Idiosyncratic Risk and Expected Returns in REITs

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Introduction

- **Sources of risk in the CAPM**
  - **Systematic risk**
  - **Idiosyncratic risk**
- **Relationship b/w idiosyncratic risk & returns**
  - **Modern Portfolio Theory predicts no relationship**
    - **Idiosyncratic risk should be diversifiable**
  - **Finance literature provides mixed empirical evidences**
    - **Positive Negative No relationship**
  - **Research in the Real estate literature is limited**
    - **Ooi, Wang and Webb (2009) find positive relationship in REITs**

Purpose of Study

- **Idiosyncratic risk based on**
  - **Fama-French three factor model < FF3 >**
- **Relationship b/w idiosyncratic risk and expected returns**
  - **Positive on FF3-based idiosyncratic risk (Ooi et al., 2009)**
- **Roll of property sector on idiosyncratic risk**
  - **REITs consist of homogeneous assets by property sector**
  - **(Strength of) relationship b/w idiosyncratic risk and expected returns may differ by property sector**

Literature

- **Stock analysis in the finance literature**
  - **Merton (1987)**
  - **Goyal and Santa-Clara (2003)**
  - **Ang, Hodrick, Yuhang and Xiaoyan (2006)**
  - **Bali and Cakici (2008)**
  - **Fu (2009)**
- **REIT analysis in the real estate literature**
  - **Ooi, Wang and Webb (2009)**
- **Property sector studies**
  - **Clayton and MacKinnon (2003)**
  - **Liow and Addae-Dapaah (2010)**

Data

- **Wharton Research Data Services (WRDS)**
  - **CRSP Ziman Real Estate Data Series**
  - **CRSP/COMPUSTAT Merged Database**
  - **Fama-French factors (market, size, value and momentum)**
- **Sample periods: 1996 – 2007**
- **Sample size: 183 REITs**

Descriptive Statistics

	Initial Sample in 1996			Final Sample in 2007		
	Number of REITs	ME (Median)	BE/ME (Median)	Number of REITs	ME (Median)	BE/ME (Median)
Retail	35	253	0.685	23	1,700	0.539
Office/industrial	24	234	0.675	21	1,638	0.588
Residential	22	288	0.581	18	1,301	0.404
Mortgage	8	213	0.731	16	315	0.998
Diversified	13	112	0.836	11	963	0.688
Health Care	9	305	0.611	9	1,214	0.520
Lodging	9	298	0.511	6	1,126	0.764
Storage	4	622	0.708	2	6,671	0.529
Un-classified	3	18	0.732	6	341	0.543
Total, Weighted Ave.	127	255	0.665	112	1,106	0.562

- **Property sectors (CRSP Ziman)**
  - **Major: Retail, office/industrial, residential, mortgage**
  - **Minor: Diversified, lodging and health-care**

Hypothesis

- **In real estate, each property sector has distinct characteristics**
- **In REITs, significant proportion of idiosyncratic risk could be attributed to property sector**

H: With the control for property sector, the relationship b/w idiosyncratic risk and expected returns is significantly weaken

First-pass Regression

- **Estimation of idiosyncratic risk in REITs**
  - **Monthly regression of daily-returns in previous month**
  - **Fama-French 3 Factor (FF3)**

$$R_{i,\tau} - r_{f,\tau} = \alpha_{i,t} + \beta_{MKT,i,t}(R_{MKT,\tau} - r_{f,\tau}) + \beta_{SMB,i,t}SMB_{\tau} + \beta_{HML,i,t}HML_{\tau} + \varepsilon_{i,t}$$

Second-pass Regression

FF3-based IR models controlling for additional 3 firm-level variables

Model	C	E(BETA)	ln(ME)	ln(BE/ME)	Ret(-2,-13)	E(IR)	R-square	Adj. R-square
1	0.009 ***	-0.001					0.036	0.029
	(3.37)	-(0.16)						
2	0.004					0.087 *	0.073	0.066
	(1.20)					(1.87)		
3	0.003	-0.001				0.095 **	0.099	0.087
	(0.98)	-(0.53)				(2.05)		
Size effect								
4	-0.013 ***	-0.003	0.002 ***			0.134 ***	0.130	0.113
	-(3.24)	-(1.00)	(3.26)			(2.87)		
Value effect								
5	-0.013 ***	-0.003	0.002 ***	-0.001		0.134 ***	0.149	0.125
	-(3.06)	-(1.22)	(3.11)	-(0.40)		(2.72)		
Momentum								
6	-0.015 ***	-0.004	0.002 ***	-0.001	0.015 ***	0.142 ***	0.170	0.141
	-(3.44)	-(1.39)	(2.91)	-(0.62)	(3.38)	(3.03)		

Average slope (t-statistics) from month-by-month regressions
* Denotes significance at the 10% level.
** Denotes significance at the 5% level.
*** Denotes significance at the 1% level.

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Regression Controlling for Property Sector

- **Additional control for property sectors**

- **Regression methodology**
  - **Constant dummy**
  - **Slope dummy on idiosyncratic risk**

$$R_{i,t} - r_{f,t} = \alpha_{0,t} + \sum_{k=1}^{k} \beta_{k,t} X_{k,i,t} + \sum_{l=1}^{l} \gamma_{l,t} D_l + \sum_{l=1}^{l} \delta_{l,t} X_{Idiosyncratic\,risk,i,t} D_l + \varepsilon_{i,t} \quad i = 1,2,\cdots,N_t, \quad t = 1,2,\cdots,T$$

- **Measure the influence of each property sector**
  - **In the relationship b/w idiosyncratic risk and expected returns**

Regression Controlling for Property Sector

Models controlling for 3 variables plus 4 property sectors

4 Sect. Model	C	E(BETA)	ln(ME)	ln (BE/ME)	Ret (−2, −13)	E(IR)	Constant				Slope				R-square	Adj. R square
							Mortgage	Retail	Residential	industrial &Office	Mortgage	Retail	Residential	industrial &Office		
1- 4Sec.	0.008 ***	0.000					0.000	0.001	0.002	0.003					0.101	0.070
	(2.77)	−(0.07)					−(0.12)	(0.40)	(0.98)	(1.43)						
2- 4Sec.	0.002					0.097	−0.005	0.006	0.005	0.001	0.039	−0.061	−0.046	0.043	0.220	0.171
	(0.50)					(1.57)	−(0.67)	(1.46)	(0.97)	(0.15)	(0.44)	−(0.77)	−(0.50)	(0.47)		
3- 4Sec.	0.001	−0.001				0.115 *	−0.005	0.007	0.006	0.002	0.033	−0.074	−0.054	0.035	0.244	0.190
	(0.15)	−(0.37)				(1.89)	−(0.69)	(1.64)	(1.15)	(0.31)	(0.37)	−(0.96)	−(0.60)	(0.39)		
Size effect																
4- 4Sec.	−0.015 ***	−0.002	0.002 ***			0.150 **	−0.002	0.007	0.004	−0.001	0.011	−0.091	−0.037	0.063	0.270	0.212
	−(3.43)	−(0.91)	(3.44)			(2.49)	−(0.24)	(1.64)	(0.70)	−(0.29)	(0.12)	−(1.18)	−(0.42)	(0.72)		
Value effect																
5- 4Sec.	−0.015 ***	−0.002	0.002 ***	0.000		0.155 **	0.000	0.005	0.004	−0.001	−0.006	−0.054	−0.047	0.056	0.286	0.223
	−(3.42)	−(0.90)	(3.29)	−(0.21)		(2.59)	−(0.05)	(1.09)	(0.81)	−(0.20)	−(0.06)	−(0.69)	−(0.51)	(0.65)		
Momentum																
6- 4Sec.	−0.015 ***	−0.002	0.002 ***	−0.001	0.007	0.152 **	−0.001	0.003	0.004	−0.001	−0.007	−0.032	−0.043	0.062	0.304	0.235
	−(3.52)	−(0.89)	(3.23)	−(0.42)	(1.60)	(2.55)	−(0.15)	(0.81)	(0.79)	−(0.24)	−(0.07)	−(0.41)	−(0.46)	(0.70)		

Average slope (t-statistics) from month-by-month regressions
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Regression Controlling for Property Sector

Models controlling for 3 variables plus 7 property sectors

7 Sect. Model	C	E(BETA)	ln(ME)	ln (BE /ME)	Ret(−2, −13)	E(IR)	Constant							Slope							R− sq.	Adj. R sq.
							Mort gage	Retail	Resi den	ind. & Office	Lodg ing	Hlth care	Diver sified	Mort gage	Retail	Resi den	ind. & Office	Lodg ing	Hlth care	Diver sified		
1− 7Sec.	0.008 ***	0.000					0.000	0.001	0.002	0.003	−0.002	0.001	0.001								0.135	0.086
	(2.82)	−(0.04)					−(0.07)	(0.40)	(0.86)	(1.30)	−(0.52)	(0.40)	(0.21)									
2− 7Sec.	0.006					0.069	−0.009	0.002	0.001	−0.003	−0.013	−0.004	0.000	0.067	−0.033	−0.018	0.071	0.137	0.064	−0.073	0.310	0.234
	(1.16)					(0.68)	−(1.17)	(0.38)	(0.15)	−(0.61)	−(1.61)	−(0.53)	(0.02)	(0.57)	−(0.30)	−(0.16)	(0.65)	(0.97)	(0.48)	−(0.61)		
3− 7Sec.	0.005	0.000				0.092	−0.009	0.003	0.002	−0.002	−0.011	−0.003	0.000	0.055	−0.054	−0.032	0.052	0.099	0.033	−0.076	0.325	0.246
	(0.88)	−(0.07)				(0.92)	−(1.15)	(0.55)	(0.31)	−(0.41)	−(1.38)	−(0.40)	(0.05)	(0.46)	−(0.50)	−(0.28)	(0.48)	(0.71)	(0.24)	−(0.64)		
Size effect																						
4− 7Sec.	−0.009	−0.002	0.002 ***			0.099	−0.007	0.001	−0.002	−0.007	−0.011	−0.004	−0.002	0.060	−0.043	0.012	0.102	0.095	0.037	−0.028	0.349	0.266
	−(1.59)	−(1.04)	(3.42)			(0.96)	−(0.98)	(0.24)	−(0.34)	−(1.16)	−(1.35)	−(0.54)	−(0.29)	(0.50)	−(0.38)	(0.10)	(0.91)	(0.67)	(0.27)	−(0.23)		
Value effect																						
5− 7Sec.	−0.009	−0.002	0.002 ***	0.000		0.102	−0.006	−0.001	−0.001	−0.006	−0.011	−0.003	−0.003	0.045	−0.007	0.005	0.097	0.104	0.028	−0.008	0.366	0.277
	−(1.59)	−(1.11)	(3.31)	−(0.24)		(0.95)	−(0.71)	−(0.11)	−(0.23)	−(1.01)	−(1.33)	−(0.46)	−(0.38)	(0.37)	−(0.06)	(0.04)	(0.82)	(0.70)	(0.21)	−(0.07)		
Momentum																						
6− 7Sec.	−0.010 *	−0.002	0.002 ***	−0.001	0.006	0.122	−0.006	−0.001	0.000	−0.005	−0.011	−0.002	−0.001	0.016	−0.008	−0.017	0.075	0.100	−0.002	−0.038	0.383	0.289
	−(1.81)	−(1.13)	(3.17)	−(0.52)	(1.63)	(1.08)	−(0.67)	−(0.18)	−(0.06)	−(0.83)	−(1.31)	−(0.32)	−(0.21)	(0.13)	−(0.07)	−(0.13)	(0.61)	(0.66)	−(0.01)	−(0.29)		

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Result

- **None of constant and slope dummies displays statistical significance in all of 5 models with the control for either 4 or 7 property sectors**
- **With the control for 4 property sectors,**
  - **Positive relationship remains significant in 4 out of 5 models**
- **With the control for 7 property sectors,**
  - **Positive relationship turns to insignificant in all of 5 models**
- **Hypothesis is rejected since none of dummy variables shows significance.**

Robustness Check

- **F-test**
  - **Test for the joint effect of the dummy variables**
  - **Overall significance of a regression model b/w with and w/o dummy variables for property sectors**

$$F = \frac{(R_b^2 - R_a^2)/k_b}{(1 - R_b^2)/(n - (k_a + k_b) - 1)}$$

  - **Null hypothesis:**
  - **The coefficients of supplemental variables (dummy variables) is not zero.**

Result - Robustness Check

- **F-test**

Model	R-square			F-test	
	No dummy variable models (Table 2)	4 sector dummy models (Table 3)	7 sector dummy models (Table 4)	4 sector dummy models	7 sector dummy models
2	0.072	0.220	0.310	3.629 ***	3.728 ***
3	0.099	0.244	0.325	3.564 ***	3.542 ***
4	0.130	0.270	0.349	3.538 ***	3.532 ***
5	0.149	0.286	0.366	3.566 ***	3.583 ***
6	0.170	0.304	0.383	3.535 ***	3.560 ***

* Denotes significance at the 10% level.

** Denotes significance at the 5% level.

*** Denotes significance at the 1% level.

Conclusion

- **Control for property sector eliminate the relationship b/w idiosyncratic risk and expected returns, but none of dummy variables are not statistically significant**
- **F-tests present overall significance of control for property sector in each models. (Robustness check)**

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