EPRA

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ACADEMIC RESEARCH

Does Listed Real Estate Behave Like Direct Real Estate?

Updated and Broader Evidence

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EXECUTIVE SUMMARY

Real estate has been shown to provide significant diversification benefits in a portfolio containing financial assets but also other types of alternative assets. Against this background, the question of whether listed real estate behaves as private real estate or as equities is an important one for investors. If listed and direct real estate returns are generated by a common "real estate factor" over the long-horizon, then real estate securities – at least when leverage in controlled for – are expected to provide similar returns and return volatilities and the same diversification benefits as direct real estate in a mixed-asset portfolio of a long-horizon buy-and-hold investor, such as a pension fund or a sovereign wealth fund. Obviously, listed real estate investments would then constitute an appealing avenue for investing in the asset class given the low transaction costs, flexibility and liquidity of such investments. Understanding the linkages between listed and direct real estate returns is also important to invest in a timely manner. For instance, the deviations from the long-run relations between the securitized and direct real estate markets that emerged during the Global Financial Crisis suggest that an investor should increase rather than decrease REIT allocations after a drastic drop in REIT prices caused by a financial crisis.

Given the importance of the topic for numerous types of investors, it is not surprising that the relationship between listed and direct real estate has been investigated intensively in the scholarly literature. While in the short-term listed real estate returns correlate strongly with the stock market rather than with the underlying real estate market returns, over the longer horizon listed real estate returns tend to co-move with the direct real estate market and the correlation with stock returns is weaker. The observed discrepancy between short- and long-term correlations is not surprising given the notable frictions in direct real estate markets that tend to make direct market price adjustments sluggish. Such sluggish price adjustments can cause lead-lag relations between REIT and direct market returns that diminish the short-term correlations. Concerning the similarity of returns and their volatilities for listed and direct investments, the evidence suggests that REIT and direct real estate mean returns and return volatilities do not differ from each other in a statistically significant manner.

While the trend in academic research has been towards using more and more narrowly defined real estate categories when comparing the return characteristics of listed with those of direct real estate investments, we move in the opposite direction in the current paper. That is, our aim is to ask a question that is relevant to many investors: do the broad REIT index return characteristics generally reflect those of the broad direct markets? If the answer is yes, an investor does not necessarily need to concentrate on the geographic and sectoral mixes in order to track broad private market performance by REITs. Hence, the aim of this paper is different from most of the recent studies on the topic: we do not aim to consider the sectoral mix, but rather explore whether, notwithstanding the effect of leverage, investing in the REIT index generates similar return characteristics (and therefore substitutability) as the direct real estate investment portfolio of institutional investors in that country.

Using data for six countries (U.K., France, Germany, the Netherlands for Europe, and the U.S. and Australia for the rest of the world) for the period 1998-2017, our results indicate that over the mid- to long-horizon, REIT and direct returns have similar return and risk characteristics and are highly correlated. Interestingly, the correlation is high whether or not one controls for the leverage of listed investments. In addition, the two types of exposure exhibit similar reactions to economic shocks. Thus, the paper makes a case that the two types of exposure to the asset class are largely substitutable over the long term and that investors do not need to worry much about compositional effects when aiming to track broad direct market performance with REITs.

While this appears to apply for a portfolio that is well diversified across major countries, it does not apply for all individual countries (Germany is an example). Moreover, the implication applies if the aim is to track a direct portfolio that would include similar leverage to that of REITs. If the aim is to track the unlevered direct portfolio performance, an investor would have to use other capital market instruments to remove the effect of leverage in REITs.

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Introduction

Real estate has been shown to provide significant diversification benefits in a portfolio containing financial assets but also other types of alternative assets (Hoesli et al., 2004; Lizieri, 2013; Pagliari, 2017; Delfim and Hoesli, 2019). Against this background, the question of whether listed real estate behaves as private real estate or as equities is an important one for investors. If listed and direct real estate returns are generated by a common "real estate factor" over the long horizon, then real estate securities – at least when leverage in controlled for – are expected to provide similar returns and return volatilities and the same diversification benefits as direct real estate in a mixed-asset portfolio of a long-horizon buy-and-hold investor, such as a pension fund or a sovereign wealth fund. Obviously, listed real estate investments would then constitute an appealing avenue for investing in the asset class given the flexibility, liquidity and low transaction costs of such investments.

Understanding the linkages between listed and direct real estate returns is also important to invest in a timely manner. For instance, the deviations from the long-run relations between the securitized and direct real estate markets that emerged during the Global Financial Crisis (GFC) (Hoesli and Oikarinen, 2012; Hoesli et al., 2015) suggest that, in contrast to the reported evidence such as in Devos et al. (2013), an investor should increase rather than decrease REIT allocations after a drastic drop in REIT prices caused by a financial crisis.

Given the importance of the topic for numerous types of investors, it is not surprising that the relationship between listed and direct real estate has been investigated intensively in the scholarly literature. The early studies indicated that, over the short term, listed real estate returns correlate strongly with the stock market rather than with the underlying real estate market returns (Giliberto, 1990; Gyourko and Keim, 1992). More recent evidence is also in line with that implication (MacKinnon and Al Zaman, 2009; Hoesli and Oikarinen, 2012). However, it also has been shown that over the longer horizon – at least when controlling for property type and the leverage of REITs – listed real estate returns tend to co-move with the direct real estate market and the correlation with stock returns is weaker (e.g., Hoesli and Oikarinen, 2012). The observed discrepancy between short- and long-term correlations is not surprising given the notable frictions in direct real estate markets that tend to make direct market price adjustments sluggish. Such sluggish price adjustments can cause lead-lag relations between REIT and direct market returns that diminish the short-term correlations. A number of studies provide evidence of such lead-lag relations (Geltner and Kluger, 1998; Li et al., 2009; Oikarinen et al., 2011; Hoesli and Oikarinen, 2012; Yunus et al., 2012; Haran et al., 2013; Hoesli et al., 2015).

The evidence on the similarity of returns and their volatilities is somewhat more mixed. In Pagliari et al. (2005) and Hoesli and Oikarinen (2016), REIT and direct real estate mean returns and return volatilities do not differ from each other in a statistically significant manner. Riddiough et al. (2005), in turn, report a three percentage point difference between REIT and direct real estate returns. Ling and Naranjo (2015) provide evidence of the REIT market outperforming the private real estate market in some property sectors, while direct real estate investments provide higher returns in some other markets. The latter two papers do not test for the significance of the differences, though. All of these studies aim to carefully control for property type and leverage.

While the trend in academic research has been towards using more and more narrowly defined real estate categories when comparing the return characteristics of listed with those of direct real estate investments, we move in the opposite direction. That is, our aim is to ask a question that is relevant to many investors: do the broad REIT index return characteristics generally reflect those of the broad direct markets? If the answer is yes, an investor does not necessarily need to concentrate on the geographic and sectoral mixes in order to track broad private market performance by REITs. Hence, the aim of this paper is different from most of the recent studies on the topic: we do not aim to consider the sectoral mix, but rather explore whether, notwithstanding the effect of leverage, investing in the REIT index generates similar return characteristics (and therefore substitutability) as the direct real estate investment portfolio of institutional investors in that country.

This study adds to the knowledge on how closely listed real estate returns reflect direct real estate returns in many ways. Relative to the extant literature on the topic, the paper contains several contributions in addition to using more recent data. These contributions include: (1) using data for more countries – altogether six (U.K., France, Germany, the Netherlands for Europe, and the U.S. and Australia for the rest of the world); (2) the estimation of both country-specific and panel models to increase the reliability and generalizability of the analysis; and (3) the estimation of a structural vector autoregressive model to better and more reliably interpret the various economic shocks in the model. This method helps identifying which shocks cause similar or different reactions on the two types of real estate exposure.

In addition to the listed and direct real estate and stock market indexes, we incorporate in the analysis a number of fundamental variables that are expected to influence and have been found to affect listed and direct real estate returns significantly and that can be utilized to identify the structural (i.e., more reliably identifiable) economic shocks. These variables include economic growth, the short-term interest rate, the default risk premium, consumer sentiment, and a global liquidity variable. The inclusion of the liquidity variable is a novelty and is done in order to investigate the influences of global liquidity shocks. We use annual data for the six countries for the period 1998-2017 and control for the leverage of listed investments.

Our results indicate that over the mid to long horizon, REIT and direct returns have similar return and risk characteristics and are highly correlated. Interestingly, the correlation is high whether or not one controls for the leverage of listed investments. Also, the two types of exposure exhibit similar reactions to economic shocks. Thus, the paper makes a case that the two types of exposure to the asset class are largely substitutable over the long term and that investors generally do not need to worry much about compositional effects when aiming to track broad direct market performance with REITs.

The remainder of the paper is structured as follows. We next present the method, before discussing the data. The following section contains a discussion of the results. A final section contains some concluding remarks.

Methods

In the empirical analysis, we investigate the mean returns, return volatilities, and correlation structures of listed and direct real estate investments. In addition, we estimate a structural vector-autoregressive (SVAR) model to study the return dynamics. Throughout the analysis, log returns are used, i.e., returns are computed as first differences of broad public and private real estate total return indexes in the natural log form.

Similar to previous studies that have investigated the question with statistical tests (Pagliari et al., 2005; Hoesli and Oikarinen, 2016), we apply the conventional F-test to study the equality of listed and direct real estate returns and volatilities. A novelty compared with earlier studies is the use of panel tests: we conduct tests including all the six countries together as a panel in addition to investigating each country separately. The panel approach enables us to consider the broader view. Both country level and panel level statistics are reported for the return correlations, too.

A complication that may weaken the reliability of the conventionally used F-test is that the F-test results can be highly dependent on the ending and starting dates of the sample period. Given the observed lead-lag relations between listed and direct real estate returns and the tendency of direct market prices to react to changes sluggishly, this can be problematic particularly if the starting or ending period represents an abnormal time period, such as a financial crisis time or a period with otherwise notable shocks in the market fundamentals. Also, (abnormally) prominent cycles, such as the one due to the GFC of the 2000s, and thereby unusually high return volatility in the sample period, increases the likelihood of accepting the null of similar returns in the F-test.

Hence, we also estimate panel regression models – that are less vulnerable to such complications – to test for the long-term relationship between the returns. In these regression models, (the natural log of) the REIT total return index (REIT) is the left-hand side variable, while the broad direct market return index (MSCI) is the right-hand side variable:

$$REIT_{i,t} = \alpha_i + \beta_i MSCI_{i,t} + \varepsilon_{i,t}. \quad (1)$$

Given that direct market returns can be endogenous with respect to REIT returns, we apply the Panel Fully-Modified OLS (FMOLS) estimator of Pedroni (2000, 2001) in these regressions. While the conventional fixed-effects and random-effects OLS estimators can exhibit endogeneity bias, the FMOLS estimator is consistent even in the presence of endogenous regressors and endogeneity arising due to possible omitted variables (Pedroni, 2001, 2007). We report regression results for both the pooled FMOLS estimator (PFMOLS) that does not allow for heterogeneity across the countries other than the country-specific fixed-effects (i.e., β_i is the same for all countries *i*) and the FMOLS mean-group estimator (MG-FMOLS) that allows for heterogeneity in the parameter estimate across countries for the direct market return index too (i.e., β_i varies across *i*). In contrast with the fixed-effects OLS estimator, the FMOLS estimators are also super-consistent in the presence of non-stationary but cointegrated data.

Based on the FMOLS regressions we then test for cointegration between the return indexes using the CIPS panel unit root test (Pesaran, 2007), and test for the hypothesis that $\beta_i = 1$ with the Wald F-test both for individual countries and at the panel level. This provides an additional advantage over the simple F-test on returns: a one-to-one cointegrating relation between two asset return indexes would indicate that the equivalence of mean returns is not just a coincidence that is likely to vanish in the future, but that there are strong economic forces keeping the series together in the long run due to an equilibrium relation between the series. This analysis is less prone to the potential complications caused by sample period timing: while the F-test is to a major extent based on the starting and ending values of return indexes, the tests grounded on the regression models are based on the relationship between the return indexes during the whole sample period. Moreover, the concept of cointegration allows for even large temporary deviations from a long-run equilibrium relation, and cointegration of return indexes would indicate that the return correlation approaches one as the assumed investment horizon is extended.

Any observed comovement between the REIT and direct market returns may be an indirect effect of economic factors, not due to a pure influence of the markets on each other; hence, it is interesting to study the influences of shocks in various economic factors that can be expected to affect listed and direct real estate returns. Vector autoregressive (VAR) models provide a useful tool to conduct such investigations. In particular, the investigation of impulse response functions derived from VAR models allows for the comparison of the reaction patterns of returns to various shocks. The analysis is particularly interesting if the shocks can be given economic interpretations in that the model restrictions are based on economic arguments and the observed impulse responses of the fundamental economic variables are sensible (i.e., they support the interpretation of the shock origin). In such case, the model may be called SVAR.

Given the limited number of observations for each individual country, we estimate a panel SVAR model to have enough observations for a meaningful analysis. To be more precise, the estimated model is a cointegrated SVAR, i.e., a model that includes an error-correction mechanism that takes account of the observed stationary long-term relations (cointegration) between the return indexes.

In panel (S)VAR models, the presence of lagged dependent variables on the right-hand side of the system of equations causes the well-known Nickell bias (Nickell, 1981). Therefore, we estimate the SVAR model with the Arellano and Bover (1995) GMM estimator that removes the bias. To identify the shocks for the purposes of impulse response analysis, only short-run restrictions are used in this analysis. The restrictions applied to identify the shocks are discussed in the results section.

It should be noted that all the panel analyses give equal weight to each of the six markets included in the analysis. Hence, the results from these analyses basically concern a portfolio with equal weights for each of the six countries.

Data

Given that much of the empirical evidence concerns the U.S. and to a lesser extent the U.K. (exceptions include Hoesli and Oikarinen 2012; Yunus et al., 2012; and Haran et al., 2013), our objective is to include as many countries as possible for which sufficient data are available. The available data allows us to include annual data for six countries, i.e., the U.K., France, Germany and the Netherlands for Europe, and the U.S and Australia for the rest of the world. The set of countries is highly representative as they account for over 70% of the free float of REIT market capitalization in developed countries. For direct real estate, we use the MSCI indexes of institutional real estate holdings, while for listed investments we use the FTSE EPRA Nareit indexes. The time period is from 1998 to 2017.

Direct returns are desmoothed using a desmoothing parameter of 0.5. Listed real estate returns are unlevered using the actual leverage of constituent companies in the FTSE EPRA Nareit indexes for each country. Similar to Pagliari et al. (2005) and Hoesli and Oikarinen (2016), we compute the unlevered REIT returns using the formula that is based on the well-known proposition of Modigliani and Miller (1958):

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

where r_{uit} = the unlevered REIT return in country *i* in period *t*, r_{eit} = the return on equity of REITs in country *i* in period *t*, r_{dit} = the cost of debt in country *i* in period *t*, and LTV_{it} = the REIT loan-to-value ratio in country *i* in period *t*. The cost of debt applied in the computations is the BBB rated corporate bond yield for the corresponding country sourced from Macrobond.

Figure 1 depicts the mean leverage level of constituent listed property companies over the time period. As one would expect, the leverage varies over time. Leverage also appears to be lower at the end of the time period than at the beginning. Figure 2 shows the indexes of direct real estate and unlevered listed investments. The indexes for the two types of exposure move by and large in line, except for Australia and Germany. In Australia, the listed market suffered heavily during the GFC and was slow in recovering thereafter. As a result, the increase in the index for the direct market is much more pronounced than that for the listed market. In Germany, the listed market outperformed the direct market as a consequence of the much higher weight of the residential sector in the listed index than in the direct index. Figure 3 depicts the indexes of levered and unlevered listed real estate. Leverage exerts a significant impact on returns. For instance, the drops in levered returns were much more pronounced than their unlevered counterparts during the GFC.

Based on theoretical considerations (i.e., the basic asset pricing formula) and previous empirical evidence (Hoesli and Oikarinen, 2012; Hoesli et al., 2015), the set of economic fundamentals incorporated in the SVAR model includes GDP, the risk premium, the short-term risk-free interest rate, and consumer sentiment. GDP measures growth in the real economy that influences the demand for real estate space, and thereby the expected rental cash flows. The default risk premium (*D*), which is defined as the spread between the low-grade corporate bond benchmark yield (BBB, Moody's) and the 10-year government bond yield, is expected to influence the risk premium component of the discount factor (i.e., the required rate of return) in the asset pricing formula. The short-term interest rate (*R*), too, can be assumed to affect the discount rate, and is measured by the three-month interbank rate. Finally, we use confidence indicators from national consumer opinion surveys to capture the consumer sentiment that is expected to predict future economic growth, and thereby rental cash flow growth. The sentiment component of the confidence indicators can be regarded as the component that is unrelated to prevailing economic fundamentals. Therefore, similar to, e.g., Lemmon and Portniaguina (2006), Ling et al. (2014), and Hoesli and Oikarinen (2015), we regress the differenced confidence indicator on the three economic fundamentals (differenced) mentioned above and use the residual series of this OLS regression as our sentiment measure (*S*). For France, Germany and the Netherlands, the GDP and *S* are at the country level, whereas *D* and *R* reflect the whole Euro area. For Australia, the U.K., and the U.S., all the aforementioned series are national ones.

As a novelty compared with earlier research on REIT and direct real estate market reactions to economic shocks, we additionally include in the analysis a variable that aims to capture global liquidity (*L*). Following the definition by the Bank of International Settlements (BIS), the term "global liquidity" refers here to the ease of financing in global financial markets. Given that we are interested in the influence of market and funding liquidity on the asset returns, our measure of global liquidity is the total credit from banks to the non-bank sector globally (this liquidity indicator is provided by BIS; for the global liquidity definitions, see Domanski et al., 2011). The liquidity measure as well as data on all the other economic fundamentals are downloaded from Macrobond.

As a preliminary check, we report panel unit root tests to examine the stationarity of each variable. Since the data include notable cross-sectional correlation, we report the cross-sectional augmented IPS (CIPS) panel unit root test (Pesaran, 2007). The CIPS test is based on ADF regressions that are augmented with cross-sectional averages of the variables (i.e., CADF regressions) and is thereby not biased by cross-sectional dependence in the data. The test also allows for heterogeneity across countries, as the CADF regressions are estimated separately for each country. The results reported in Table 1 indicate that, as expected based on earlier empirical evidence, the variables should be treated as non-stationary in levels. For all the differenced variables, the test statistics indicate stationarity.

Empirical analysis

RETURN AND VOLATILITY COMPARISONS

Table 2 reports the average returns, standard deviation of returns, and F-tests of equality of means and standard deviations for listed and direct real estate investments. Results are reported at the panel level and also by country. Most important for the purposes of this study is to consider the panel level results, reported at the top of Table 2: the panel level results in particular correspond to our "broad view" in terms of considering, in practice, a portfolio with equal weights for each of the six countries.

Panel results indicate that the returns on direct and listed investments are not statistically different from one another regardless of whether listed returns are levered or unlevered. In contrast, the variance of levered listed returns is much greater than that of direct real estate. This difference in variance disappears once listed returns are unlevered. The conclusions remain by and large the same when Germany – which differs from the other countries included in the analysis due to the greater discrepancy between FTSE EPRA Nareit and MSCI in the property sector composition – is excluded from the panel.

Returns of direct and listed real estate are not significantly different in any of the countries, and the return point estimates of unlevered REITs are close to those of direct real estate. The lack of any significant differences in average returns in individual countries may be partly due to the low number of observations (n = 19), though. In Germany and Australia, the difference between the average unlevered REIT returns and MSCI returns has been somewhat greater than in the other countries, over two percentage points in absolute value. REIT returns have been more volatile than direct real estate returns in all of the countries. However, the unlevered REIT returns were more volatile than the MSCI returns only in Germany and the Netherlands during the sample period, and the direct market appears to be very volatile in both the U.S. and the U.K. Germany stands out: the direct market has a very low volatility (even after desmoothing) and unlevered listed returns are much higher than returns on direct investments.[1]

Table 3 reports the correlations between investments over one- and two-year horizons at the panel level and by country. Table 3 also reports the correlations between real estate returns and overall stock market returns.[2] The panel results indicate that the correlation between listed and direct real estate increases with the time horizon, which is in line with the results of Hoesli and Oikarinen (2016) using property sector data for the U.S. market. At the two-year horizon, the correlation between listed and direct real estate is comparable to the correlation between listed real estate and common stocks. This can be seen clearly also in Figure 4 which shows the correlations at the panel level depending on the assumed investment horizon from one to five years. Beyond the two-year horizon the correlation between listed and direct real estate continues to increase while the correlation between listed real estate and stocks declines. Unlevering listed returns does not alter any of those conclusions.

While the small number of observations does not allow for similar country-level correlation curves as presented in Figure 4, the panel level analysis in any case is the important one for the broad view of comparing the listed and direct markets. Nevertheless, country-level results also show that the correlation between listed and direct real estate increases with the time horizon extending from one to two years (Table 3). However, those results show contrasting results pertaining to the linkages between listed real estate and direct investments and stocks, respectively. While listed real estate appears to be much more highly correlated with stocks than with direct real estate in Germany and the Netherlands, listed real estate is more heavily related with direct investments than with stocks in the U.K. and in the U.S. (only at the two-year horizon).

In Germany, the correlation between listed and direct real estate is very low. This is due to different property types being considered in each index – residential REITs versus commercial real estate for the

[1] The desmoothing parameter of 0.5 implies that appraised values take one year to reflect market conditions. We also tested whether the volatility difference between MSCI and unlevered REITs in Germany becomes insignificant if a desmoothing parameter of 0.67 is applied (this parameter assumes that it takes two years for the appraisals to reflect market conditions). With this desmoothing parameter, the direct market standard deviation increases from 3.64% to 4.97%, but the volatility difference between the assets remains significant even in this case.

[2] The correlations over horizons longer than one year are computed using overlapping observation windows to keep the number of observations greater and thus to be able to estimate the correlations more reliably. The stock returns are based on broad stock market total return indexes for each country: ASX (Australia), CAC40 (France), MDAX (Germany), AEX All Share (Netherlands), FTSE All Share (U.K.), and S&P 500 Composite (U.S.).

direct market. This implies that if the property-type mixes are "too" far apart, then the broad REIT and direct market portfolios/indexes do not work as substitutes, although they do so at the broad international, multi-country level.

Table 4 contains the FMOLS results. In the FMOLS and SVAR models, we use only unlevered REIT data. The pooled FMOLS results show that there has been no statistically significant difference in the long-term developments between listed and direct real estate: the point estimate is 1.02, and the one-to-one relationship between the indexes cannot be rejected by the Wald test. The MG-FMOLS estimate also is close to one, indicating that over the long run the return indexes have grown at about the same pace, although the point estimate of 1.11 is statistically different from one implying that unlevered REIT returns have overall been slightly greater over the sample period than the broad direct market returns. These models also are cointegrated based on the CIPS test, indicating that the estimated relationship represents a tight long-term relationship between the indexes towards which the markets tend to move. Figure A1 in the appendix shows that – despite some notable deviations in the short-term, especially around the GFC period – the REIT (unlevered) total return indices follow the estimated relations closely during the sample period.

Given the peculiarity of the German case, we repeat the estimations without Germany. Again, the point estimates are close to one, and the hypothesis of the coefficient on MSCI being equal to one is now accepted in both PFMOLS and MG-FMOLS models, only the MG-FMOLS model being stationary though. Therefore, the panel FMOLS models overall present evidence of similar unlevered REIT and direct real estate investment market returns in the long run. That is, even though there is heterogeneity across countries as exhibited by the homogeneity test statistics and the individual country point estimates, the key insight of the regression models is that an investor can track the longer-run return developments of a broad direct market investment portfolio that includes real estate from the six developed countries by investing in broad REIT indices for the same countries. The observed heterogeneity suggests that the GM-FMOLS results are more reliable, i.e., the GM-FMOLS results are the preferred ones.

The detected cointegrating relationship between unlevered listed and direct real estate is in line with several previous studies for individual countries in which property type has been controlled for (Boudry et al., 2012; Hoesli and Oikarinen, 2012, 2016; Yunus et al., 2012; Hoesli et al., 2015; of these, only Hoesli and Oikarinen, 2016, test for the one-to-one relationship between REIT and direct market return indexes). These analyses generally suggest that only direct real estate prices adjust towards the long-run relation. An exception is the study by Boudry et al. (2012) which reports significant adjustment of both securitized and direct markets.

PANEL SVAR ANALYSIS

Given that the return indexes are cointegrated, the estimated SVAR model includes an error-correction mechanism: the one period lagged deviation of REITs (based on the MG-FMOLS model) from the long-term relation is included in the analysis as an additional variable in the equations for real estate returns. Hence, the estimated system is a cointegrated SVAR model (or a "structural vector error-correction model"). In line with most previous evidence, only direct market returns appear to be significantly affected by the deviation of REITs from the equilibrium relation (i.e., only the direct market adjusts towards the long-run relation), the estimated annual adjustment speed being 23%. Nevertheless, we do not restrict REITs to be weakly exogenous, i.e., we allow for REITs too to adjust towards the long-term relation (the adjustment speed is approximately 1%). This does not affect the SVAR results.

In addition to the real estate returns and the error-correction term, the SVAR model includes five fundamentals: *GDP*, *D*, *R*, *S*, and *L*, of which GDP and global liquidity are in the natural log form. The fundamentals are included in the model in differences, as they are non-stationary in levels but stationary in the first difference. The model includes one lag based on the Schwartz Bayesian Criterion.

In this analysis, the aim of the estimation of the cointegrated SVAR model is to investigate and compare the reaction patterns of broad REIT market returns and broad direct real estate market returns to various economic shocks. Hence, the computation and examination of impulse response functions (IRFs) is of major interest here. We identify the shocks from the system by exposing 15 short-term restrictions in the model. Hence, the model is just-identified. The restrictions are based on theoretical considerations and previous empirical observations regarding the reactions of the variables to various shocks. It is assumed that GDP is only affected contemporaneously by its own shocks, but shocks in GDP influence all the other variables simultaneously. This is a common assumption in SVAR models, as the real economy is usually assumed and has been shown to respond only sluggishly to shocks in other variables, and because changes in income (GDP) are expected to affect rapidly the other variables.

The sentiment, too, is assumed to be sluggish to react: *S* is allowed to react contemporaneously only to shocks in GDP, since sentiment tends to be considerably more rigid to adjust in the short term than financial variables. As listed securities should react immediately to shocks in the fundamentals, we do not impose any restrictions on the short-term REIT reactions. However, given the substantial frictions in the direct real estate market and the lead-lag relations between REIT and direct market returns observed in the literature (Hoesli and Oikarinen, 2012; Yunus et al., 2012; Haran et al., 2013; Hoesli et al., 2015), the direct market is restricted to react to REIT shocks only with lag. Although the empirical literature suggests that the direct market absorbs the information revealed by the listed market only sluggishly, we also investigated whether the IRFs are notably different if the direct market is allowed to concurrently react to REIT shocks. While there are no more than negligible differences in the other IRFs, the assumption affects the short-term reaction of direct real estate to a REIT shock. Hence, we also show the direct real estate response based on the alternative assumption below.

To distinguish the shocks stemming from financial market variables from each other, we impose restrictions to the short-term reactions of *D*, *L*, and *R*. For one, we wish to be able to make a distinction between credit/liquidity supply shocks ("global liquidity shocks") and credit demand shocks. In the empirical literature, it has proven to be extremely hard to separate between credit supply and credit demand shocks in SVAR analyses (Peek et al., 2003; Uhlig, 2005; Helbling et al., 2011). Second, the aim is to identify a risk premium shock that can be distinguished from the credit supply and demand shocks. For these purposes, we allow *R* to simultaneously react to the other two financial market shocks, while L does not respond immediately to shocks originating from *R*, and *D* is restricted not to react immediately to shocks taking place in *L* or *R*. Furthermore, *D*, *L*, and *R* are restricted not to react concurrently to the real estate market shocks, which also helps in distinguishing real estate shocks from shocks that potentially originate from the economic fundamentals included in the analysis. As explained below, the imposed restrictions yield shocks that can be interpreted as liquidity supply, credit demand, and risk premium shocks as wished.[3]

Figures 5 to 6 show the reactions (i.e., the IRFs) of unlevered REIT returns and direct market returns to the seven shocks up to eight years from the shock.[4] The accumulated IRFs are shown to illustrate the overall longer-term reactions. The first shock is interpreted as an aggregate demand shock in the

[3] The identification of the IRFs is based on a short-term restriction structure similar to the Choleski decomposition. Nevertheless, since the ordering of the variables, i.e. the imposed restrictions, are based on economic considerations and reasonable economic interpretation can be given for each of the seven shocks, the model can be seen as a SVAR.

[4] In the SVAR analysis too, the results basically are based on assuming similar portfolio weights for each of the countries.

economy, as it increases both GDP and the short-term interest rate in the short and long term.[5] The second shock is a positive sentiment innovation that leads to asset price increases and to GDP growth with lag. The third shock can be interpreted as an unexpected increase in the risk premium, leading to lower GDP, asset prices, and global liquidity. The fourth and fifth shocks, in turn, can be distinguished as a positive global liquidity (credit supply) shock and positive credit demand shock. A positive credit supply shock is one that increases credit with no increase, or even a decrease as in our case, in the interest rate. In contrast, a positive credit demand shock leads to increases in both credit and the interest rate. Finally, the two last shocks are those originating from the direct real estate market (sixth shock) and the REIT market (seventh shock).

Figure 5 includes the reactions of listed and direct real estate to the five first shocks, i.e., to shocks in the economic fundamentals. The most important observation is that the reactions to the different shocks generally are similar. This is particularly prominent over longer horizons, implying that REITs and direct real estate provide similar exposures to various economic risk factors over investment horizons that are typical for real estate investors, and is in line with the results reported above in that a broad REIT index can be used to track the broad direct market performance reasonably well. The estimated IRFs are also in line with those presented in Hoesli and Oikarinen (2012). The important difference between this analysis and that of Hoesli and Oikarinen (2012) is that, in contrast with the latter paper, sectoral-mix is not controlled for in the current analysis. Thus, our SVAR results too include the novel implication that an investor does not necessarily need to worry about sectoral composition when aiming to track the broad direct investment market performance by REITs, as a broad REIT index appears to do a good job in giving such an exposure, at least if an investor is aiming to diversify across the six countries included in this analysis.

Other novelties in this analysis compared with that in Hoesli and Oikarinen (2012) are the use of a panel of multiple countries, the examination of the shocks based on a structural VAR, and the inclusion of the global liquidity measure in the model, and hence the investigation of the influences of a global liquidity shock. As expected, real estate returns are positively influenced by the sentiment and global liquidity shocks: while higher sentiment predicts greater growth in demand for real estate space, better liquidity (thereby greater availability of credit) is expected to increase asset demand. Also in line with prior expectations, a risk premium shock has a negative impact on real estate values. The influence of the aggregate demand shock on real estate is negative initially due to an increased interest rate (discount factor effect), but turns positive over the longer run. Because of the increased interest rate, the short-term effect of a credit demand shock on real estate returns is negative, but this influence vanishes in the long term.

Interestingly, the real estate shocks have a positive effect on global liquidity. This interaction between global liquidity (i.e., global availability of credit) and real estate values[6] is in line with the financial accelerator mechanism (Bernanke et al., 1996, 1999; Kiyotaki and Moore, 1997). Such interaction can create a strong mechanism through which self-reinforcing cycles between real estate values and credit supply takes place and can strengthen or even cause macroeconomic cycles. This can also be seen in the listed and direct real estate reactions to the global liquidity shock: they keep increasing still many years after the initial shock.

Figure 6 presents the reaction of real estate returns to shocks in each other. While the listed market reacts rapidly to direct real estate market shocks, the response of the direct market to shocks in the listed market is highly sluggish. This is in line with earlier literature. Naturally, the observed direct

[5] This kind of shock can originate, e.g., from increased demand for exports.

[6] It is reasonable to assume that the influence of a global liquidity shock on the real estate market total returns take place (at least mostly) through changes in the listed and direct real estate values, rather than through rental cash flows.

market reaction is more rapid if direct real estate is allowed to immediately react to REIT shocks (shown by the dashed curve), but even in that case the first year reaction is less than half of the eventual overall influence of the shock. Anyhow, over the longer horizon the responses of listed and direct markets converge, indicating that over a several year horizon the two types of real estate assets react to the shocks in a similar manner.

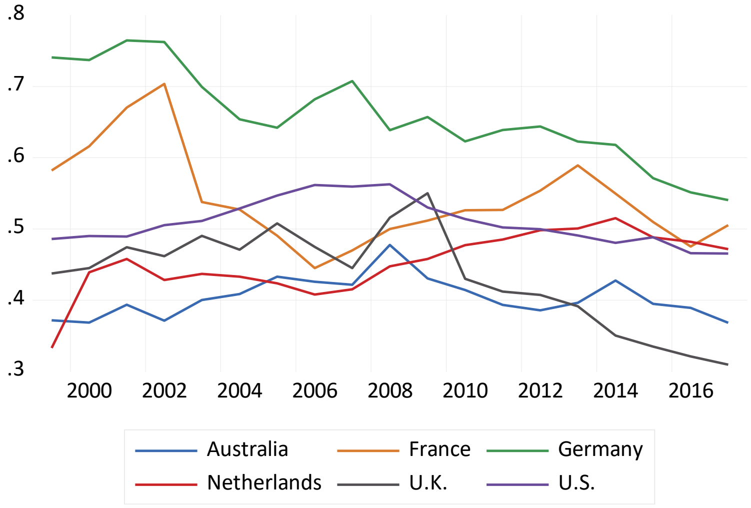
Conclusions

This paper makes use of data for six important countries (Australia, France, Germany, the Netherlands, the U.K., and the U.S., together accounting for over 70% of the free float of REIT market capitalization in developed countries) and modern panel econometric modelling to shed more light on the relationship between listed and direct real estate investments. In contrast to prior research, we adopt a broad approach in that we consider a panel of several countries and whether investing in a REIT index rather than a direct index – i.e., without controlling for compositional effects related to property types and locations – yields similar return and risk characteristics. Our results suggest that this is indeed the case. Once leverage has been controlled for, the return and risk characteristics of the two types of real estate exposure are not significantly different at the panel level. The correlation between listed and direct real estate increases with the time horizon, while the correlation between listed real estate and stocks declines. The returns of the two types of exposure also react similarly to various economic shocks, including shocks in the listed and direct real estate markets. This indicates that the broad listed and direct real estate return indexes provide similar exposures to economic risk factors.

Given the aim, data, and methods in this study, the main conclusions concern an investor who aims to track the performance of a broad portfolio of direct real estate investment in a number of prominent markets by investing in listed real estate. For such an investor, the key implication is that one does not necessarily need to put effort in trying to track the property type mix and within country geographic composition of the direct investment market (or, a broad direct market return index, such as the MSCI index), as even the broad REIT indexes appear to do reasonably well in tracking the broad direct market performance over a mid- to long-term investment horizon.

While this appears to be the case for a portfolio that is well diversified across major countries, it does not apply for all individual countries: in single countries the discrepancy in the property type compositions of REITs compared with the direct market (as proxied by the MSCI index) can be large enough to yield notable differences in the performance between the listed and direct markets (Germany is an example). Moreover, the implication applies if the aim is to track a direct portfolio that would include similar leverage to that of REITs. If the aim is to track the unlevered direct portfolio performance, an investor would have to use other capital market instruments to remove the effect of leverage in REITs.

Figure 1. Mean leverage of listed companies



Source: EPRA

Figure 2. Indexes of unlevered listed and direct real estate

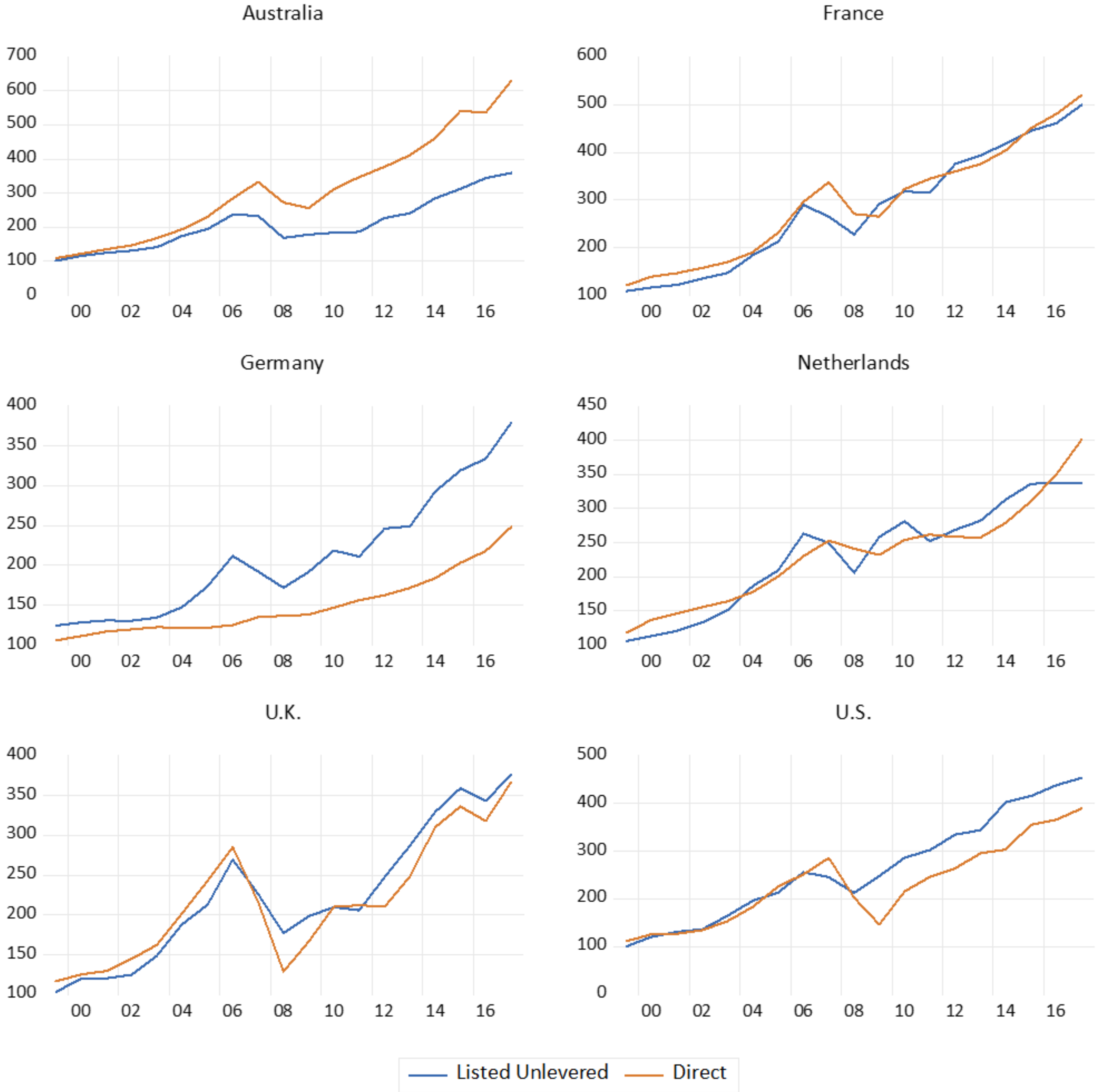


Figure 3. Indexes of levered and unlevered listed real estate

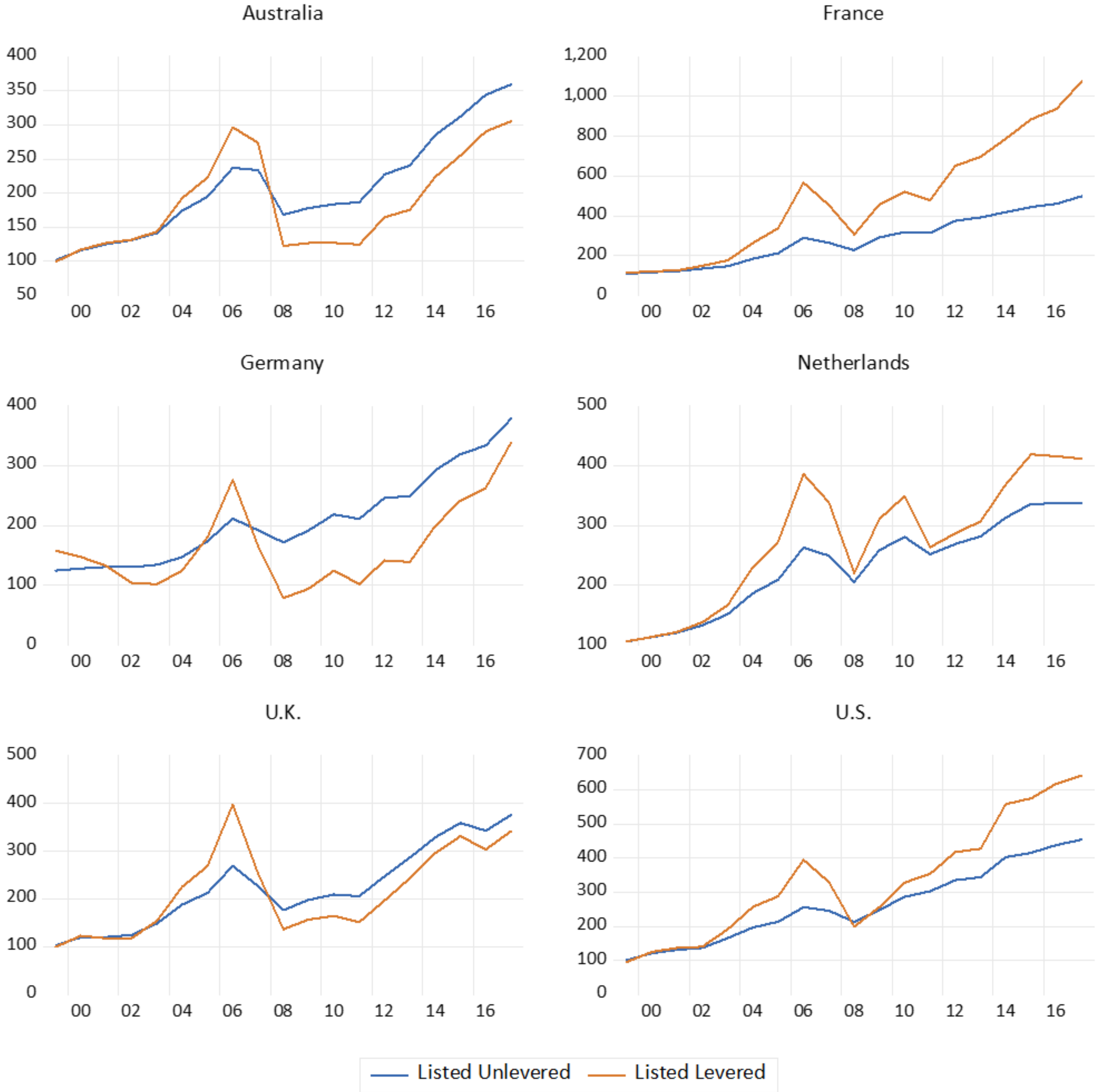


Figure 4. Correlations between listed real estate and direct real estate and stocks

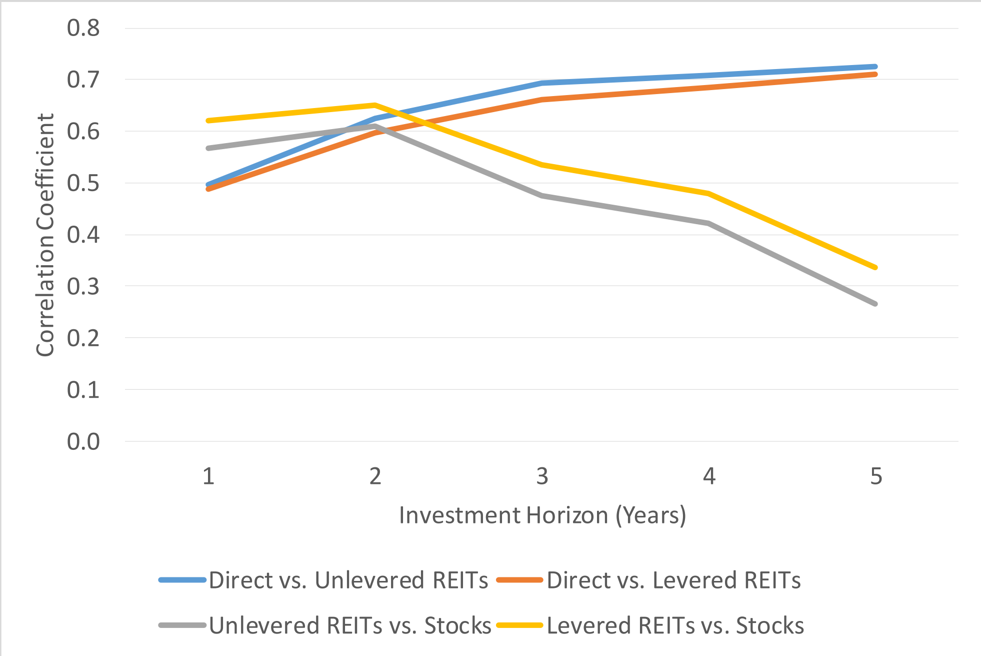


Figure 5. Accumulated impulse responses of listed and direct real estate to one standard deviation shocks in economic fundamentals

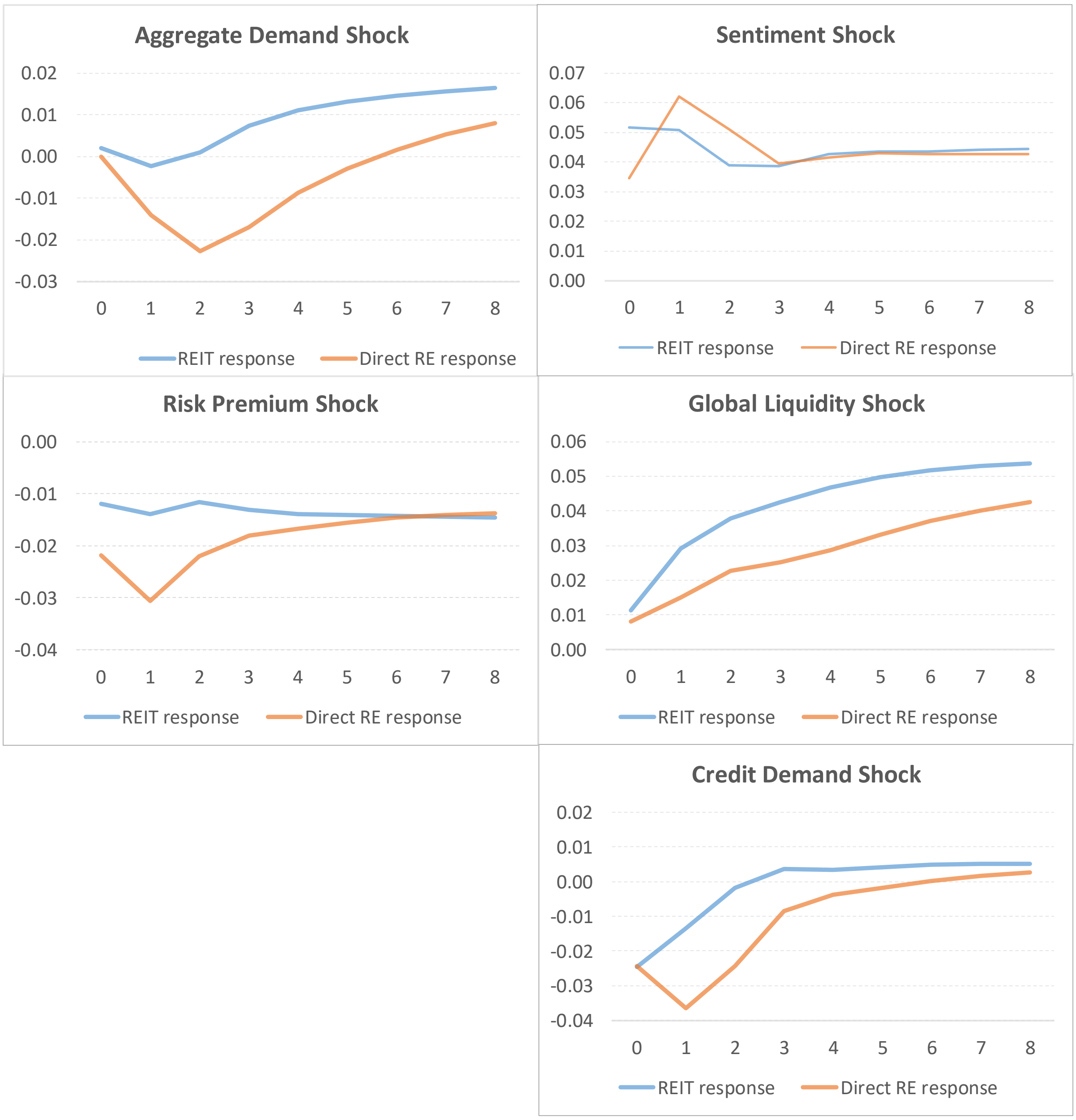


Figure 6. Accumulated impulse responses of listed and direct real estate to one standard deviation shocks in each other

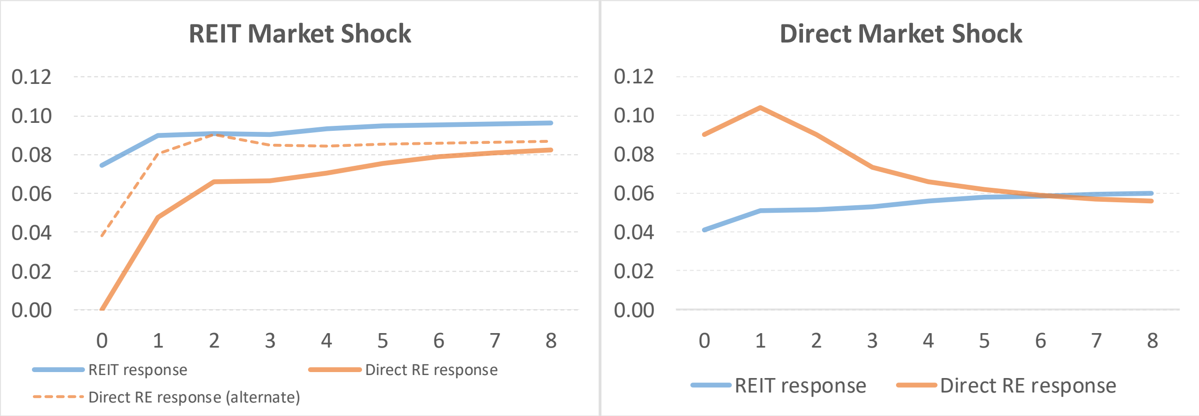


Table 1. CIPS unit root test statistics

Variable	Level	Difference
REIT	−1.115	−3.786**
Direct real estate	−2.240	−3.133**
GDP	−1.277	−1.729*
Interest rate	−1.726	−2.673**
Risk premium	−2.146	−5.939**
Sentiment	−2.274	−3.569**
Global liquidity [a]	−1.374 [a]	−2.086* [a]

Note: * and ** denote statistical significance in the CIPS unit root test at the 5% and 1% level, respectively. The null hypothesis in the CIPS test is that of non-stationarity. The CIPS test statistics are based on country-specific CADF regressions. The number of lags in the CADF regressions is allowed to vary across countries. For each country, the lag length is based on the general-to-specific method, using a threshold significance level of 5% and a maximum lag length of four. The CADF regressions for levels include a country-specific intercept, and those for differenced variables do not include any deterministic variables. [a] Since the global liquidity variable is the same for all the countries, the DF-GLS unit root test is applied to the global liquidity series.

Table 2. Means, standard deviations, and F-tests by country and overall (with and without Germany)

	With Germany				Without Germany			
	Average (%)	Std Dev (%)	F-test (p-value) of Equal Means	F-test (p-value) of Equal Variances	Average (%)	Std Dev (%)	F-test (p-value) of Equal Means	F-test (p-value) of Equal Variances
Panel Overall								
Direct	7.41	11.91			7.93	12.91		
Listed Lev.	8.09	23.65	0.785	0.000***	8.42	21.71	0.851	0.000***
Listed Unlev.	7.25	10.50	0.918	0.181	7.30	10.74	0.716	0.077*
Australia								
Direct	9.68	9.70						
Listed Lev.	5.88	23.52	0.519	0.001***				
Listed Unlev.	6.73	11.58	0.401	0.461				
France								
Direct	8.67	9.95						
Listed Lev.	12.51	21.24	0.480	0.002***				
Listed Unlev.	8.46	10.84	0.951	0.719				
Germany								
Direct	4.78	3.44						
Listed Lev.	6.42	22.71	0.827	0.000***				
Listed Unlev.	7.01	9.42	0.340	0.000***				
Netherlands								
Direct	7.31	6.31						
Listed Lev.	7.45	19.51	0.977	0.000***				
Listed Unlev.	6.39	10.62	0.749	0.033**				
U.K.								
Direct	6.84	18.94						
Listed Lev.	6.47	25.44	0.960	0.221				

Listed Unlev.	6.97	12.65	0.980	0.095*
U.S.				
Direct	7.16	16.50		
Listed Lev.	9.79	19.97	0.661	0.426
Listed Unlev.	7.96	8.68	0.853	0.009***

Table 3. Correlations between investments over one- and two-year horizons

	One-Year Correlations			Two-Year Correlations		
Panel Overall (With Germany)	Direct	Listed Levered	Listed Unlevered	Direct	Listed Levered	Listed Unlevered
Listed Levered	0.488***			0.597***		
Listed Unlevered	0.496***	0.962***		0.625***	0.956***	
Stocks	0.372***	0.620***	0.568***	0.396***	0.651***	0.609***
Panel Overall (Without Germany)	Direct	Listed Levered	Listed Unlevered	Direct	Listed Levered	Listed Unlevered
Listed Levered	0.581***			0.704***		
Listed Unlevered	0.536***	0.988***		0.666***	0.986***	
Stocks	0.434***	0.608***	0.578***	0.483***	0.596***	0.596***
Australia	Direct	Listed Levered	Listed Unlevered	Direct	Listed Levered	Listed Unlevered
Listed Levered	0.705***			0.832***		
Listed Unlevered	0.665***	0.992***		0.825***	0.996***	
Stocks	0.508**	0.789***	0.768***	0.647***	0.803***	0.822***
France	Direct	Listed Levered	Listed Unlevered	Direct	Listed Levered	Listed Unlevered
Listed Levered	0.522**			0.623***		
Listed Unlevered	0.490***	0.990***		0.612***	0.985***	
Stocks	0.585***	0.587***	0.549**	0.586**	0.669***	0.637***
Germany	Direct	Listed Levered	Listed Unlevered	Direct	Listed Levered	Listed Unlevered
Listed Levered	0.072			0.108		
Listed Unlevered	0.001	0.971***		0.012	0.978***	
Stocks	0.058	0.682***	0.562**	-0.059	0.850***	0.804***
Netherlands	Direct	Listed Levered	Listed Unlevered	Direct	Listed Levered	Listed Unlevered
Listed Levered	0.244			0.354		
Listed Unlevered	0.202	0.992***		0.341	0.584**	
Stocks	0.349	0.629***	0.592***	0.298	0.538**	0.989***

U.K.	Direct	Listed Levered	Listed Unlevered	Direct	Listed Levered	Listed Unlevered
Listed Levered	0.849***			0.893***		
Listed Unlevered	0.820***	0.994***		0.870***	0.994***	
Stocks	0.605***	0.571**	0.549**	0.576**	0.637***	0.630***
U.S.	Direct	Listed Levered	Listed Unlevered	Direct	Listed Levered	Listed Unlevered
Listed Levered	0.424*			0.700***		
Listed Unlevered	0.352	0.984***		0.632***	0.982***	
Stocks	0.370	0.607***	0.518**	0.518**	0.632***	0.542**

Table 4. FMOLS results

Dependent variable: REIT				
Right-hand side variable: MSCI				
Panel Results				
	With Germany		**Without Germany**	
	Pooled FMOLS	Mean-Group FMOLS	Pooled FMOLS	Mean-Group FMOLS
Coefficient	1.017***	1.114***	0.988***	1.053***
(Standard Error)	(0.055)	(0.037)	(0.053)	(0.036)
CIPS Test	– 2.152***	– 2.670***	– 1.507	– 2.546***
Wald Test	0.756	0.000***	0.816	0.141
Homogeneity Test		0.000***		0.000***

Individual Country Coefficients

	Australia	France	Germany	Netherl.	U.K.	U.S.
Coefficient	0.659***	1.119***	1.412***	1.153***	1.137***	1.199***
(Standard Error)	(0.047)	(0.042)	(0.000)	(0.086)	(0.079)	(0.106)
Wald Test	0.000***	0.017***	0.006***	0.114	0.156	0.105

Note: The CIPS unit root tests do not include deterministic variables, since the residuals from FMOLS equations should not be trending in the presence of cointegration (adding a constant term in the tests would allow for trending residuals). The homogeneity test is the F-test proposed by Pedroni (2007), where the null hypothesis is that of homogenous slope coefficients across countries. The null hypothesis in the Wald test is that the coefficient on MSCI equals one.

References

Arellano, M. & Bover, O. (1995). Another Look at the Instrumental Variable Estimation of Error-Components Models, Journal of Econometrics, 68(1), 29-51.

Bernanke, B., Gertler, M. & Gilchrist, S. (1996). The Financial Accelerator and the Flight to Quality, Review of Economics and Statistics, 78, 1-15.

Bernanke, B., Gertler, M. & Gilchrist, S. (1999). The Financial Accelerator in a Quantitative Business Cycle Framework, in Taylor, J. and M. Woodford (Eds), Handbook of Macroeconomics, Amsterdam: North-Holland.

Boudry, W. I., Coulson, N. E., Kallberg, J. G. & Liu, C. H. (2012). On the Hybrid Nature of REITs, Journal of Real Estate Finance and Economics, 44(1/2), 230-249.

Delfim, J.-C. & Hoesli, M. (2019). Real Estate in Mixed-Asset Portfolios for Various Investment Horizons, Journal of Portfolio Management, 45(7), 141-158.

Devos, E., Ong, S.-E., Spieler, A. C. & Tsang, D. (2013). REIT Institutional Ownership Dynamics and the Financial Crisis, Journal of Real Estate Finance and Economics, 47(2), 266-288.

Domanski, D., Fender, I. & McGuire, P. (2011). Assessing Global Liquidity, BIS Quarterly Review, December 2011, 57-71.

Geltner, D. & Kluger, B. (1998). REIT-Based Pure-Play Portfolios: The Case of Property Types, Real Estate Economics, 26(4), 581-612.

Giliberto, S. M. (1990). Equity Real Estate Investment Trusts and Real Estate Returns, Journal of Real Estate Research, 5(2), 259–263.

Gyourko, J. & Keim, D. B. (1992). What Does the Stock Market Tell Us about Real Estate Returns?, Real Estate Economics, 20(3), 457–485.

Haran, M., Davis, P., McCord, M., Grissom, T. & Newell, G. (2013). Equities or Real Estate? An International Evaluation of Listed Property Markets, Journal of European Real Estate Research, 6(2), 139-162.

Helbling, T., Huidrom, R., Kose, M. A. & Otrok, C. (2011). Do Credit Shocks Matter? A Global Perspective, European Economic Review, 55(3), 340-353.

Hoesli, M., Lekander, J. & Witkiewicz, W. (2004). International Evidence on Real Estate as a Portfolio Diversifier, Journal of Real Estate Research, 26(2), 161-206.

Hoesli, M. & Oikarinen, E. (2012). Are REITs Real Estate: Evidence from International Sector Level Data, Journal of International Money and Finance, 31(7), 1823-1850.

Hoesli, M. & Oikarinen, E. (2016). Are Public and Private Asset Returns and Risks the Same? Evidence from Real Estate Data, Journal of Real Estate Portfolio Management, 22(2), 179-198.

Hoesli, M., Oikarinen, E. & Serrano, C. (2015). Do Public Real Estate Returns Really Lead Private Returns?, Journal of Portfolio Management, 41(6), 105-117.

Kiyotaki, N. & Moore, J. (1997). Credit Cycles, Journal of Political Economy, 105(2), 211-248.

Lemmon, M. & Portniaguina, E. (2006). Consumer Confidence and Asset Prices: Some Empirical Evidence, Review of Financial Studies, 19(4), 1499-1529.

Li, J., Mooradian, R. M. & Yang, S. X. (2009). The Information Content of the NCREIF Index, Journal of Real Estate Research, 31(1), 93-116.

Ling, D. C., Naranjo, A. & Scheick, B. (2014). Investor Sentiment, Limits to Arbitrage and Private Market Returns, Real Estate Economics, 42(3), 531-577.

Ling, D. C. & Naranjo, A. (2015). Returns and Information Transmission Dynamics in Public and Private Real Estate Markets, Real Estate Economics, 43(1), 163-208.

Lizieri, C. (2013). After the Fall: Real Estate in the Mixed Asset Portfolio in the Aftermath of the Global Financial Crisis, Journal of Portfolio Management, 39(5), 43-59.

MacKinnon, G. H. & Al Zaman, A. (2009). Real Estate for the Long Term: The Effect of Return Predictability on Long-Horizon Allocations, Real Estate Economics, 37(1), 117-153.

Nickell, S. (1981). Biases in Dynamic Models with Fixed Effects, Econometrica, 49(6), 1417-1426.

Oikarinen, E., Hoesli, M. & Serrano, C. (2011). The Long-Run Dynamics between Direct and Securitized Real Estate, Journal of Real Estate Research, 33(1), 73-103.

Pagliari Jr, J. L. (2017). Another Take on Real Estate's Role in Mixed-Asset Portfolio Allocations, Real Estate Economics, 45(1), 75-132.

Pagliari Jr, J. L., Scherer, K. A. & Monopoli, R. T. (2005). Public versus Private Real Estate Equities: A More Refined, Long-Term Comparison, Real Estate Economics, 33(1), 147-187.

Pedroni, P. (2000). Fully Modified OLS for Heterogeneous Cointegrated Panels, in Baltagi, B.H. (Ed.), Nonstationary Panels, Cointegration in Panels and Dynamic Panels. Amsterdam: Elsevier.

Pedroni, P. (2001). Purchasing Power Parity Tests in Cointegrated Panels, Review of Economics and Statistics, 83(4), 727–731.

Pedroni, P. (2007). Social Capital, Barriers to Production and Capital Shares: Implications for the Importance of Parameter Heterogeneity from a Nonstationary Panel Approach, Journal of Applied Econometrics, 22(2), 429–451.

Peek, J., Rosengren, E. S. & Tootell, G. M. B. (2003). Identifying the Macroeconomic Effect of Loan Supply Shocks, Journal of Money, Credit and Banking, 35(6), 931-946.

Pesaran, M. H. (2007). A Simple Panel Unit Root Test in the Presence of Cross-Section Dependence, Journal of Applied Econometrics, 22(2), 265–312.

Riddiough, T. J., Moriarty, M. & Yeatman, P. J. (2005). Privately Versus Publicly Held Asset Investment Performance, Real Estate Economics, 33(1), 121-146.

Uhlig, H. (2005). What are the Effects of Monetary Policy on Output? Results from an Agnostic Identification Procedure, Journal of Monetary Economics, 52(2), 381-419.

Yunus, N., Hansz, J. A. & Kennedy, P. J. (2012). Dynamic Interactions between Private and Public Real Estate Markets: Some International Evidence, Journal of Real Estate Finance and Economics, 45(4), 1021-1040.

Appendix

Figure A1. Actual unlevered listed indexes and MG-FMOLS fits