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Economic Research-Ekonomska Istraživanja

ISSN: 1331-677X (Print) 1848-9664 (Online) Journal homepage: http://www.tandfonline.com/loi/rero20

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To cite this article: Ghulam Ali & Khalid Zaman (2017) Do house prices influence stock prices? Empirical investigation from the panel of selected European Union countries, Economic Research-Ekonomska Istraživanja, 30:1, 1840-1849, DOI: 10.1080/1331677X.2017.1392882

To link to this article: https://doi.org/10.1080/1331677X.2017.1392882

Published online: 06 Nov 2017.

ECONOMIC RESEARCH-EKONOMSKA ISTRAŽIVANJA, 2017
VOL. 30, NO. 1, 1840–1849
https://doi.org/10.1080/1331677X.2017.1392882

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Do house prices influence stock prices? Empirical investigation from the panel of selected European Union countries

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ABSTRACT

This study examines the long-run and causal relationship between house prices and stock prices in the panel of 22 European Union (EU) countries, covering the monthly data from January 2007 to October 2012. The results show that house prices and stock prices variables are stationary at their first difference, and Pedroni's heterogeneous cointegration test does not confirmed the long-run relationship between the two variables; hence, it is imperative to employed dynamic OLS estimator for robust statistical inference. The results of dynamic OLS (DOLS) reveal that, among 22 countries, there are five countries which show the negative association between house prices and stock prices, while except France and Italy, the remaining 15 countries show the positive relationship between the variables. There is no significant relationship observed in the case of France and Italy. The panel results confirmed the negative impact of house prices on stock prices in the region. The results of panel causality confirmed the stock led house prices in the short-run, while the causality runs in both directions between the variables in the long-run.

ARTICLE HISTORY
Received 5 January 2015
Accepted 28 October 2016

KEYWORDS
House Prices; Stock Prices; Dynamic OLS; EU Countries

JEL CLASSIFICATIONS
C33; E31; G15

1. Introduction

Real estate has remained a topic of research interest since the 1980s, but most has focused on the issue of why investors chose to own real estate and the potential benefits of the diversifying real estate (Liao, Zhao, Lim, Wong, & Wong, 2015). One group of the researchers has focused on portfolio analysis of real estate (e.g., Case, Goetzmann, & Rouwenhorst, 2000; Eichholtz, Hoesli, MacGregor, & Nanthakumaran, 1995), while another has focused on both real estate and financial assets (e.g., Graeme & James, 1996; Hoesli, Lekander, & Witkiewicz, 2004). Globalisation has impelled different manifestations of financial liberalisation, which has shaped the local and international real estate markets. Therefore, an increasing trend of foreign liquidity in local real estate has been observed (Bardhan & Kroll, 2007). According

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to the statistics of 2009, ~ 10% of the real estate sales were generated from foreigners, while this figure was 35% in the Asian Pacific region (Liao et al., 2015). These statistics identify that foreigners are a cure for the bearish real estate market. Nevertheless, in the case of tight real estate markets, housing affordability might worsen.

A house price stun in one region effects the house price in another region, called the 'ripple effect'. Some of the studies have noted a ripple effect in different markets of the same country (Oikarinen, 2004), while another has been noted in different countries (Chen, Chien, & Lee, 2011). However, Nneji, Brooks, and Ward (2013) are of the view that real estate (i.e., the house market) is more sensitive to the stock market. Stock and house markets are very important for investors, because credit and wealth effects have crucial roles to determine their relationship (Lin & Lin, 2011). However, recent booms and busts have made the relationship between stock and house markets questionable. Both the assets (i.e., house and stocks) are substitute investment, but house prices have an additional feature of consumable goods. According to McMillan (2011), the relationship between both the assets is assumed to be non-linear, as their pace of price adjustment is not similar. Therefore, it has become very confusing for the policy-makers to understand the direction of this causality because of the price bubble phenomenon (McMillan, 2011). At the same time, the literature on the price bubble phenomenon in house and stock markets is limited (Nneji et al., 2013).

Normally, causality leads from stock prices to house prices. Suppose a surprising gain from stocks gives rise to additional wealth that could be reinvested in any alternative market or more investment in houses. Contrarily, the credit effect moves causality from house prices to stock prices. However, the value of collateral is increased in response of rising house prices. This tendency leads to either an increase in consumption or an increase in investment. Both these suppositions would lead to a rise in stock prices. Consequently, this revolving cycle will give rise to stock and house prices.

As mentioned, the relationship between stock price and house prices is supposed to be non-linear. Literally, this supposition is justified on the basis of two grounds. First, both investments are supposed to be alternative investments. The spontaneous change in one asset will not instigate the investors to change their investment into the other alternative due to transactions costs. However, equilibrium reversion is expected only in a case if a large deviation in the relationship of both variables happens (Hiang Liow, 2012).

The overall discussion confirms the importance of house prices and stock prices across the globe. The main objective of the study is to examine the long-run relationship between stock prices and house prices in the 22 selected European countries**,** covering the monthly data from January 2007 to October 2012. In addition, the study examined the causal relationship between the two variables.

The remaining paper is divided into sections 2–5. Sections 2 and 3 cover a literature review and data and methodology of the study, respectively. Section 4 contains data analysis and results. The final section represents conclusions and practical implications of the study.

2. Literature review

Investors have two major investment alternatives, i.e., securities and real assets that are well documented in the early literature (Chen, 2001; Darrat & Glascock, 1989; Green, 2002; Li & Wang, 1995; Ling & Naranjo, 1999; Liu, Hartzell, Greig, & Grissom, 1990). One point of view is that real estate property prices and stock price are bound in a positive

relation, whereas another point of view is that both have a negative relation with each other. According to the first point of view, real estate property is used as an investment tool and has a substitute relationship with financial assets, i.e., bonds and stocks (Brueggeman, Chen, & Thibodeau, 1984). Real estate returns were compared with other investment alternatives and documented that portfolio managers use real estate as an alternative investment in case the correlation between bonds and stock markets becomes weak (Ibbotson & Siegel, 1984). The supportive argument is that both stocks and real estate property have a feature of switching investment opportunities. They argued that, if there is a rise in one market, it also affects the alternative market. Therefore, a positive relation is suggested for both investments (Chen & Lee, 1998; Kim, 1993). The above discussion facilitates to formulate the hypothesis of the study, i.e.,

H1: House prices have a positive relationship with stock prices in EU countries

A study by Ambrose, Ancel, and Griffiths (1992) used data from US markets to evaluate the co-integration relationship between the stock markets and real estate prices, and found that both the variables are co-integrated in the long-run. Myer and Webb (1993) postulated the association between equity returns and real estate returns and reported that real estate returns behave like stock returns, while another study confirmed that real estate Granger cause stock prices, which implies that causality running from real estate to stock prices but not vice versa (Okunev, Wilson, & Zurbruegg, 2000). Sim and Chang (2006) provided the proof of Granger causality, i.e., stock prices are affected by house prices in Korea, while another studies results confirmed the long-run association between house prices and stock prices in the context of Singapore (Liow, 2006). The empirical results demonstrated that stock markets and property markets are correlated in the UK and US (Apergis & Lambrinidis, 2007). Threshold co-integration tests were applied by Liu and Su (2010), and the results showed a non-linear interlock between stock prices and real estate prices in China. The study by Oikarinen (2010) also revealed that co-movement between the stock market and house market was not undermined; even the restriction on foreign ownership was abolished in Finland. Furthermore, data of 13 developed countries was analysed and concluded with the same results (Hiang Liow, 2010). A recent study by Su (2011) investigated non-linear causality between real and stock prices in European countries and confirmed the long-run causality between the variables. Recent research on Greek economy has revealed the co-integration between stock prices and house prices, but a negative relation is documented between the markets (Gounopoulos, Merikas, Merika, & Triantafyllou, 2012). On the other hand, many studies evidenced that property prices and stock prices are moving independently and there was no intertwine relation between them. For example, low correlation is found among real estate price, bond prices, and stock prices using long-run data from the US over the period of 1960–1982 (Ibbotson & Siegel, 1984). The evidence of segmentation was found between commercial property and stock prices and different barriers, namely amount, cost, and efficient information were identified using data from the US (Liu et al., 1990). The second hypothesis corresponds to the particular discussion of the co-integration relationship between stock prices and house prices, i.e.,

H2: House prices and stock prices both are co-integrated in the long-run

Two different studies were conducted, i.e., the first is related with the co-integration relationship, while the second is related with co-movement of stock prices and real estate. The results of both studies postulated that real estate prices and stock returns are not bounded in an interacting relation in the case of US markets (Quan & Titman, 1997, 1999). The interlinking between real estate and stock market using data from Hong Kong and the UK is examined. The analysis is performed through data mining technique and it is concluded that these markets are neither positively correlated nor co-moving (Hui, Zuo, & Hu, 2011). Lean and Smyth (2014), however, do not signify the co-integration relationship between stock and house prices; however, the study established the stock led house prices in Malaysia. Kallberg, Liu, and Pasquariello (2014) confirmed the co-movement between stock and house prices that largely exists due to sound financial markets in US' metropolitan areas. Batayneh and Al-Malki (2015) concluded that house prices have a significant and positive association with the stock prices in Saudi Arabia financial markets that escalate a country's economic growth; on the other hand, the study established the stock led house prices in a country. Nyakabawo, Miller, Balcilar, Das, and Gupta (2015) supported the house prices led the economic growth hypothesis by using the consistent time series quarterly data of the US, which shows the soundness of the financial market to support the economic system in a country. The study formulated the third hypothesis regarding the causal relationship between stock prices and house prices, i.e.,

H3: House prices and stock prices both have a causal relationship in the short- and long-run

In summing up the review of previous studies, the majority of the studies have focused on developed countries, specifically the US and UK, but little has been done in the European countries and in the panel of EU countries. Some individual studies have focused on countries like Singapore, Korea, Hong Kong, Thailand, and China. This research differs from previous studies because this study brings the data of selected 22 EU countries estimated individually and pooled the data across the time period. The panel estimation is applied for unit roots and co-integration tests as well as short-run and long-run Granger causality. Panel estimation is preferred to investigate the segmentation or integration hypotheses rather than using individual estimation for each country.

3. Data and methodology

Monthly data for stock prices and house prices of 22 countries for the European Union is analysed from January 2007 to October 2012. House prices data is collected from the Bank for International settlement (BIS) and stock prices data is collected from DataStream databases. Twenty-two European Union countries out of 27 countries, including Austria, Belgium, Bulgaria, Croatia, Cyprus, Denmark, Estonia, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Slovakia, Slovenia, Spain, Sweden, and the UK) is selected as a sample of the study due to the availability of monthly data during the stated time period, while, on the other side, the volatility of the house prices and stock prices are more prone to these selected countries during the given time period. The

relationship between stock prices and house prices is analysed through panel unit-root test, panel co-integration test, Dynamic OLS, and panel causality test, respectively.

First, the panel unit root is used to assess the stationarity series of the candidate variables. For this purpose, the study used two panel unit root tests, including Im, Pesaran, and Shin (2003) and Levin, Lin. and Chu (LLC) (2002). LLC assumes a common unit root process while the Im, Pesaran and Shin (IPS) panel unit root test combined both the cross-section dimension and the time series dimension to test the significant power of the observations. Second, the Pedroni panel co-integration test is employed to examine the long-run relationship between stock and house prices (see, Pedroni, 1999, 2004). This test has some advantages, as any homogeneity among the cointegrated vectors is not assumed, while co-integration equations are based on heterogeneity in intercepts and slopes.

To compute residuals from the panel co-integration regression,

$$SP_{i,t} = \alpha_i + \delta_i t + \beta_i HP_{i,t} + e_{i,t} \tag{1}$$

where SP represents stock prices, HP represents house prices, and α_i is donated as country-specific intercepts. The slope coefficients representing by β_i are assumed to be changed across the countries, and δ_i signifies deterministic time trends.

Third, co-integration coefficients of variables are estimated using panel DOLS. The two-step Engle and Granger causality test (see, Engle & Granger, 1987) is applied to estimate the direction of causality between the variables. The panel error correction model is presented as follows:

$$\Delta SP_{it} = \beta_{1i} + \sum_{L=1}^{k} \beta_{11L} \Delta SP_{it-L} + \sum_{L=1}^{k} \beta_{12L} \Delta HP_{it-L} + \lambda_1 \varepsilon_{it-1} + \mu_{1it} \tag{2}$$

$$\Delta HP_{it} = \beta_{2i} + \sum_{j=1}^{k} \beta_{21L} \Delta HP_{it-L} + \sum_{j=1}^{k} \beta_{22it-L} \Delta SP_{it-L} + \lambda_2 \varepsilon_{it-1} + \mu_{2it} \tag{3}$$

where Δ signifies first differences and j represents maximum lag length use for explanatory variables, $\beta_{ij}(i = 1, 2; j = 1, 2)$ denotes the country and time effects. λ_j is a short-term adjustment coefficient and $\varepsilon_{it\text{-}1}$ is the error correction term and μ_j are disturbance terms. In equation (2), if β_{12L} (all the coefficients) are equal to zero, this means that there is no causality running from house prices to stock prices in the short-run. Similarly, in equation (3), stock prices does not have a cause-effect relationship with the house prices if β_{22L} (all the coefficients) are equal to zero in the short-run. The joint tests of hypotheses are applied to verify significance of both sources of causation in case of granger causality. Joint hypotheses are as follows:

H_0: $\lambda_1 = 0$ and $\beta_{12L} = 0$ for all i

H_0: $\lambda_2 = 0$ and $\beta_{22L} = 0$ for all i

The joint tests of hypotheses determine the variable that contributes to make adjustments in long-run equilibrium after each innovation in the system.

4. Data analysis and results

At first, we used the panel heterogeneous unit root test to ensure whether the data is stationary or non-stationary, and results confirmed that data is stationary at their first difference. Table 1 presents the panel unit root estimates.

The results confirm that both the house prices and stock prices variables have the same order of integration, i.e., I(1) variables. This result implies that both the variables fluctuated over the period of time; however, taking first differenced, these variables exhibit the stationary properties.

At the second stage, the study employed Panel Co-integration tests developed by Pedroni (2000, 2004). Pedroni (2000, 2004) tests used seven panel tests statistics, including four panel statistics and three group statistics. The results of panel cointegration tests are presented in Table 2. The results accepted the null hypothesis of no cointegration, as none of the panel statistics or group statistics show any significance level over the period of time. Therefore, the study safely concludes that there is no co-integration relationship between these two variables. The results are consistent with the previous studies of Lean and Smyth (2014) and Kallberg et al. (2014), both the studies confirmed that stock prices and house prices are not interconnected in the long-run.

Table 3 shows the dynamic OLS approach to find out the co-integrating coefficients. The results show that, out of 22 countries, there are five countries which exhibit a negative association between house prices and stock prices, while there are 15 countries which indicate a positive relationship between the variables. With an increase in the house prices in Austria, Belgium, Germany, Luxembourg, and Spain, there is a significant decrease in the stock prices, whereas, Bulgaria, Croatia, Cyprus, Denmark, Estonia, Greece, Hungry, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, Sweden, and the UK show a positive association between house prices and stock prices. In the case of panel DOLS, the overall results confirmed there is a significant and negative relationship between stock prices and house prices, i.e., a 1% increase in house prices brings change of −1.7405% in stock prices. The results imply that, along with the increase in the house prices, there is a significant decrease in the stock prices; therefore, the desirable policy instruments are required to evaluate the impact of house prices on the stock market in a given countries contexts. The results are consistent with previous studies of Batayneh and Al-Malki (2015) and Nyakabawo et al. (2015), both these studies confirmed the negative relationship between stock prices and house prices across their countries.

Table 1. Panel heterogeneous unit root test results.

	Im, Pesaran, and Shin, W-stat	
Variables	Level	First difference
SP	−0.602	−13.963**
HP	10.994	−32.565**
Levin, Lin, and Chu, *t*-stat		
SP	−1.020	−5.671**
HP	1.968	−2.031*

Source: Authors' estimation.
Note: SP indicates stock prices and HP indicates house prices.
*5% level of significance.
**1% level of significance.

Table 2. Pedroni's heterogeneous panel co-integration test results.

Within-dimension	Test statistic	Between-dimension	Test statistic
Panel v-Statistic	−1.788		
Panel rho-Statistic	2.065	Group rho-Statistic	4.240
Panel PP-Statistic	1.359	Group PP-Statistic	3.305
Panel ADF-Statistic	1.605	Group ADF-Statistic	3.598

Source: Authors' estimation.

Table 3. Dynamic OLS estimates.

	Dependent variable: ln(SP)	
Countries	Coefficient	*t*-statistics
Austria	−1.7405*	−2.5099
Belgium	−3.0121**	−3.0746
Bulgaria	1.3484**	7.0632
Croatia	3.3544**	2.7958
Cyprus	2.4603**	3.7492
Denmark	2.5247**	2.6014
Estonia	1.0483**	5.7960
France	−0.1285	−0.0971
Germany	−19.364**	−8.2285
Greece	5.1159**	5.8452
Hungry	1.9166*	2.0821
Italy	−2.9469	−0.6302
Latvia	0.6543**	4.8773
Lithuania	1.0960**	5.8059
Luxembourg	−2.1814**	−3.1228
Malta	6.5546**	5.7801
Poland	5.6981**	4.7397
Slovakia	3.1065**	5.4793
Slovenia	6.7464**	4.2079
Spain	−1.3867**	−3.7211
Sweden	2.8970**	7.3880
UK	2.8970**	7.3880
Panel DOLS	−1.7405**	−11.7789

Source: Authors' estimation.
Note: Asymptotic distribution of *t*-statistic is standard normal as time (T) and countries (N) go to infinity.
*5% level of significance.
**1% level of significance.

Table 4. Panel causality test results.

	Short run		Long run	
Panel causality	ΔSP	ΔHP	ΔSP	ΔHP
ΔSP	—	3.524**	—	6.436**
ΔHP	0.0029	—	5.766**	—

Source: Authors' estimation.
Note: All values are *F*-statistic for estimated error correction terms.
**1% level of significance. Δ, first difference.

The short- and long-run causality results are shown in Table 4. All these reported values are *F*-statistics for the causality equations. According to the results, stock prices cause house prices both in the short-run and in the long-run, while house prices only cause stock prices in the long-run. The results clearly indicate the feedback relationship between stock prices and house prices in the long-run. The results are consistent with the previous studies of Myer and Webb (1993), which confirmed the causality running from house prices to stock

prices, while Oikarinen (2010) confirmed the co-movement between the stock prices and house prices.

5. Conclusions

This study investigated the role of house prices on stock prices in a panel of 22 European countries and found that house prices decrease stock prices in five European countries, while the reverse is true in 15 countries. The remaining two countries do not hold a significant relationship between the two variables. The panel results reveal that house prices significantly decreases stock prices in a region. The panel causality results confirmed the stock led house prices in the short-run, while, in the long-run, there is a joint inter-dependence between the variables to confirm the feedback hypothesis. This study filled the gap of the existing literature, where the dearth of the literature is available on the EU countries. The results supported the previous studies results in the following manners, i.e.,

- Previous studies confirmed that the data of stock prices and house prices are volatile in nature, which fluctuated over the period of time. This result has been clearly visible in the panel unit root estimation, where the panel of EU countries' stock prices and house prices are differenced stationary.
- The previous studies show the mixed results to confirm the co-integration relationship between the stock prices and house prices. This study confirmed that both the variables are not co-integrated over the period of time.
- The results regarding the '*a priori*' expectation between the variables are a challenge, as the number of previous studies confirmed either a positive or negative association between the house and stock prices. This study confirmed that 15 EU countries show a positive relationship, while five countries confirm the negative relationship between them. However, in the aggregated panel of EU countries data, the overall results come to the conclusion that house prices significantly decrease stock prices in a region.
- Finally, there are very few studies which confirmed the co-movement between the stock prices and house prices in the causality framework. This study confirmed that both the variables jointly move together over the period of time and have bidirectional causality between them in the long-run. However, stock led house prices was established in the short-run.

There is a required strong policy framework to sustain the economic policies both for inflationary and deflationary periods, as house prices and stock prices are highly volatile in nature; therefore, the impact of both the inflationary and deflationary policies may affect the domestic prices that lead to affect stock prices in the long-run. During inflation, tight economic policy is the desirable option for yielding the higher returns of the stock. In the short-term period, the possible prospects of higher price levels may put a negative pressure on the stock market; however, this is a good time to invest at the best price if the market is further falling down. Investment in stock is one of the viable solutions to hedge against the rising price level in the long-run.

Disclosure statement

No potential conflict of interest was reported by the authors.

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