefficients. Equations 1 and 2 provide long-run symmetric parameter estimates. To incorporate possible asymmetric impact among variables, following Shin et al. (2014), we establish the NARDL model. To this end, we decompose changes in *BIST* and *house* as positive and negative changes and develop new variables representing them.

$$\ln(house_t) = \beta_0 + \beta_1 \ln(BIST_t) + \beta_2\, R_t + \beta_3 \ln(BIST_t^{+}) + \beta_4 \ln(BIST_t^{-}) + \varphi_t \tag{5}$$

$$\ln(BIST_t) = \pi_0 + \pi_1 \ln(house_t) + \pi_2\, R_t + \pi_3 \ln(house_t^{+}) + \pi_4 \ln(house_t^{-}) + \omega_t \tag{6}$$

β_i and $\pi_i$are long-run parameters. The asymmetric effects of stock market and real estate market are incorporated by positive changes $BIST_t^{+}$, $house_t^{+}$ and negative changes $BIST_t^{-}$, $house_t^{-}$. $BIST_t^{+}$ and $house_t^{+}$ are the partial sums of positive changes in stock and real estate market whereas $BIST_t^{-}$ and $house_t^{-}$ are the partial sums of negative changes in these variables. These are defined in equations 7-10, below.

$$BIST^{+} = \sum_{i=1}^{t} \Delta\ln(BIST_i^{+}) = \sum_{i=0}^{t} max\,(\Delta\ln BIST_i\ \ ,0) \tag{7}$$

$$BIST^{-} = \sum_{i=1}^{t} \Delta\ln(BIST_i^{-}) = \sum_{i=0}^{t} min\,(\Delta\ln BIST_i\ \ ,0) \tag{8}$$

$$house^{+} = \sum_{i=1}^{t} \Delta\ln(house_i^{+}) = \sum_{i=0}^{t} max\,(\Delta\ln house_i\ \ ,0) \tag{9}$$

$$house^{-} = \sum_{i=1}^{t} \Delta ln(house_i^{-}) = \sum_{i=0}^{t} min\,(\Delta ln\, house_i\ \ ,0) \tag{10}$$

We proceed by substituting these new variables into equations 5 and 6 and reach the NARDL models as below:

$$\Delta \ln(house_t) = \gamma_0 + \sum_{k=1}^{m} \gamma_{1k}\, \Delta\ln(house_{t-k}) + \sum_{k=1}^{m} \gamma_{2k} \Delta {BIST^{+}}_{t-k} + \sum_{k=1}^{m} \gamma_{3k} \Delta {BIST^{-}}_{t-k} + \sum_{k=1}^{m} \gamma_{4k}\, \Delta(R_{t-k}) + \delta_1 \ln(house_{t-1}) + \delta_2 {BIST^{+}}_{t-1} + \delta_3 {BIST^{-}}_{t-1} + \delta_4 \mathrm{R}_{t-1} + u_t \tag{11}$$

$$\Delta \ln(BIST_t) = \rho_0 + \sum_{k=1}^{m} \rho_{1k}\, \Delta\ln(BIST_{t-k}) + \sum_{k=1}^{m} \rho_{2k} \Delta {house^{+}}_{t-k} + \sum_{k=1}^{m} \rho_{3k} \Delta {house^{-}}_{t-k} + \sum_{k=1}^{m} \rho_{4k}\, \Delta(R_{t-k}) + \vartheta_1 \ln(BIST_{t-1}) + \vartheta_2 {house^{+}}_{t-1} + \vartheta_3 {house^{-}}_{t-1} + \vartheta_4 \mathrm{R}_{t-1} + v_t \tag{12}$$

Shin et al. (2014) revealed that conventional bounds testing approach by Pesaran et al. (2001) is applicable after estimation of equations 11 and 12. If the bounds test statistics indicate cointegration, the next step is to test for short-run and long-run asymmetries. Wald test for asymmetric association rests on the null hypothesis stating size of negative and positive coefficients are the same. Hence rejection of the null hypothesis provides evidence of presence of asymmetries. These hypotheses are described in Table 2.

Table 2. Hypotheses for Asymmetric Impact

Hypothesis	Wealth Effect		Credit-Price Effect	
	Short-run Asymmetry	**Long-run Asymmetry**	**Short-run Asymmetry**	**Long-run Asymmetry**
H_0	$\gamma_{2k} = \gamma_{3k}$	$\delta_2 = \delta_3$	$\rho_{2k} = \rho_{3k}$	$\vartheta_2 = \vartheta_3$
H_1	$\gamma_{2k} \neq \gamma_{3k}$	$\delta_2 \neq \delta_3$	$\rho_{2k} \neq \rho_{3k}$	$\vartheta_2 \neq \vartheta_3$

4. Empirical Results

We start with examining unit root tests to investigate the integration properties of the series. To this end we both employ Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) tests. We use both tests to ensure none of the variables are I(2), since the bounds testing methodology fails in that case.

Table 3. Unit Root Tests (ADF and PP)

Variables	ADF Unit Root Test				PP Unit Root Test			
	c		c+t		c		c+t	
	Level	**First Diff**	**Level**	**First Diff**	**Level**	**First Diff**	**Level**	**First Diff**
	2.058	-11.188*	-0.012	-11.522*	1.995	-11.188*	-0.069	-11.519*
lnBIST	1.866	-4.424*	0.202	-4.181*	4.762	7.462*	2.502	-8.108*
lnhouse	-1.781	-5.756*	-3.629**	-5.742*	-1.669	-5.910*	-2.782	-5.883
R	2.058	-11.188*	-0.012	-11.522*	1.995	-11.188*	-0.069	-11.519*

Note: c and c+t refer to models with drift and with drift and trend, respectively. * and ** denote rejection of unit root at 1 and 5 percent respectively based on MacKinnon (1991).

The results of unit root tests in Table 3 indicate that none of the variables is integrated of order 2, I(2). Hence, we can proceed with the bounds testing approach. Table 4 presents the linear ARDL bounds test results.

Table 4. Linear ARDL Bounds Test Result

	Wealth Effect		Credit-Price Effect	
F-stat	6.017		3.846	
Significance	**Lower bound**	**Upper bound**	**Lower bound**	**Upper bound**
10%	2.630	3.350	2.630	3.350
5%	3.100	3.870	3.100	3.870
1%	4.130	5.000	4.130	5.000

Note: F-statistic is based on the bounds test, Pesaran et al. (2001). Lag length is determined by AIC.

Linear ARDL bounds test results indicate strong evidence of wealth effect. This finding is consistent with Ibrahim (2010), Lee (2017), and Irandoust (2021). However, evidence toward the credit-price effect is significant only at the 10% level since the F statistic falls into the inconclusive region at 5 percent and 1 percent levels. Hence, we proceed with the NARDL bounds testing approach. The results are presented in Table 5. The NARDL bounds test results indicate strong evidence towards the existence of long-run relationships among variables. We find that both wealth and credit-price effects are present in the sample period.

Table 5. NARDL Bounds Test Result

	Wealth Effect		Credit-Price Effect	
F-stat	5.820		8.311	
Significance	**Lower bound**	**Upper bound**	**Lower bound**	**Upper bound**
10%	2.370	3.200	2.370	3.200
5%	2.790	3.670	2.790	3.670
1%	3.650	4.660	3.650	4.660

Note: F-statistic is based on the bounds test, Pesaran et al. (2001). Lag length is determined by AIC.

Proceeding with the error correction mechanism (ECM), we search for the short-run adjustment processes. The estimates of ECM of the linear ARDL model are reported in Table 6. The ECM results for linear ARDL models reveal that error correction terms (Cointeq(-1)) are negative and statistically significant. Hence, we can conclude that the speed of adjustment is 1.8 percent per month for the wealth effect model while it is 2.4 percent per month for the credit-price model. In other words, for the wealth effect model, 1.8 percent of the deviations from the long-run equilibrium are corrected within a month.

Table 6. NARDL Bounds Test Result

Wealth Effect ARDL (4,4,4)		Credit-Price Effect ARDL (1,1,1)	
Variable	**Coefficient**	**Variable**	**Coefficient**
D(ln(house)-1)	0.655* (0.076)	D(ln(*house*))	-0.345 (0.306)
D(ln(house)-2)	0.018 (0.094)	D(ln(*R*))	-0.219* (0.083)
D(ln(house)-3)	0.300* (0.075)	***Cointeq(-1)***	-0.024* (0.005)
D(ln(BIST))	0.0001 (0.009)		
D(ln(BIST)-1)	0.006 (0.010)		
D(ln(BIST)-2)	-0.020*** (0.010)		
D(ln(BIST)-3)	-0.019 (0.010)		
D(ln(R))	-0.056* (0.013)		
D(ln(R)-1)	0.055* (0.018)		
D(ln(R)-2)	-0.027 (0.018)		
D(ln(R)-3)	-0.029** (0.015)		
Cointeq(-1)	-0.018* (0.003)		

Note: The numbers in parentheses are the standard errors. ARDL models are specified based on AIC. * and ** denote significance at 1 and 5 percent, respectively.

We also provide the ECM results for the NARDL model. The results are presented in Table 7. The ECM results from the NARDL model indicate that the coefficient of the ECM term, *Cointeq(-1)*, is negative and statistically significant. We observe a 2.3 percent correction per month in the wealth effect model while the speed of correction is 6.7 percent in the credit-price model.

Table 7. Estimates of ECM of NARDL Model

Wealth Effect ARDL (4,4,1)		Credit-Price Effect ARDL (1,0,0)	
Variable	**Coefficient**	**Variable**	**Coefficient**
D(ln(house)-1)	0.677* (0.075)	*D(ln(house))*	-0.375 (0.329)
D(ln(house)-2)	0.017 (0.092)	*D(ln(R))*	-0.313* (0.096)
D(ln(house)-3)	0.333* (0.073)	*Cointeq(-1)*	-0.067* (0.010)
D(ln(R))	-0.067* (0.013)		
D(ln(R)-1)	0.065* (0.017)		
D(ln(R)-2)	-0.025 (0.018)		
D(ln(R)-3)	-0.029** (0.014)		
D(ln(BIST))$^{+}$	-0.036* (0.014)		
D(ln(BIST))$^{-}$	0.042* (0.018)		
Cointeq(-1)	-0.023* (0.004)		

Note: The numbers in parentheses are the standard errors. ARDL models are specified based on AIC.

We proceed by testing for long-run asymmetric impact based on NARDL models. The results are reported in Table 8. The results in Table 8 provide F-statistics based on the Wald test, assuming a symmetric coefficient. The findings provide evidence of a long-run asymmetric relationship between real estate and stock markets. This evidence is valid in both wealth effect and credit price effect models.

Table 8. Long-run Asymmetry

	Wealth Effect	**Credit-Price Effect**
	F-stat	**F-stat**
Long-run asymmetry	3.605** (0.029) [1,134]	14.443* (0.000) [1,138]

Note: Long run asymmetry test rests on the null hypothesis of symmetric coefficient. * and ** denote rejection of null hypothesis at 1 and 5 percent significantly.

The results in Table 9 indicate that asymmetric impact is present both in wealth-effect and credit-price effect models. In the wealth-effect NARDL model, we find that a percentage increase in the BIST return leads to an increase of 0.549 percent in real estate prices, on average. This finding is in line with the findings of Al Refai et al. (2021), and Mahmoudinia and Mostolizadeh

(2023). However, the fall in BIST return does not have any significant effect on real estate prices. This result represents a departure from Al Refai et al. (2021) but it is meaningful for the Turkish economy over the sample period. In the last decade, the Turkish stock market has attracted many new domestic and foreign investors owing to its high return potential. Particularly, domestic investors who have built up substantial wealth through stock market operations transferred their earnings toward the real estate market. Hence higher demand has resulted in higher prices in the real estate market. However, a decline in the stock market returns does not have a significant impact on the real estate market.

Table 9. Long-run NARDL Coefficient Estimates

Wealth Effect		**Credit-Price Effect**	
Variable	**NARDL Coefficient**	**Variable**	**NARDL Coefficient**
ln(BIST)$^+$	0.549* (0.165)	*ln(house)*$^+$	1.489* (0.269)
ln(BIST)$^-$	0.369 (0.278)	*ln(house)*$^-$	-32.187* (12.204)
ln(R)-1	0.284** (0.045)	*ln (R)*	-1.249** (0.492)
c	3.205* (0.291)	*c*	9.198* (1.119)

The credit-price effect NARDL model results are presented in the last column of Table 9. The findings are surprising to the end that the asymmetric impact of real estate prices on the stock market is very strong in case of bad times in the real estate market than the good times. These two markets are strongly interrelated with each other. Moreover, real estate investments and construction have been one of the major sources of economic growth over the last decade. An increase in real estate returns may be transferred to the stock market for financial investment opportunities. However, when the real estate market experiences a negative shock, this may serve as a signal of economic instability. This signal is negative not only for domestic investors but also for foreign investors. Hence a dramatic decline in the demand for the Turkish stock market is experienced as the negative and statistically significant -32.187 coefficient of *ln(house)* indicates.

Overall, our findings comprising the dynamics of real estate and stock markets in Türkiye indicate a clear asymmetric relationship. We find evidence towards the existence of both the wealth effect and credit price effect. The NARDL results have produced valuable information for policymakers and investors. The asymmetric association is clearly more dominant in the credit price effect model. Long-run positive changes in the real estate prices lead to a small positive impact on the Turkish stock market while a negative shock in the real estate sector leads to a dramatic decline in the stock market. The findings of the study provide valuable information for the policymakers in the sense that to promote the stability of the economy they should pay particular attention to fluctuations in the real estate prices and policies towards regulating real estate the market. The investors will also benefit from these findings and should adjust their portfolios considering the possible asymmetric associations.

5. Conclusion

This study investigates the association between the real estate market and the stock market in Türkiye using both linear and non-linear ARDL cointegration models. Consistent with previous studies, the linear ARDL cointegration test finds evidence of wealth effect (Kakes and Van Den End, 2004; Ibrahim, 2010; Lee, 2017; Irandoust, 2021). However, following Shin et al. (2014), we control the possible asymmetric associations among the variables and find evidence towards the existence of both wealth and credit price effects. It is notable to state that the NARDL process through the wealth effect model reveals that an increase in stock prices will lead to an increase in real estate prices. This finding is consistent with the findings of Okunev et al. (2000), Al Refai et al. (2021), and Mahmoudinia and Mostolizadeh (2023). However, the decline in stock prices does not have a significant impact on the real estate market. Interestingly, when we estimate the credit price effect model, we observe that both increases and decreases in real estate prices lead to significant changes in the stock market. However, the increases in real estate prices seem to have a small positive impact on the stock market whereas a decline in real estate prices will lead to a dramatic downturn in the stock market.

Overall, these findings provide important information for investors while setting up their portfolios and the policymakers to ensure economic stability. The strong asymmetric association among the real estate and stock markets is an important signal for investors who plan to include both assets in their portfolios. Strong asymmetric characteristics of this relationship over the downturn periods of the real estate market may discourage investors from including both assets in their portfolios at the same time. Moreover, the findings of the study reveal valuable information for the researchers. Linear ARDL models may provide misleading information about the association among the variables. Investigating the asymmetric nature of the relationship will demonstrate more relevant and precise policy recommendations. The results of the study unveil important information for the policymakers in the sense that to promote the stability of the economy they should pay particular attention to fluctuations in the real estate prices and develop policies towards regulating real estate the market.

Declaration of Research and Publication Ethics
This study which does not require ethics committee approval and/or legal/specific permission complies with the research and publication ethics.

Researcher’s Contribution Rate Statement
The authors declare that they have contributed equally to the article.

Declaration of Researcher’s Conflict of Interest
There are no potential conflicts of interest in this study.

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