ERES Conference 2011, 15th-18th June, Eindhoven

Are Reits Real Estate? Evidence from Sector Level Data

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Abstract

The aim of this study is to examine whether securitized real estate returns reflect direct real estate returns or general stock market returns. In contrast to previous research, which has generally relied on overall real estate market indices and neglected the potential long-term dynamics, our econometric evaluation is based on sector level data for the U.S and aims to cater for both the short-term and long-term dynamics of the assets. The use of sector level data is likely to yield more accurate results regarding the linkages between direct and securitized real estate. In addition to the real estate and stock market indices, the analysis includes a number of fundamental variables that are expected to influence real estate and stock returns significantly. We estimate vector error-correction models and investigate the forecast error variance decompositions and impulse responses of the assets. Both the variance decompositions and impulse responses suggest that the long-run REIT market performance is much more closely related to the direct real estate market than to the general stock market. Consequently, REITs and direct real estate should be relatively good substitutes in a long-horizon investment portfolio.

JEL code: G11

Keywords: REITs, direct real estate, dynamics, portfolio allocation

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The authors are grateful for comments by David Geltner and Jim Clayton as well as by participants at the 27th Annual conference of the American Real Estate Society in Seattle (WA).

1. Introduction

Direct real estate investments have been shown to provide significant diversification benefits in a portfolio containing stocks (Hoesli, Lekander and Witkiewicz, 2004; MacKinnon and Al Zaman, 2009; Brounen, Porras Prado and Verbeek, 2010). However, direct real estate assets have several disadvantages such as relatively low liquidity, high transaction costs, and lumpiness. The securitized real estate market has developed to circumvent these complications, so that many investors prefer to invest in real estate securities rather than in direct real estate.

If securitized and direct real estate returns are driven by a common 'real estate factor' over the long horizon, then real estate securities are expected to provide the same diversification benefits as direct commercial real estate in a mixed-asset portfolio of a long-horizon buy-and-hold investor, such as a pension fund. On the other hand, if securitized real estate behaves like the general stock market, real estate equities do not provide the diversification opportunities exhibited by the direct real estate market. Although the question of whether real estate securities behave as real estate or as equities is an old one and an important one for a large number of investors, the answer to the question is still not conclusive.

Securitized real estate prices may embed stock market noise that is not related to the fundamentals driving real estate returns. Therefore, the attractive diversification features of direct real estate may be lost by investing in REITs instead of in direct real estate assets. Indeed, it is well known that the contemporaneous correlation between securitized and direct real estate returns is relatively low (e.g. Mueller and Mueller, 2003; Brounen and Eichholtz, 2003). Instead of co-moving with direct real estate returns, early empirical evidence, mainly concerning the U.S. market, identified a similar return behavior between securitized real estate and the general stock market (Goetzmann and Ibbotson, 1990; Ross and Zisler, 1991). More recently, the results regarding the co-movement between securitized real estate returns and general stock market returns have been mixed.

The short-run co-movement between the securitized and direct real estate markets may also be significantly diminished by the typically sluggish adjustment of direct real estate market prices to changes in the fundamentals. On the other hand, as in the long run both markets should adjust to shocks in the fundamentals and the impact of noise in securitized real estate prices should vanish, securitized real estate should strongly co-vary with the returns on a portfolio composed of equivalent direct real estate investments, since the fundamental asset is essentially the same in both markets. In line with this assumption, it has been established that over long horizons the linkages between indirect and direct real estate are substantially stronger than suggested by the simple contemporaneous correlation figures (Giliberto, 1990; Geltner and Kluger, 1998; MacKinnon and Al Zaman, 2009; Oikarinen, Hoesli and Serrano, 2011).

Conventionally, the question has been studied by only including the three asset classes in the analysis while neglecting the role of economic fundamentals. Furthermore, the analyses have generally been based on the aggregate real estate indices. The overall direct and securitized real estate indices typically differ notably with respect to the property-type mixes. Since the return dynamics between various real estate sectors may substantially vary (Wheaton, 1999; Oikarinen, Hoesli and Serrano, 2010), the use of overall indices may diminish the estimated co-movement between securitized and direct real estate markets. That is, using sector level data should yield more accurate results regarding the linkages between direct and securitized real estate.

The aim of this study is to examine whether securitized real estate returns reflect direct real estate returns or general stock market returns. Similarly to a recent study by Sebastian and Schätz (2009), we include economic fundamentals in the econometric analysis. This allows us to cater for the effects that result from the interdependences between the fundamentals and the asset returns. However, while Sebastian and Schätz use the overall real estate market indices, in this article the econometric evaluation is based on sector level real estate data for the U.S. This is important as portfolio composition effects may be masking the linkages between asset classes. To the best of our knowledge, only one study (Pavlov and Wachter, 2010) has examined the relationship between REIT returns and returns on similar direct real estate portfolios at the sector level while including fundamentals in the analysis. However, these authors do not consider the influence of lead-lag relations and potential long-run relationships in their investigation. Also, as in Sebastian and Schätz (2009), these authors use appraisal-based returns which may further distort their results due to potential appraisal smoothing. Our analysis relies on transaction-based rather than appraisal-based data. Moreover, we propose that, in addition to the tests used in the previous literature, impulse response analysis can be utilized to investigate the substitutability between securitized and direct real estate. Given the complications and mixed results in the previous literature, more research on the linkages between securitized and direct real estate is warranted to assess whether REITs can be used as a surrogate for direct real estate to achieve greater inter-asset diversification in the long term.

We estimate vector error-correction models separately for four real estate sectors (apartments, offices, and industrial and retail real estate), and examine the variance decompositions of securitized and direct real estate returns and of general stock market returns as well as study the reaction patterns of the assets to shocks in the fundamentals and in the asset returns themselves. A particular emphasis is placed on analyzing whether securitized real estate returns are more tightly related to direct real estate returns or to overall stock market returns, especially in the long horizon.

Our results suggest that the long-term REIT market performance is substantially more tightly related to the direct real estate performance than to the general stock market returns. Based on variance decompositions, neither direct real estate nor stock market shocks drive REIT market performance. Nevertheless, the linkage between the direct and securitized markets appears to be tight, since a major part of the long-horizon forecast error variance of the direct real estate indices can be explained by REIT return shocks. This implies that the direct and securitized markets are closely linked and the predictability goes from REITs to TBI, i.e., ‘real estate shocks’ take place first in the REIT market after which the direct market adjusts to these shocks. Furthermore, our analysis indicates that, in general, the long-run accumulated responses of REIT and direct real estate returns to various shocks closely resemble each other. Importantly, the resemblance between REITs and TBI is substantially greater than that between REITs and the general stock market. The apartment sector appears to be a different case, though, as we cannot identify tight links between the three assets (REITs, stocks and direct real estate).

Our findings have several practical implications. Since REITs seem to behave much like direct real estate investments in the long horizon, the substitutability between REITs and direct real estate appears to be relatively good. That is, while the short-term comovement between REITs and stocks is stronger than that between REITs and direct real estate, REITs are likely to provide a similar exposure to various risk factors as direct real estate in a long-horizon investment portfolio. In other words, REITs are expected to offer similar attractive diversification properties as direct real estate investments, at least to some extent. The results also suggest that it is important to cater for the differences between the real estate sectors when making portfolio decisions. Finally, our analysis provides one more piece of evidence concerning the predictability of direct real estate performance.

The next section reviews previous literature on the interdependence between direct real estate, securitized real estate and overall stock markets. In the third section, we delineate the research methodology, after which the data used in the empirical analysis are described. The empirical findings are reported in section five, while we provide some concluding remarks in a final section.

2. Literature Review

It is well known that the contemporaneous correlation between securitized and direct real estate returns is relatively low (e.g. Mueller and Mueller, 2003; Brounen and Eichholtz, 2003). However, it has also been established that over long horizons, the linkages between indirect and direct real estate are substantially stronger than suggested by the simple contemporaneous correlation figures (Giliberto, 1990; Geltner and Kluger, 1998; Oikarinen, Hoesli and Serrano, 2011).

Instead of co-moving with direct real estate returns, early empirical evidence, mainly concerning the U.S. market, identified a similar return behavior between securitized real estate and the general stock market (Goetzmann and Ibbotson, 1990; Ross and Zisler, 1991). Giliberto (1990), on the other hand, finds that the residuals from regressions of direct and indirect real estate returns on financial asset returns are significantly correlated. This implies that there is a common factor (or factors) associated with real estate that influences both direct and indirect real estate returns. Also, Mei and Lee (1994) present some evidence of a common real estate factor driving both equity REITs and direct real estate.

Some recent results regarding the co-movement between securitized real estate returns and general stock market returns are mixed. While Ling and Naranjo (1999) find that REITs are integrated with stocks, but segmented from direct real estate, the difference between indirect and direct real estate returns has diminished according to Clayton and MacKinnon (2001 and 2003), Pagliari, Scherer and Monopoli (2005), and Lee, Lee and Chiang (2008). Clayton and MacKinnon (2003) find that prior to the 1990s REIT returns exhibit the greatest sensitivity to large cap stocks. The sensitivities appear to be time-varying, however, and they report increasing sensitivity of REITs w.r.t. direct real estate through time – greater than w.r.t. to the other asset returns during the late sample period (1992-1998). They further find small cap stocks to be a more significant contributor than large cap stocks to REIT return volatility during the late sample period. Hoesli and Serrano (2007), in turn, find evidence of a decreasing correlation between the securitized real estate and equity markets. Nevertheless, some studies also show that the comovement between REIT returns and general stock market returns has increased recently (Ambrose, Lee and Peek, 2007; Simon and Ng, 2009).

The short-term comovement between securitized and direct real estate may be substantially diminished by the direct market frictions. In the long run, as the direct market is able to adjust, the comovement between the markets is likely to be notably stronger. Indeed, Giliberto (1990) and Geltner and Kluger (1998) show that the relationship between REIT and direct real estate returns is considerably stronger when a lead in the REIT returns is considered. Other evidence supporting the leading role of securitized real estate with respect to direct real estate is presented, e.g., by Gyourko and Keim (1992), Myer and Webb (1993), Barkham and Geltner (1995), and more recently by Li, Mooradian and Yang (2009), Oikarinen, Hoesli and Serrano (2011), and Yunus, Hansz and Kennedy (forthcoming). The lead-lag relationships are likely to diminish the short-term correlation between the markets relative to the longer-horizon comovement.

An important issue regarding the substitutability between securitized and direct real estate in a long-horizon portfolio is the potential existence of long-term dynamics between the securitized and direct real estate returns. If there are tight long-run dynamics between the securitized and direct real estate markets, the long-horizon comovement between the markets is considerably greater than the short-term correlations will indicate. Some authors have tested for the existence of long-run interdependence between the markets by conducting cointegration tests. In an early study, Ong (1995) does not find support for cointegration between indirect and direct real estate return indices in Singapore. However, Wang (2001) reports a cointegrating relation between direct and securitized real estate return indices in the U.K. Oikarinen, Hoesli and Serrano (2011) present evidence for cointegration between the NAREIT and NCREIF total return indices, and Yunus, Hansz and Kennedy (forthcoming) find cointegration between securitized and direct real estate indices in several countries. All of these analyses suggest that only direct real estate prices adjust towards the long-run relation.

With the exception of Pagliari, Scherer and Monopoli (2005), and Li, Mooradian and Yang (2009), the above mentioned studies are based on the overall direct and securitized real estate indices that do not cater for the differing property-type mixes between the indices. The studies by Wheaton (1999), Yavas and Yildirim (2011), and by Oikarinen, Hoesli and Serrano (2010) indicate that the price dynamics may notably differ between real estate sectors. Since the overall indices typically vary considerably with respect to the property-type mixes, the use of aggregate data may mask valuable sector specific information and diminish the observed interrelationships between securitized and direct markets.

Furthermore, the earlier mentioned papers generally do not cater for the influence of fundamentals on the co-movement between the markets. That is, any observed co-movement between the markets may be an indirect effect of economic factors, not due to a pure influence of the markets on each other. Recently, Sebastian and Schätz (2009) and Pavlov and Wachter (2010) include macroeconomic variables in their analyses to tackle this issue. Based on data for the 1992-2008 period, Sebastian and Schätz find that securitized real estate performance is significantly influenced by direct real estate market performance over the long term in the U.S. and U.K. While the stock market notably influences securitized real estate returns in the short run, the longer the investment horizon the stronger is the influence of the direct real estate market on REIT performance. Pavlov and Wachter also cater for the property-type mix. Their regression analysis shows significant dependence between REIT and direct real estate returns only in the office sector, when taking account of the influence of the fundamentals. However, the empirical analysis does not consider the potential lagging relationship of direct market returns with respect to REIT returns or the potential long-run relations between the markets. Given that price movements in the direct market appear to lag those in the securitized market and that there may be significant long-run dynamics between the markets, the estimated weak relationship between REITs and the underlying direct real estate may well be due to sluggish adjustment of the direct market rather than due to the lack of dependence between the two markets. Moreover, both these studies use appraisal-based direct real estate data, which may somewhat distort the results.

The recent study by MacKinnon and Al Zaman (2009) is also closely related to our analysis. They examine how the predictability of real estate returns affects the risk of, and optimal allocations to, real estate for investors with differing investment horizons. They find that the correlation between direct real estate and REITs increases with horizon, but it never exceeds 0.54. However, MacKinnon and Al Zaman use overall REIT and direct real estate indices and the results are based on a model that only caters for the short-run dynamics between the variables. Therefore, further analysis on this issue that takes account of the potential consequences of long-term dynamics and property-type mixes is desirable.

In summary, despite considerable research, there is still no conclusive evidence concerning the question of whether securitized real estate behaves like direct real estate investments in the long run or whether securitized real estate performance is more closely related to the general stock market. Previous studies reach inconsistent results which are largely dependent on the selected method, market or sample periods. We contribute to the literature by examining the interrelations between REIT, direct real estate and overall stock markets using sector level NAREIT and TBI indices and by considering both short-term and long-term dynamics as well as the influence of economic fundamentals on those dynamics. We also suggest that, in addition to variance decomposition, impulse response analysis based on a vector error-correction model can help identify the true nature of REITs.

3. Research Methodology

There are sound a priori theoretical reasons to expect that the securitized and direct real estate markets might be tightly related in the long horizon. Moreover, there may be cointegrating relationships between the fundamentals and the asset return indices. Since cointegration between the variables would have important implications regarding the asset return dynamics, we investigate the existence of such long-term relationships by employing the Johansen Trace test for cointegration. Due to the relatively small number of observations and large number of variables in our data, we conduct the cointegration tests based on the methodology proposed by Harbo et al. (1998). The Vector Error-Correction Model (VECM) used in the Trace test is the following:

$$\Delta X_t = \alpha(\beta_X', \beta_1)(X'_{t-1}, t)' + \alpha\beta_Z' Z_{t-1} + \Gamma_1 \Delta X_{t-1} + \ldots + \Gamma_{k-1}\Delta X_{t-k+1} + \gamma_1 \Delta Z_{t-1} + \ldots + \gamma_{k-1}\Delta Z_{t-k+1} + \mu + \Psi D_t + \varepsilon_t$$

$$\Delta Z_t = \mu_z + \varepsilon_{zt}, \quad (1)$$

where ΔX_t is X_t - X_{t-1}, X_t is a three-dimensional vector of asset index values, μ is a three-dimensional vector of drift terms, Γ_i and γ_i are 3 x 3 matrices of coefficients for the lagged differences of the asset indices and of the economic fundamentals (Z) at lag *i*, *k* is the maximum lag, i.e. the number of lags included in the corresponding vector autoregressive (VAR) model, and α is a three-dimensional vector of the speed of adjustment parameters. ΔZ_t, in turn, is Z_t - Z_{t-1}, where Z_t is a four-dimensional vector of fundamental variables. $\alpha(\beta_X', \beta_1)(X'_{t-1}, t)' + \alpha\beta_Z' Z_{t-1}$ forms the long-run relationship(s), and ε is a vector of white noise error terms. Finally, a vector of three seasonal dummy variables (D) is included in the test if suggested by the Hannan-Quinn Information Criteria (HQ). HQ is also used to select the lag length of the model. However, more lags are included if needed based on the Lagrange Multiplier test at four lags, LM(4).

In the tested model, the fundamentals (Z) are assumed to be weakly exogenous variables. In other words, it is assumed that the fundamentals do not adjust towards the cointegrating relation(s). In the case of a large system and relatively small number of observations, the efficiency of the Trace test and the stability of the long-run parameters can be improved by modelling only the partial model, where partial model refers to the equations for the potentially non-weakly exogenous variables (X) (Harbo et al., 1998; Juselius, 2006). Our analysis includes several fundamentals in addition to the three assets. Given the relatively small number of observations (68), it is reasonable to restrict the VECM so that more efficient tests can be conducted. Moreover, testing several restrictions on the long-term relation and α at the same time would be highly problematic.

To keep the model as simple and compact as possible, we are interested only in the cointegrating relations towards which at least one of the assets adjusts. That is, we are interested in the long-term relations that determine the long-term level for one or more assets. Efficient estimation of the cointegrating relations necessitates that the Z variables are indeed weakly exogenous w.r.t. the estimated cointegrating relations. A priori, it seems reasonable to assume that fundamentals do not adjust towards a long-run relation that determines the long-run level for an asset price; rather is should be the asset price that is determined by the fundamentals. We also check whether the fundamentals can be assumed to be weakly exogenous w.r.t. to the estimated cointegrating relations. In line with our hypothesis, the weak exogeneity restrictions appear to be reasonable.

The selection of the number of cointegrating vectors (r) is done by comparing the estimated Trace statistics with the quantiles reported by Harbo et al. (1998). Regarding a case with three variables in X, the Harbo et al. tables do not report the quantiles for a model that includes more than four variables in Z. Hence, we have to restrict the dimension of Z to four. Since we have more than four fundamental variables in the analysis, the selection of the fundamentals to be included in the Trace test is done by HQ. The fact that we have to exclude some variables from the cointegration tests should not matter, since in all cases the excluded variables would be highly insignificant in the long-term model (i.e, they could be excluded from the cointegrating relation in any case).

If cointegrating relationships are found, we conduct the usual weak exogeneity and long-run exclusion tests for the variables. The tested model also includes a deterministic time trend (t) in the long-term relation. The exclusion of the trend and of the assets and fundamentals from the cointegrating relationship is tested by the Bartlett small-sample corrected Likelihood Ratio (LR) test suggested by Johansen (2000). That is, the variables included in the cointegrating relation are decided based on the LR test. The Johansen (1996) LR test is used to test for the weak exogeneity of the assets. As a diagnostic check, we also examine the stability of the potential long-term relations by the recursive and backwards recursive Max Test statistics (in the R-form) of constancy of the estimated long-run relation explained in Juselius (2006). The stability of all the estimated long-term relations can be accepted at the 5% level of significance.

Innovation Accounting

Based on the cointegrating long-run relations, we estimate VECMs to study the dynamics of the asset returns more carefully. The VECMs include the three assets and the fundamentals that belong to the respective cointegrating relationships. In addition, we use the Sim's small-sample corrected LR test to decide whether additional fundamentals should be incorporated in the short-run dynamics of the models. The estimated VECMs are used to conduct innovation accounting. The innovation accounting is based on the Choleski decomposition.

We derive the impulse responses of asset returns, i.e., we estimate the reaction speeds and patterns of the returns, to unanticipated changes in the fundamentals and in the asset returns themselves. If two assets are good substitutes for each other in the long horizon, their long-term reactions to shocks in various factors should be similar or, less restrictively, the relative reaction magnitudes between the two assets should be similar regardless of the shock. If, for instance, the change in REIT prices was twice that in TBI prices after any shock in the fundamentals, 50% leveraged direct real estate investments would create similar reactions to those of REITs, and REITs and direct real estate would appear to be good substitutes for one another. In contrast, if the relative reaction magnitudes of REITs and TBI notably differed between different shocks, REITs would not appear to correspond that closely to direct real estate investments. As we restate the REIT indices to cater for the impact of leverage, we would not expect to have systematic differences in the response magnitudes between the REIT and direct markets. We investigate the long-run response magnitudes by the accumulated reactions of the asset returns. If the long-term accumulated responses of two markets are similar, then the markets are integrated in the sense that the risk premia for various factors are the same in both markets.

In this analysis also variance decomposition is of particular interest. If the forecast error variance decompositions show that a notable share of the long-term forecast error variance of securitized real estate returns is explained by innovations in the direct real estate market returns and that only a small share is explained by the stock market innovations, the analysis indicates that the long-term influence of the direct real estate market on the securitized real estate market is greater than that of the general stock market. The greater the difference between the shares, the stronger this kind of result is. The causality can also run in the other direction, however. That is, if a substantial share of the long-run forecast error variance of direct real estate can be explained by shocks in REIT returns, then direct and securitized real estate would appear to be tightly linked. Instead, if we found that the impact of general stock market shocks on the securitized real estate market is greater than that of the direct real estate market even in the long run and that REIT market innovations do not explain direct market dynamics, the results would thus indicate that REITs behave more like stocks even in the long run.

The inclusion of market fundamentals in the models eliminates any indirect effects of these economic factors on the co-movement between the REIT, direct real estate and stock markets. Stated differently, assuming that the models include the major economic fundamentals, the observed variance decomposition shares shows the ‘pure’ effect of the asset markets on each other. Hence, the results are expected to be more reliable when the economic fundamentals are included in the analysis.

4. Data

We include four real estate sectors in the analysis: Apartments, offices, industrial property, and retail property. For securitized real estate, the FTSE/NAREIT Equity REIT sector level indices are used and for direct real estate we use the sector level transaction-based NCREIF (TBI) indices.[i] The sector level data cover a period from 1994Q1 to 2010Q4. All the real estate indices employed in the analysis are total return indices. The overall stock market performance is captured by the S&P 500 total return index (*s*). Since the previous literature has shown that REIT performance may be more tightly linked to small cap stocks than the overall stock market (Clayton and MacKinnon, 2003), we also include the Russell 2000 total return index (*sc*) in the analysis to check whether the use of small cap stocks instead of the S&P 500 index notably influences the results. The Russell 2000 that measures the performance of the small-cap segment of the U.S. equity universe is also used by Clayton and MacKinnon in their analysis.

While NAREIT includes the impact of leverage, the TBI indices consist of unleveraged properties. The magnitude of leverage naturally affects the mean and volatility of securitized real estate returns. Moreover, time-variation in the leverage may hinder the cointegration tests and distort the estimated long-run parameters. Therefore, we restate the NAREIT returns for the effect of leverage. Similar to Pagliari et al. (2005), the unlevered returns are computed using the formula that is based on the well-known proposition of Modigliani and Miller (1958):

$$r_{uit} = r_{eit}(1-LTV_{it}) + r_{dt}LTV_{it}, \quad (2)$$

where r_{uit} = the unlevered REIT return of sector i in period t, r_{eit} = the return on equity of sector i in period t, r_{dt} = the cost of debt in period t, and LTV_{it} = the loan-to-value ratio of sector i in period t. The cost of debt is proxied by the U.S. home mortgages contract interest rate. The average leverage of REITs during the sample period is 48% in the apartment and office sectors, 43% in the industrial property sector, and 51% in the retail property sector.

In addition to the real estate and stock market indices, we incorporate in the analysis a number of fundamental variables that are expected to influence and have been found to affect real estate and stock returns significantly. These variables include economic growth (Ling and Naranjo, 1997; Payne, 2003; Ewing and Payne, 2005), economic sentiment (Berkovec and Goodman, 1996; Ling, Naranjo and Scheick, 2010; Oikarinen, Hoesli and Serrano, 2010), the short-term interest rates and the term structure of interest rates (Chan et al., 1990; Ling and Naranjo, 1997), the default risk premium (Chan et al., 1990; Karolyi and Sanders, 1998; Oikarinen, Hoesli and Serrano, 2010), and the inflation rate (Chan et al., 1990; Ling and Naranjo, 1997; Payne, 2003; Ewing and Payne, 2005).

We measure economic growth with the change in U.S. GDP (y). The economic sentiment (se), that gives a more forward looking measure of growth in economic activity, is captured by the University of Michigan consumer sentiment index regarding the five year economic outlook. Changes in the consumer price index (i) are used to track movements in the general price level, while the three month T-bill rate and the spread between the 10-year government treasury bond yield and the three month T-bill rate measure the short-term interest rates (ir) and the term structure of interest rates (ts), respectively. Finally, the spread between low-grade corporate bond (Baa, Moody's) and the 10-year government treasury bond yield is used as the measure of default risk premium (*rp*) as suggested by Chen et al. (1986), Bernanke and Blinder (1992), and Ewing (2001).

In the econometric analysis, we use only real indices regarding asset returns and GDP. The nominal values are deflated using CPI to get the real indices. Furthermore, the real estate and GDP indices are used in the natural log form. Also the short-term interest rate is measured in real terms. Expectedly and in line with the previous literature, all the return indices appear to be non-stationary in levels and stationary in differences, and also the fundamental variables seem to be I(1) (see Table A1 in the Appendix). Therefore, only difference variables are included in the short-run dynamics of the VECMs.

Table 1 presents some descriptive statistics regarding the unlevered total returns in the apartment (*apt_tbi, apt_reit*), industrial (*ind_tbi, ind_reit*), office (*of_tbi, of_reit*) and retail (*re_tbi, re_reit*) sectors. The volatilities between the unlevered REIT returns and the TBI returns do not notably differ from each other at the quarterly level. However, Table 1 shows that the TBI returns were substantially greater than the unlevered REIT returns during the sample period regardless of the property type. This is most prominent in the apartment sector. Figure 1 illustrates that direct real estate substantially outperformed REITs and even S&P 500 during the sample period. This does not necessarily imply that TBI returns are expected to outperform REIT and stock market returns. Rather, the notable difference between the reported average returns is most likely explained by the unusual sample period. According to Oikarinen et al. (2011), the overall TBI total return index was substantially below the long-run relation between the TBI and NAREIT indices in 1994, while the TBI index was clearly above the relationship in 2008; thus the observed outperformance of TBI returns over the period.

Table 1 Descriptive statistics of the asset returns, 1994Q1-2010Q4

Variable	**Mean (annualized %)**	**Standard deviation (annualised %)**	**Jarque-Bera test for normality (p-value)**	**Ljung-box test for auto-correlation (p-value, 4 lags)**
apt_tbi	8.1	8.7	.02	.02
apt_reit	3.7	8.5	.00	.02
ind_tbi	7.1	10.9	.00	.04
ind_reit	3.2	12.4	.00	.11
of_tbi	6.6	8.9	.05	.00
of_reit	4.4	9.4	.00	.06
re_tbi	6.8	8.7	.00	.06
re_reit	3.1	9.2	.00	.03
S&P 500	4.9	17.6	.35	.37
R 2000	4.9	22.9	.42	.22

Table 2 reports the contemporaneous quarterly correlations between the variables. In line with the contemporaneous correlations documented in the earlier literature, the co-movement between REIT returns and general stock market returns is substantially stronger than that between REIT and direct real estate return at the quarterly horizon. Even the lowest correlation between REITs and stocks is 0.41, while the largest REIT-TBI correlation is 0.26. The TBI-stock correlations are similar to the TBI-REIT correlations. The long-run comovements may significantly differ from the contemporaneous quarterly correlations. For instance, lead-lag relationships may notably diminish the observed short-run comovements. Therefore, more rigorous analysis is needed to reach more definite conclusions regarding the long-term similarities of the assets. Table 2 also reveals that the quarterly correlations w.r.t. fundamentals are similar between REITs and stocks.

Table 2 Contemporaneous quarterly correlations between the differenced variables, 1994Q1-2010Q4

	Δtbi	*Δreit*	*Δs*	*Δsc*	*Δy*	*Δse*	*Δir*	*Δts*	*Δdrisk*	*Δdinf*
Δapt_tbi	1.00	.25**	.26**	.20*	.36***	-.02	.06	-.12	-.08	-.03
Δapt_reit	.25**	1.00	.42***	.40***	.12	.25**	-.07	-.09	-.40***	.38*
Δind_tbi	1.00	.26**	.25**		.22*	.13	.09	.12	-.20*	-.07
Δind_reit	.26**	1.00	.50***		.22*	.16	-.32***	-.32***	-.38***	.36***
Δof_tbi	1.00	.26**	.23**		.37***	-.01	.07	-.28**	.06	-.04
Δof_reit	.26**	1.00	.52***		.34	.29**	-.16	-.22*	-.42***	.20*
Δre_tbi	1.00	.18	-.11		.23**	.10	.15	-.11	-.01	-.12
Δre_reit	.18	1.00	.41***		.18	.25**	-.24**	-.19	-.40***	.27**
ΔS&P 500			1.00	.90***	.20*	.34***	-.17	-.09	-.41***	.21*
ΔR 2000					.10	.30**	-.14	.02	-.45***	.18

*, ** and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

5. Empirical Findings

Long-Term Relations

Table 3 reports the cointegration test results. The Trace test statistics imply that long-term dynamics are present in each of the four separate models. Conveniently, the statistics suggest that each model includes only one cointegrating relation towards which at least one of the assets adjusts. Since it is only the TBI returns that appear to adjust towards the estimated relationships, the cointegrating vectors can be interpreted as long-term relations for the TBI indices. Consequently, we normalize the vectors w.r.t. the TBI and place the TBI on the left hand side of the long-run equations presented in Table 3.

In each of the estimated long-run relation all the parameter estimates are highly statistically significant. The apartment sector model includes only one asset, i.e., *apt_tbi*, in the cointegrating relation. The REIT index is incorporated in all the other long-term relations. The presence of REITs in three out of four long-run relations indicates long-term dynamics between TBI and REITs, but is not sufficient to draw conclusions on whether REIT returns reflect more the general stock market returns or the real estate market performance. Moreover, the general stock market also enters the long-term equations for *of_tbi* and *re_tbi* albeit with relatively small coefficients. GDP belongs to all the long-run equations. The office sector model also incorporates the term spread and the apartment model the default risk premium in the long-term dynamics.

While the estimated speeds of adjustment of the TBI are relatively fast, from 68% per quarter in the industrial sector to 22% per quarter in the apartment sector, the weak exogeneity of stocks and securitized real estate can be clearly accepted. Figure 2 shows the TBI indices together with the estimated long-run relations. The TBI indices generally track closely the long-term relations. However, the apparently slow reaction of direct real estate prices to the recent financial crisis induced notable deviations from the long-run relations during 2008-2009.

Table 3 Cointegration test statistics and the estimated long-run relations

OFFICE (k=2)			
Hypothesis	r=0	r≤1	r≤2
(5% critical value)	(69.7)	(44.5)	(22.9)
Trace statistics	83.2	29.1	10.1
P-value in the LR test for exclusion of trend, *ir* and *d* and for weak exogeneity of *s* and *of_reit*			.43
Long-run relation	*of_tbi* = 1.12*of_reit* – .258*s* + 1.82*y* – 5.61*ts*		
(standard error)	(.118) (.046) (.231) (.808)		
Adjustment speed of *of_tbi*	-.44		
(standard error)	(.054)		
INDUSTRIAL (k=1)			
Hypothesis	r=0	r≤1	r≤2
(5% critical value)	(69.7)	(44.5)	(22.9)
Trace statistics	97.0	41.7	13.1
P-value in the LR test for exclusion of trend, *s*, *ir*, *d* and *se* and for weak exogeneity of *s* and *in_reit*			.65
Long-run relation	*ind_tbi* = .618*ind_reit* + 2.33*y*		
(standard error)	(.048) (.115)		
Adjustment speed of *in_tbi*	-.679		
(standard error)	(.084)		
RETAIL (k=1)			
Hypothesis	r=0	r≤1	r≤2
(5% critical value)	(69.7)	(44.5)	(22.9)
Trace statistics	87.1	43.4	13.5
P-value in the LR test for exclusion of trend, *ir*, *d* and *se* and for weak exogeneity of *s* and *re_reit*			.58
Long-run relation	*re_tbi* = .916*re_reit* – .127*s* + 2.36*y*		
(standard error)	(.010) (.052) (.249)		
Adjustment speed of *re_tbi*	-.355		
(standard error)	(.053)		
APARTMENTS (k=2)			
Hypothesis	r=0	r≤1	r≤2
(5% critical value)	(69.7)	(44.5)	(22.9)
Trace statistics	81.7	41.8	13.9
P-value in the LR test for exclusion of trend, *apt_reit*, *s*, *ir* and *se* and for weak exogeneity of *s* and *apt_reit*			.18
Long-run relation	*apt_tbi* = 3.75*y* – 12.7*d*		
(standard error)	(.136) (2.02)		
Adjustment speed of *ap_tbi*	-.219		
(standard error)	(.026)		

The Trace test statistics are based on the methodology proposed by Harbo et al. (1998), and the Bartlett small-sample corrected LR test by Johansen (2000) is used to test for exclusion and weak exogeneity. k is the maximum lag in the tested VECM.

Variance Decomposition

We study the forecast error variance decompositions and impulse response functions based on separate VECMs on all the four sectors. In addition to the three assets and the fundamentals included in the long-run relations, all the VECMs include *ir* in the short-term dynamics.[ii] We use the Choleski decomposition to conduct the innovation accounting. In our baseline models, the ordering is *y*-*ir*(-*ts*)(-*rp*)-*s*-*reit*-*tbi*.[iii] Therefore, it is assumed that GDP shocks affect all the other variables simultaneously, and all the fundamentals are allowed to influence the asset returns instantaneously. On the other hand, none of the other variables are allowed to have an immediate impact on GDP. Given the sluggishness of the real economy, it seems reasonable to assume that GDP does not react to changes in the other variables immediately. *ir*, in turn, should be placed before *ts*, since *ir* affects directly one component in the term spread. Since the use of the small cap index instead of S&P 500 does not notably alter the main results, we concentrate on reporting the findings from the benchmark model.[iv]

We are particularly interested in the long-term interdependence between the variables. The contemporaneous correlations in Table 2 show that the short-term comovement between REITs and stocks is greater than that between the direct and securitized real estate markets. Due to the direct real estate market frictions and to the short-run noise in REIT prices it is expected that the links between TBI and REITs are substantially stronger that suggested by the quarterly correlations, however. In line with this assumption, the long-horizon variance decompositions generally show a tight link between TBI returns and REIT returns. The 40-quarter horizon variance decompositions of the asset return indices derived from the baseline model are summarized in Table 4. The reported values show the proportions of the forecast error variances of the return indices that are due to shocks in the other assets and in the asset itself. For instance, 50.8 in the office market TBI-ΔREIT cell indicates that about 51% of the forecast error variance of the office TBI is due to shocks in office REIT returns.

Table 4 Forecast error variance decompositions (%) of the assets at the 40-quarter horizon

Shock to	Variance decomposition of		
		office	
	REIT	*TBI*	*STOCK*
ΔREIT	59.2	50.8	16.5
ΔTBI	0.0	0.3	0.0
ΔSTOCK	16.8	3.8	49.8
		Industrial	
	REIT	*TBI*	*STOCK*
ΔREIT	58.6	48.1	10.0
ΔTBI	0.0	0.5	0.0
ΔSTOCK	15.1	14.8	57.7
		Retail	
	REIT	*TBI*	*STOCK*
ΔREIT	67.8	65.4	10.4
ΔTBI	0.0	0.9	0.0
ΔSTOCK	6.9	3.2	57.2
		Apartments	
	REIT	*TBI*	*STOCK*
ΔREIT	48.6	0.6	0.1
ΔTBI	0.0	0.7	0.0
ΔSTOCK	0.7	0.1	28.0

The table shows the magnitudes of the forecast error variances that are explained by shocks in the asset returns. The presented variance decompositions are those of the levels, i.e., of the total return indices. The reported values are based on VECMs in which the ordering in the Choleski decomposition is as follows: *y*-*ir*(-*ts*)(-*rp*)-*s*-*reit*-*tbi*.

Based on the values in Table 4, it is clear that the direct real estate market shocks do not drive REIT market performance. REITs appear to be (at least close to) exogenous w.r.t. both direct real estate and the overall stock market in the sense that shocks in those markets do not seem to have notable effects on REIT returns. Nevertheless, the linkage between the direct and securitized markets appears to be tight, since a major part of the long-horizon forecast error variance of the TBI indices can be explained by REIT return shocks. This implies that the direct and securitized markets are closely linked and that the predictability goes from REITs to TBI, i.e., 'real estate shocks' take place first in the REIT market after which the direct market adjusts to these shocks. This is in line with the recent findings by Yavas and Yildirim (2011). In the words of Clayton and MacKinnon (2003), 'if REITs work as better processors of information, then the REIT market may be reflecting changes in private real estate values far more quickly than a private real estate market index'.

There do not seem to be similar strong relations between the stock market and either of the real estate markets. Given that stock market shocks do not seem to greatly influence either REIT or TBI performance and that REITs do not appear to drive general stock market returns, the variance decomposition analysis suggests that REITs and direct real estate markets are much more closely related than are the REIT and stock markets in the long run. An exception is the apartment sector, where the REIT index does not enter the long-run dynamics. In the apartment model, it is only the fundamentals that seem to have a notable long-run impact on direct real estate returns. Even in the apartment sector, it is clear that *s* does not drive the long-run performance of REITs, though.

Note that the remaining part of the forecast error variances is explained by the fundamentals. For instance, the economic fundamentals explain 24% of the long-run forecast error variance of *of_reit*. The variance decompositions generally converge to the eventual long-run values at the 2-4 year horizon. The convergence speeds vary only slightly between the assets and sectors.[v]

Since the ordering in the Choleski decomposition may notably affect the results, we check for the robustness of the variance decompositions with respect to the imposed identifying restrictions, i.e., w.r.t. the ordering in the Choleski decomposition, by comparing the variance decompositions computed based on different asset orderings. The main results generally appear to be robust w.r.t. the ordering. The ordering of the TBI does not notably matter, and the TBI does not appear to have a notable simultaneous impact on the other assets even if it is placed before stocks and REITs. Therefore, it is reasonable to place the TBI the last in the baseline model.

The ordering between stocks and REITs is based on the assumption that the potential causality runs from the general stock market to the REIT market rather than the other way round. The ordering between REITs and the stock market seems to have some influence on the results. If *s* is placed after REITs, stock market shocks account for a negligible share of the REIT variance decomposition, whereas the share of REIT shocks in the stock market decomposition notably increases. This does not alter the main implication of the variance decomposition analysis, however. Even if we assume that stocks should be after REITs in the correct Choleski ordering, the results indicate that REITs are not driven by the general stock market. Instead, REIT market shocks would have a notable impact on the general stock market. Again, the apartment sector is different: in the apartment model even the ordering between *s* and REITs does not influence the results.

Impulse Response Analysis

We further investigate the relationships between the asset market dynamics based on impulse response analysis. If securitized real estate is a close substitute for direct real estate in a long-horizon investment portfolio, the long-run accumulated reactions of REIT and TBI returns to various shocks should not notably deviate from each other. If the reaction magnitudes differ significantly, then securitized real estate brings a different exposure to various risk factors than direct real estate into a long-term portfolio, i.e., REITs and direct real estate cannot generally be considered as good substitutes in the portfolio. Figures 3-6 show the accumulated reactions of the asset returns to shocks in the fundamentals and in the assets themselves up to four years after the shocks based on the baseline model.

[Figures 3-6 here]

The figures indicate that, in general, the long-run accumulated responses of REITs and TBI closely resemble each other and that the relative magnitudes of the long-run reactions do not greatly differ. Importantly, the resemblance between REITs and TBI is substantially greater than that between REITs and the general stock market. In principle, the differences between REITs and the stock market might due to leverage in *s*, for instance. However, also the relative magnitudes of the reactions vary notable more between stocks and REITs than between TBI and REITs. This is in line with the hypothesis that REITs are more real estate than stocks and with the results from the variance decomposition analysis.

The similarity between REIT and TBI responses and constancy of the relative reaction magnitudes are most prominent in the retail and industrial sectors. In the office sector this picture is somewhat obscured by the dissimilarity of the real estate responses to a term spread shock. The importance of *ts* shocks w.r.t REIT and stock dynamics appears to be only small. Shocks in *ts* explain a notable share of *of_tbi* forecast error variance, though. In the industrial sector model, in turn, the estimated REIT response to a shock in *ir* is somewhat closer to the stock market response than that of TBI. In any case, in the office, industrial and retail sectors, REIT dynamics seem to be notably closer to the direct real estate market dynamics than to the general stock market dynamics. The apartment sector is a different case also regarding the impulse responses. It is hard to reach any conclusion on whether REITs are closer to stocks or direct real estate based on the apartment model.

The impulse responses seem to be relatively robust with respect to the asset ordering. In line with the hypothesis that direct real estate market prices react more sluggishly to various shocks than REIT and stock prices, the impulse responses show a generally smaller short-term response of the TBI to the shocks (relative to the eventual long-run response). This slow reaction of the direct market is most likely a major reason for the relatively small quarterly correlation between TBI and REIT returns. The stock market reaction to shocks in the fundamentals is similar regardless of the model.

An interesting question is the reason behind the difference between the apartment sector results compared to the findings regarding the other sectors. One potential explanation for the apartment sector results is the major difference between apartment REITs and direct apartment investment during the 2000s. There was a big condominium boom, which resulted in a quasi-arbitrage from buying apartments and converting them to condos and selling the condos. This drove up the price of apartments in the direct market. As apartment REITs are long-run rental investors not involved in the condo-conversion business, the condo-conversion premium did not get priced into the REITs.

Also based on the small cap index the linkage between REITs and TBI is generally tighter than that between REITs and stocks. However, the picture is less clear in the office sector, if the small cap performance is used as a proxy for the stock market. One potential explanation for this is the more prominent presence of REITs in the small cap index than in the overall stock market index. In any case, even in the office sector there is no evidence of small cap stocks driving REIT returns.

6. Summary and Conclusions

Even though the question of whether real estate securities behave as real estate or as equities is an old one and an important one for a large number of investors, the answer to the question in the extant literature is still not conclusive. This study brings further empirical evidence on the issue. It appears that our analysis is the first one on the theme that incorporates the economic fundamentals and sector level real estate data, and that caters for both the short-run and long-run dynamics of the asset returns.

We propose that the long-run nature of REIT returns can be studied rigorously by investigating the forecast error variance decompositions and impulse responses computed from vector error-correction models (VECM). Our findings that are based on sector level NAREIT and TBI indices and on separate VECMs for four real estate sectors (apartments, offices, and industrial, and retail real estate) suggest that the REIT and direct real estate markets are tightly linked in the long run. It appears that REIT returns are largely independent with respect to shocks in the other asset – neither direct real estate nor stock market shocks seem drive REIT market performance. However, a major part of the long-horizon forecast error variance of the direct real estate indices can be explained by REIT return shocks. This implies that the direct and securitized markets are closely linked and the predictability goes from REITs to TBI, i.e., 'real estate shocks' take place first in the REIT market after which the direct market adjusts to these shocks. In addition, the long-run accumulated impulse responses of REIT and direct real estate returns to various shocks closely resemble each other. The resemblance between REITs and TBI is substantially greater than that between REITs and the general stock market.

Therefore, while the short-term comovement between REITs and stocks is stronger than that between REITs and direct real estate, REITs are likely to bring a similar exposure to various risk factors as direct real estate into a long-horizon investment portfolio. REITs are also expected to have similar attractive diversification properties as direct real estate investments in the long horizon, as least to a considerable extent. These findings have important implications with respect to asset allocation in a long-horizon multi-asset portfolio, since they point to opportunities for investors to combine the advantages of listed real estate with the attractive diversification features of direct real estate investments.

The apartment sector appears to be a different case, though. In the apartment sector we cannot identify tight long-term links between the three asset categories. Hence, the results also show that it may be important to cater for the differences across real estate sectors when making portfolio decisions. Finally, our results provide one more piece of evidence pointing to sluggish adjustment of direct real estate prices and to notable predictability of direct real estate market performance.

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Figure 1 Sector level (unlevered) NAREIT and TBI real total return indices and real S&P 500 total return index, 1994Q1-2010Q4

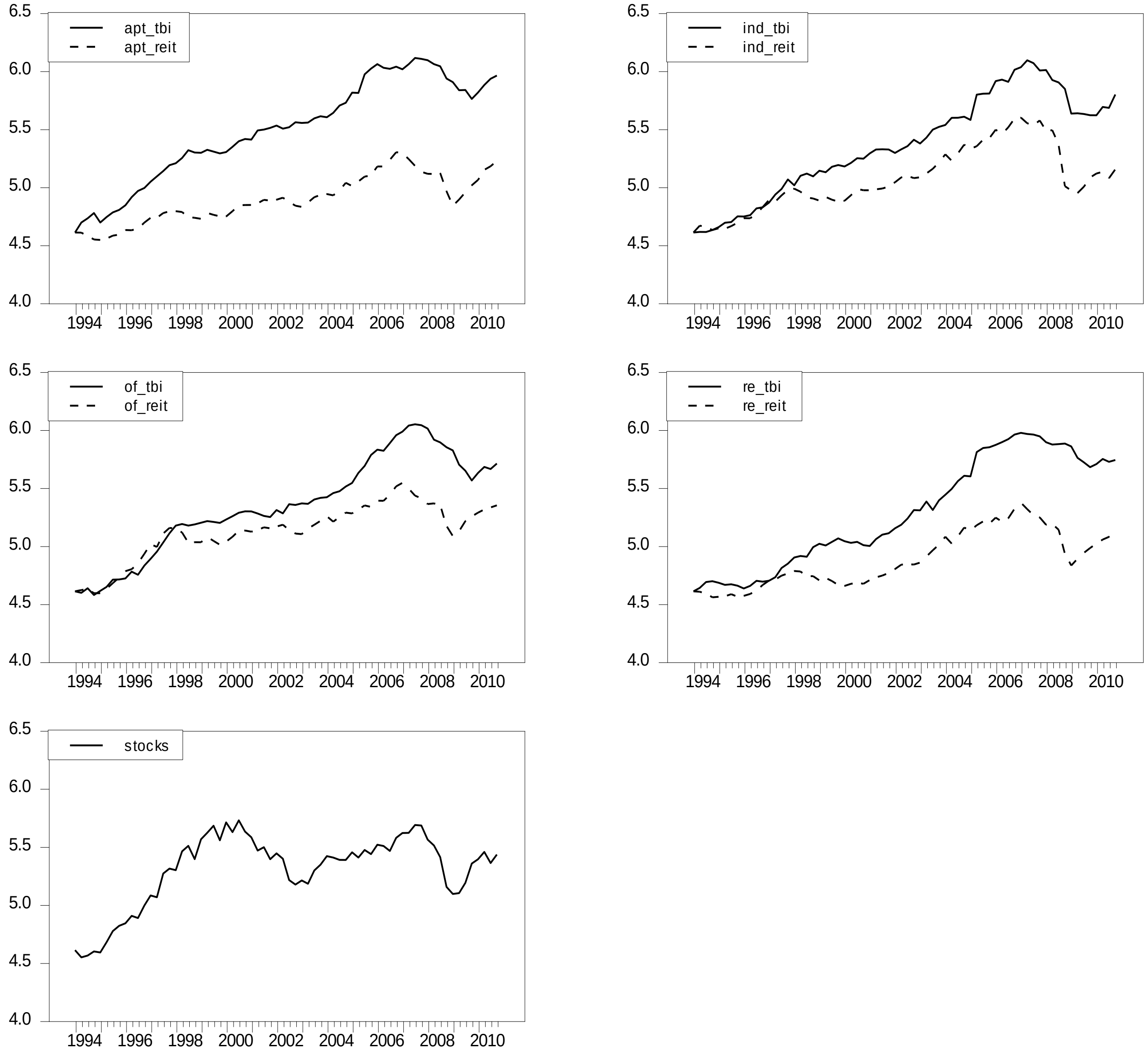


Figure 2 TBI indices and estimated long-run relations, 1994Q1-2010Q4

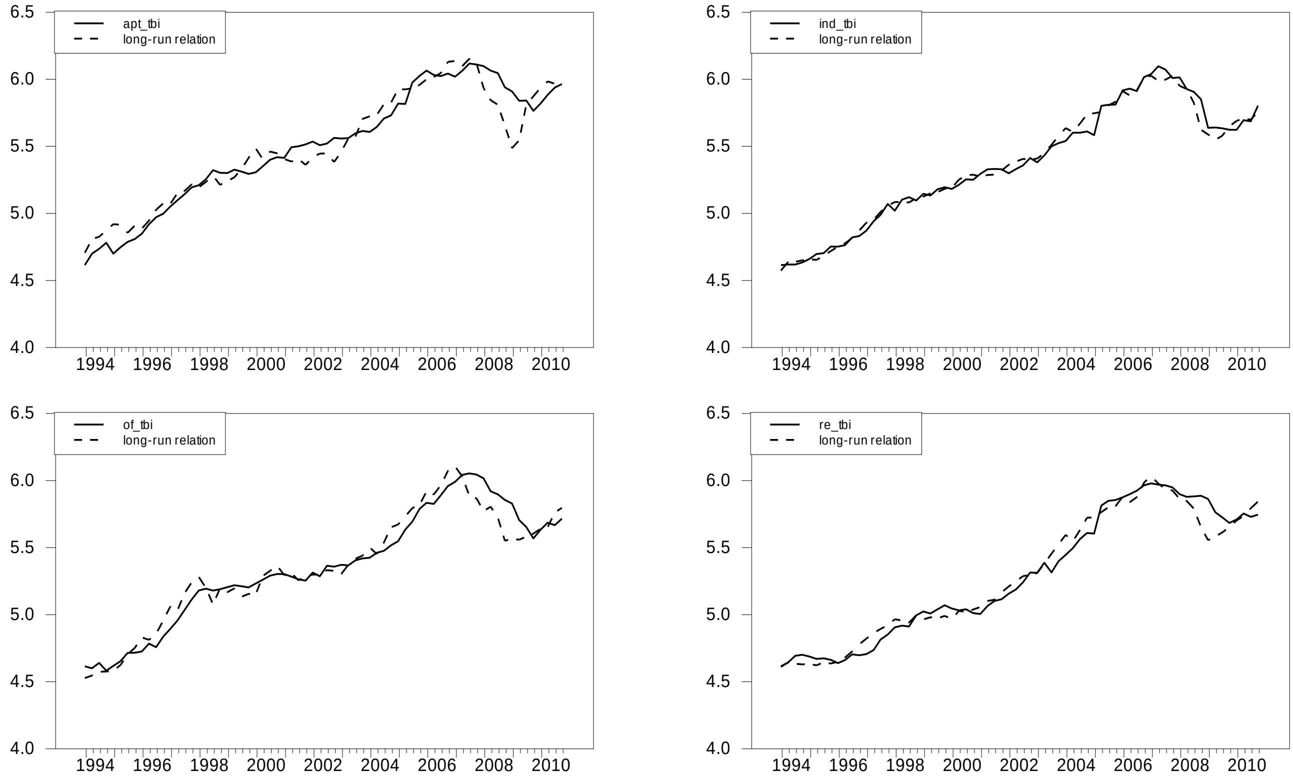


Figure 3 Accumulated impulse responses of asset returns to one unit shocks, the office sector

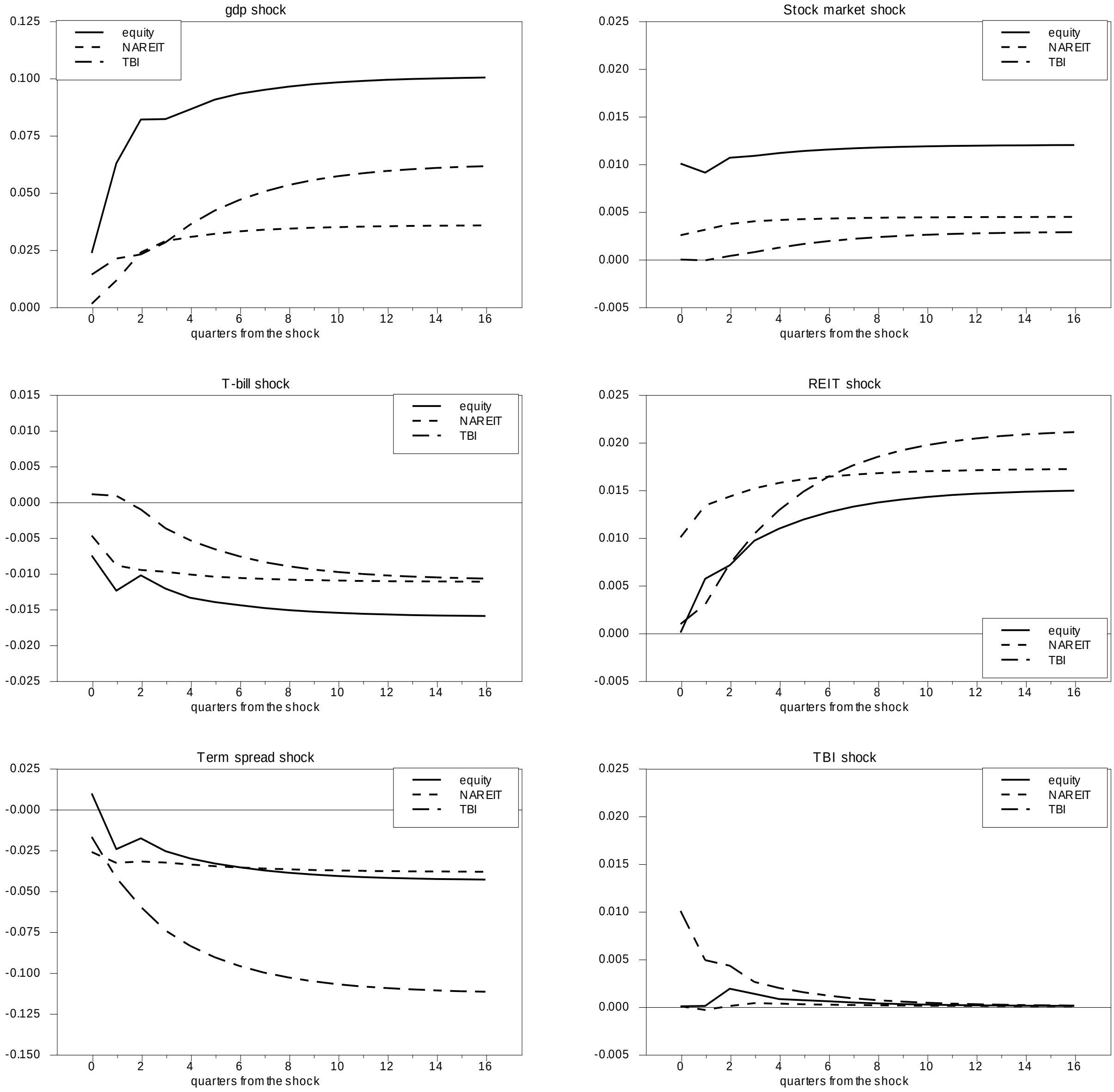


Figure 4 Accumulated impulse responses of asset returns to one unit shocks, the industrial sector

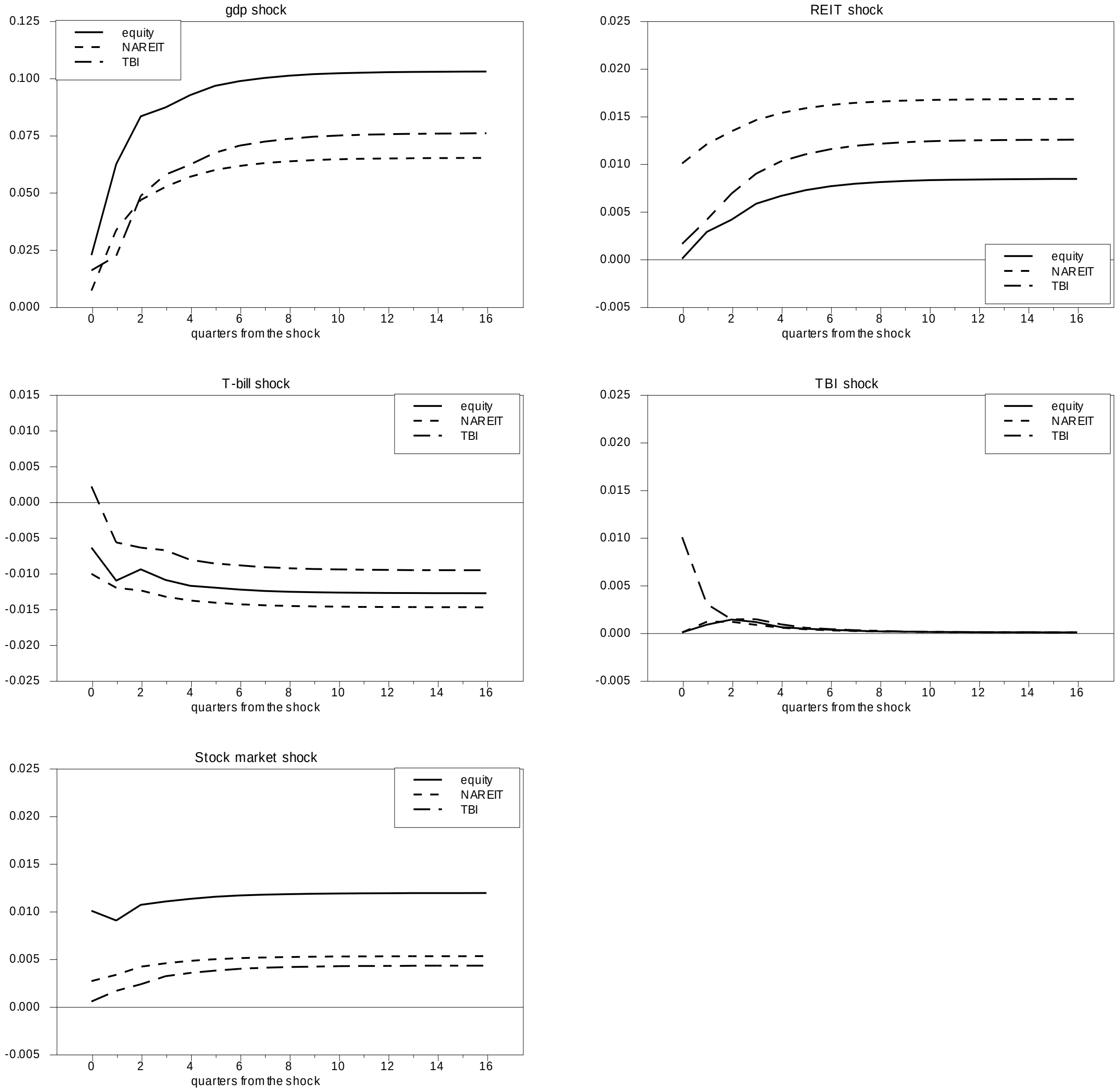


Figure 5 Accumulated impulse responses of asset returns to one unit shocks, the retail sector

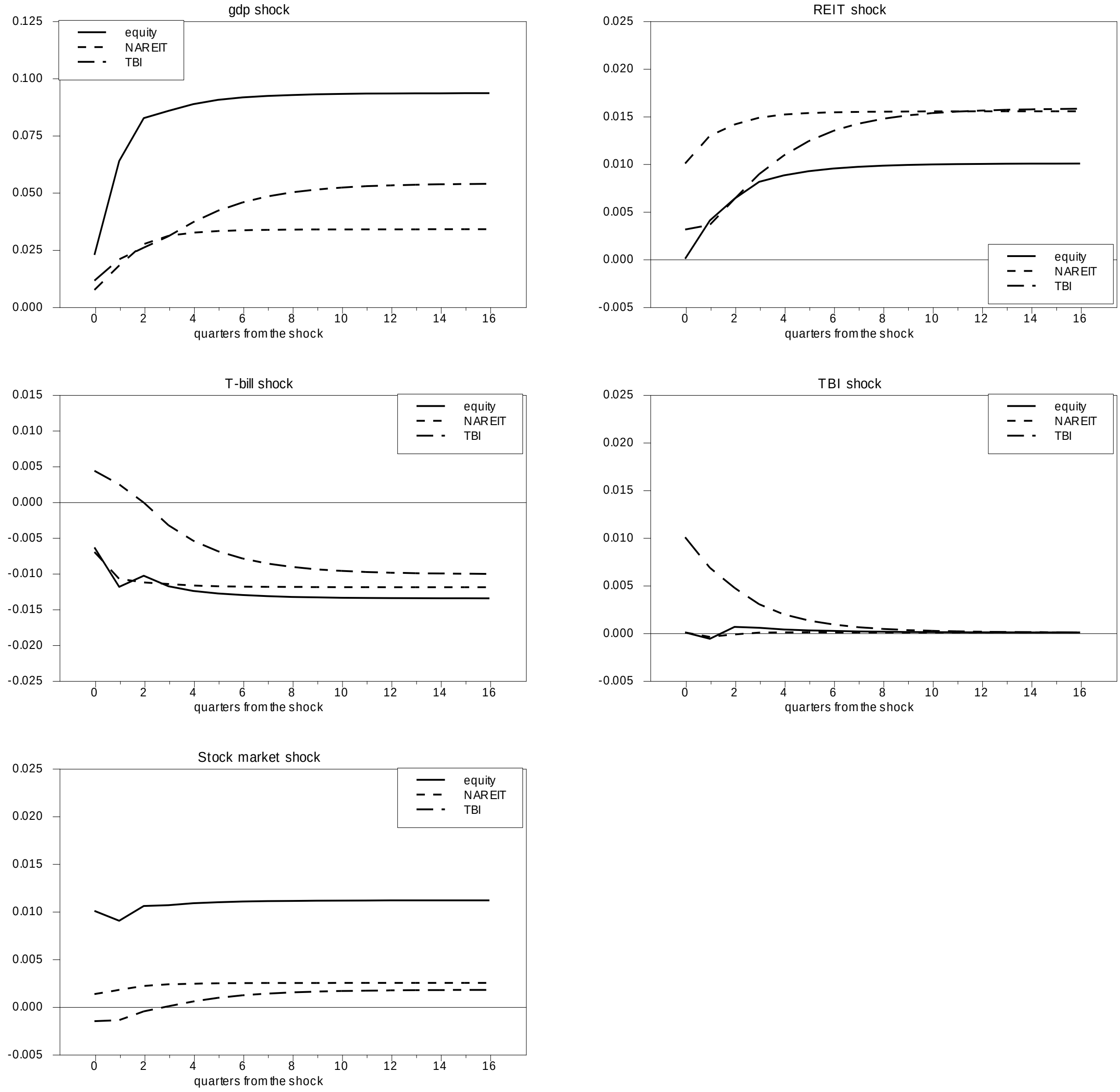
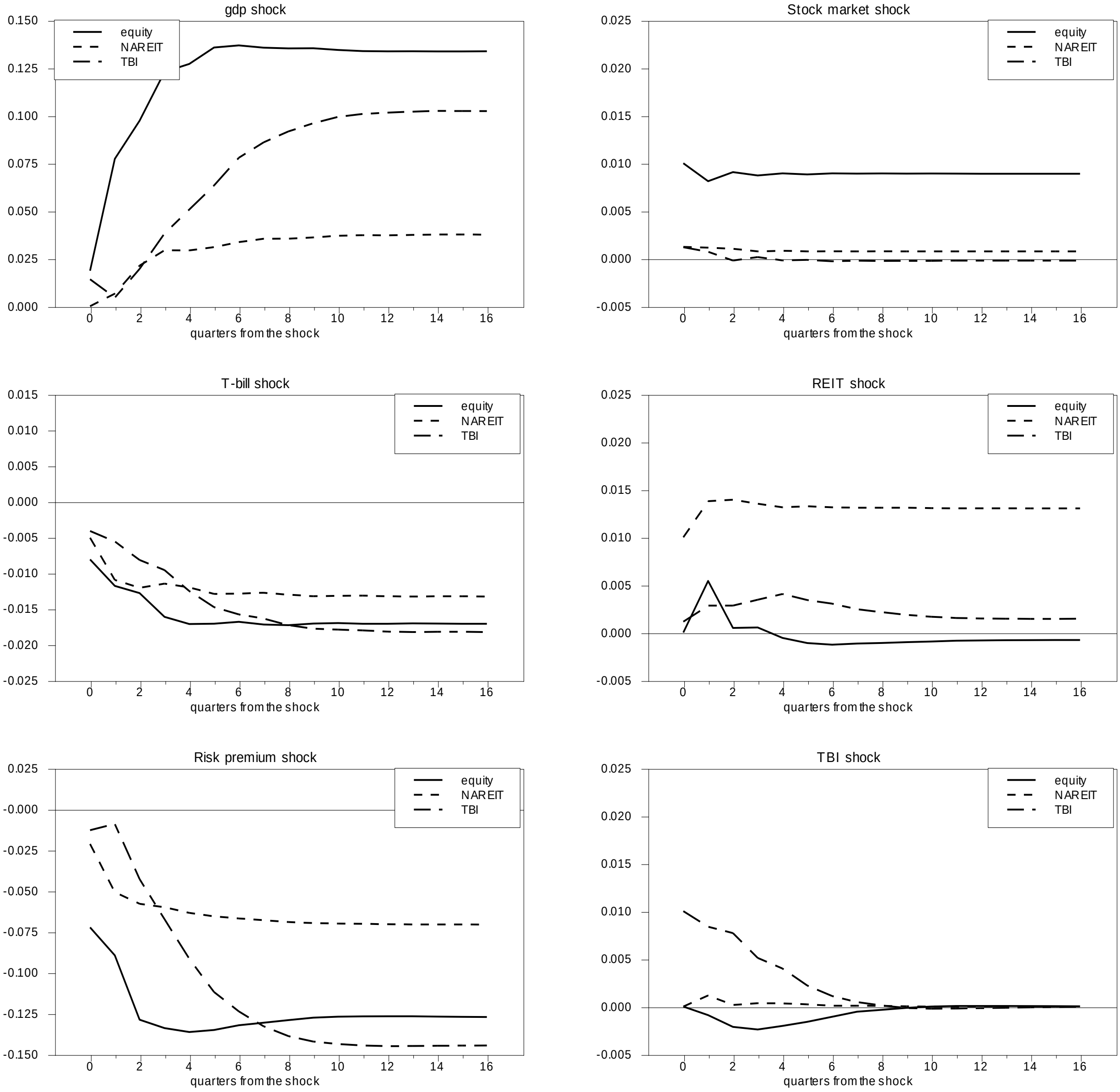


Figure 6 Accumulated impulse responses of asset returns to one unit shocks, the apartment sector



APPENDIX

Table A1 DF-GLS unit root test results, 1994Q1-2010Q4

Variable	Level (lags)	Difference (lags)
apt_tbi	0.38 (2)[c]	-3.30** (1)
apt_reit	-0.34 (1)[c]	-5.03** (0)
ind_tbi	-0.10 (3)[c]	-2.23* (2)
ind_reit	-0.72 (1)[c]	-5.95** (0)
of_tbi	-0.29 (2)[c]	-2.80** (1)
of_reit	-0.40 (1)[c]	-5.31** (0)
re_tbi	0.01 (3)[c]	-2.75** (2)
re_reit	-0.57 (1)[c]	-5.38** (0)
S&P 500	-0.58 (0)[c]	-4.30** (1)
Russell 2000	-0.64 (1)[c]	-10.0** (1)
Real interest rate	-1.56 (6)	-5.34** (6)
Term Spread	-1.12 (0)	-8.24** (0)
Inflation rate	-0.91 (10)	-3.89**(9)
GDP	0.19 (4)[c]	-4.37** (1)[s]
Sentiment	-1.73 (0)[c]	-9.76** (0)
Risk premium	-0.54 (0)	-6.36** (1)

* and ** denote for statistical significance at the 5% and 1% level, respectively. Critical values at the 5% and 1% significance levels are -1.95 and -2.60. The number of lags included in the ADF tests is decided based on the Akaike Information Criteria (AIC). A constant term ([c]) is included in the tested model if the series clearly seem to be trending or if the ADF test without the constant term suggests that the series are exploding. In addition, three seasonal dummies ([s]) are added to the test if recommended by AIC.

[i] The data used in this study were sourced from *Thomson Datastream* and from NAREIT.

[ii] All the VECMs except for the apartment model include one lag in differences. The apartment VECM has two lags.

[iii] Any of the estimated VECMs does not include *i* or *se*.

[iv] More detailed results from the models including the Russell 2000 index instead of S&P 500 are available from the authors upon request.

[v] More detailed information about the variance decompositions over various horizons is available from the authors upon request.