Discussion Paper No. 06-057

Cointegration of Real Estate Stocks and REITs with Common Stocks, Bonds and Consumer Price Inflation – an International Comparison –

Peter Westerheide

ZEW

Zentrum für Europäische
Wirtschaftsforschung GmbH

Centre for European
Economic Research

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Non-Technical Summary

This paper analyses the performance of real estate securities and their relationship to other asset classes as well as to consumer price inflation in an international comparison over a 15 year period from 1990 to 2004. In contrast to many existing studies the analysis focuses on the long run relationships, applying three different cointegration tests. The analysis covers the US, Canada, Australia, Japan, the Netherlands, Belgium, France and Germany.

Results show that real estate securities in most countries had a remarkably high performance in nominal and real terms. The average performance over the whole period (1990 – 2004) has been particularly high in capital market oriented countries in the sample (US, Australia), and also in France. Real estate securities have outperformed bond markets on a risk adjusted basis only in the US and in Australia, while an outperformance of stock markets can be observed also in Japan and France. Particularly in the period 2001 to 2004 real estate security market have soared in most countries with the notable exception of Germany, where average returns have been negative.

In general, real estate securities seem to represent an asset class distinct from bonds and stocks in most countries. In the long run they seem to reflect the performance of direct real estate investments and provide a potential for further diversification of asset portfolios. Additionally, real estate stocks provide a (weak) hedge against consumer price inflation in almost every country.

The overall picture indicates furthermore, that the existence of specialised, tax transparent vehicles like REITs is not always correlated with high performance of securitised real estate. Although our analysis does – due to data limitations – not investigate the relationship between real estate market performance and real estate securities, one might well assume that characteristics of the surrounding markets – i.e. the stock market capitalization relative to the GDP as an indicator of the development stage of the stock markets – might have additional explanatory power.

In light of the international experience, the poor performance of the German real estate stock market can potentially be attributed to a couple of problems: Aside from the fundamental problems of the German market real estate market, Germany is the only real estate security market where REITs or similar investment vehicles have not existed until now. Additionally, the capital market capitalisation in relation to GDP is still low in international comparison.

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Keywords: REITs, Real Estate Securities, Cointegration, Stock Markets, Bond Markets

L 7, 1	Tel.:	0621 / 1235 - 146
P.O. Box 10 34 43	Fax:	0621 / 1235 - 223
D-68034 Mannheim	E-mail:	westerheide@zew.de

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1 Introduction

Investment in securitised real estate is frequently considered as an instrument for participating in the long run development of the real estate market without suffering from its typical disadvantage – its illiquidity. However, there is an extensive debate on the risk-return characteristics of Real Estate Investment Trust (REITs) and other real estate stocks. The main question is whether real estate security returns primarily reflect real estate market developments and provide a corresponding potential for portfolio diversification, or whether their returns are dominated by the general stock market or bond market movements. Former studies yield diverging results, depending on the research methodology applied as well as on the country and the time period under consideration.

This paper analyses the performance of real estate securities and their relationship to other asset classes as well as to consumer price inflation in an international comparison over a 15 year period from 1990 to 2004. In contrast to many existing studies the analysis focuses on long run relationships, applying three different cointegration tests. The analysis covers the US, Canada, Australia, Japan, the Netherlands, Belgium, France and Germany. The real estate security markets in this sample are heterogeneous regarding their experience with highly specialised, exchange traded real estate investment vehicles like REITs or similar tax privileged instruments. Furthermore the countries differ with respect to the importance of stock markets for corporate finance and private wealth accumulation. Therefore it is interesting to see whether differences in the performance and relationship with other asset classes coincide with these market characteristics.

The paper's outline is as follows: After reviewing the existing literature, the second part of the analysis focuses on the performance of REITs and real estate stocks. In the third part short term correlations with the bond and the general stock market are analysed. The fourth part of the paper looks at the long run relationships between REITs and real estate stocks on the one hand and the general stock market and the bond market on the other hand. As an important characteristic of real estate investment, the ability to hedge against consumer price inflation is scrutinised as well. The fifth part summarises the main findings.

2 Literature review

Studies on the relationship between real estate stocks, particularly REITs and the common stock market are numerous. Some former studies have also analysed the inflation hedging ability of real estate securities. However, most of the former studies analyse short term correlations or relations based on linear regressions of periodical term returns. Cointegration techniques have rarely been applied in the past. The majority of studies refer to the US market, particularly to exchange traded US REITs.

Many previous studies find a significant positive correlation between common stocks and real estate stocks. A further common result is that inflation hedging capabilities of real estate stocks seem to be limited, in contrast to direct real estate investment, which should provide some inflation protection.

Our review highlights only some of the important studies. For a broader overview we refer the reader to the survey by Zietz, Sirmans, Friday (2003), for the older literature we refer to the review by Gorgel, McIntosh, and Ott (1995).

In an early study on the inflation-hedging characteristics of equity REITs, Murphy and Kleiman (1989) find for the period from 1972 to 1985, that REIT returns do not provide inflation protection.

Myer and Webb (1994) scrutinize the relationship between retail stocks, retail REITs and retail real estate in linear regressions with contemporaneous and lagged variables and in VAR models during the period from 1983 to 1991. They find a positive contemporaneous correlation among retail stocks and retail REITs, but not among retail real estate and REITs or among retail real estate and retail stocks.

Yobaccio, Rubens and Ketcham (1995) test, with linear regressions, for the inflation hedging characteristics of US REITs during the period from 1972 to 1992 and find that REITs provide some hedging against expected, but not against unexpected inflation. In total inflation hedging capabilities of REITs are therefore poor.

Eichholtz and Hartzell (1996) analyse the relationship between property shares and common stocks in the UK and the US from 1977 to 1993 and in Canada from 1985 to 1993. They find evidence for a strong contemporaneous relationship between common stocks and real estate stocks, though differing across countries.

Mull and Soenen (1997) analyse the correlations between US REITs, domestic stocks, domestic bonds and domestic CPI inflation for the time period from 1985 to 1994 in the G-7 countries. They find a positive correlation with stocks, low – mostly negative – correlation with bonds and rather small, mostly positive correlation with consumer price inflation.[1] They conclude that due to the positive correlation with stocks, the diversification potential of US REITs is limited. By comparing a three asset model portfolio consisting of domestic bonds, domestic equity and US-REITs with a two asset portfolio without REITs they show that the inclusion of REITs does not improve the Sharpe ratio in most cases. However, these results depend heavily on the time period under consideration.

Okunev and Wilson (1997) test for cointegration of US REITs with the stock market for the period from 1979 to 1993 and find no cointegration when using standard Engle Granger tests. They test a nonlinear model to describe the relationship between REITs and wider stock markets and conclude that there is evidence for a nonlinear dependency between both markets. The link, however, seems to be very weak and divergences between both market decrease slowly over time, therefore diversification potential remains.

Liu, Hartzell and Hoesli (1997) evaluate inflation hedging properties of property trusts in Australia, France, Japan, South Africa, Switzerland, the UK and the US for the period from 1980 to 1991. They find that property trusts are not a better inflation hedge than common stocks and in some countries returns are like those of common stocks - but even stronger than those – inversely related to inflation. They also apply linear regression techniques like Fama/Schwert (1997) and Solnik (1983). Reverse causation between property return changes and inflation changes – i.e. that property return changes are predictors for inflation rate changes – is also tested and some evidence for this relation is found.

Chatrath and Arjun (1998) test for cointegration of US REITs with inflation. They find evidence for cointegration in the period from 1972 to 1995 when using Johansen tests, but no evidence with other cointegration tests.

Ling and Naranjo (1999) test for integration of common stocks and real estate stocks in multifactor asset pricing models for the period from 1978 to 1994 in the US. They find evidence for (short term) integration between both markets, based on the hypothesis that risk premia in the returns are identical for both asset classes.

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[1] Mull and Soenen seem to interpret correlation results for the CPI inflation in a wrong way. They assess *negative* correlation of REIT returns and inflation as an indicator of inflation protection (see p. 57). The reverse is true.

Glascock, Lu and So (2000) analyse cointegration of US-REIT returns with bonds, equities, unsecuritised real estate and consumer prices in the US. They apply Engle-Granger-tests (EG tests) and error-correction models (ECM) for the time period from 1972 to 1996. They find cointegration between stocks and REITs after the 1993 tax reform in the US and cointegration between bonds and REITs in the time period before the reform. They also find evidence for cointegration of REITs with unsecuritised real estate, measured by the NCREIF indices, and with consumer price inflation.

Maurer and Sebastian (2002) analyse inflation hedging characteristics of real estate securities in France, Germany, Switzerland and the UK for the period from 1980 to 2000. They find that only German investment funds provide an inflation hedge, but not real estate stocks in Germany and the other countries. The analysis is based on traditional linear regression techniques following Fama/Schwert (1997) and the extension provided by Yobaccio, Rubens and Ketcham (1995) to test for the correlation between returns and expected and unexpected inflation. They also calculate short fall risk measures for real returns of real estate stocks and German real estate funds.

Brounen and Eichholtz (2003) analyse the diversification potential of property shares for the UK and the US for the period from 1986 to 2002. They find decreasing correlations between the asset classes and calculate that even in a worst case scenario Sharpe optimal portfolios should contain a real estate share of around 10 per cent.

Lizieri, McAllister and Ward (2003) study the convergence of real estate equities in the European monetary union in comparison to the stock markets, applying correlation analysis, principal component analysis, Granger causality tests and VAR analysis. They conclude that commercial real estate equities are much less integrated than wider equity markets.

Hamelink and Hoesli (2004) analyse the determinants of real estate security returns in a cross-country analysis on company level for 10 countries during the period from 1990 to 2003. They find that country-specific effects dominate returns, but also property type, size, value and growth characteristics of the company are important.

Cauchie and Hoesli (2004) test for the integration of Swiss real estate investment funds with stock and bond markets, using asset pricing models for the period from 1986 to 2002. They conclude that these funds are more integrated with the stock market than with bonds.

3 Descriptive characteristics

The analysis covers the US, Canada, Australia, Japan, the Netherlands, Belgium, France and Germany. While in all of these countries real estate stocks are traded, not all of them have extended experience with real estate investment trusts (REITs) or similar specialised vehicles for indirect real estate investments. REITs are characterised by their obligation to derive most of their income from real estate business activities (i.e. owning and operating income producing real estate such as apartments, shopping centers, offices, hotels and warehouses). REITs usually do not pay taxes on the company level, but are obliged to distribute nearly all of their income to their shareholders. REITs and similar real estate investment vehicles in other countries are frequently regarded as driving forces for the indirect real estate investment market: On one hand, they provide an opportunity for liquid investments in particular segments (property types, regions) of the real estate market. On the other hand, their regulation usually warrants a high degree of transparency and investor protection.

With respect to their REIT history the countries can be broadly arranged in two groups: While in some countries REITs or similar vehicles have a comparatively long tradition (US, the Netherlands, Australia, Canada), other countries recently introduced REITs (Japan, France). In Germany, the introduction of REITs and their legal design is currently a hot debate (for an overview of the introduction years of REITs in different markets see table 1). The countries differ also with respect to the type of their financing systems: While both the European countries in the sample and Japan have a bank based financing system, Australia, the US and Canada are known as countries with a more capital-market oriented financing system. Fig. 1 shows a graphical representation of countries ordered according to the market capitalisation of domestic equities in relation to their gross domestic product on one axis, and their experience with REITS or similar instruments on the other axis.

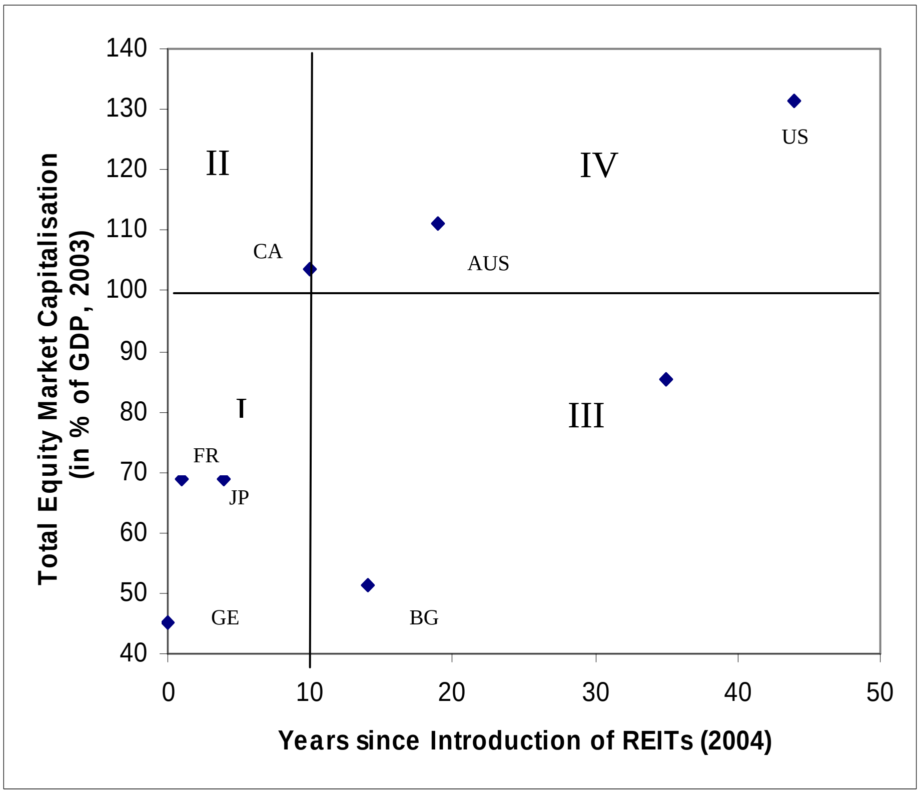
Combining both criteria, one can distinguish three groups of countries in a broad classification: Some countries have a long history of specialised real estate stock investment vehicles, traded in mature capital markets (quadrant IV). In other countries specialised real estate stock investment, via REITs or similar instruments, has also been available for a long time, however within an underdeveloped market surrounding (quadrant III). Finally, in the third group of countries, specialised real estate stock investments are available only for a short period of time, and public equity markets are, at the same time, comparatively immature (quadrant I).

Table 1: Introduction of REITs

Country	Year of Introduction
US	1960
Netherlands	1969
Australia	1985
Belgium	1990
Canada	1994
Japan	2000
France	2003
Germany	Under consideration

Source: EPRA.

Figure 1: Market Characteristics



Source: WFE, Sachverständigenrat, own calculations.

3.1 The Data

The real estate security market is represented by the indices of the NAREIT (the U.S. National Association of Real Estate Investment Trusts) and the EPRA (European Public Real Estate Association). The NAREIT data cover all REITs trading on the New York Stock Exchange, the NASDAQ National Market System and the American Stock Exchange. Aside from REITs (or their national pendants, respectively), the EPRA indices include also other listed stocks. EPRA provides not only European indices, but also indices for Australia, Japan, and Canada.

The inclusion of a company in the EPRA indices requires a minimum free float and turnover as well as a minimum share of revenues from relevant real estate activities[2](see table 2). Therefore the EPRA indices mainly include large companies and cover only a part of the market. According to EPRA estimates their indices represent on average around 85 per cent of the total market capitalisation. [3] The EPRA indices are capitalisation weighted with free float adjustment.

All NAREIT and EPRA indices are calculated as performance indices. For Germany we alternatively apply the DIMAX (Deutscher Immobilienaktien-Index). The DIMAX is a capitalisation but not free float weighted index, calculated on the basis of 45 publicly quoted German real estate companies by the German private bank Ellwanger and Geiger.[4] For the inclusion in the DIMAX 75 % of turnover and revenues have to come from real estate activities.[5]

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2 Real estate activities are defined as the "ownership, trading and development of income-producing real estate" (see EPRA (2005), Point 1.5.). Not included are e.g., the construction of residential homes for sale, the provision of construction management, general contracting and project management services, the provision of property management, facilities management, brokerage and investment management services, holding companies (see EPRA (2005), point 1.6).

3 Telephone interview with Fraser Hughes, Research Director EPRA, on Sept. 28. 2004.

4 As of Dec. 31, 2004. For details see http://www.privatbank.de/web/home.nsf/VCO/VSIN-59XEBA/$file/Dimaxde.pdf.

5 Real estate activities are defined as rent and lease, real estate management, trading in real estate, project development, and consulting.

Table 2: Requirements for the inclusion in EPRA indices

	Free float market capitalisation	Annualised trading volume in a three months period	Share of EBITDA[6] originating from real estate activities
Australia	200 Mill. US-$	100 Mill. US-$	60 %
Belgium	50 Mill. €	25 Mill. €	75 %
France	50 Mill. €	25 Mill. €	75 %
Japan	200 Mill. US-$	100 Mill. US-$	60 %
Canada	200 Mill. US-$	100 Mill. US-$	75 %
Netherlands	50 Mill. €	25 Mill. €	75 %
Germany	50 Mill. €	25 Mill. €	75 %

Source: EPRA.

In terms of bonds we use government bond indices with maturities from 7 to 10 years, calculated by Thomson Financial Datastream. For Germany, the REX (Deutscher Rentenindex), calculated by Deutsche Börse AG, is used instead. All indices are performance indices. As stock market indicators MSCI equity performance indices are used for all countries, except Germany, where the DAX 30 performance index, calculated by the Deutsche Börse AG, is used.

All time series consist of month end values for the period 1990 to 2004. The observation period for Canada is the only one that is substantially shorter, as no company fulfils the requirements for the Canadian EPRA index from 1993 to 1996. Therefore the Canadian series start with January 1997.

4 Risk and Return Profiles

A first look into the average annual rate of return reveals that for the whole 15 year period 1990 – 2004 real estate stocks and REITs have performed well in most countries. However, differences between countries are substantial: Real average rates of return, calculated as nominal rates of return minus consumer price inflation, amount to more than 10 per cent each year on average in the US, Canada (from 1997), and Australia. With 9 per cent real rate of return p.a. French real estate has also performed very well. Comparatively low are the long term average profits in the other European

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6 Earnings before Interest, Depreciation and Amortization (operatives Geschäftsergebnis vor Zinsen, Steuern und Abschreibungen).

markets (Belgium, the Netherlands and Germany). In Germany, marked differences exist between the broad DIMAX index (with only 0.4 % annual real rate of return) and the EPRA index, which only consists of 3 large companies (with 3 per cent p.a.). Japan is a special case, where the burst of the real estate market bubble in 1990 induced a long lasting decline of the whole stock market. Real estate stocks – like the general stock market – had on average a negative nominal and real yield of around 4 per cent p.a. over the whole period.

A look at sub periods shows some further heterogeneity across countries and some interesting tendencies as well: In most of the countries real estate stocks performed poorly in the first half of the nineties, but in the second half of nineties the situation improved remarkably. Exceptions include Australia, where the performance continuously has been extraordinarily high and rather stable, and the US, where the real performance was stable and substantial as well. During the years 2001 to 2004 the performance of real estate stocks improved drastically again in all countries except Germany, where the situation deteriorated, and Australia, where performance declined a bit, albeit coming from a high level.

We calculated risk adjusted returns (following Modigliani/Modigliani (1997)) to compare real estate stock performance with the general equity market performance and the bond market performance. RAP is defined as

$$(1)\quad RAP_i = (\sigma_m / \sigma_i)(r_i - r_f) + r_f\ .$$

with

σ_m = standard deviation of benchmark

σ_i = standard deviation of asset i

r_i = return of asset i

r_f = risk free rate of return

RAP can be compared directly among investment alternatives, because all portfolios are adjusted by leverage operations to the risk σ_m of the benchmark.

The RAP relative to bonds (i.e. the difference of RAP for real estate stocks, using bonds as the benchmark, to the rate of return on bonds) is positive for the whole period only in the US, Canada and Australia. For different sub periods the picture is as follows: In the first half of the nineties there was no country with a positive value except Germany, using the EPRA index. Also in the second half of the nineties the bond market performed better in almost every country or at least as good as the real estate market on a risk adjusted basis. During the years 2001 to 2004 real estate stocks usually performed better than bonds, except in Japan and Germany.

With respect to the stock market, differences in risk adjusted returns (calculated again against bonds as the benchmark for comparable figures) are higher. This is true particularly for the period from 2001 to 2004 because real estate stocks did not suffer as much from the burst of the technology bubble. In turn, the risk adjusted return in the second half of the nineties and 2000 was usually lower than on the general stock market. Over the whole 15 year period, real estate stocks performed better than general stocks on a risk adjusted basis in the US, Australia, Japan and France.

Table 3: Performance of Real Estate Stocks/REITs

	USA	CA*	AU	JP	NL	BE	FR	GE **	GE***
Annual Return									
1990-2004	13.3%		15.7%	-3.9%	5.9%	3.4%	10.8%	2.7%	5.2%
1990-1995	11.0%		15.1%	-11.6%	-5.7%	-4.4%	0.6%	-0.4%	13.1%
1996-2000	9.7%	12.8%	17.6%	-1.7%	9.2%	6.0%	15.3%	13.2%	4.0%
2001-2004	20.9%	18.1%	13.2%	6.0%	19.3%	13.5%	21.1%	-4.9%	-4.1%
Real Annual Return									
1990-2004	10.4%		13.1%	-4.0%	3.4%	1.4%	9.0%	0.4%	3.0%
1990-1995	7.7%		12.0%	-12.5%	-8.3%	-6.9%	-1.7%	-3.8%	9.7%
1996-2000	7.2%	11.0%	15.5%	-1.6%	7.0%	4.3%	14.1%	11.8%	2.6%
2001-2004	18.5%	15.9%	10.4%	6.6%	16.9%	11.6%	19.2%	-6.4%	-5.5%
RAP Bonds (Diff.)									
1990-2004	0.6%		1.4%	-4.9%	-3.1%	-4.9%	-1.8%	-3.9%	-2.8%
1990-1995	-2.2%		-1.7%	-7.0%	-8.6%	-7.3%	-5.4%	-5.7%	1.0%
1996-2000	0.8%	-0.6%	1.4%	-5.0%	-1.6%	-3.1%	0.4%	-0.1%	-3.5%
2001-2004	5.7%	1.9%	4.5%	-1.9%	1.3%	1.3%	1.0%	-7.8%	-5.7%
RAP Equity (Diff.)									
1990-2004	1.4%		4.0%	0.8%	-0.7%	-1.6%	1.4%	-1.2%	-0.2%
1990-1995	-1.4%		4.1%	0.2%	-7.9%	-3.1%	-1.1%	-3.3%	3.3%
1996-2000	-2.6%	-1.1%	3.4%	0.7%	-2.5%	-2.2%	-0.5%	-1.5%	-4.8%
2001-2004	11.9%	7.1%	3.1%	2.0%	8.7%	6.7%	8.0%	-1.0%	1.1%

Source: Datastream, EcoWin, EPRA, NAREIT, own calculations. Real annual return = annual return minus CPI-Inflation. RAP Bonds (Diff.) = RAP with benchmark bonds market, difference to annual return on bonds, RAP Equity (Diff.) = RAP with benchmark bonds market, difference to RAP on equity (calculated with benchmark bond market). * Data only available for 1997 to 2004 **, DIMAX index = real estate stocks, *** EPRA index = real estate stocks.

5 Correlation Analysis

Correlations are measured on the basis of monthly rates of returns for different time periods (see table 4). The correlations between the general stock market and real estate stocks are positive and range from 0.26 to 0.74 for the whole period from 1990 to 2004. In the first half of the 1990s the correlations have, on average, been higher than later. Particularly high correlations can be observed in the Japanese market, which declined most of the time. But also the Netherlands and Australia show substantial positive short term correlation of real estate stocks and general stock markets.

The correlation with the bond market is low or even slightly negative in almost every country. The only exception with a substantial positive correlation on average is Australia. Similar to the correlation with the general stock markets, the correlations with the bond markets tend to decrease in time. In the first half of the 1990s the correlations with the bond market have been higher in every country, except in Germany.

Table 4: Correlation of real estate stocks/REITs with general stocks and bonds

	US	CA*	AU	JP	NL	BE	FR	GE**	GE***
Stocks									
1990-2004	0.34	0.37	0.59	0.74	0.51	0.45	0.45	0.42	0.26
1990-1995	0.51		0.66	0.90	0.50	0.63	0.60	0.48	0.25
1996-2000	0.23	0.42	0.62	0.54	0.61	0.46	0.28	0.33	0.03
2001-2004	0.36	0.25	0.38	0.55	0.58	0.28	0.46	0.47	0.49
Bonds									
1990-2004	0.14	0.18	0.44	-0.03	0.10	0.27	0.26	-0.01	-0.10
1990-1995	0.38		0.58	0.11	0.34	0.35	0.55	0.21	0.19
1996-2000	0.06	0.24	0.48	-0.14	0.08	0.31	-0.07	-0.25	-0.28
2001-2004	-0.02	0.06	0.07	-0.32	-0.14	0.03	-0.03	0.03	-0.19

Source: Datastream, EcoWin, EPRA, NAREIT, own calculations. * Data only available for 1997 to 2004, ** DIMAX index = real estate stocks, *** EPRA index = real estate stocks.

6 Cointegration Analysis

The potential for portfolio diversification by investment in real estate securities depends not only on their short term correlations, but also on their long run relationships with other asset categories. Long run relationships are particularly important for investors who regard indirect real estate investments as an alternative to direct investments, which is usually long term oriented. We therefore analyse whether real estate stocks and REITs are cointegrated with the general stock market and the bond market. Since real estate investment is frequently regarded as an inflation hedge, we also look for cointegration of real estate security indices with consumer price indices.

6.1 Methodological Issues

We test for cointegration by applying three different procedures, going from limited to more general models. In the first step we have carried out Engle Granger tests (EG) for cointegration. In the second step we have estimated single equation error correction models (ECM) to account for short run dynamics. Finally in the third approach we have applied the Johansen procedure to take endogeneity of all variables in the system into consideration.[7]

For the EG-Tests the linear regression (2) is estimated:

$$(2)\quad RE_t = \alpha + \beta * X_t + \varepsilon_{1t}$$

with RE_t = real estate stock index or REIT index, X_t = stock market index, bond market index or CPI, ε_{1t} = residual and α, β as estimated constant and coefficient. Subsequently we have tested with ADF-tests whether the ε_{1t} is stationary, applying the Akaike criterion to determine the appropriate lag length, and using the MacKinnon (1996) values as critical values.

The ECM-models are specified according to equation 3, assuming weak exogeneity for X_t for the cointegration vector:

$$(3)\quad \Delta RE_t = \gamma + \sum_{i=0}^{n} \Phi \Delta X_{t-i} + \sum_{i=1}^{n} \Gamma \Delta RE_{t-i} + \delta (RE_{t-1} - \beta X_{t-1} - \alpha) + \varepsilon_{2t}$$

The symbols have the same meaning as in equation 2, with Φ and Γ as matrix of coefficients for the short term dynamics in the model, ε_{2t} = residual and γ, δ as estimated constant and coefficients. The lag length *n* of the ECM was determined using the Akaike criterion, for critical values of δ we referred to Ericsson/MacKinnon (2002).

[7] For a comparison of assumptions and advantages/disadvantages of the three procedures see Ericsson/McKinnon (2002).

The Johansen models are specified as the two-equation system 4 (a, b)

$$\text{(4a)}\quad \Delta RE_t = \gamma_1 + \sum_{i=1}^{n} \Phi_1 \Delta RE_{t-i} + \sum_{i=1}^{n} \Gamma_1 \Delta X_{t-i} + \delta_1 (RE_{t-1} - \beta X_{t-1} - \alpha) + \varepsilon_{3t}$$

$$\text{(4b)}\quad \Delta X_t = \gamma_2 + \sum_{i=1}^{n} \Phi_2 \Delta RE_{t-i} + \sum_{i=1}^{n} \Gamma_2 \Delta X_{t-i} + \delta_2 (RE_{t-1} - \beta X_{t-1} - \alpha) + \varepsilon_{4t}$$

The symbols have again the same meaning as in equations 2 and 3, the coefficients now being indexed to assign them to one of the two equations in the system. The lag length of the VAR is again determined by the Akaike criterion.

All series have been tested for unit roots by Augmented Dickey Fuller tests, using different criteria (Schwarz, Akaike and Modified Akaike) for the appropriate lag length specification (for details see table 6 a/b in the appendix). Usually all series are I(1), except the CPI series in the US, France, the Netherlands and Germany in specifications with the Modified Akaike criterion, that recommends very long lag lengths for the unit root tests of these series. These results indicate, that the series could be I(2) as well. Further exceptions are real estate stocks and general stocks in Japan, that are I(0).

6.2 Results

Cointegration between real estate stocks/REITs and the general equity market

Cointegration between the general equity market and real estate securities is unobservable in almost every country (see table 5, for details see tables 7, 9, 10, 12 in the appendix). One exception is Australia, where the EG tests indicate an equilibrium relationship between the general stock market and real estate stocks. However, in the ECM specification, the adjustment coefficient of the error correction term is insignificant. Cointegration is indicated in the Johansen specification as well, but the adjustment coefficient for the first equation is not significant and has the wrong (positive) sign. This implies that an equilibrium relationship exists, but the general stock market adjusts to the real estate stock market instead of the reverse.

In Japan EG results indicate stationarity of the residuals for the regression of the general stock indicator on the real estate stocks as well. However, due to the Japanese recession in the 1990s both indicators are stationary in levels; therefore stationarity of residuals does not really prove cointegration. Consequently the ECM model shows an insignificant adjustment coefficient for the error correction term. The Johansen results indicate two cointegrating equations and the sign of the coefficient in the cointegration vector is positive, indicating that both indicators are diverging in time. In the Netherlands, where the Johansen test statistics indicate cointegration, the coefficient in the cointegration vector as well as the adjustment coefficients are signed incorrectly.

Cointegration between real estate stocks/REITs and the bond market

Evidence is mixed concerning cointegration with bonds. The US and Australia show no indication of cointegration between real estate stocks and bonds in all three procedures (see table 5, for details see tables 7, 9, 10, 12 in the appendix). For Japan, cointegration of real estate stocks with bonds is indicated in all three procedures. However, the results are misleading due to the different orders of integration of the time series. The bonds market performance indicator has been rising steadily over time and is I(1), while the real estate stock performance indicator was stationary in levels. Therefore the Johansen results show two cointegrating vectors, and the coefficient of the bond market indicator in the error correction term has a positive sign.

In Canada, where the observation period is substantially shorter, ECM and EG results weakly indicate cointegration between real estate securities and bonds. For the European countries few results point to cointegration between bonds and real estate. In Belgium and the Netherlands only Johansen results are significant but indicate two cointegrating vectors. EG and ECM results are not significant on a satisfying level, however, in both cases the test statistics (the ADF-Test and the t-test for the adjustment coefficient of the error correction term) point at least weakly to cointegration. In France Johansen results indicate cointegration between bonds and real estate stocks on at least the 20 per cent significance level. In Germany only the ECM results for the model with the EPRA index weakly point to cointegration of real estate stocks with the bond market. Johansen and EG results show no evidence of cointegration.

It would be interesting to analyse to what extent these cross country differences in the relationship between real estate stocks and bond markets depend on the average gearing of real estate companies. Unfortunately average figures over the whole period of time are not available, and available data for single years (see UBS (2004)) does not show any congruence between the cointegration pattern with the bond markets and the average gearing of real estate companies.

Cointegration between real estate stocks/REITs and the CPI

The tests for cointegration of real estate securities with the CPI do not yield significant results in every country (see table 5, for details see tables 7, 9, 10, 12 in the appendix). However, in most countries at least some weak evidence exists for long run equilibria between the development of consumer price indices and real estate stock/REIT indices.

Significant cointegration on usual levels is not at all observed in Germany and Australia. In Germany the CPI is I(0) with a significant drift term, according to unit root tests based on the Schwarz and Akaike criterion, but I(2) according to the Modified Akaike criterion. The evidence from the Johansen tests is not clear (the adjustment coefficient is incorrectly signed), but EG results point to weak cointegration in the specification with the DIMAX index. In Australia significant cointegration is also not indicated, but the results of EG and ECM point at least weakly to the existence of long run equilibria between both series. In every other country at least one test shows significant cointegration between the consumer price level and the development of real estate stocks.

In the US the ECM indicates cointegration only on the – usually not applied – 20 per cent level, but the Johansen results show significant cointegration on the 5 per cent level. However, the results may be influenced by CPI time series characteristics. The Akaike and the Modified Akaike criterion recommend testing for unit roots of the US CPI with a 14 to 15 month lag length. ADF results then indicate that the CPI series is not clearly I(1), but probably I(2).

In Japan EG, ECM and Johansen all three procedures indicate cointegration. However, as CPI is I (1), while real estate stocks seem to be I (0), results are misleading. In Canada, EG provides strong evidence for cointegration, the ECM results support this at least on a 20 per cent level. However, the Johansen test fails to indicate cointegration.

In the Netherlands, the Johansen results are significant, but EG and ECM weakly indicate cointegration as well. In France ECM does not provide evidence for cointegration but the Johansen results do and the EG test also shows weak signs for cointegration. Similar to the US, however, CPI is not clearly I(1), when Akaike or modified Akaike criterion are applied in unit root testing. In Belgium the Johansen results clearly point to cointegration, evidence in EG tests is weaker but significant as well.

Table 5: Cointegration of real estate stock indices with equity market, bond market and consumer price indices (for details see table 7, 9, 10, 12 in the Appendix)

	Equity			Bonds			CPI		
	EG	ECM	J	EG	ECM	J	EG	ECM	J
US	N	N	N	N	N	N	N	(Y)	Y**
AU	Y**	N	Y	N	N	N	N	N	N
JP	Y*	N	N	N	N	N	N	N	N
NL	N	N	N	N	N	N	N	N	Y*
FR	N	N	N	N	N	(Y)	N	N	Y**
BG	N	N	N	N	N	N	Y*	N	Y**
GE DIMAX	N	N	N	N	N	N	(Y)	N	N
GE EPRA	N	N	N	N	(Y)	N	N	N	N
CA	N	N	N	Y***	(Y)	N	Y***	(Y)	N

Source: own calculations, ***/**/*: Significance on 1/5/10 per cent level, (Y) significance on 20 per cent level.

Summarising the findings on cointegration of real estate stocks with the general equity market, the results let us conclude that – contrary to their positive short term correlations – almost no evidence exists for a tight long run relationship between real estate securities and the development of broader stock markets.

With respect to bonds, there is also little evidence for a stable long run relationship to real estate securities. For most European markets little evidence for cointegration of real estate stock markets with national bond markets exists. Only in one other non-European market – namely Canada – cointegration with the bond market can be observed. However, the Canadian sample is not strictly comparable to the others due to a much shorter time period under consideration.

Some indication for cointegration of real estate stocks with the CPI is observable in six of eight countries. In almost every country weak evidence exists for a long run equilibrium between real estate stock indicators and the CPI, indicating that real estate stocks could basically serve as an inflation hedge.

7 Conclusion

Our analysis has shown that real estate securities in most countries had a remarkably high performance in nominal and real terms. The average performance over the whole period from 1990 to 2004 has been particularly high in the capital market oriented countries in the sample (US, Australia), but also in France. Real estate securities have outperformed the bond markets on a risk adjusted basis only in the US and in Australia, while outperformance of the stock markets can be observed also in Japan and France. Particularly during the period 2001 to 2004 real estate security markets have soared in most countries with the notable exception of Germany, where average returns have been negative.

Despite the rather high short term correlation of monthly returns with the wider stock markets in most countries, usually no cointegration with the stock markets exists. In some markets weak signs for cointegration with the bond markets can be observed. In general, however, real estate securities seem to represent an asset class distinct from bonds and stocks in most countries. In the long run they seem to reflect the performance of direct real estate investments and provide a potential for further diversification of asset portfolios. Additionally, real estate stocks provide a (weak) hedge against consumer price inflation in almost every country: This results stands in contrast to the outcome of many previous studies, which have not focused on long run cointegrating relationships.

The overall picture indicates furthermore, that the existence of specialised, tax transparent vehicles like REITs is not always correlated with high performance of securitised real estate. Although our analysis does – due to data limitations – not investigate the relationship between real estate market performance (i.e. the performance of direct real estate investments) and the performance of real estate stocks and REITs, it is plausible to assume that characteristics of the surrounding markets – i.e. the stock market capitalization relative to the GDP as an indicator of the development stage of the stock markets – might have additional explanatory power. In light of the international experience, the poor performance of the German real estate stock market can potentially be attributed to a couple of problems: Aside from the fundamental problems of the German market real estate market, Germany is the only real estate security market where REITs or similar investment vehicles have not existed until now. Additionally, the stock market capitalisation in relation to GDP is still low in international comparison.

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8 Appendix

Table 6a: Unit Root Test (Schwarz Criterion)

	Levels				1. Diff.			
	Bonds	Equity	Real Estate	CPI	Bonds	Equity.	Real Estate	CPI
US								
No. of Values	180	180	180	180	180	180	180	180
No. of Lags	0	0	0	1	0	0	0	0
Test	-0.990	-1.220	0.594	-2.743	-12.043	-13.711	-12.800	-9.961
Prob	0.757	0.665	0.989	**0.069**	**0.000**	**0.000**	**0.000**	**0.000**
Canada								
No. of Values	96	96	96	96	96	96	96	96
No. of Lags	0	0	0	0	0	0	0	0
Test	-0.307	-1.579	-1.275	0.756	-11.061	-8.051	-8.721	-8.606
Prob	0.919	0.489	0.639	0.993	**0.000**	**0.000**	**0.000**	**0.000**
Australia								
No. of Values	180	180	179	177	179	179	179	177
No. of Lags	0	0	1	3	0	0	0	2
Test	-2.489	-0.326	-0.357	-0.154	-12.163	-14.709	-16.779	-3.265
Prob	0.120	0.917	0.912	0.940	**0.000**	**0.000**	**0.000**	**0.018**
Japan								
No. Of Values	180	180	180	180	179	179	179	179
No. Of Lags	0	0	0	0	0	0	0	0
Test	-1.533	-3.351	-4.356	-1.833	-12.024	-13.056	-13.540	-12.532
Prob	0.515	**0.014**	**0.000**	0.364	**0.000**	**0.000**	**0.000**	**0.000**
Netherlands								
No. of Values	180	180	180	180	179	179	179	177
No. of Lags	0	0	0	0	0	0	0	2
Test	-0.772	-1.368	1.783	-1.624	-11.815	-12.892	-10.807	-5.788
Prob	0.824	0.597	1.000	0.468	**0.000**	**0.000**	**0.000**	**0.000**

	Levels				1. Diff.			
	Bonds	Equity	Real Estate	CPI	Bonds	Equity.	Real Estate	CPI
Belgium								
No. of Values	179	180	180	180	179	179	179	179
No. of Lags	1	0	0	0	0	0	0	0
Test	-1.746	-0.595	0.157	-1.917	-11.505	-12.159	-12.111	-11.959
Prob	0.407	0.867	0.969	0.324	**0.000**	**0.000**	**0.000**	**0.000**
France								
No. of Values	180	180	179	180	179	179	179	179
No. of Lags	0	0	1	0	0	0	0	0
Test	-1.462	-0.851	1.186	-2.055	-11.454	-12.247	-10.612	-12.781
Prob	0.551	0.801	0.998	0.263	**0.000**	**0.000**	**0.000**	**0.000**
Germany (DI-MAX)								
No. of Values	180	180	180	180	180	180	180	180
No. of Lags	0	0	1	0	0	0	0	2
Test	-0.406	-1.060	-1.135	-5.542	-12.485	-12.868	-11.032	-5.294
Prob	0.904	0.731	0.702	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Germany (EPRA)								
No. of Values			179				178	
No. of Lags			0				0	
Test			-2.350				-12.879	
Prob			0.158				**0.000**	

Table 6b: Unit Root Test (Modified Akaike Criterion)

	Levels				1. Diff.			
	Bonds	Equity	Real Estate	CPI	Bonds	Equity.	Real Estate	CPI
US								
No. of Values	180	180	180	180	180	180	180	180
No. of Lags	2	0	0	15	0	11	11	15
Test	-0.973	-1.220	0.594	-1.618	-12.043	-2.716	-3.118	-2.383
Prob	0.762	0.665	0.989	0.471	**0.000**	**0.073**	**0.027**	0.148
Canada								
No. of Values	96	96	96	96	96	96	96	96
No. of Lags	0	1	0	2	0	9	6	0
Test	-0.307	-1.780	-1.275	0.833	-11.061	-2.584	-3.173	-8.606
Prob	0.919	0.388	0.639	0.994	**0.000**	**0.100**	**0.025**	**0.000**
Australia								
No. of Values	177	179	178	175	170	177	172	175
No. of Lags	3	1	2	5	9	2	7	4
Test	-2.364	-0.212	-0.442	-0.753	-3.304	-7.862	-3.849	-3.953
Prob	0.154	0.933	0.898	0.829	**0.016**	**0.000**	**0.003**	**0.002**
Japan								
No. Of Values	177	180	180	177	178	175	179	167
No. Of Lags	3	0	0	3	1	4	0	12
Test	-2.467	-3.351	-4.356	-1.345	-8.439	-5.399	-13.540	-3.393
Prob	0.125	**0.014**	**0.000**	0.608	**0.000**	**0.000**	**0.000**	**0.013**
Netherlands								
No. of Values	177	180	179	176	176	168	167	169
No. of Lags	3	0	1	4	3	11	12	10
Test	-1.163	-1.368	1.212	-1.191	-5.425	-2.716	-2.649	-2.088
Prob	0.690	0.597	0.998	0.678	**0.000**	**0.073**	**0.085**	0.250

	Levels				1. Diff.			
	Bonds	Equity	Real Es-tate	CPI	Bonds	Equity.	Real Estate	CPI
Belgium								
No. of Values	179	180	175	165	172	168	170	167
No. of Lags	1	0	5	15	7	11	9	12
Test	-1.746	-0.595	0.094	-0.445	-3.999	-2.905	-3.229	-3.036
Prob	0.407	0.867	0.964	0.897	**0.002**	**0.047**	**0.020**	**0.034**
France								
No. of Values	176	180	173	165	176	168	174	166
No. of Lags	4	0	7	15	3	11	5	13
Test	-1.339	-0.851	1.070	0.374	-4.915	-3.040	-3.772	-2.509
Prob	0.611	0.801	0.997	0.981	**0.000**	**0.033**	**0.004**	0.115
Germany (DI-MAX)								
No. of Values	180	180	180	180	180	180	179	180
No. of Lags	0	0	12	10	3	4	12	9
Test	-0.406	-1.060	-1.311	-2.471	-5.394	-5.460	-2.800	-1.974
Prob	0.904	0.731	0.624	0.124	**0.000**	**0.000**	**0.060**	0.298
Germany (EPRA)								
No. of Values			179					164
No. of Lags			0					14
Test			-2.350					-2.401
Prob			0.158					0.143

Table 7: Results Engle Granger Tests for Cointegration of Real Estate Securities

		Equity	Bonds	CPI
US	No. of Values	167	179	179
	No. Of Lags	12	0	0
	ADF test	-1.677	-1.955	-2.019
Australia	No. Of Values	179	178	177
	No. Of Lags	0	1	2
	ADF test	-3.461**	-1.774	-2.490
Japan	No. Of Values	179	179	179
	No. Of Lags	0	0	0
	ADF test	-3.224*	-4.047***	-4.222***
Netherlands	No. Of Values	178	178	165
	No. Of Lags	1	1	14
	ADF test	0.726	-1.993	-2.020
Belgium	No. Of Values	174	178	174
	No. Of Lags	5	1	5
	ADF test	-1.646	-2.000	-3.329*
France	No. Of Values	172	177	173
	No. Of Lags	7	2	6
	ADF test	0.334	-1.289	-2.684
Germany (DIMAX)	No. Of Values	179	167	166
	No. Of Lags	0	12	13
	ADF test	-1.776	-2.510	-2.819 (*)
Germany (EPRA)	No. Of Values	179	179	179
	No. Of Lags	0	0	0
	ADF test	-2.305	-2.177	-2.043
Canada	No. Of Values	96	96	96
	No. Of Lags	1	14	1
	ADF test	-1.819	-7.364***	-4.556***

Source: NAREIT, EPRA, EcoWin, Thomson Financial Datastream, own calculations. ***/**/*/(*) = 1%/5%/10%/20% significance level. Lag determination by Akaike criterion, maximum lag order 15.

Table 8: Critical values Engle Granger Tests (with constant)

No. of obs.	1%	5%	10%	20%
96	-4,013	-3,401	-3,089	2,7427
165	-3,965	-3,374	-3,071	2,7139
166	-3,965	-3,374	-3,071	2,7138
167	-3,964	-3,374	-3,071	2,7137
172	-3,962	-3,373	-3,070	2,7132
173	-3,962	-3,372	-3,070	2,7132
174	-3,962	-3,372	-3,070	2,7132
177	-3,961	-3,372	-3,069	2,7132
178	-3,960	-3,372	-3,069	2,7128
179	-3,960	-3,371	-3,069	2,7127

Source: MacKinnon (1996), calculations for 20 per cent level with program provided on http://qed.econ.queensu.ca/pub/faculty/mackinnon/numdist/

Table 9: Results of Error Correction Models with 1 and 2 Lags

	Equity		Bonds		CPI			Equity		Bonds		CPI	
	Coeff	t-value	Coeff	t-value	Coeff	t-value		Coeff	t-value	Coeff	t-value	Coeff.	t-value
							US						
Δ Endog (-1)	-0.05	-0.63	0.06	0.81	0.05	0.71	Δ Endog (-1)	-0.04	-0.55	0.06	0.80	0.05	0.68
Δ Exog	0.30	4.88***	0.30	1.91*	-0.83	-0.47	Δ Endog (-2)	0.11	1.46	0.12	1.53	0.10	1.30
Δ Exog (-1)	0.19	2.96***	0.09	0.59	-1.27	-0.75	Δ Exog	0.31	4.99***	0.31	1.96*	-1.02	-0.57
Res(-1)	0.01	0.79	-0.05	-1.79	-0.07	-2.55	Δ Exog (-1)	0.19	2.85***	0.10	0.65	-0.61	-0.33
C	0.01	2.43**	0.01	2.32**	0.01	2.60**	Δ Exog (-2)	-0.03	-0.39	-0.04	-0.25	-1.23	-0.72
							Res(-1)	0.01	0.52	-0.05	-2.02	-0.07	-2.76
							C	0.01	2.00**	0.01	1.84*	0.02	2.29**
Adj. r2	0.14		0.02		0.02		Adj. r2	0.14		0.02		0.02	
DW	1.99		2.01		2.01		DW	2.02		2.01		2.00	
AIC	-3.85		-3.72		-3.72		AIC	-3.84		-3.71		-3.70	
							Canada						
Δ Endog (-1)	0.14	1.35	0.16	1.57	0.14	1.42	Δ Endog (-1)	0.09	0.85	0.10	0.98	0.11	1.03
Δ Exog	0.37	3.84***	0.88	2.44**	-0.55	-0.30	Δ Endog (-2)	0.11	1.10	0.08	0.83	0.08	0.75
Δ Exog (-1)	0.04	0.38	0.45	1.25	0.29	0.15	Δ Exog	0.36	3.82***	0.82	2.28**	-0.50	-0.26
Res(-1)	-0.02	-0.91	-0.13	-2.59	-0.12	-2.69	Δ Exog (-1)	0.08	0.75	0.57	1.56	0.47	0.25
C	0.01	1.44	0.00	0.32	0.01	1.56	Δ Exog (-2)	-0.08	-0.74	0.21	0.56	-0.81	-0.42
							Res(-1)	-0.01	-0.69	-0.12	-2.42	-0.11	-2.39
							C	0.01	1.12	0.00	-0.15	0.01	1.32
Adj. r2	0.14		0.10		0.05		Adj. r2	0.13		0.07		0.01	
DW	2.04		2.06		2.02		DW	2.01		2.00		1.98	
AIC	-3.21		-3.16		-3.11		AIC	-3.22		-3.16		-3.09	
							Australia						
Δ Endog (-1)	-0.13	-1.70*	-0.23	-3.12***	-0.21	-2.96***	Δ Endog (-1)	-0.11	-1.41	-0.20	-2.61***	-0.19	-2.46**
Δ Exog	0.48	9.33***	0.71	7.03***	-31.75	-2.75***	Δ Endog (-2)	0.07	0.87	0.04	0.59	0.13	1.80*
Δ Exog (-1)	-0.02	-0.26	-0.04	-0.39	31.43	2.82***	Δ Exog	0.47	9.18***	0.69	6.82***	-29.31	-2.50**
Res(-1)	-0.02	-0.96	-0.03	-1.67	-0.06	-2.30	Δ Exog (-1)	-0.01	-0.23	-0.08	-0.69	21.89	1.24

	Equity		Bonds		CPI			Equity		Bonds		CPI	
	Coeff	t-value	Coeff	t-value	Coeff	t-value		Coeff	t-value	Coeff	t-value	Coeff.	t-value
C	0.01	4.84***	0.01	3.81***	0.01	2.19**	Δ Exog (-2)	0.03	0.54	0.17	1.49	7.05	0.61
							Res(-1)	-0.02	-0.89	-0.03	-1.47	-0.07	-2.46
							C	0.01	3.84***	0.01	2.78***	0.01	1.83*
Adj. r2	0,36		0,25		0,10		Adj. r2	0.36		0.26		0.11	
DW	1,95		1,91		1,94		DW	1.98		1.97		1.98	
AIC	-4,53		-4,38		-4,20		AIC	-4.52		-4.37		-4.19	
							Japan						
Δ Endog (-1)	-0.05	-0.65	0.03	0.38	0.03	0.47	Δ Endog (-1)	-0.05	-0.62	0.01	0.19	0.04	0.53
Δ Exog	1.11	14.22***	-0.37	-0.86	1.97	1.28	Δ Endog (-2)	0.02	0.20	-0.04	-0.56	-0.02	-0.34
Δ Exog (-1)	0.03	0.30	0.03	0.07	1.33	0.86	Δ Exog	1.11	14.15***	-0.43	-1.00	2.13	1.36
				-		-							
Res(-1)	-0.08	-2.33	-0.15	3.97***	-0.15	4.54***	Δ Exog (-1)	0.03	0.30	-0.09	-0.21	1.18	0.76
C	0.00	0.26	0.00	-0.19	0.00	-0.51	Δ Exog (-2)	-0.10	-0.88	0.61	1.47	3.10	2.00**
													-
							Res(-1)	-0.08	-2.34	-0.13	-3.46**	-0.17	4.61***
							C	0.00	0.14	0.00	-0.46	0.00	-0.58
Adj. r2	0.56		0.07		0.09		Adj. r2	0.55		0.06		0.09	
DW	2.00		1.99		2.02		DW	1.95		1.94		1.95	
AIC	-2.76		-2.01		-2.04		AIC	-2.74		-2.00		-2.03	
							Netherlands						
ΔEndog (-1)	0.22	2.90***	0.21	2.85***	0.20	2.71***	Δ Endog (-1)	0.21	2.68***	0.19	2.56**	0.19	2.54**
ΔExog	0.34	8.20***	0.24	1.23	-1.36	-1.01	Δ Endog (-2)	0.02	0.27	0.06	0.81	0.06	0.74
ΔExog (-1)	-0.02	-0.50	0.06	0.32	-0.38	-0.28	Δ Exog	0.34	8.04***	0.30	1.48	-1.27	-0.93
Res(-1)	0.01	0.86	-0.03	-1.90	-0.03	-2.11	Δ Exog (-1)	-0.02	-0.42	0.06	0.29	-0.30	-0.22
C	0.00	0.66	0.00	0.58	0.01	1.51	Δ Exog (-2)	0.03	0.60	0.32	1.65	0.04	0.03
							Res(-1)	0.01	0.89	-0.03	-1.67	-0.04	-2.19
							C	0.00	0.53	0.00	-0.29	0.01	1.15
Adj. r2	0.29		0.05		0.05		Adj. r2	0.29		0.06		0.04	
DW	2.02		2.03		2.02		DW	1.98		2.00		2.00	
AIC	-4.22		-3.92		-3.92		AIC	-4.19		-3.92		-3.90	

	Equity		Bonds		CPI			Equity		Bonds		CPI	
	Coeff	t-value	Coeff	t-value	Coeff	t-value		Coeff	t-value	Coeff	t-value	Coeff.	t-value
							Belgium						
Δ Endog (-1)	0.07	0.99	0.09	1.18	0.09	1.13	Δ Endog (-1)	0.08	1.07	0.10	1.36	0.09	1.10
Δ Exog	0.35	6.38***	0.67	3.04***	-2.05	-1.42	Δ Endog (-2)	-0.13	-1.69*	-0.09	-1.17	-0.14	-1.78*
Δ Exog (-1)	0.05	0.86	0.40	1.78*	0.28	0.20	Δ Exog	0.34	6.12***	0.61	2.74***	-1.89	-1.28
Res(-1)	-0.02	-0.96	-0.03	-1.69	-0.04	-2.16	Δ Exog (-1)	0.05	0.79	0.39	1.70*	-0.42	-0.29
C	0.00	-0.01	-0.01	-1.48	0.01	1.30	Δ Exog (-2)	0.01	0.23	-0.17	-0.72	-0.13	-0.09
							Res(-1)	-0.01	-0.71	-0.03	-1.61	-0.03	-1.68
							C	0.00	0.14	0.00	-0.82	0.01	1.43
Adj. r2	0.20		0.10		0.03		Adj. r2	0.19		0.09		0.03	
DW	1.98		1.96		1.98		DW	1.98		1.96		1.94	
AIC	-3.79		-3.67		-3.60		AIC	-3.78		-3.66		-3.60	
							France						
Δ Endog (-1)	0.08	1.15	0.22	2.93***	0.23	3.05***	Δ Endog (-1)	0.12	1.60	0.24	3.20***	0.25	3.27***
Δ Exog	0.31	6.76***	0.69	3.41***	-0.02	-0.01	Δ Endog (-2)	-0.03	-0.42	-0.09	-1.16	-0.10	-1.35
Δ Exog (-1)	0.16	2.96***	0.17	0.82	-1.14	-0.63	Δ Exog	0.31	6.65***	0.69	3.41***	-0.10	-0.05
Res(-1)	0.01	1.23	-0.02	-1.46	-0.03	-1.67	Δ Exog (-1)	0.15	2.80***	0.17	0.78	-1.42	-0.78
C	0.00	1.87*	0.00	0.11	0.01	1.69*	Δ Exog (-2)	-0.07	-1.24	-0.13	-0.62	0.85	0.47
							Res(-1)	0.01	1.04	-0.02	-1.43	-0.02	-1.43
							C	0.01	1.98**	0.00	0.48	0.01	1.44
Adj. r2	0.27		0.11		0.04		Adj. r2	0.27		0.11		0.04	
DW	1.92		1.94		1.94		DW	2.01		1.98		1.97	
AIC	-3.86		-3.67		-3.59		AIC	-3.85		-3.65		-3.58	
)							Germany (DIMAX						
Δ Endog (-1)	0.12	1.71*	0.19	2.58**	0.19	2.52**	Δ Endog (-1)	0.14	1.82*	0.20	2.61***	0.19	2.51**
Δ Exog	0.23	6.54***	-0.02	-0.12	-2.76	-2.27**	Δ Endog (-2)	0.00	0.02	-0.05	-0.62	-0.01	-0.17
Δ Exog (-1)	0.07	1.71*	0.01	0.07	0.22	0.18	Δ Exog	0.23	6.51***	-0.04	-0.23	-3.01	-2.41**
Res(-1)	-0.04	-2.12	-0.02	-1.71	-0.02	-1.32	Δ Exog (-1)	0.07	1.61	0.00	-0.01	-0.02	-0.02
C	0.00	0.27	0.00	0.66	0.01	1.68*	Δ Exog (-2)	-0.03	-0.76	-0.11	-0.62	1.61	1.28
							Res(-1)	-0.04	-2.21	-0.02	-1.75	-0.02	-1.24
							C	0.00	0.32	0.00	0.89	0.00	1.07

	Equity		Bonds		CPI			Equity		Bonds		CPI	
	Coeff	t-value	Coeff	t-value	Coeff	t-value		Coeff	t-value	Coeff	t-value	Coeff.	t-value
Adj. r2	0.25		0.03		0.05		Adj. r2	0.25		0.02		0.05	
DW	1.98		1.98		1.99		DW	1.98		1.99		1.97	
AIC	-4.07		-3.81		-3.83		AIC	-4.05		-3.79		-3.82	
							Germany (EPRA)						
Δ Endog (-1)	0.04	0.54	0.04	0.54	0.04	0.59	Δ Endog (-1)	0.04	0.50	0.04	0.49	0.05	0.64
Δ Exog	0.25	3.50***	-0.61	-1.87*	-2.45	-1.08	Δ Endog (-2)	0.13	1.77*	0.10	1.31	0.15	1.94*
Δ Exog (-1)	-0.05	-0.63	-0.17	-0.55	-0.47	-0.20	Δ Exog	0.27	3.75***	-0.56	-1.70*	-3.64	-1.58
Res(-1)	-0.05	-2.46	-0.05	-2.58	-0.04	-1.89	Δ Exog (-1)	-0.06	-0.75	-0.19	-0.58	-0.89	-0.39
C	0.00	0.75	0.01	1.73*	0.01	1.35	Δ Exog (-2)	0.04	0.51	-0.12	-0.40	3.99	1.74*
							Res(-1)	-0.05	-2.52	-0.05	-2.71	-0.04	-2.17
							C	0.00	0.64	0.01	1.64	0.00	0.63
Adj. r2	0.09		0.03		0.01		Adj. r2	0.10		0.03		0.03	
DW	2.01		2.01		2.01		DW	2.01		2.01		2.02	
AIC	-2.68		-2.62		-2.60		AIC	-2.68		-2.61		-2.61	

Source: NAREIT, EPRA, EcoWin, Thomson Financial Datastream, own calculations. Endog = Real Estate Security Index, Exog = Equity, Bond, or CPI Index, RES = Engle Granger Residual

Table 10: Results of Error Correction Models with 3 and 4 Lags

	Equity		Bonds		CPI			Equity		Bonds		CPI	
	Coeff	t-value	Coeff	t-value	Coeff	t-value		Coeff	t-value	Coeff	t-value	Coeff.	t-value
							US						
Δ Endog (-1)	-0.05	-0.64	0.07	0.86	0.05	0.67	Δ Endog (-1)	-0.04	-0.51	0.07	0.84	0.05	0.62
Δ Endog (-2)	0.15	1.88*	0.14	1.75*	0.11	1.36	Δ Endog (-2)	0.15	1.91*	0.13	1.72*	0.10	1.34
Δ Endog (-3)	0.12	1.54	0.08	1.02	0.04	0.53	Δ Endog (-3)	0.10	1.24	0.08	0.95	0.04	0.51
Δ Exog	0.33	5.26***	0.35	2.19**	-1.21	-0.65	Δ Endog (-4)	-0.06	-0.76	-0.02	-0.19	-0.01	-0.15
Δ Exog (-1)	0.20	3.01***	0.07	0.42	-0.64	-0.34	Δ Exog	0.33	5.22***	0.34	2.11**	-1.37	-0.73
Δ Exog (-2)	-0.04	-0.59	0.00	0.00	-1.41	-0.74	Δ Exog (-1)	0.19	2.80*	0.07	0.41	-0.65	-0.33
Δ Exog (-3)	-0.13	-1.91*	-0.29	-1.78*	-0.30	-0.17	Δ Exog (-2)	-0.05	-0.68	0.00	-0.02	-1.28	-0.66
Res(-1)	0.00	0.13	-0.07	-2.40	-0.08	-2.87	Δ Exog (-3)	-0.13	-1.86*	-0.29	-1.78*	-0.44	-0.22
C	0.01	1.77*	0.01	1.88*	0.02	2.16**	Δ Exog (-4)	0.06	0.84	0.00	0.01	0.92	0.50
							Res(-1)	0.00	0.29	-0.06	-2.21	-0.08	-2.58
							C	0.01	1.83*	0.01	1.84*	0.02	1.81*
Adj. r2	0.15		0.03		0.01		Adj. r2	0.14		0.02		0.00	
DW	1.97		1.99		1.98		DW	2.00		1.99		2.00	
AIC	-3.83		-3.70		-3.68		AIC	-3.81		-3.67		-3.65	
							Canada						
Δ Endog (-1)	0.09	0.79	0.11	1.03	0.13	1.18	Δ Endog (-1)	0.09	0.82	0.11	1.01	0.13	1.19
Δ Endog (-2)	0.12	1.16	0.09	0.81	0.09	0.82	Δ Endog (-2)	0.15	1.34	0.09	0.85	0.11	0.99
Δ Endog (-3)	0.07	0.68	0.11	1.05	0.10	0.93	Δ Endog (-3)	0.09	0.84	0.12	1.08	0.12	1.14
Δ Exog	0.37	3.86***	0.84	2.25**	-0.77	-0.40	Δ Endog (-4)	-0.09	-0.85	0.01	0.08	-0.04	-0.40
Δ Exog (-1)	0.07	0.66	0.51	1.35	0.33	0.17	Δ Exog	0.37	3.73***	0.84	2.18**	-0.84	-0.43
Δ Exog (-2)	-0.04	-0.38	0.21	0.54	-0.88	-0.45	Δ Exog (-1)	0.07	0.65	0.49	1.25	0.32	0.16
Δ Exog (-3)	-0.15	-1.46	-0.16	-0.43	-1.12	-0.57	Δ Exog (-2)	-0.05	-0.46	0.19	0.50	-1.42	-0.70
Res(-1)	-0.02	-0.89	-0.14	-2.58	-0.13	-2.65	Δ Exog (-3)	-0.18	-1.62	-0.18	-0.47	-0.95	-0.48
C	0.01	1.08	0.00	-0.16	0.01	1.37	Δ Exog (-4)	0.04	0.34	-0.06	-0.16	-1.72	-0.88
							Res(-1)	-0.02	-0.86	-0.14	-2.45	-0.14	-2.70
							C	0.01	1.21	0.00	-0.08	0.02	1.67*
Adj. r2	0.13		0.06		0.00		Adj. r2	0.12		0.04		0.00	
DW	1.98		2.00		2.00		DW	1.95		1.99		2.01	
AIC	-3.19		-3.12		-3.06		AIC	-3.15		-3.06		-3.02	
							Australia						
Δ Endog (-1)	-0.10	-1.28	-0.20	-2.51**	-0.19	-2.45**	Δ Endog (-1)	-0.11	-1.43	-0.19	-2.48**	-0.19	-2.40**

	Equity		Bonds		CPI			Equity		Bonds		CPI	
	Coeff	t-value	Coeff	t-value	Coeff	t-value		Coeff	t-value	Coeff	t-value	Coeff.	t-value
Δ Endog (-2)	0.06	0.81	0.03	0.39	0.15	1.89*	Δ Endog (-2)	0.08	1.00	0.04	0.55	0.16	2.02**
Δ Endog (-3)	0.01	0.18	-0.05	-0.69	0.00	-0.02	Δ Endog (-3)	0.00	-0.01	-0.07	-0.86	-0.01	-0.09
Δ Exog	0.48	9.14***	0.69	6.69***	-33.85	-2.71***	Δ Endog (-4)	0.01	0.19	-0.03	-0.38	-0.04	-0.58
Δ Exog (-1)	-0.02	-0.27	-0.08	-0.66	25.92	1.41	Δ Exog	0.48	9.20***	0.70	6.74***	-36.87	-2.88***
Δ Exog (-2)	0.03	0.49	0.18	1.54	19.14	1.07	Δ Exog (-1)	-0.01	-0.14	-0.07	-0.57	30.35	1.56
Δ Exog (-3)	-0.05	-0.79	0.02	0.21	-11.22	-0.95	Δ Exog (-2)	0.04	0.60	0.19	1.60	16.24	0.88
Res(-1)	-0.02	-0.99	-0.03	-1.41	-0.06	-2.24	Δ Exog (-3)	-0.05	-0.86	0.03	0.29	-4.80	-0.26
C	0.01	3.63***	0.01	2.77***	0.01	1.56	Δ Exog (-4)	-0.11	-1.77*	-0.06	-0.56	-5.21	-0.44
							Res(-1)	-0.03	-1.19	-0.04	-1.68	-0.06	-2.20
							C	0.01	3.63***	0.01	2.75***	0.01	1.72*
Adj. r2	0.35		0.25		0.10		Adj. r2	0.38		0.25		0.10	
DW	1.99		1.97		1.98		DW	1.95		1.97		1.99	
AIC	-4.50		-4.35		-4.17		AIC	-4.52		-4.34		-4.15	
							Japan						
Δ Endog (-1)	-0.05	-0.66	0.01	0.10	0.02	0.29	Δ Endog (-1)	-0.06	-0.74	0.01	0.18	0.05	0.64
Δ Endog (-2)	0.00	0.05	-0.06	-0.75	-0.04	-0.58	Δ Endog (-2)	0.01	0.12	-0.03	-0.40	-0.03	-0.40
Δ Endog (-3)	-0.03	-0.34	0.07	0.97	0.08	1.05	Δ Endog (-3)	-0.02	-0.31	0.09	1.18	0.09	1.20
Δ Exog	1.08	13.62***	-0.60	-1.38	2.01	1.30	Δ Endog (-4)	0.00	0.06	0.03	0.35	0.05	0.74
Δ Exog (-1)	0.02	0.17	-0.12	-0.27	1.68	1.08	Δ Exog	1.08	13.53***	-0.64	-1.46	2.29	1.46
Δ Exog (-2)	-0.10	-0.85	0.48	1.12	3.49	2.28**	Δ Exog (-1)	0.02	0.20	-0.26	-0.58	1.79	1.15
Δ Exog (-3)	0.10	0.88	-0.46	-1.09	-0.18	-0.11	Δ Exog (-2)	-0.11	-0.92	0.59	1.37	3.81	2.42**
Res(-1)	-0.07	-1.86	-0.12	-3.05*	-0.15	-3.80**	Δ Exog (-3)	0.10	0.82	-0.29	-0.67	-0.10	-0.06
C	0.00	0.36	0.00	0.26	0.00	-0.32	Δ Exog (-4)	0.08	0.69	-0.76	-1.80*	1.65	1.05
							Res(-1)	-0.07	-1.78	-0.14	-3.30**	-0.17	-4.05***
							C	0.00	0.44	0.00	0.63	0.00	-0.36
Adj. r2	0.53		0.04		0.07		Adj. r2	0.53		0.05		0.07	
DW	2.02		2.01		1.98		DW	2.00		1.99		2.01	
AIC	-2.74		-2.03		-2.06		AIC	-2.72		-2.02		-2.05	

	Equity		Bonds		CPI			Equity		Bonds		CPI	
	Coeff	t-value	Coeff	t-value	Coeff	t-value		Coeff	t-value	Coeff	t-value	Coeff.	t-value
							Netherlands						
Δ Endog (-1)	0.22	2.82***	0.19	2.48**	0.19	2.51**	Δ Endog (-1)	0.21	2.64***	0.19	2.46**	0.19	2.53**
Δ Endog (-2)	0.02	0.23	0.06	0.73	0.05	0.68	Δ Endog (-2)	0.03	0.36	0.05	0.65	0.05	0.66
Δ Endog (-3)	0.07	0.88	0.04	0.54	0.02	0.29	Δ Endog (-3)	0.06	0.76	0.04	0.54	0.03	0.34
Δ Exog	0.33	7.94***	0.29	1.42	-1.10	-0.78	Δ Endog (-4)	0.08	1.05	0.01	0.12	-0.01	-0.09
Δ Exog (-1)	-0.02	-0.34	0.08	0.39	-0.15	-0.11	Δ Exog	0.34	7.93***	0.31	1.45	-1.30	-0.91
Δ Exog (-2)	0.03	0.61	0.34	1.72*	-0.04	-0.03	Δ Exog (-1)	-0.02	-0.39	0.05	0.23	-0.40	-0.27
Δ Exog (-3)	-0.10	-1.92*	-0.04	-0.17	-0.77	-0.55	Δ Exog (-2)	0.03	0.68	0.38	1.84*	-0.20	-0.14
Res(-1)	0.01	0.55	-0.03	-1.72	-0.04	-2.21	Δ Exog (-3)	-0.09	-1.81*	-0.03	-0.13	-0.59	-0.40
C	0.00	0.72	0.00	-0.35	0.01	1.20	Δ Exog (-4)	-0.07	-1.47	0.05	0.24	1.12	0.78
							Res(-1)	0.00	0.19	-0.03	-1.76	-0.04	-2.20
							C	0.00	0.75	0.00	-0.52	0.01	0.90
Adj. r2	0.30		0.06		0.03		Adj. r2	0.30		0.05		0.03	
DW	2.03		2.00		1.99		DW	2.00		2.00		1.97	
AIC	-4.19		-3.89		-3.87		AIC	-4.17		-3.87		-3.85	
							Belgium						
Δ Endog (-1)	0.09	1.10	0.11	1.46	0.09	1.18	Δ Endog (-1)	0.10	1.27	0.12	1.61	0.09	1.14
Δ Endog (-2)	-0.11	-1.48	-0.08	-1.04	-0.11	-1.49	Δ Endog (-2)	-0.09	-1.21	-0.06	-0.78	-0.09	-1.15
Δ Endog (-3)	-0.03	-0.33	-0.01	-0.15	-0.04	-0.49	Δ Endog (-3)	-0.03	-0.44	-0.03	-0.45	-0.05	-0.71
Δ Exog	0.33	5.85***	0.49	2.13**	-2.78	-1.92*	Δ Endog (-4)	0.16	2.15**	0.20	2.63***	0.16	2.07**
Δ Exog (-1)	0.06	0.99	0.45	1.93*	-0.68	-0.48	Δ Exog	0.31	5.56***	0.53	2.30**	-3.05	-2.08**
Δ Exog (-2)	0.01	0.24	-0.15	-0.65	0.14	0.09	Δ Exog (-1)	0.06	0.92	0.49	2.08**	-0.65	-0.45
Δ Exog (-3)	0.01	0.11	0.07	0.32	-3.82	-2.66***	Δ Exog (-2)	0.01	0.17	-0.12	-0.50	-0.29	-0.20
Res(-1)	-0.01	-0.85	-0.04	-1.91	-0.04	-1.97	Δ Exog (-3)	0.01	0.16	0.11	0.48	-3.01	-2.02**
C	0.00	0.00	0.00	-0.94	0.02	2.49**	Δ Exog (-4)	-0.08	-1.25	-0.05	-0.22	-0.29	-0.19
							Res(-1)	-0.02	-1.08	-0.04	-1.78	-0.04	-2.02
							C	0.00	0.09	-0.01	-1.16	0.01	2.14**
Adj. r2	0.18		0.08		0.07		Adj. r2	0.19		0.11		0.08	
DW	1.98		1.97		2.00		DW	2.01		1.99		1.98	
AIC	-3.77		-3.66		-3.65		AIC	-3.77		-3.67		-3.64	
							France						
Δ Endog (-1)	0.12	1.54	0.25	3.23***	0.26	3.33***	Δ Endog (-1)	0.13	1.59	0.25	3.25***	0.25	3.26***

	Equity		Bonds		CPI			Equity		Bonds		CPI	
	Coeff	t-value	Coeff	t-value	Coeff	t-value		Coeff	t-value	Coeff	t-value	Coeff.	t-value
Δ Endog (-2)	-0.01	-0.13	-0.10	-1.30	-0.12	-1.47	Δ Endog (-2)	-0.01	-0.06	-0.10	-1.20	-0.10	-1.26
Δ Endog (-3)	0.08	1.06	0.03	0.41	0.05	0.63	Δ Endog (-3)	0.06	0.74	0.02	0.27	0.04	0.47
Δ Exog	0.32	6.73***	0.68	3.24***	-0.20	-0.11	Δ Endog (-4)	-0.01	-0.12	0.05	0.68	0.04	0.57
Δ Exog (-1)	0.15	2.82***	0.17	0.77	-1.36	-0.75	Δ Exog	0.32	6.67***	0.69	3.24***	-0.48	-0.26
Δ Exog (-2)	-0.07	-1.32	-0.14	-0.64	0.99	0.54	Δ Exog (-1)	0.14	2.67***	0.12	0.56	-1.38	-0.75
Δ Exog (-3)	-0.07	-1.34	0.13	0.59	-0.84	-0.46	Δ Exog (-2)	-0.07	-1.32	-0.12	-0.54	1.09	0.60
Res(-1)	0.01	0.69	-0.02	-1.34	-0.03	-1.50	Δ Exog (-3)	-0.07	-1.22	0.16	0.73	-0.73	-0.40
C	0.01	1.82*	0.00	0.21	0.01	1.38	Δ Exog (-4)	0.04	0.69	-0.06	-0.26	-1.23	-0.68
							Res(-1)	0.01	0.78	-0.03	-1.62	-0.03	-1.74
							C	0.00	1.72*	0.00	0.08	0.01	1.44
Adj. r2	0.27		0.10		0.04		Adj. r2	0.26		0.10		0.04	
DW	1.98		1.98		2.00		DW	1.96		1.98		1.99	
AIC	-3.83		-3.63		-3.56		AIC	-3.81		-3.61		-3.55	
							Germany (DIMAX)						
Δ Endog (-1)	0.13	1.80*	0.21	2.66***	0.20	2.67***	Δ Endog (-1)	0.14	1.89*	0.20	2.58**	0.21	2.64***
Δ Endog (-2)	0.01	0.08	-0.07	-0.85	-0.03	-0.42	Δ Endog (-2)	0.01	0.08	-0.07	-0.86	-0.03	-0.40
Δ Endog (-3)	0.05	0.64	0.04	0.54	0.04	0.58	Δ Endog (-3)	0.04	0.53	0.04	0.49	0.05	0.59
Δ Exog	0.24	6.75***	-0.01	-0.04	-2.71	-2.13**	Δ Endog (-4)	-0.03	-0.35	0.00	-0.02	-0.01	-0.14
Δ Exog (-1)	0.07	1.66*	-0.09	-0.46	0.22	0.17	Δ Exog	0.25	6.73***	-0.02	-0.11	-2.68	-2.07**
Δ Exog (-2)	-0.03	-0.77	-0.12	-0.68	1.83	1.45	Δ Exog (-1)	0.06	1.54	-0.12	-0.61	0.27	0.21
Δ Exog (-3)	-0.05	-1.20	0.00	0.00	-1.66	-1.28	Δ Exog (-2)	-0.03	-0.81	-0.09	-0.48	1.87	1.44
Res(-1)	-0.04	-2.41	-0.02	-1.77	-0.02	-1.26	Δ Exog (-3)	-0.05	-1.16	-0.01	-0.03	-1.64	-1.25
C	0.00	0.53	0.00	1.01	0.01	1.45	Δ Exog (-4)	0.03	0.70	0.23	1.28	-0.29	-0.22
							Res(-1)	-0.04	-2.20	-0.02	-1.53	-0.02	-1.25
							C	0.00	0.45	0.00	0.62	0.01	1.43
Adj. r2	0.26		0.01		0.05		Adj. r2	0.25		0.01		0.04	
DW	1.97		2.00		2.00		DW	1.99		1.99		2.00	
AIC	-4.06		-3.77		-3.81		AIC	-4.04		-3.76		-3.78	
							Germany (EPRA)						
Δ Endog (-1)	0.04	0.48	0.03	0.45	0.04	0.53	Δ Endog (-1)	0.04	0.49	0.04	0.52	0.05	0.59
Δ Endog (-2)	0.13	1.71*	0.09	1.23	0.15	1.93*	Δ Endog (-2)	0.13	1.66*	0.09	1.22	0.15	1.94*

	Equity		Bonds		CPI			Equity		Bonds		CPI	
	Coeff	t-value	Coeff	t-value	Coeff	t-value		Coeff	t-value	Coeff	t-value	Coeff.	t-value
Δ Endog (-3)	0.09	1.24	0.09	1.20	0.12	1.49	Δ Endog (-3)	0.10	1.23	0.10	1.26	0.12	1.46
Δ Exog	0.27	3.61***	-0.66	-1.95*	-3.95	-1.66*	Δ Endog (-4)	0.00	-0.05	-0.04	-0.53	-0.06	-0.70
Δ Exog (-1)	-0.04	-0.50	-0.08	-0.24	-1.20	-0.52	Δ Exog	0.27	3.54***	-0.67	-1.96*	-3.98	-1.66*
Δ Exog (-2)	0.04	0.49	-0.27	-0.80	4.26	1.85*	Δ Exog (-1)	-0.04	-0.47	-0.02	-0.06	-1.01	-0.42
Δ Exog (-3)	-0.10	-1.39	0.40	1.29	-0.51	-0.22	Δ Exog (-2)	0.03	0.45	-0.32	-0.95	4.42	1.86*
Res(-1)	-0.06	-2.77	-0.06	-2.84	-0.05	-2.38	Δ Exog (-3)	-0.10	-1.38	0.52	1.55	-0.68	-0.29
C	0.00	0.70	0.01	1.30	0.01	0.77	Δ Exog (-4)	0.02	0.26	-0.01	-0.03	0.19	0.08
							Res(-1)	-0.06	-2.59	-0.05	-2.52	-0.05	-2.17
							C	0.00	0.65	0.01	1.09	0.01	0.66
Adj. r2	0.11		0.04		0.04		Adj. r2	0.09		0.03		0.03	
DW	1.99		1.97		1.98		DW	1.97		2.00		1.98	
AIC	-2.67		-2.60		-2.59		AIC	-2.64		-2.58		-2.57	

Source: NAREIT, EPRA, EcoWin, Thomson Financial Datastream, own calculations. Endog = Real Estate Security Index, Exog = Equity, Bond, or CPI Index, RES = Engle Granger Residual.

Table 11: Critical Values for Error Correction Term

	All Countries except Canada				Canada				
	20 %	10 %	5 %	1 %		20 %	10 %	5 %	1 %
1 Lag	-2.54	-2.92	-3.23	-3.84		-2.54	-2.93	-3.25	-3.88
2 Lags	-2.54	-2.92	-3.23	-3.84		-2.54	-2.93	-3.25	-3.88
3 Lags	-2.54	-2.92	-3.23	-3.84		-2.54	-2.93	-3.25	-3.89
4 Lags	-2.54	-2.92	-3.23	-3.84		-2.54	-2.93	-3.25	-3.89

Source: Ericsson/MacKinnon (2002), calculations with program provided on http://qed.econ.queensu.ca/pub/faculty/mackinnon/ecmtest/

Table 12: Results of Johansen Cointegration Tests

		No. Cointegrat. Relation	No. of Lags	Trace Stat.	Prob.	Max-Eigen Statistic	Prob	Coef. in Cointegrat. Vector	Adjustment Coefficients (2^{nd} line standard error)	
									Real Estate Securities	Other Variable
US	Equity	0	1	3.29	0.952	2.461	0.976	1.722	0.001	-0.003
		1		0.829	0.363	0.829	0.363		0.002	0.002
	Bonds	0	0	6.263	0.664	6.04	0.608	-1.666	-0.041	0.011
		1		0.223	0.637	0.223	0.637		0.02	0.01
	CPI	0	1	14.864	**0.062**	9.403	0.254	-5.502	-0.043	0.011
		1		5.461	**0.019**	5.461	**0.019**		0.017	0.001
Canada	Equity	0	1	4.736	0.836	3.238	0.93	-42.166	0.000	0.001
		1		1.498	0.221	1.498	0.221		0.001	0.001
	Bonds	0	0	7.969	0.469	7.799	0.4	-1.543	-0.117	0.012
		1		0.171	0.68	0.171	0.68		0.049	0.014
	CPI	0	0	9.171	0.35	8.594	0.322	-4.826	-0.121	-0.001
		1		0.576	0.448	0.576	0.448		0.041	0.002
Australia	Equity	0	1	14.123	**0.08**	13.85	**0.058**	-1.435	0.033	0.112
		1		0.272	0.602	0.272	0.602		0.026	0.031
	Bonds	0	1	9.771	0.299	8.651	0.316	-1.764	-0.006	0.017
		1		1.12	0.29	1.12	0.29		0.012	0.008
	CPI	0	5	7.087	0.568	6.656	0.531	-2.529	-0.075	0.000
		1		0.431	0.512	0.431	0.512		0.030	0.000
Japan	Equity	0	0	22.535	**0.004**	19.499	**0.007**	0.007	-1.135	-0.08
		1		3.036	**0.081**	3.036	**0.081**		0.031	0.02
	Bonds	0	0	27.107	**0.001**	22.54	**0.002**	0.180	-0.141	-0.013
		1		4.567	**0.033**	4.567	**0.033**		0.034	0.006
	CPI	0	0	27.611	**0.001**	25.313	**0.001**	-0.935	-0.131	0.004
		1		2.299	0.13	2.299	0.13		0.031	0.002
Netherlands	Equity	0	0	19.012	**0.014**	18.214	**0.011**	0.322	0.011	-0.016
		1		0.797	0.371	0.797	0.372		0.005	0.008
	Bonds	0	0	21.4	**0.006**	16.869	**0.019**	-1.641	-0.028	-0.001
		1		4.531	**0.033**	4.531	**0.033**		0.003	0.003
	CPI	0	1	13.832	**0.088**	13.65	**0.062**	-4.862	-0.031	0.001
		1		0.182	0.67	0.182	**0.067**		0.009	0.001

		No. Coin-tegrat. Re-lation	No. of Lags	Trace Stat.	Prob.	Max-Eigen Statistic	Prob	Coef. in Cointegrat. Vector	Adjustment Coefficients (2nd line standard error)	
Belgium	Equity	0	0	6.507	0.636	5.295	0.704	-1.055	-0.014	0.002
		1		1.212	0.271	1.212	0.271		0.007	0.009
	Bonds	0	1	16.141	**0.04**	11.101	0.149	-1.577	-0.019	0.002
		1		5.04	**0.025**	5.04	**0.025**		0.006	0.002
	CPI	0	4	16.217	**0.039**	16.141	**0.025**	-4.079	-0.052	0.016
		1		**0.077**	0.782	**0.077**	0.782		0.002	0.001
France	Equity	0	1	6.666	0.617	6.451	0.556	0.002	0.011	-0.009
		1		0.215	0.643	0.215	0.643		0.007	0.01
	Bonds	0	1	12.281	0.144	10.619	0.174	-2.649	-0.013	0.002
		1		1.663	0.197	1.663	0.197		0.005	0.002
	CPI	0	1	15.473	**0.05**	15.254	**0.035**	-8.585	-0.03	0.001
		1		0.218	0.64	0.218	0.64		0.011	0.001
Germany (DIMAX)	Equity	0	1	7.412	0.53	5.803	0.639	-0.541	-0.046	-0.028
		1		1.609	0.205	1.609	0.205		0.019	0.036
	Bonds	0	1	5.749	0.725	5.573	0.668	-0.543	-0.023	-0.009
		1		0.176	0.675	0.176	0.675		0.013	0.006
	CPI	0	0	31.373	**0.000**	29.905	**0.000**	-104.748	0.000	0.000
		1		1.469	0.226	1.468	0.226		0.000	0.000
Germany (EPRA)	Equity	0	0	9.67	0.307	8.591	0.322	-0.189	-0.052	-0.038
		1		1.079	0.299	1.079	0.299		0.019	0.02
	Bonds	0	0	6.847	0.596	6.715	0.523	-0.048	-0.042	-0.003
		1		0.132	0.716	0.132	0.716		0.018	0.004
	CPI	0	0	39.296	**0.000**	34.34	**0.000**	-14.798	0.003	0.001
		1		4.957	**0.026**	4.957	**0.026**		0.004	0.000

Source: NAREIT, EPRA, EcoWin, Thomson Financial Datastream, own calculations. Other Variable = Equity, Bond, or CPI Index. Lags in 1. Differences, lag order determined by Akaike criterion.