
THE LIMITED DIVERSIFICATION POTENTIAL OF 21ST CENTURY REAL ESTATE: AN INTERNATIONAL ANALYSIS

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Annual ERES meeting, Cergy-Pontoise, France
4th July 2019

Motivation

Does the world need another real estate diversification study?

- Many existing studies use established MPT framework but are limited in terms of geographic scope and data availability
- Most studies do not distinguish between the short-term and long-term relationship

This study:

- Global scope
- Separate short and long-term estimation

Previous work

- In direct real estate, sufficient diversification may only be achievable for very large institutional portfolios, REITs potentially offer an attractive alternative
- Most studies point to a positive correlation between REITs and equity markets (Peterson and Hsieh, 1997, Hoesli and Serrano, 2007, Lizieri, 2013, Hoesli and Oikarinen, 2016).
- Inflation hedge: (Hoesli and Lizieri, 2008), stronger for private than public RE
- Eichholtz et al (1995): property type vs regional diversification, USA vs UK. US-retail portfolio is nearly as diversified as a fully diversified portfolio.
- Heaney and Srikanthakumar (2012), Lizieri (2013) and Sing and Tan (2013) relationship between equity market returns and those of the direct real estate market not stable over time, co-movement higher during downturns

Previous work (continued)

- Adams et al (2015): US REITs spillover effects: stronger for REITs in spatial proximity and during financial crises
- Summary: most studies find co-movement, particularly during market downturns and financial crises

Data

- Sources:
 - MSCI (ex IPD): returns per country and per segment ;
 - OECD: weighted composite index of housing prices (benchmark).
- Final sample:
 - 14 countries, 3 segments (residential/commercial/office)
 - Annual returns from 2001 to 2017

MSCI Multi-Country Total Return Data 2001-17

Table 1: Real estate data returns - Descriptive statistics

	AU	DE	FI	FR	GE	IR	NL	NO	PL	SA	SP	SW	UK	USA
Mean	0.126	0.079	0.065	0.088	0.044	0.079	0.069	0.086	0.078	0.108	0.076	0.076	0.067	0.075
Mediane	0.146	0.071	0.059	0.083	0.044	0.097	0.077	0.096	0.102	0.113	0.09	0.092	0.068	0.079
Std Error	0.129	0.048	0.018	0.058	0.027	0.177	0.045	0.077	0.049	0.164	0.082	0.087	0.146	0.124
Kurstosis	-1.223	1.657	2.446	1.107	0.142	1.382	-1.243	-0.962	-1.499	-1.048	-0.416	-0.385	2.037	0.501
Skewness	-0.107	1.464	1.472	0.331	0.484	-0.887	-0.291	-0.181	-0.514	0.121	-0.651	-0.327	-1.127	-0.037
Minimum	-0.092	0.032	0.04	-0.023	0.001	-0.353	-0.01	-0.06	0.001	-0.153	-0.099	-0.082	-0.328	-0.147
Country level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector level	No	No	Yes	Yes	Yes	No	Yes	No	No	No	No	Yes	Yes	Yes

Notes: This table reports descriptive statistics of real estate data returns. Initial dataset is extracted from MSCI (ex IPD) database. MSCI provides returns in local currencies, so returns are converted in EUR.

Empirical challenges

I) Data issues:

- REITS

- Pros : availability of market data, high frequency data;
- Cons: returns tend to be correlated with equity markets, difficult to classify into sectors.

- MSCI (ex IPD):

- Pros: directly observed performance of assets, systematic classification into sectors
- Cons: valuation-based, data limitations.

Empirical challenges

II) Econometric issues:

- Small sample: < 50 observations per country and per segment :
 - Methodology
 - Coefficient estimates
 - Robust confidence intervals
- Potential bias: returns are subject to heteroscedasticity and autocorrelation

Empirical analysis

I) Diversification potential among countries and segments, on average and in the short/long run ?

- Parametric estimation:
 - Pearson's correlation coefficient ;
 - Confidence intervals:
 - *t-percentile* bootstrap method ;
 - Bias-corrected and accelerated bootstrap method (BCa).
- Non parametric estimation:
 - Spearman's rank correlation coefficient ;
 - Confidence intervals:
 - *t-percentile* bootstrap method ;
 - Bias-corrected and accelerated bootstrap method (BCa).
- Coherence estimation
 - Frequency analysis.

Empirical analysis

II) Diversification potential in the short/long run?

- CAPM estimated:
$$E(r_{i,t}) - r_{f,t} = \alpha_i + \beta_{iB} \cdot (E(r_{B;t}) - r_{f,t}) + \epsilon_{i,t}.$$
 - in a balanced panel as in Blomquist and Westerlund (2013) ;
 - considering band pass regression properties as in Engle (1974) and Croux et al. (2001).
- Country fixed effects as in Petersen (2009) and Ando and Bai (2014) ;
- Homogeneity test from Pesaran et al. (2008) ;
- Driscoll and Kraay (1998) correction is applied such that standard errors are robust to heteroscedasticity and autocorrelation.

Results

Table 2: Parametric correlations - Segments aggregated sample - Pearson's coefficient of correlation

	AU	DK	FN	FR	GE	IR	NL	NW	PL	SA	SP	SW	UK	USA
AU	1	0.23	0.48	0.58	-0.16	0.19	0.36	0.56	0.27	0.59	0.38	0.6	0.18	0.01
DK		1	0.7	0.83	-0.36	0.54	0.7	0.65	0.66	0.21	0.72	0.28	0.34	0.3
FN			1	0.87	0.02	0.35	0.68	0.73	0.56	0.24	0.61	0.54	0.16	0.29
FR				1	-0.1	0.66	0.72	0.8	0.62	0.38	0.8	0.67	0.49	0.48
GE					1	0.13	0.22	-0.06	0.12	-0.25	0.18	0.19	-0.03	0.28
IR						1	0.46	0.36	0.51	0.25	0.77	0.44	0.77	0.65
NL							1	0.58	0.92	0.14	0.89	0.28	0.14	0.21
NW								1	0.45	0.32	0.54	0.68	0.45	0.47
PL									1	0.13	0.84	0.08	0.21	0.13
SA										1	0.28	0.43	0.43	0.22
SP											1	0.46	0.47	0.47
SW												1	0.51	0.65
UK													1	0.76
USA														1

Notes: This table reports estimates of Pearson's coefficient of correlation. Confidence intervals are estimated via bootstrap following Hall's (1989) methodology of t-percentile.

Results

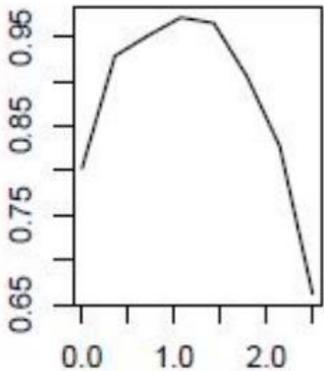
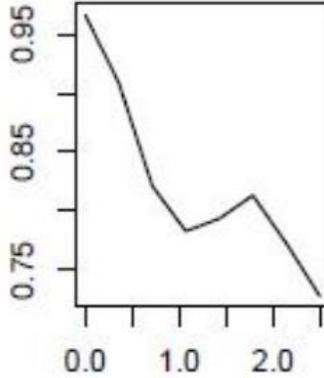
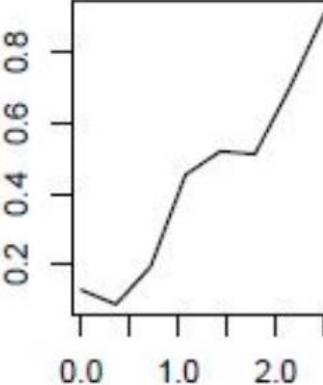
Table 4: Parametric correlations - Segments disaggregated sample - Pearson's coefficient of correlation

	FI RT	FI O	FI RS	FR RT	FR O	FR RS	GE RT	GE O	GE RS	NL RT	NL O	NL RS	SW RT	SW O
FI RT	1	0,64	0,21	0,91	0,85	0,85	-0,02	-0,42	-0,19	0,84	0,52	0,28	0,58	0,38
FI O		1	[-0.43 ; 0.54]	[0.82 ; 0.97]	[0.53 ; 0.96]	[0.7 ; 0.96]	[-0.69 ; 0.49]	[-0.84 ; 0.1]	[-0.66 ; 0.27]	[0.67 ; 0.94]	[0 ; 0.87]	[-0.19 ; 0.71]	[0.2 ; 0.8]	[-0.13 ; 0.24]
FI RS			1	[0.29 ; 0.87]	[0.52 ; 0.91]	[0.02 ; 0.76]	[-0.39 ; 0.64]	[-0.39 ; 0.65]	[-0.32 ; 0.54]	[0.34 ; 0.88]	[0.61 ; 0.96]	[0.43 ; 0.89]	[-0.19 ; 0.68]	[-0.23 ; 0.69]
FR RT				1	[-0.29 ; 0.49]	[-0.15 ; 0.56]	[-0.01 ; 0.73]	[-0.47 ; 0.14]	[-0.09 ; 0.65]	[-0.47 ; 0.41]	[-0.53 ; 0.27]	[-0.57 ; 0.01]	[0.07 ; 0.87]	[0.34 ; 0.48]
FR O					1	[0.8 ; 0.98]	[-0.56 ; 0.47]	[-0.78 ; 0.29]	[-0.58 ; 0.24]	[0.71 ; 0.95]	[0.21 ; 0.85]	[0.04 ; 0.8]	[0.35 ; 0.89]	[0.02 ; 0.61]
FR RS						1	[-0.21 ; 0.61]	[-0.56 ; 0.58]	[-0.26 ; 0.4]	[0.46 ; 0.9]	[0.58 ; 0.87]	[0.37 ; 0.82]	[0.29 ; 0.93]	[0.15 ; 0.56]
GE RT							1	[-0.58 ; 0.33]	[-0.83 ; 0.08]	[-0.58 ; 0.19]	[0.69 ; 0.95]	[-0.25 ; 0.64]	[0.61 ; 0.91]	[0.19 ; 0.57]
GE O								1	[0.32 ; 0.88]	[0.78 ; 0.96]	[-0.77 ; 0.17]	[-0.37 ; 0.63]	[-0.31 ; 0.6]	[0.3 ; 0.14]
GE RS									1	[-0.76 ; 0.08]	[-0.26 ; 0.73]	[-0.15 ; 0.85]	[-0.54 ; 0.35]	[-0.27 ; 0.41]
NL RT										1	[-0.73 ; -0.08]	[-0.51 ; 0.52]	[-0.49 ; 0.58]	[0.2 ; 0.22]
NL O											1	[0.26 ; 0.88]	[0.01 ; 0.81]	[-0.25 ; 0.25]
NL RS												1	[0.76 ; 0.96]	[-0.22 ; 0.2]
SW RT													1	[-0.36 ; 0.91]
SW O														1
SW RS														
UK RT														
UK O														
UK RS														
USA RT														
USA O														
USA RS														

Notes: This table reports estimates of Pearson's coefficient of correlation. Confidence intervals are estimated via bootstrap following Hall's (1989) methodology of t-percentile.

Results

Table 6: Coherence analysis - Countries Aggregated Sectors

	Hyperbole curve	Decreasing curve	Increasing curve
Scheme			
Ratio of countries	71%	16%	13%

Notes: This table reports a summary of coherence estimations between each pair of countries. For easier reading it was refrained from reporting all the 91 pairwise countries coherences.

Results

Table 7: CAPM - Panel of countries - Aggregated segments

	Total		Long term		Short term	
	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
α	0.055*	(0.031)	0.055	(0.071)	0.028	(0.040)
β	0.871***	(0.068)	0.860***	(0.275)	0.777***	(0.054)
<i>Adj.R</i> ²	0.49		0.27		0.42	

Notes: This table reports estimates of the panel version of Sharpe's CAPM based on the GLM method. The Driscoll and Kraay (1998) correction is applied such that standard errors are robust to heteroscedasticity and autocorrelation. The notations ***, ** and * indicate that the null hypothesis of a zero coefficient is statistically rejected at 99%, 95% and 90%.

Main empirical findings

- Country level:
 - On average, diversification opportunities exist ;
 - Diversification opportunities are higher in the short run than in the long run.
- Segment level:
 - On average, diversification opportunities are weak in a given country ;
 - Diversification opportunities are higher in the short run than in the long run.

Main empirical findings

- According to our empirical findings, geographical diversification appears to be more efficient than sector diversification in a given geographical entity;
- Diversification potential is higher in the short than in the long run
- Are short-term investment strategies exploiting the short-term potential feasible?

Conclusions

- We analyse diversification potential of direct and listed real estate markets.
- Using a parametric and non-parametric analysis in 15 national real estate market annual return indices covering the period 2001-2017, we find that real estate markets do not generally present significant diversification opportunities except for a few countries (e.g. US, Germany).
- Coherence analysis show significant differences between short and long run co-movements.
- Panel-type CAPM model estimation with direct index real estate returns by property type and short and long-run components: diversification in the short run, tends to dissipate in the longer run.
- Next steps: Studying shock transmission and contagion, longer time series and range of countries, sub-period analysis