# More Evidence on the Relationship between the Stock and the Real Estate Market

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**Abstract**

This study explores the relationship between the stock market and the real estate market. Through the methodologies of cointegration and the Error Correction modeling and data from both the US and the UK stock and the real estate markets over the period 1985 through 2006 the results display that the two markets are considered highly integrated. The empirical findings have implications for managing property assets fund managers, for the pricing efficiency within the real estate market, and for policy makers regarding economic safety.

*Keywords*: stock market; real estate market; cointegration and error correction modeling; US and UK market data
*JEL Classification*: G1; C32

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## 1. Introduction

The goal of this research study is to investigate whether a relationship does exist or not between the stock market and the real estate market. The study attempts to identify the presence of such a relationship for the case of the US and the UK markets by making use of the cointegration and Error Correction (EC) causality methodologies. The contribution of this study is that it makes use of the econometric approaches in conjunction with alternative US stock indices and physical real estate indices to strengthen or weaken the results obtained so far in the relevant literature, while it employs an extended time-period sample for both countries. The identification of such a relationship is critical for both investors in both markets and for policymakers who need such information prior the designing of a national growth strategy. It is well known that investors aim at handling well differsified portfolios that include not only stock market securities but also real estate assets in such a way that the non-systematic risk is totally eliminated. The combined effect of such investments tends to affect their overall wealth, their consumption expenses and finally aggregate demand and employment. Moreover, the presence of such a link tends to affect the designing of a proper tax and growth strategy.

In the majority of worldwide countries, changes in the real estate market are a large as well as a significant part of the future trend of the overall economic activity. The number as well as the quality of investments in the real estate market (e.g. the number and the quality of new homes, apartments and industrial plants) tends to affect the economic development of the entire economy. Therefore, a rising crisis in the real estate market would be very critical for the future of the economy, in terms of productivity growth, employment and income growth. At the same time, unforeseen capital gains arising in the stock market lead to higher spending or consumption (the wealth effect) and, in turn, to higher income and employment. Therefore, the question which arises has to do with whether a significant portion of this higher spending turns to the real estate market. In addition to the wealth effect, the credit price effect also identifies that changes in the price of real estate lead to changes in corporate profitability and,

thus, to stock prices of those corporations. This phenomenon occurs because changes in the prices of real estate assets affect the asset side of corporate balances that reflect higher or lower prices for their incorporate fixed assets. Moreover, changes in real estate prices reflect analogous changes to the credit capacity of those corporations since these changes tend to affect the capacity of a corporation to use its fixed assets as collateral in the process of obtaining more or less bank loans. The changing borrowing capacity of such a corporation is automatically reflected in its capacity to implement more or less investment projects. As a result, the book value of the corporation changes, which leads to changing stock market prices.

The rest of the paper is organized as follows. Section 2 reports the literature related to the study under investigation and section 3 presents the empirical analysis and discusses the results. Finally, section 4 provides some concluding remarks and policy implications.

## 2. The Literature

The presence of an association between the stock market and the real estate market lies in the field of market integration or segmentation. The hypothesis of integration between these two markets assumes that low gains in risk reductions exist through holding assets from both markets. The literature on this issue has generated mixed results so far. In particular, one group of researchers support the view that there exists a connection between the two asset markets while a different group of economists claim that the two markets remain separable and such a connection does not exist. Schnare and Struyk (1976), Goodman (1978, 1981), Grissom *et al* (1987), Kuhle (1987), Geltner (1990) and Wilson and Okunev (1996) provide evidence in favor of compartmentization or segmentation of the two markets. On the other hand, Zeckhauser and Silverman (1983), Liu *et al.* (1990), Miles *et al.* (1990), Ross and Zisler (1991), Ambrose *et al.* (1992), Gyourko and Keim (1992) and Koh and Ng (1994) in the context of capital asset pricing modeling provided evidence in favor of the presence of a relationship between the two asset markets under study. In particular, Zeckhauser and Silverman (1983) observed that 25 percent of a corporation's value is closely related to the real estate market. Within such a framework, a substantial part of stock market assets risks is closely and positively associated with changes in the value of the corporation which owns real estate assets. Such a significant as well as positive relationship between the two markets

is attributed to the fact that it is common economic factors that seem to driving the two markets under investigation. Moreover, Gyourko and Keim (1992) showed that a substantial part of western corporations' value is closely associated with the real estate market, while Myer and Webb (1993, 1994) found that the distinction between securitized and unsecuritized real estate plays a critical role in identifying the true association between the two markets. More recent studies by Okunev and Wilson (1997), Lizieri and Satchell (1997) and Quan and Titman (1999) investigated the relationship between the real estate market index and the S&P 500 index in the US. Their empirical analysis, through linear and non- linear causality tests, displayed that there exist mixed findings. In particular, linear causality tests showed that the real estate market provides short-run information content for explaining and/or predicting the behavior of the stock market.

Studies concerning other international economies have been also implemented to identify the causality link between the two markets. More specifically, Ong (1994) through a vector autoregression methodology showed that the stock market is highly integrated with the real estate market for the case of Singapore, while Kapopoulos and Siokis (2005) showed that for the case of Greece the stock market seems to provide explanatory information for the behavior of the real estate market, especially for Athens, the capital of the country. Finally, Fu *et al.* (1994) found evidence in favor of the segmentation hypothesis in the Hong Kong asset markets. The same evidence was also supported by Oliver (1993) and Wilson *et al.* (1996) for the case of Australia.

## 3. Empirical Analysis

*Data*

Quarterly data on stock price indices (P) proxied by the Dow Jones index (DJ), the S&P 500 index (SP500), the NYSE index (NYSE) and the FTSE 100 index (FTSE) and on physical real estate (unsecuritized) prices (RE) measured by the Federal Housing Enterprise Oversight index for the US (REUS) and the Halifax Index for the UK (REUK) were obtained from Bloomberg data base from the first quarter of 1985 to the second quarter of 2006. Throughout the paper, small letters represent variables expressed in natural logarithms. The reason for making use of logarithms of prices instead of price levels is that the study needs to account for the characteristic of asset series in which price dispersion tends to increase with the

absolute level (Nelson and Plosser, 1982; Perron, 1988). Finally, the RATS 6.35 software assisted with the empirical analysis.

*Integration Analysis*

Unit root non-stationarity is tested by Dickey-Fuller (1981) unit root tests. The results, reported in Table 1, pointed out that all variables under study were non-stationary in their levels. When first differences, however, were used unit root non-stanionarity was rejected. The unit root results recommend the presence of likely cointegration between the two variables under study.

*Cointegration Analysis*

To test for cointegration we follow the methodology of Johansen and Juselius (1990). Having identified two jointly dependent stochastic variables integrated of the same order [i.e. I(1)], a vector autoregression (VAR) model is specified to obtain a long-run relationship. The tests for cointegration results are reported in Table 2. Both the eigenvalue and the trace test statistics indicate that in all cases a single long-run relationship exists between stock prices and real estate prices. The cointegration findings suggest that there are no gains to be obtained through portfolio holdings that contain both real estate and equity assets. In other words, the two markets under study seem to be integrated.

Next, the methodology of dynamic least-squares (DOLS), proposed by Stock and Watson (1993), was employed to provide estimations of the cointegration equations. The methodology estimates the long-run parameters using a linear model with leads and lags. According to Maddala and Kim (1998), this is the best way to estimate a long-run regression, since the Johansen estimator has large variation. Three leads and lags were included, while the results (available upon request) were not sensitive to alternative leads and lags. Newey- West corrected t-statistics are also provided along with figures in brackets denoting p-values:

lDJ-LREUS

lDJ = 0.897 + 0.292 lREUS – 0.0663 DUM87

*t-statistics*: 16.81[0.0] 5.46[0.0] -6.44[0.00]

Adj $R^2 = 0.42$

lSP500-LREUS

lSP500 = 0.981 + 0.277 lREUS – 0.0531 DUM87

*t-statistics*: 21.50[0.0] 6.07[0.0] -5.83[0.00]

Adj $R^2 = 0.51$

lNYSE-LREUS

lNYSE = 0.948 + 0.301 Lreus – 0.0658 DUM87

*t-statistics*: 16.94[0.0] 5.38[0.0] -6.18[0.00]

Adj $R^2 = 0.45$

lFTSE-LREUK

lFTSE = 0.897 + 0.292 Lreuk – 0.0482 DUM87

*t-statistics*: 16.81[0.0] 5.46[0.0] -5.74[0.00]

Adj $R^2 = 0.42$

where figures in parentheses denote p-values. All estimations include a dummy variable that considers the October 1987 'Black Monday' crash effect. Its impact on stock prices is negative and statistically significant in all four cases. From the cointegrating vectors, real estate prices clearly exert a positive and statistically significant effect on stock prices. In particular, the elasticity of stock prices with respect to real estate prices runs from 0.28 to 0.30 in the US while it is equal to 0.29 in the UK.

*EC Causality Analysis*

In our next step a bivariate EC model is estimated. Its estimation will be used to back out the identification of causality effects between the two variables under consideration. The results for stock prices and real estate prices causality tests yielded:

lREUS→lDJ EC coefficient = -1.70 [p-value=0.08]

LM [p-value = 0.87] RESET [p-value = 0.70] HE [p-value = 0.53]

lDJ→lREUS EC coefficient = -5.38 [p-value=0.00]

LM [p-value = 0.22] RESET [p-value = 0.13] HE [p-value = 0.36]

lREUS→lSP500 EC coefficient = -3.41 [p-value=0.00]
LM [p-value = 0.67] RESET [p-value = 0.28] HE [p-value = 0.82]
lSP500→lREUS EC coefficient = -5.45 [p-value=0.00]
LM [p-value = 0.29] RESET [p-value = 0.15] HE [p-value = 0.35]

lREUS→lNYSE EC coefficient = -2.47 [p-value=0.00]
LM [p-value = 0.90] RESET [p-value = 0.76] HE [p-value = 0.68]
lNYSE→lREUS EC coefficient = -2.25 [p-value=0.00]
LM [p-value = 0.88] RESET [p-value = 0.61] HE [p-value = 0.28]

lREUK→lFTSE EC coefficient = -2.68 [p-value=0.00]
LM [p-value = 0.19] RESET [p-value = 0.32] HE [p-value = 0.81]
lFTSE→lREUK EC coefficient = -4.06 [p-value=0.00]
LM [p-value = 0.55] RESET [p-value = 0.78] HE [p-value = 0.65]

The error correction (EC) terms are negative and statistically significant in all cases. In other words, the significance of the EC term implies that stock prices show predictability due to stock prices over long horizons and vice versa. In other words, there exist feedback effects between the two markets. The causality from the stock market to the real estate market indicate that the implied wealth effect from stock market capitalization gains led to increased investments in real estate. Diagnostics display the absence of serial correlation in residuals (LM test), the acceptance of the functional form of the model (RESET test), and the absence of heteroskedasticity (HE test) in all EC equations.

**4. Concluding Remarks and Policy Implications**

This empirical work attempted to investigate, through cointegration and EC causality methodologies whether stock markets and (unsecuritized) real estate markets in the US and in the UK are integrated or segmented. The results displayed that the two markets are integrated,

implying the absence of gains for portfolio holders that include both assets in those portfolios. In addition, the results exemplify the absence of exogenous factors, such as locational diversity (Ong, 1995), that are related exclusively to the physical real estate market.

The empirical findings could have substantial implications not only for managing property assets in the relevant funds industry and for the pricing efficiency within the property market but also for policy makers regarding economic safety.

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## APPENDICES

Table 1. Unit Root Tests

| Var. (X) | ADF criterion levels | First differences |
|---|---|---|
| lFTSE | -0.96(9) | -4.54(4)* |
| lDJ | -1.29(5) | -4.09(4)* |
| lSP500 | -2.12(6) | -4.90(4)* |
| lNYSE | -1.62(5) | -4.42(3)* |
| lREUS | -0.28(5) | -6.89(2)* |
| lREUK | -2.11(8) | -4.97(4)* |

*Notes*: Numbers in parentheses denote the number of augmentation terms which ensure white noise residuals (through the final prediction error –FPE- criterion).
* denotes significance at 5 percent.

Table 2. Johansen-Juselius cointegration tests

| r | n-r | m.λ. | 95% | Tr | 95% |
|---|---|---|---|---|---|
| lDJ-lREUS | | | | | |
| r=0 | r=1 | 27.7376 | 15.8700 | 33.6159 | 20.1800 |
| r<=1 | r=2 | 5.8784 | 9.1600 | 5.8784 | 9.1600 |
| lSP500-lREUS | | | | | |
| r=0 | r=1 | 27.3732 | 15.8700 | 31.5213 | 20.1800 |
| r<=1 | r=2 | 4.1481 | 9.1600 | 4.1481 | 9.1600 |
| lNYSE-lREUS | | | | | |
| r=0 | r=1 | 27.1653 | 15.8700 | 30.5920 | 20.1800 |
| r<=1 | r=2 | 3.3939 | 9.1600 | 3.3939 | 9.1600 |
| lFTSE-lREUK | | | | | |
| r=0 | r=1 | 27.8200 | 15.8700 | 29.0494 | 20.1800 |
| r<=1 | r=2 | 1.2294 | 9.1600 | 1.2294 | 9.1600 |

*Notes*: r = number of cointegrating vectors, n-r = number of common trends, m.λ.= Maximum eigenvalue statistic, Tr = Trace statistic.