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More Evidence on the Relationship between the Stock and the Real Estate Market ♣,♣♣

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This study explores the relationship between the stock market and the real estate market. The methodologies of cointegration and the Error Correction modelling along with data from both the US and the UK stock and the real estate markets over the period 1985-2006 were used. The results display that the two markets are considered as 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. **JEL codes: G1; C32.**

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1. Introduction

The goal of this research study is to investigate whether a direct relationship exists between the stock market and the real estate market. The study attempts to identify the presence of such a relationship for both of the US and the UK markets by making use of the cointegration and Error Correction (EC) causality methodologies as well as alternative stock indices. The motivation behind this research effort is that the results can yield several insights that may assist participants in both markets to forecast the future behaviour of one market from the counterpart of the other. The issue of the relation between the two markets is of great significance because it also implies the presence of non-periodic investment cycles that could affect investor's asset allocation strategies in various maturities.

Moreover, the degree of integration indicates the extent to which both markets are driven by similar economic factors, such as industrial production, per capita consumption, T-bills yields, expected and unexpected inflation (Ling and Naranjo (1997). It is the impact of such factors that determines the pricing of risk in either market. In addition, the degree of integration indicates the extent of substitutability between the two markets in a sense that changes in either market are expected to affect prices in the other market.

The contribution of this study is that it makes use of the cointegration approach in conjunction with alternative mainstream stock indices as well as physical real estate indices from both the US and the UK markets to strengthen or weaken the results obtained so far in the relevant literature. Recent studies by Winniford (2003) and Najand and Lin (2004), though they consider the investigation of such a relationship, they finally do not examine it under alternative equity indices, while our study does it. Moreover, it distinguishes between non-securitized and securitized real estate markets. In particular, the Real Estate Investment Trust (REIT) institution (the proxy of securitized real estate markets), especially in the US market, has shown considerable growth. The inclusion of such a market tends to increase investors' awareness and investment, particularly from index-based fund managers (Ling and Naranjo, 2004). Finally, it employs an extended time-period sample for both countries.

The identification of such a relationship is critical for investors in both markets as well as for policymakers who need such information prior to the designing of a national growth strategy. It is well known that investors aim at handling well diversified 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. The presence of such a link also affects the designing of a proper tax and growth strategy. According to the life cycle theory of consumption, consumers attempt to smooth out consumption over their life span. Within this context, consumers spread out unexpected gains or losses in their wealth by increasing or decreasing current spending by a fraction of their wealth change. In relation to the framework developed in this study, the wealth effect arises from both financial and housing asset holdings, yet in a differential manner. According to theoretical arguments, consumption responds more intensively to changes in more liquid types of wealth, such as financial assets vis-à-vis housing assets.

In the majority of worldwide countries, changes in the real estate market are a large and 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 consumption spending, due to the presence of the wealth effect, and, in turn, to higher income and employment. Therefore, the question which arises is whether a significant portion of this higher consumption spending turns to the real estate market.

In addition to the wealth effect, the credit price effect also identifies that changes in the prices of real estate lead to changes in corporate profitability and, thus, to the stock prices of those corporations. This occurs because changes in the prices of real estate assets tend to affect the asset side of corporate balances that reflect higher or lower prices for their fixed assets. Moreover, changes in real estate prices reflect analogous changes to the credit capacity of those corporations since these changes affect the capacity of corporations to use their fixed assets as collateral in obtaining more bank loans. This changing borrowing capacity is automatically reflected as changes in the capacity to implement more investment projects. As a result, the book value of the corporations changes, leading to volatile stock market prices. Within this issue Ghosh *et al.* (1997) argue that stock market participants make use of all available information news emerging from the real estate market to estimate how common stock prices respond. Another transmission channel indicates that the value of several firms is tied up in real estate (Okunev *et al.*, 2000). As a result, the risk associated with stock returns could be partially explained by changes in stock prices for firms that are owners of lands and structures, implying a positive association between real estate returns and their counterparts in the stock market. Alternatively, several firms invest heavily in properties scheduled to be used for operational or development purposes, with these properties occupying a significant portion of the firms' assets (Liow, 1999; Seiler *et al.*, 2001). Thus, the market risk for holding these properties constitutes a factor in capital asset pricing, which is reflected in a premium in the stock market. Finally, the measurement of such properties on the assets side of the firm tends to reflect news that affects stock prices due to the growth opportunities generated by these real estate holdings.

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 studies support the view that there is a connection between the two asset markets, while a different group claims that the two markets remain separable and, thus, 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 favour of segmentation of the two markets. On the other hand, Zeckhauser and Silverman (1983), Miles *et al.* (1990), Ross and Zisler (1991), Ambrose *et al.* (1992), Gyourko and Keim (1992) and Koh and Ng (1994) within the context of capital asset pricing modelling, provide evidence in favour of the presence of a relationship between the two asset markets under study. In particular, Zeckhauser and Silverman (1983) observe 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 these real estate assets. Such a significant as well as positive relationship between the two markets is attributed to the fact that common economic factors drive these two markets.

Very few studies, however, have examined the role of the REIT markets in influencing alternative mainstream capital markets. Liu *et al.* (1990), Gyourko and Keim (1992), Mei and Lee (1994) and Li and Wang (1995) investigate whether there is any evidence of integration between REITs and common stocks, while Myer and Webb (1993, 1994) find that the distinction between securitized and non-securitized 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) investigate the relationship between REITs and the S&P 500 index in the US. Based on both linear and non-linear causality tests, their empirical analysis displays that mixed findings are present. In particular, causality tests show that although the two markets are related, the level of deviations between these two can be extensive, displaying a very low degree of mean reversion. Their results also find mixed support for the US markets by papers such as Glascock *et al.* (2000) and Lee and Chiang (2004).

Studies concerning other international economies have been also implemented to identify the causality link between the two markets. More specifically, Ong (1994) shows that the stock market is highly integrated with the real estate market in Singapore, while Kapopoulos and Siokis (2005) show that in Greece the stock market provides explanatory information for the behaviour of the real estate market, especially for the area of Athens, the capital of the country. Finally, Fu *et al.* (1994) find evidence in favour of the segmentation hypothesis in the Hong Kong asset markets. The same evidence is also supported by Oliver (1993) and Wilson *et al.* (1996) for the case of Australia.

3. Empirical Analysis

Data

Quarterly data on stock prices (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 both physical real estate (non-securitized) and Equity REITs prices (RE) measured by the Federal Housing Enterprise Oversight index (REUS) and the Morgan Stanley Equity REIT Preferred Index (REUSREIT) for the US and the Halifax Index (REUK) for the UK were obtained from the Bloomberg data base spanning the period 1985:Q1 to 2006:Q2. The Morgan Stanley index was first calculated and maintained from June 20, 2005. Prior to this date the index was calculated and maintained by the AMEX. The corresponding Equity REIT for the UK was not used because REITs were introduced in the UK in January 2007. 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 assists with the empirical analysis.

Integration Analysis

For empirical testing, we need to know whether our time series variables are stationary or non-stationary. A stationary variable is characterized by a time-invariant mean and a time-invariant variance. Thus, before specifying any cointegration or causality test, we test for unit root in the levels of stock prices and real estate prices, as well as in first differences. Unit root non-stationarity is tested by the Augmented Dickey-Fuller (ADF) test, suggested by Dickey and Fuller (1981). The ADF test involves the estimation of the following regression:

$$\Delta X_t = \alpha + \beta t + \gamma X_{t-1} + \sum_{i=1}^{v} \delta_i \, \Delta X_{t-i} + \varepsilon_t$$

where X is the variable under consideration. The results, reported in Table 1, point out that all variables under study are non-stationary in their levels. When first differences, however, are used unit root non-stanionarity is rejected. The unit root results recommend the presence of a cointegrating relationship between the two variables under study.

Cointegration Analysis

The methodology of cointegration, an econometric approach signifying co-movements among trending variables which could be exploited to infer conclusions for the presence of equilibrium relationships within a fully dynamic framework, lies on the fact that a significant part of economic theory deals with long-run equilibrium relationships generated by market forces and behavioural rules. Thus, the aim behind cointegration is the detection and analysis of long-run relationships amongst economic time series and appropriate econometric methodologies are required to evaluate such long-run relationships within a dynamic framework. The high value of cointegration is also built upon the requirement that the entailed variables should be stationary, a property characterized by constant unconditional means and variances over time and highly evaluated in economics, in which many series display strong deterministic trends. In other words, once we have two variables that share a common trend, then a linear (or sometimes non-linear) combination of the two could exist, which does not include in trend properties. In such a case the regression type of association between these two variables indicates that this regression is meaningful, not spurious.

Although stationarity seems appropriate in statistical terms, a problem associated with it is that it removes relevant long-run information. Thus, cointegration provides a way of retaining both short-run and long-run information. In addition, cointegration is closely associated with the necessary adjustment back to the equilibrium once it has temporarily distorted. By ignoring the potential deviations from this long-run equilibrium path implies by the presence of cointegrating vectors, will affect the future course of the variables involved and this will entail a serious misspecification error. Therefore, necessary conditions are imposed that ensure that the equilibrium will eventually be re-established.

To test for cointegration we follow the methodology recommended by Johansen and Juselius (1990). This procedure is based on the maximum likelihood estimation in a Vector Autoregressive (VAR) model, and calculates two statistics – the trace statistic and the maximum Eigenvalue. These two tests investigate the presence of a number of cointegrating vectors against the hypothesis of more cointegrating vectors. The plus of this approach is not only its very high power against alternative tests but also that it considers all variables included in the cointegration test as being endogenous and, therefore, it avoids the issue of imposing a unique cointegrating vector. Having identified two jointly dependent stochastic variables integrated of the same order [i.e. I(1)], a VAR model is specified to obtain a long-run relationship. The 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), is employed to provide estimations for 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 variations. Three leads and lags are included, while the results (available upon request) are not sensitive to alternative leads and lags. The results are reported in Table 3. The t-statistics make inferences about the significance of the explanatory variables in the relevant equations and are based on Newey-West heteroskedasticity and autocorrelation consistent solution, suggested by Newey and West (1987), and which takes into account both heteroskedasticy and autocorrelation of unknown forms. In particular, this approach assumes the correlation between residuals approaches zero as the distance between observations goes to infinity.

The reported p-values show that the null hypothesis of long-run zero restriction is rejected at 1% level of significance. All estimations contain a dummy variable (DUM87) that considers the October 1987 'Black Monday' crash effect. Its impact on stock prices is negative and statistically significant in all cases. The cointegrating vectors display that real estate prices (both on a non-securitized and on securitized basis) 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 for the non-securitized case and from 0.35 to 0.38 in the US, while it is 0.29 in the UK. Nevertheless, while there exists a long-run relationship between the variables under study, the relationship is far from being perfect once the estimated long-run coefficients fall short of its theoretical value of unity. This outcome could be due to possible influence of other variables, such income, interest rates or other fundamentals or even institutional changes and reforms, affecting the equilibrium prices which were not captured in this paper but tended to be undertaken in a future report effort.

Error Correction (EC) Causality Analysis

If two variables are found to cointegrated, then there must be causality between them, either uni-directionally or bi-directionally. Therefore, given that the variables are co-integrated, we proceed to estimate the EC association to capture any short-run dynamics between the variables under investigation. In such a case, the causality can be identified by including in the equation referring to the cointegrated variables an EC term, representing the residuals from the cointegrating regression. The general form of the equation employed is:

$$\Delta Y_t = a_1 + \sum_{i=1}^{q}\beta_i \Delta Y_{t-i} + \sum_{i=1}^{q}\gamma_i \Delta X_{t-i} + \lambda\, EC_{t-1} + \varepsilon_t$$

$$\Delta X_t = a_2 + \sum_{i=1}^{q}\delta_i\, \Delta Y_{t-i} + \sum_{i=1}^{q}\kappa_i\, \Delta X_{t-i} + \mu\, EC_{t-1} + \eta_t$$

where y_t and x_t are two cointegrated variables, while EC is the residuals from the cointegrating regression. This EC term indicates the adjustment of the dependent variable to the lagged deviations from the long-run equilibrium path as well as the direction of the adjustment process. In particular, if the coefficients λ and μ are both negative and statistically significant, it means that the dependent variable adjusts towards its long-run level. The statistical significance of λ shows that X has the appropriate information set to infer causality from X to Y and the statistical significance of μ has the appropriate information set to infer causality from Y to X. Thus, a bivariate error correction (EC) model is estimated, which is used to back out the identification of causality effects between the two variables under consideration. In estimating the model, one lag for all the variables included in the equations were found to be sufficient to make the residuals to become white noise. The results yield:

ΔlogREUS$\rightarrow\Delta$logDJ EC coefficient = -1.70 [0.08]
LM [0.87] RESET [0.70] HE [0.53]

ΔlogDJ$\rightarrow\Delta$logREUS EC coefficient = -5.38 [0.00]
LM [0.22] RESET [0.13] HE [0.36]

ΔlogREUSREIT$\rightarrow\Delta$logDJ EC coefficient = -3.64 [0.03]
LM [0.68] RESET [0.62] HE [0.49]

ΔlogDJ$\rightarrow\Delta$logREUSREIT EC coefficient = -6.44 [0.00]
LM [0.28] RESET [0.17] HE [0.41]

ΔlogREUS$\rightarrow\Delta$logSP500 EC coefficient = -3.41 [0.00]
LM [0.67] RESET [0.28] HE [0.82]

ΔlogSP500$\rightarrow\Delta$logREUS EC coefficient = -5.45 [0.00]
LM [0.29] RESET [0.15] HE [0.35]

ΔlogREUSREIT→ΔlogSP500 EC coefficient = -4.57 [0.00]

LM [0.72] RESET [0.33] HE [0.78]

ΔlogSP500→ΔlogREUSREIT EC coefficient = -6.19 [0.00]

LM [0.34] RESET [0.20] HE [0.39]

ΔlogREUS→ΔlogNYSE EC coefficient = -2.47 [0.00]

LM [0.90] RESET [0.76] HE [0.68]

ΔlogNYSE→ΔlogREUS EC coefficient = -2.25 [0.00]

LM [0.88] RESET [0.61] HE [0.28]

ΔlogREUSREIT→ΔlogNYSE EC coefficient = -2.79 [0.00]

LM [0.85] RESET [0.74] HE [0.64]

ΔlogNYSE→ΔlogREUSREIT EC coefficient = -2.83 [0.00]

LM [0.84] RESET [0.67] HE [0.35]

ΔlogREUK→ΔlogFTSE EC coefficient = -2.68 [0.00]

LM [0.19] RESET [0.32] HE [0.81]

ΔlogFTSE→ΔlogREUK EC coefficient = -4.06 [0.00]

LM [0.55] RESET [0.78] HE [0.65]

where Δ represents first differences and numbers in brackets denote p-values.

The error correction (EC) terms are negative and statistically significant in all cases, implying that both stock and real estate prices show predictability over long horizons. In other words, there are feedback effects between the two markets. In particular, stock prices adjust to correct for disequilibrium and in that sense affect real estate prices and vice versa. The predictability shows higher power in the US and for the securitized case, indicating that stock prices are considered more substitutable assets with equity real estate prices than with direct real estate prices. Moreover, the fact that the EC terms are above one indicates that this could be a sign of an over-reaction of either market to shocks in the other market, which goes beyond the correction of either market to the long-run equilibrium with the other market. The speed of adjustments seems to be reasonable given the characteristics facing the two markets (high efficiency, developed and highly specialized institutions).

The causality observed from the stock market to the real estate market indicates that the implied wealth effect from stock market capitalization gains lead to more investments in the real estate market. The presence of such causality effects reinforces the argument that these two markets are closely related. More specifically, the causality pattern, indicating that real estate changes carry an informational content for the stock market, is based on the argument that property changes affect the role the value of a firm's collateral plays in determining corporate investment (through the relaxation of financing constraints and the increase of their leverage) and, thus, changes in the value of shareholder's equity. Finally, based on zero p-value statistics, diagnostics display the absence of serial correlation in residuals (LM test), indicating the absence of persistence, the acceptance of the functional form of the model (RESET test), denoting the absence of non-linearity, and the presence of homoskedasticity (HE test), indicating the absence of clustering effects that contribute to much noise in the information content provided by the model, in all equations.

4. Concluding Remarks and Policy Implications

This empirical work has attempted to investigate, through the cointegration and EC causality methodologies, the dynamics between the common stock and (securitized and non-securitized) real estate market in both the US and in the UK. In particular, it has attempted to investigate whether stock markets and real estate markets are integrated or segmented. The results displayed that the two markets are rather integrated, with the relationship increasing when the securitized real estate markets are considered. The results imply that there may be certain trading strategies exploiting all available knowledge regarding forecasting power from either market to be used for the exploitation of abnormal profits. In addition, the results exemplify the absence of exogenous factors, such as spatial diversity (Ong, 1995), that are associated exclusively with the real estate market. The exact causes of these new results are not however unambiguously clear. According to certain comments, raised by a referee of this work, the association in the value of real estate market could be attributed to a wealth effect, but this is not the case for commercial real estate, especially in the UK where investors see housing and shares as weak substitutes. Our results, however, point to a strong association of either type of real estate with the stock market. Therefore, further research associating real estate markets and various stock market sector indices is more than a necessity.

Nevertheless, the empirical findings could have substantial implications not only for managing property assets and for the pricing efficiency within the real estate market, but also for policy makers regarding economic safety. In particular, the results can provide investors with valuable information regarding the manner the two assets in question are substitutable assets and policy makers about the mechanisms that these two markets may affect either each other or their interrelation with the macroeconomic features of the economy since their close association indicates that both can be exposed to the same economic shocks. These findings also indicate the minimization of the role of liquidity, regardless of the fact that real estate markets are characterized by low levels of liquidity, implying a different attitude towards investments from a portfolio manager with high levels of funds.

Our results also point to possible research avenues that will provide a clearer understanding of the mechanisms behind real estate asset ownership and its role in explaining risk-return rewards as well as stock market performance. Such an avenue is to provide more research not only for the main capital and real estate markets but also for different economies that have various institutional characteristics and market structures. Finally, this paper was written prior to the housing market crisis and excludes any considerations which relate to the current period. Therefore, it would be interesting some research efforts to incorporate the characteristics of the current crisis into the investigated analysis and to see whether the results alter.

References

Dickey, D. A. and Fuller, W. A. (1981), Likelihood Ratio Statistics for Autoregressive Time Series With a Unit Root, *Econometrica* 49, 1057-1072.

Fu, Y., Leung, W. K. and Lo, W. C. (1994), The Dynamics of Residential Property Markets and the Stock Market in Hong Kong, Paper presented in the Asia/Pacific Finance Conference, Sydney.

Geltner, D. (1990), Return Risk and Cash Flow Risk with Long-Term Riskless Leases in Commercial Real Estate, *Journal of the American Real Estate and Urban Economics Association* 18, 377-402.

Ghosh, C., Guttery, R. S. and Sirmans, C. F. (1997), Effects of the Real Estate Crisis on Institutional Stock Prices, *Real Estate Economics* 25, 591-614.

Grissom, T. V., Kuhle, J. L. and Walther, C. H. (1987), Diversification Works in Real Estate, Too, *Journal of Portfolio Management* 3, 66-71.

Johansen, S. and Juselius, C. (1990), Maximum Likelihood Estimation and Inference on Cointegration-With Applications to the Demand for Money, *Oxford Bulletin of Economics and Statistics* 52, 169-210.

Kapopoulos, P. and Siokis, F. (2005), Stock and Real Estate Prices in Greece: Wealth vs. ‘Credit-Price’ Effect, *Applied Economics Letters* 12, 125-128.

Koh, T. H. and Ng, E. H. (1994), Optimal Holding Period of a Real Estate Investment, Asia/Pacific Finance Conference, Sydney.

Kuhle, J. L. (1987), Portfolio Diversification and Return Benefits – Common Stocks vs Real Estate Investment Trusts (REITS), *The Journal of Real Estate Research* 2, 1-9.

Ling, D. C. and Naranjo, A. (1997), Economic Risk Factors and Commercial Real Estate Returns, *Journal of Real Estate Finance and Economics* 14, 283-307.

Liow, K. H. (1999), Corporate Investment and Ownership in Real Estate in Singapore: Some Empirical Evidence, *Journal of Corporate Real Estate* 1, 329-342.

Liu, C. H., Hartzell, D. J., Greig, W. and Grissom, T. V. (1990), The Integration of the Real Estate Market and the Stock Market: Some Preliminary Evidence, *Journal of Real Estate Finance and Economics* 3, 261-282.

Lizieri, C. and Satchell, S. (1997), Interaction between Property and Equity Markets: An Investigation of the Linkages in the United kingdom 1972-1992, *Journal of Real Estate Finance and Economics* 15, 11-26.

Maddala, G. S. and Kim, I.M. (1998), *Unit Roots, Coindegration, and Structural Change*, Cambridge University Press: Cambridge, U.K.

Miles, M., Cole, R. and Guilkey, D. (1990), A Different Look at Commercial Real Estate Returns, *Journal of the American Real Estate and Urban Economics Association* 18, 403-430.

Myer, F. C. N. and Webb, J. R. (1994), Retail Stocks, Retail REITS and Retail Real Estate, *The Journal of Real Estate Research* 9, 65-84.

Myer, F. C. N. and Webb, J. R. (1993), Return Properties of Equity REITS, Common Stocks and Commercial Real Estate, *The Journal of Real Estate Research* 8, 87-106.

Nelson, C. R. and Plosser, C. I. (1982), Trends and Walks in Macroeconomic Time Series: Some Evidence and Implications, *Journal of Monetary Economics* 10, 139-162.

Newey, W. K. and West, K. D. (1987), A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix, *Econometrica* 55, 703-708.

Okunev, J. and Wilson, P. (1997), Using Nonlinear Tests to Examine Integration Between Real Estate and Stock Markets, *Real Estate Economics* 25, 487-503.

Okunev, J., Wilson, P. and Zurbruegg, R. (2000), The Causal Relationship Between Real Estate and Stock Markets, *Journal of Real Estate Finance and Economics* 21, 252-262.

Oliver, S. (1993), Speculation in the Australian Residential Real Estate Market, 22nd Conference of Economists, Perth.

Ong, S. E. (1995), Singapore Real Estate and Property Stocks – A Co-Integration Test, *Journal of Property Research* 12, 29-39.

Ong, S. E. (1994), Structural and Vector Autoregressive Approaches to Modelling Real Estate and Property Stock Prices in Singapore, *Journal of Property Finance* 5, 4-18.

Perron, P. (1988), Trends and Random Walks in Macroeconomic Time Series: Further Evidence from a New Approach, *Journal of Economic Dynamics and Control* 12, 297-332.

Quan, D. C. and Titman, S. (1999), Do Real Estate Prices and Stock Prices Move Together?

An International Analysis, *Real Estate Economics* 27, 183-207.

Ross, S. A. and Zisler, R. C. (1991), Risk and Return in Real Estate, *Journal of Real Estate and Economics* 4, 175-190.

Seiler, M., Chatrath, A. and Webb, J. (2001), Real Asset Ownership and the Risk and Return to Stockholders, *Journal of Real Estate Research* 22, 138-144.

Stock, J. H. and Watson, M. W. (1993), A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems, *Econometrica* 61, 783-820.

Wilson, P. J. and Okunev, J. (1996), Evidence of Segmentation in Domestic and International Property Markets, *Journal of Property Finance* 7, 78-97.

Wilson, P. J., Okunev, J. and Ta, G. (1996), Are Real Estate and Securities Markets Integrated? Some Australian Evidence, *Journal of Property Valuation & Investment* 14, 7-24.

Table 1. Unit Root Tests

Var.	ADF criterion	
(X)	Levels	First differences
logFTSE	-0.96(9)	-4.54(4)*
logDJ	-1.29(5)	-4.09(4)*
logSP500	-2.12(6)	-4.90(4)*
logNYSE	-1.62(5)	-4.42(3)*
logREUS	-0.28(5)	-6.89(2)*
log REUSREIT	-0.35(6)	-7.85(3)*
logREUK	-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).

* Significant at 5 percent.

Table 2. Johansen-Juselius Cointegration Tests

r	n-r	m.λ.	95%	Tr	95%
logDJ-logREUS					
r=0	r=1	27.7376	15.8700	33.6159	20.1800
r<=1	r=2	5.8784	9.1600	5.8784	9.1600
logDJ-logREUSREIT					
r=0	r=1	34.8723	15.8700	38.5422	20.1800
r<=1	r=2	4.5681	9.1600	4.5681	9.1600
logSP500-logREUS					
r=0	r=1	27.3732	15.8700	31.5213	20.1800
r<=1	r=2	4.1481	9.1600	4.1481	9.1600
logSP500-logREUSREIT					
r=0	r=1	33.5228	15.8700	40.5472	20.1800
r<=1	r=2	3.4512	9.1600	3.4512	9.1600
logNYSE-logREUS					
r=0	r=1	28.4227	15.8700	35.4722	20.1800
r<=1	r=2	3.5723	9.1600	3.5723	9.1600
logNYSE-logREUSREIT					
r=0	r=1	31.1653	15.8700	36.5920	20.1800
r<=1	r=2	3.3939	9.1600	3.3939	9.1600
logFTSE-logREUK					
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.

Table 3. Long-Run (Cointegration) Estimates

Dependent Variable	Constant	REUS	REUSREIT	REUK	DUM87	Adjusted R^2
	Independent Variables					
DJ	0.897	0.292	---	---	-0.0663	0.42
	16.81[0.0]	5.46[0.0]			-6.44[0.0]	
DJ	0.762	---	0.348	---	-0.0732	0.51
	13.44[0.0]		7.21[0.0]		-5.83[0.0]	
SP500	0.981	0.277	---	---	-0.0531	0.51
	21.50[0.0]	6.07[0.0]			-5.83[0.0]	
SP500	0.681	---	0.382	---	-0.0569	0.46
	17.46[0.0]		6.83[0.0]		-5.16[0.0]	
NYSE	0.948	0.301	---	---	-0.0658	0.45
	16.94[0.0]	5.38[0.0]			-6.18[0.0]	
NYSE	0.837	---	0.372	---	-0.0577	0.48
	18.73[0.0]		6.11[0.0]		-5.74[0.0]	
FTSE	0.897	---	---	0.292	-0.0482	0.42
	16.81[0.0]			5.46[0.0]	-5.74[0.0]	

Notes: Numbers below estimates denote t-statistics, while those in brackets denote p-values. All variables are expressed in logs.

* statistical significance at 1%

♣ This paper was written prior to the housing market crisis, as the investigated sample period indicates, and excludes any considerations which relate to the current period.

♣♣ The views expressed here are personal to the authors and do not necessarily reflect those of the other staff, faculty or students of this or any other institution.

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