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Diversification Gains, Sector Exposure and Systematic Risk in International Public Real Estate Markets

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Background and Motivation

- **Part of Wider Project on Risk and Investment Strategies for International Real Estate Securities**
  - ***Aim to study interaction of international real estate and financial markets in context of globalisation and market integration***
  - ***MC's doctoral thesis and joint papers***
  - ***Updates paper originally presented in Vienna***
- **Context of Growth in Investment Strategies Using Global RE Securities in Portfolio Allocations**
  - ***As part of international real estate securities strategy***
  - ***To augment (domestic) private real estate strategy***
- **Context of Literature on Equity/RE Market Integration**
- **RQ: What is Optimal Global RE Investment Strategy?**
- **RQ: Do National Index Effects Apply Across Different Sectors and with Specific City Exposure?**

Prior Work (Brief Outline)

- **Substantial Literature on Benefits of RE Diversification**
  - ***Much of it in MPT / Correlation / ICAPM framework***
  - ***Typically at National (index) level***
- **Equity Market Literature on Integration and Balance of Country vs. Industry Factors**
  - ***e.g. Ang, Baca et al., Bekaert and co-workers, Cavaglia et al., Eun & Lee, Forbes & Rigobon, Gagnon & Karolyi, Goetzmann & Karolyi, Van Dijk & Keizer etc. etc.***
- **Real Estate Literature on Long-Run Integration**
  - ***Gerlach et al., Kleiman et al., Liow and co-workers, Schindler, Wilson & co-workers, Yunnus etc. etc.***
  - ***Gallo & Zhang (2010), Gallo et al. (2013) – division into cointegrated and independent portfolios.***

Set Up

- **Prior Research Typically at Index Level**
- **However, Investors May Have Sector Mandate or Apply Filters that Tilt Portfolio Holdings**
- **Examine Cointegration of Markets at National and Regional Level**
- **Identify Risk Exposure and Risk Drivers ...**
- **Then Disaggregate Firms by Sector (and City):**
  - ***Is Same Pattern of Integration Observed?***
  - ***Do Risk Drivers and Diversification Benefits Differ?***
- **What Are Implications for Investment Strategy?**

Data ...

- **RE Securities Data Monthly 1995-2013**
  - *GPR data, 353 firms and 15 countries*
  - *Total returns including dividends*
  - *Deflated using US CPI*
  - *Augmented by SNL, EPRA*
  - *Aggregated using value weighting*
- **Identify Specialist Firms**
  - *Sector specialists >50% in individual sector*
  - *Firms with high exposure to international financial gateway cities (GFCI ranked cities)*
- **This Paper US$ Basis**
  - *Results Hold in Local Currency*
- **Economic and Financial Control Variables**
  - *RP, Term Structure, Carhart factors, inflation, industrial production, oil price, institutional trading flows*

Methods – 1 (Antecedent Papers)

- **Initial Processing:**
  - ***Test global, regional, national indices using Heston & Rouwenhorst approach***
  - ***Multi-factor approach, decompose influences of market, sector, national, city drivers***
  - ***Factor model using WLS and focus on relative returns, orthogonalise factors***
- **Integration: Test for Cointegration, Breaks**
  - ***DF, ADF, PP, KPSS, Zivot & Andrews for stationarity and allow for structural break(s)***
  - ***Analyse multivariate cointegration, modified Johansen***
  - ***Disaggregate to region, sector / city exposure and test differences***

Methods – 2 (This Paper)

- Define integrated and independent portfolios
- Compare portfolio performance using Sharpe ratios;
- Examine risk sensitivity using a Carhart four factor model;

$$R_{pt} = \alpha_i + \beta_{p1} R_{mt} + \gamma_{p2} GSMB_{2p} + \lambda_{p3} GMOM_{3p} + \zeta_{p4} GHML_{4p} + \varepsilon_{t,} \quad (7.3)$$

- Decompose risk using Fama-Macbeth 2-stage process, rolling windows, expanding windows
- Canonical approach to identify independent components, test against financial and economic variables

$$\varphi_{it} = \gamma_{i0} + \gamma_{i1} RP_t + \gamma_{i2} TS_t + \gamma_{i3} CPI_t + \gamma_{i4} IP_t + \gamma_{i5} OIL_t + \gamma_{i6} FLOW_t + \upsilon_{i,} \quad (7.7)$$

- Repeat for disaggregated sector / gateway city indices
- Robustness checks (different time periods, local currency, ex-US, out of sample tests).

Results – 1: Antecedent Research

- **Initial results show strong common factors in returns but these vary by region, country and sector**
- **Integration results at Index level**
  - ***Evidence of regional cointegration***
  - ***Regionally independent have global drivers (US, Canada, Japan, HK, Finland, Belgium)***
  - ***Regional diversification effects exist***
- **Disaggregated sector/city integration results**
  - ***Major sectors: integration is global not regional***
  - ***Financial gateway exposure: integration is global***
  - ***Substantial differences in performance***

Results – 2: Index Level Performance

- **Sharpe Ratio:**
  - ***Regionally Cointegrated Group superior (0.119 to 0.040, z 4.223)***
- **4-Factor Model**
  - ***Global/Indep group more sensitive to market (β 1.15 to 0.77)***
  - ***Regionally integrated group larger α in 2nd half of data***
- **Fama-Macbeth**
  - ***Global/indep higher sensitivity to market, negative sensitivity to value factor; sensitivities differ over groups***
  - ***Over time, correl global integration and risk increases***
- **Canonical Factor Model**
  - ***Global/indep has more sensitivity to RP, TS, higher γs generally***
- **In general: lower regional integration brings greater portfolio risk and less diversification benefit**

Results – 3: Sector and City Level

- **Key Insight – Results Differ Substantially!**
  - *Country mix varies, sensitivities vary*
  - *Integration here is global not regional*
- **Offices**
  - *Large globally integrated group (81% by value)*
  - *Clear evidence of strong global drivers*
  - *Global lower Sharpe and higher betas*
  - *F-M results indep higher total risk but lower systematic risk*
- **Retail**
  - *More even split global (52%) and independent*
  - *Global Sharpe higher but more exposed to global risk factors*
  - *Global sensitive to RP, TS, fund flows and oil prices*
  - *Cointegration reduces diversification but risk-return better?*
- **Financial Gateway Cities**
  - *Somewhat similar to offices, as expected*
  - *Global very strong risk sensitivity (high betas, R^2)*
  - *Global portfolio underperforms independent, sensitivity to shocks*

Discussion and Preliminary Conclusions

- **Paper Takes Long Run Risk Sensitivity Approach to Understanding Performance / Diversification Benefits**
- **At Index Level, Diversification Benefits Linked to Regional Integration**
- **But Do Investors "Buy the Index"?**
  - ***Liquidity / large cap stock preference***
  - ***Sector specialists and sector preferences***
  - ***City focus, mirroring underlying private market?***
- **Sector and City Results Differ Substantially**
  - ***Global not regional integration***
  - ***Global integration, weaker performance, risk sensitivity***
  - ***Different mix of integrated countries across sectors***
- **Points to Need (and Opportunity) to Fine-Tune Stock Selection in International Investment Strategies**

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Aggregate Results - 1

Table 7.1: Property Portfolio Correlation Analysis, Aggregate Indices

	REGINDE vs. REGCOIN	REGINDE vs. Benchmark	REGCOIN vs. Benchmark
Contemporaneous	0.341[a]	0.729[a]	0.436[a]
Rolling 60-month Window	0.296[a]	0.559[a]	0.427[a]

Table 7.3: Summary of Property Portfolio Performance, Aggregate Indices

Portfolio	Return	Standard Deviation	Sharpe ratio	Z-stat$_{(GPR\ index)}$	Z-stat (REGINDE vs. REGCOIN)	Portfolio Correlation	Portfolio Market Weight
REGINDE	0.552%	8.002%	0.040	1.280	-	0.881	68.676%
REGCOIN	1.277%	8.795%	0.119	4.780[b]	4.230[b]	0.530	31.324%
GPR Global Index	0.603%	4.760%	0.078	-	-	-	100.000%
One-month T-bill	0.232%	0.183%	-	-	-	-	-

Aggregate Results - 2

Table 7.4: Four-Factor Property Portfolio Performance, Aggregate Indices

	α_p	α_p (-stat)	β_{p1}	β_{p1} (-stat)	γ_{p2}	γ_{p2} (-stat)	λ_{p3}	λ_{p3} (-stat)	ζ_{p4}	ζ_{p4} (-stat)	
Panel A: Four-factor performance model											
REGINDE	0.003	(0.810)	1.151[a]	(9.010)	-0.337[c]	-(1.930)	-0.245	-(1.560)	-0.011	-(0.100)	0.545
REGCOIN	0.006	(1.030)	0.772[a]	(7.290)	0.045	(0.190)	0.404[c]	(1.840)	0.063	(0.570)	0.201
Panel B: Intertemporal four-factor performance model (01/1995-05/2004)											
REGINDE	0.006	(1.480)	1.383[a]	(8.820)	-0.224[c]	-(1.780)	-0.033	-(0.270)	-0.009	-(0.130)	0.279
REGCOIN	0.012	(1.640)	0.671[b]	(2.520)	0.298	(0.950)	0.409[c]	(1.750)	0.007	(0.040)	0.152
Panel C: Intertemporal four-factor performance model (06/2004-10/2013)											
REGINDE	0.002	(0.470)	1.327[a]	(8.160)	-0.667[c]	-(1.670)	-0.658	-(1.520)	-0.080	-(0.350)	0.666
REGCOIN	0.016[c]	(1.780)	0.847[a]	(7.370)	-0.236	-(0.530)	0.410	(0.650)	0.086	(0.530)	0.257

Aggregate Results - 3

Table 7.5: Long-term Property Portfolio Risk Decomposition, Aggregate Indices

Coefficient	REGINDE $Mean_{REGINDE}$	REGINDE $SD_{REGINDE}$	REGCOIN $Mean_{REGCOIN}$	REGCOIN $SD_{REGCOIN}$	H_0	t-stat
Four-factor performance model (Rolling Window)						
Intercept	0.004	0.003	0.007	0.011	$A_{REGINDE}=\alpha_{REGCOIN}$	3.197[a]
R_{mt}	1.362	0.123	0.528	0.152	$B_{REGINDE}=\beta_{REGCOIN}$	18.949[a]
GSMB	-0.331	0.213	-0.171	0.428	$\Gamma_{REGINDE}=\gamma_{REGCOIN}$	0.812[a]
GHML	-0.489	0.494	0.540	0.685	$\Lambda_{REGINDE}=\lambda_{REGCOIN}$	17.659[a]
GMOM	-0.250	0.171	0.036	0.282	$Z_{REGINDE}=\zeta_{REGCOIN}$	12.347[a]
MSE	0.002	0.015	0.010	0.020	$MSE_{REGINDE}=MSE_{REGCOIN}$	19.741[a]
Four-factor performance model (Expanding Window)						
Intercept	0.003	0.001	0.016	0.007	$A_{REGINDE}=\alpha_{REGCOIN}$	22.819[a]
R_{mt}	1.361	0.048	0.649	0.119	$B_{REGINDE}=\beta_{REGCOIN}$	16.828[a]
GSMB	-0.122	0.052	0.066	0.167	$\Gamma_{REGINDE}=\gamma_{REGCOIN}$	14.758[a]
GHML	-0.172	0.182	0.324	0.143	$\Lambda_{REGINDE}=\lambda_{REGCOIN}$	44.425[a]
GMOM	-0.258	0.123	0.041	0.140	$Z_{REGINDE}=\zeta_{REGCOIN}$	72.240[a]
MSE	0.002	0.004	0.009	0.007	$MSE_{REGINDE}=MSE_{REGCOIN}$	61.376[a]

Aggregate Results - 4

Table 7.6: Property Portfolio Systematic Risk Factors, Aggregate Indices

	a	γ_{i1}RP	γ_{i2}TS	γ_{i3}CPI	γ_{i4}IP	γ_{i5}OIL	γ_{i6}FLOW	R^2
REGINDE Variate								
Coefficient	5.990	29.570[b]	29.290[b]	-61.410[a]	-13.960	-2.270	-93.260[a]	0.141
(t-stat)	(0.230)	(2.250)	(2.530)	-(3.350)	-(0.250)	-(0.570)	-(6.060)	
REGCOIN Variate								
Coefficient	11.150[a]	1.747	0.391	-41.160	-16.970	-0.930	-7.770[c]	0.049
(t-stat)	(10.630)	(0.630)	(0.110)	-(1.010)	-(1.550)	-(0.890)	-(1.890)	
GPR Benchmark								
Coefficient	0.007	0.123[c]	0.026[b]	-0.425[b]	-0.579	-0.104	-0.310[c]	0.093
(t-stat)	(1.380)	(1.750)	(2.120)	-(2.270)	-(0.830)	-(1.360)	-(1.870)	