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Investor Perception of Retail Property Risk: Evidence from REIT Portfolios

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REITs offer a unique and convenient way to study retail property portfolios because of abundant available information with which the market prices risk and return metrics. In this study, we assess how retail portfolio risk is priced in the public real estate investment market. The results reveal which retail portfolio risk factors, such as the degree of diversification (measured with Herfindahl indexes based on retail property sub-type and geography), portfolio obsolescence (measured as the weighted effective age of the property portfolio), and other factors affect various measures of financial risk. Also, in contrast to most other financial studies, we will test the retail portfolio risk effects associated with various demographic trends and forecasts. The results show that the retail portfolio risk of REITs increase with diversification into different geographic regions and decrease with self-management, property type diversification, net leased properties, and increased portfolio size.

Introduction

Real Estate Investment Trusts (REITs) offer a simple alternative to private and direct investment for investors seeking a position in a retail real estate investment portfolio. In comparison to private and direct investment in retail real estate, there is abundant available information on publicly-traded REITs that the market can use to price the risk and return metrics of these investment alternatives. Due to abundant information, publicly-traded REITs offer a unique and convenient way to study retail property portfolios. In this study, we assess how retail portfolio risk is priced in the public real estate investment market. The results reveal the degree to which retail portfolio risk factors, such as the degree of diversification and property portfolio obsolescence, affect various financial measures of total risk, namely standard deviations and variances of total returns. Intuitively, the results will show how the various risk factors are perceived by investors in the aggregate. In turn, we can then make inferences about pricing decisions (risk adjustments), retail portfolio composition (components of a risk-balanced portfolio), and the relative importance of the various risk factors to investors (Levy, 1996; Liang and McIntosh, 1998, 1999).

This paper is organized into five sections. Section I examines the literature as it pertains to the public market valuation of REIT characteristics, Section II details the sample data and the methodology, Section III presents the empirical results, and Section IV concludes.

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Section I. Background and Review of Contemporary Literature

In analyzing the characteristics of a REIT property portfolio that impact its risk and subsequent pricing in the marketplace, it is useful to categorize these characteristics as follows: product type focus/diversity, geographic location focus/diversity, life-cycle stage strategies, leasing matters, and demographic or market strategies (Pagliari, 1991; Del Casino, 1995).

Product Focus/Diversity and Geographic Focus/Diversity

As a REIT makes its acquisition and disposition decisions, it is determining the future composition of its property portfolio. Intuitively, if a REIT diversifies its property portfolio, it should experience more stability in cash flow and prices. Conversely, if a REIT becomes more focused, it should exhibit more volatility in cash flow and prices, but benefit from cost efficiencies. Thus, the decision on whether or not to become more specialized (focused) or more diversified involves an assessment of the trade-off between the benefits of stabilizing overall cash flows against the costs of greater inefficiencies associated with either the geographic dispersion of properties or managing across multiple property types.

To date, research has generated mixed results on the valuation effects of REIT diversification. Capozza and Seguin (1999) show that project-level cash flows are higher with more diversification, but the cash flow gains are offset by higher managerial and administrative expenses. Anderson et al. (2001) study the technical efficiency of REITs and show that increased property type diversification increases scale efficiency, but reduces the efficiency of input usage. Bers and Springer (1998), studying economies of scale, find that geographic diversification does not contribute to scale economies in REITs. Cronqvist et al. (2001) find that the REITs expected to pursue non-focusing strategies do indeed diversify more, and are valued ex ante at a 20% discount to REITs anticipated to follow a focusing strategy. The discount is attributed to higher agency costs.

While the preponderance of the evidence suggests that property type focus is a favorable attribute in comparison to diversifying across property types, no study has looked at the issue of diversifying within a property type. For example, do investors prefer a mix of retail, such as community centers and malls or do they prefer a focus on one type of retail property. Research has shown that risk differences exist between retail property types (Litt et al., 1999; Table 6). In fact, on the private side, the historical returns and risk metrics between shopping centers and malls are dramatically different for any sub-period chosen and the correlations are strong, but certainly much less than unity, allowing for the potential of diversification benefits. Moreover, many of the same managerial skills needed to run the different forms of retail are readily transferable across retail investment formats.

However, the flip side is that capitalization rates differ considerably across the various retail property sub-types. As such, the public market traditionally has had a more difficult time assessing REITs with any type of diversity across its investment base. These difficulties often translate into "perceived" risk levels and hence a more conservative value of the REIT.

Life Cycle Strategies, Leasing Issues, and Demographic Plays

In addition to property type and geographic issues affecting a REIT's portfolio risk, the level of risk in the underlying cash flows can be dramatically impacted by the life cycle strategies and leasing practices/tenant qualities of the properties. The life cycle of a given property starts with the planning and land acquisition phases, moves to the horizontal or pre-development stage to the vertical development stage, to the lease-up point, and then finally the property becomes stabilized. At some point thereafter, the property begins to depreciate, the revenue potential is hindered, and the operating costs begin to rise. At that point, the investor can choose to renovate and start the process over or the property can be razed and the real estate value converted back into the land value (Del Casino, 1995). How the overall composition of the portfolio relates to these phases is quite critical to its valuation. Each phase of the process has different levels and types of risks that impact the required returns on the investments. For example, in the development stage, the investors have both environmental and physical risks ranging from land use regulations and zoning to labor strikes and vandalism. Properties that are purchased on completion may only have financing and lease-up risks. The purchase of older properties may have risks associated with the level and degree of future capital improvements needed. As such, the required rates of return change across different phases of the life cycle.

Also, most of the sensitivity of a property's cash flow and asset value is a function of the property's lease characteristics. The shorter the property's average lease term, the more equity-like its cash flows and thus the more sensitive it is to local market conditions. The longer the average lease term, the more bond-like its cash flows are, making it less sensitive to local market conditions. The number of tenants, the quality of the tenants, and the linkages/mix amongst the tenants dramatically influences value differences between like properties and across property sectors (Lieblich, 1995).

Finally, the demographic features of the markets in which the REIT's investments are concentrated may affect risk. Theoretically, markets with strong and stable employment and income growth should be able to support retail sales. As such, several REITs have investment strategies based on having a presence in fast-growth markets with strong current and forecasted demand.

Section II. Data and Methods

The primary data sources for this study are the SNL REIT Datasource and the CRSP (Center for the Research of Security Prices) database. The REIT Datasource provides current and historical information on the properties held by REITs. From this source, we downloaded property specific information on 77 REITs that held retail property as of year-end 2003. The 77 REITs are listed in Table 1. The SNL properties database, current as of January, 2004, yields data on 7,293 individual REIT-held retail properties. Daily and monthly return data for the subject REITs from January 2000 through December 2003 are from the CRSP database.

To assess the impact of various factors on the risks of publicly-traded retail portfolios, we test various specifications of the following general model:

$$Risk_i = f\,(risk\ factors,\ property\ portfolio\ characteristics,\ demographic\ trends) \quad (1)$$

The dependent variable, $Risk_i$, is one of three alternative measures of total REIT risk, namely the standard deviation, the log of the standard variation and the variance of total REIT returns measured either daily or monthly over a 3- or 4-year period ending December 30, 2003. A dependent variable is included to indicate REITs with an incomplete time series of returns. Thus, this variable accounts for instances where the risk measure is calculated using fewer observations than its counterparts, which are observable for the entire reference period.

The risk factors are the variables of primary interest. First, we consider diversification metrics. While recent REIT studies have shown geographic diversification as a favorable attribute and diversification across property types as an unfavorable attribute, these studies have not considered diversification within a single property type, such as retail. To measure the degree of diversification, we estimate Herfindahl indexes for the individual retail portfolios (Capozza and Seguin, 1999). Higher index values indicate focus, or heavy concentration, with a value of one indicating the entire portfolio is either invested in a single property type or located within one geographic region. Conversely, lower values suggest greater diversification. From the individual property data, we construct two Herfindahl indexes. The first is based on the type of retail property held by the REIT and is computed as:

$$Property\ Type\ Herfindahl\ Index = \Sigma\, P_i^2 \quad (2)$$

where P_i is the proportion, based on square footage, of the retail portfolio invested in property sub-type i, where the property types are as follows: shopping centers, single-tenant properties, malls, power centers, and outlet centers.

Table 1. List of REITs in the sample.

Company Name, Ticker	Company Name, Ticker
Agree Realty Corporation, ADC	Income Opportunity Realty Investors, IOT
Alexander's, ALX	Investors Real Estate Trust, IRETS
AMB Property Corporation, AMB	Kimco Realty Corporation, KIM
American Real Estate Partners LP, ACP	Kramont Realty Trust, KRT
American Realty Investors, ARL	Lexington Corporate Properties Trust, LXP
AmREIT, AMY	Macerich Company, MAC
Arden Realty ARI	Malan Realty Investors, MAL
Atlantic Realty Trust, ATLRS	Manufactured Home Communities, MHC
Bedford Property Investors, BED	Meredith Enterprises, MPQ
Boston Properties, BXP	Mills Corporation, MLS
Brookfield Properties Corporation, BPO	Monmouth Real Estate Investment Co., MNRTA
Capital Automotive REIT, CARS	New Plan Excel, NXL
CBL & Associates Properties, CBL	Newhall Land and Farming, NHL
Cedar Shopping Centers, CDR	One Liberty Properties, OLP
CenterPoint Properties Trust, CNT	Pan Pacific Retail Properties, PNP
Chelsea Property Group, CPG	Parkway Properties, PKY
Colonial Properties Trust, CLP	Pennsylvania Real Estate Investment Trust, PEI
Commercial Net Lease Realty, NNN	Price Legacy Corporation, XLG
Cousins Properties Incorporated, CUZ	Ramco-Gershenson Properties Trust, RPT
Crescent Real Estate Equities Company, CEI	Realty Income Corporation, O
Developers Diversified Realty Corporation, DDR	Regency Centers Corporation, REG
Duke Realty Corporation, DRE	Rouse Company, RSE
Entertainment Properties Trust, EPR	Saul Centers, MD, BFS
Equity Office Properties Trust, EOP	Shelbourne Properties II, HXE
Equity One, EQY	Simon Property Group, SPG
Federal Realty Investment Trust, FRT	Sizeler Property Investors, SIZ
First Real Estate Investment Trust of NJ, FREVS	Tanger Factory Outlet Centers, SKT
First Union Real Estate Equity and Mortgage Investments, FUR	Tarragon Realty Investors, TARR
Forest City Enterprises, FCE.A	Taubman Centers, TCO
General Growth Properties, GGP	Transcontinental Realty Investors, TCI
Getty Realty Corp., GTY	U.S. Restaurant Properties, USV
Glenborough Realty Trust Incorporated, GLB	United Dominion Realty Trust, UDR
Glimcher Realty Trust, GRT	Universal Health Realty Income Trust, UHT
Heritage Property Investment Trust, HTG	Urstadt Biddle Properties UBA
Highwoods Properties, HIW	USA REIT, USRE
HMG/Courtland Properties, HMG	Vornado Realty Trust, VNO
Horizon Group Properties, HGPI	Washington Real Estate Investment Trust, WRE
Imperial Parking Corporation, IPK	Weingarten Realty Investors, WRI

The second Herfindahl index is based on the geographic location of the REIT-held retail properties and is calculated as:

$$Geographic\ Herfindahl\ Index = \Sigma\ G_i^2 \tag{3}$$

where G_i is the proportion, based on square footage, of the retail portfolio invested in geographic region i, where the geographic regions are those specified by the National Council of Real Estate Investment Fiduciaries (NCREIF) as follows: Northeast, Southwest, East-North-Central, Mideast, West-North-Central, Southeast, Pacific, Mountain, and Foreign (International). The average REIT retail portfolio in the sample is more focused by property type (mean index value = 0.79) and more diversified geographically (mean index value = 0.58).

Another risk feature of a retail portfolio, related to the life-cycle of the property, is obsolescence risk. We measure obsolescence using a weighted average age of the property portfolio, which we calculate as

$$Effective\ Age = \Sigma\ (SF_j / TSF_i \times AGE_j) \tag{4}$$

where SF_j is the square footage of individual retail property j, TSF_i is the total square footage of retail property held by REIT i, and AGE_j is the estimated age of property j. Although the approach is subjective, we attempt to account for the impacts of renovations on individual properties by arbitrarily defining the property's age as the lesser of its reported age or the number of years since it was renovated. While this age measure is possibly biased, any impact of a bias is minimal because, for most properties, the reported age is being used. The effective age of the average REIT retail portfolio is 12.65 years. The average actual age of the retail property portfolios, as reported by each individual REIT, is 19.67 years.

Certain property and REIT characteristics are to be included in the models to control for other factors that may affect risk and risk-adjusted performance. The relative size of the retail portfolio is included to account for more stable cash flows expected for larger portfolios. This variable is calculated as

$$Relative\ Portfolio\ Size = SF_i / MSF \tag{5}$$

where SF_i is the square footage of the retail portfolio held by $REIT_i$ and MSF is the average square footage of all retail portfolios in the sample of REITs, namely 29,266,175 square feet. Specifically, the percentage of the REIT's investment in retail properties is included because the level of retail investment is not always 100%. Although not in the model, the average property size for a REIT retail portfolio ranges from 5,337 square feet to 1,069,955 square feet, with a mean of 250,917 square feet.

Two binary variables are included to account for additional REIT characteristics. One identifies REITs for which a majority of their properties are net leased, thus risk of fluctuating expenses are not borne by the REIT but rather by the tenants of the properties. Approximately 13% of the sample falls into this category. Another variable identifies REITs that are self-managed. Previous research has shown that self-managed REITs are more efficient. About 89% of the sampled REITs indicate they are self-managed.

Finally, we will test the risk effects of forecasted demographic trends. Using data on population and income at the zip code level, we define four variables describing the percentage of the REIT's portfolio located in areas forecast to have either high or low population or income growth. Two variables measure population growth trends. One measures the percentage of the retail portfolio in areas forecast to have negative population growth from 2003 to 2008. The other measures the percentage of the retail portfolio in areas projected to have at least a 5% increase in population over the same period. Approximately 10% of the average REIT retail portfolio falls into either category. Two additional variables measure trends in income growth. One measures the percentage of the retail portfolio in areas forecast to have income growth of less than 10% over the 2003 to 2008 period. The other measures the percentage of the retail portfolio in areas projected to have at least a 20% increase in income over the same period. Approximately 12% of the average REIT retail portfolio falls into the lower income growth category with about 8% in the higher growth category.

Table 2 provides a description of the variables. Table 3 provides summary statistics for the variables. The dependent variables are included in the various regression models in logarithmic form. Several variables have incomplete observations and result in a loss of observations for the estimation of the model. We also dropped REITs that show an effective age of zero and finite-life REITs. Except for the effective age variable and the relative portfolio size variable, the variables represented percentages. These variables were increased by one before the logarithm was calculated.

As previously mentioned, not all of the REIT retail portfolios are held by REITs that invest predominantly in retail property. Fifty-three percent of the sample are self-identified retail REITs. We split the sample into the retail REITs and the other REITs that hold retail properties. Table 4 shows the results of *t* tests for differences in the means between the two subsamples. Only six of the variables show significant statistical differences. Retail portfolios of retail REITs are more diversified geographically and have a larger average property size than retail portfolios of non-retail REITs, even though there is no statistical difference in the overall size of portfolios. Demographically, "non-retail" REITs are less likely to hold properties in areas of negative or above average projected population growth and areas with lower or higher income growth. As such, retail REITs hold more property in high and low growth areas, whereas the "non-retail" REITs hold more retail property in areas with more average demographic forecasts.

Table 2. Description of variables.

Dependent Variables
Variance – Variance of either the monthly or the daily CRSP total returns, based on either a 3-year (2001-2003) or a 4-year (2000-2003) period.
Standard deviation – The square root of the variance of either the monthly or the daily CRSP total returns, based on either a 3-year (2000–2003) or a 4-year (2000–2003) period.
Independent Variables
Incomplete Data – a binary variable with 1 indicating that the variance of the returns is based upon an incomplete set of returns
Property Type Herfindahl Index – The portfolio's Herfindahl index, based on property types and weighed by square footage
Geographic Herfindahl Index – The portfolio's Herfindahl index, based on geographic regions (as defined by NCREIF) and weighed by square footage
Relative Portfolio Size – The total square footage of the REIT retail portfolio divided by the average square-footage of all REIT retail portfolios
Net Leased – A binary variable with 1 indicating the REIT owns primarily net-leased properties, and 0 otherwise
Self-managed – A binary variable with 1 indicating a self-managed REIT, and 0 otherwise
Effective Age – The weighted average effective age of a REIT retail property portfolio using square footage as weights. The effective age equals the lesser of the actual age or the number of years since a known renovation.
Percent Retail – The square footage of retail properties owned by the REIT divided by the total square footage owned by the REIT
Negative Population Growth – Percentage of square footage of a REIT retail property portfolio located in areas with projected declining population growth
Population Growth Greater Than 5% – Percentage of square footage of a REIT retail property portfolio located in areas of projected population growth greater than 5% from 2000 to 2003.
Income Growth Less Than 10% – Percentage of square footage of a REIT retail property portfolio located in areas with projected income growth less than 10% from 2000 to 2003.
Income Growth Greater Than 20% – Percentage of square footage of a REIT retail property portfolio located in areas of projected income growth greater than 20% from 2000 to 2003

Table 3. Summary statistics of the variables.

Variable	Mean	Std. Dev.	Minimum	Maximum	*N*
Standard Deviation (3 years, daily)	0.015	0.010	8.71 E-3	0.082	54
Standard Deviation (4 years, daily)	0.015	9.82 E-3	9.07 E-3	0.079	54
Standard Deviation (3 years, monthly)	0.055	0.035	0.027	0.262	56
Standard Deviation (4 years, monthly)	0.058	0.032	0.031	0.237	56
Variance (3 years, daily)	3.18 E-4	9.07 E-4	7.59 E-5	6.75 E-3	54
Variance (4 years, daily)	3.21 E-4	8.31 E-4	8.22 E-5	6.19 E-3	54
Variance (3 years, monthly)	4.23 E-3	9.33 E-3	7.46 E-4	0.068	56
Variance (4 years, monthly)	4.33 E-3	7.83 E-3	9.50 E-4	0.056	56
Property Type Herfindahl Index	0.790	0.225	0.310	1.000	60
Geographic Herfindahl Index	0.578	0.338	0.134	1.000	60
Relative Portfolio Size	1.094	1.334	0.013	6.708	55
Average Property Size	250,917	233,437	5337	1,069,955	55
Net Leased	0.127	0.336	0	1	55
Self-managed	0.891	0.315	0	1	55
Effective Age	12.651	9.345	0.741	59.584	60
Percent Retail	0.447	0.362	0	1.108	55
Negative Population Growth	0.100	0.114	0	0.436	55
Population Growth Greater Than 5%	0.115	0.010	0	0.493	55
Income Growth Less Than 10%	0.127	0.120	0	0.347	55
Income Growth Greater Than 20%	0.076	0.086	0	0.336	55

Table 4. A comparison of retail REITs versus non-retail REITs holding retail properties.

	Retail REITs ($N = 32$)		Non-retail REITs		Difference in means test
Variable	Mean	Std. Dev.	Mean	Std. Dev.	*t* score
Standard Deviation (3 years, daily)	0.015	0.013	0.014	4.3 E-3	0.78
Standard Deviation (4 years, daily)	0.016	0.012	0.014	4.7 E-3	0.64
Standard Deviation (3 years, monthly)	0.056	0.042	0.054	0.025	0.27
Standard Deviation (4 years, monthly)	0.058	0.036	0.057	0.026	0.08
Variance (3 years, daily)	4.0 E-3	1.2 E-3	2.0 E-4	2.0 E-4	0.96
Variance (4 years, daily)	4.0 E-4	1.1 E-3	2.0 E-4	2.0 E-4	0.87
Variance (3 years, monthly)	4.8 E-3	0.012	3.4 E-3	3.9 E-3	0.62
Variance (4 years, monthly)	4.6 E-3	9.7 E-3	3.9 E-3	4.5 E-3	0.37
Property Type Herfindahl Index	0.790	0.196	0.791	0.259	0.01
Geographic Herfindahl Index	0.404	0.271	0.777	0.297	5.09***
Average Property Size (1,000s of s.f.)	307	285	173	93	2.50**
Relative Portfolio Size	1.135	1.440	1.037	1.200	0.27
Net Leased	0.094	0.296	0.174	0.388	0.87
Self-Managed	0.938	0.246	0.826	0.388	1.21
Effective Age	10.791	5.026	14.776	12.371	1.59
Negative Population Growth	0.156	0.110	0.022	0.062	5.81***
Population Growth Greater Than 5%	0.175	0.136	0.031	0.074	5.05***
Income Growth Less Than 10%	0.204	0.096	0.020	0.046	9.42***
Income Growth Greater Than 20%	0.115	0.074	0.022	0.071	4.72***

** Significant at the 10% level.* *** Significant at the 5% level.* **** Significant at the 1% level.*

Table 5. Results of models explaining REIT retail portfolio risk.

Table 5, Panel A. Daily return data over a 3-year period (2001-2003).

	Risk Measure (Dependent Variable)		
	Std. Dev.	Log of Std. Dev.	Variance
Intercept	0.029 (4.18***)	-4.070 (-18.40***)	1.89 E-3 (2.92***)
Incomplete Data Dummy	-5.04 E-4 (-0.80)	9.70 E-3 (0.05)	-1.63 E-4 (-0.29)
Property Type Herfindahl Index (log)	8.19 E-3 (2.18**)	0.196 (1.62)	8.05 E-4 (2.28**)
Geographic Herfindahl Index (log)	-6.73 E-3 (-2.16**)	-0.748 (-1.86*)	-5.66 E-4 (-1.93*)
Relative Portfolio Size (log)	-3.58 E-3 (-2.48**)	-0.168 (-3.63***)	-2.16 E-4 (-1.59)
Net Leased	-0.011 (-2.22**)	-0.419 (-2.56**)	-8.31 E-4 (-1.73*)
Self Managed	-0.018 (-4.04***)	-0.512 (-3.51***)	-1.68 E-3 (-3.95***)
Effective Age (log)	1.22 E-3 (0.62)	0.069 (1.09)	4.37 E-5 (0.24)
Percent Retail (log)	-0.026 (-2.06**)	-0.748 (-1.86*)	-2.42 E-3 (-2.05**)
Negative Population Growth (log)	0.024 (0.98)	0.444 (0.56)	2.91 E-3 (1.25)
Population Growth Greater Than 5% (log)	-7.86 E-3 (-0.42)	-0.476 (-0.79)	-2.37 E-4 (-0.13)
Income Growth Greater than 20% (log)	-0.032 (-1.29)	-0.911 (-1.16)	-2.77 E-3 (-1.20)
Income Growth Less than 10% (log)	0.048 (1.94*)	1.860 (2.35**)	3.51 E-3 (1.52)
Adjusted R^2	0.373	0.461	0.281
F value	3.63***	4.78***	2.73***
N	54	54	54

(*t*-statistics in parentheses)

Table 5, Panel B. Monthly Return Data over a 3-year (2001-2003) Period.

	Risk Measure (Dependent Variable)		
	Std. Dev.	Log of Std. Dev.	Variance
Intercept	0.109 (4.89***)	-2.492 (-9.93***)	0.021 (3.21 ***)
Incomplete Data Dummy	4.92 E-3 (0.25)	0.086 (0.39)	-1.73 E-4 (-0.03)
Property Type Herfindahl Index (log)	0.027 (2.22**)	0.222 (1.63)	8.25 E-3 (2.35**)
Geographic Herfindahl Index (log)	-0.025 (-2.44**)	-0.264 (-2.32**)	-6.34 E-3 (-2.16**)

Table 5, Panel B. (continued)

	Risk Measure (Dependent Variable)		
	Std. Dev.	Log of Std. Dev.	Variance
Relative Size (log)	-0.012 (-2.49**)	-0.142 (-2.70***)	-2.48 E-3 (-1.84*)
Net Leased	-0.044 (-2.65**)	-0.506 (-2.72***)	-0.010 (-2.10**)
Self Managed	-0.066 (-4.49***)	-0.648 (-3.92***)	-0.018 (-4.29***)
Effective Age (log)	2.92 E-3 (0.46)	0.026 E-3 (0.36)	5.49 E-4 (0.30)
Percent Retail (log)	-0.075 (-1.83*)	-0.483 (-1.06)	-0.025 (-2.11**)
Negative Population Growth (log)	0.062 (0.77)	0.240 (0.27)	0.026 (1.12)
Population Growth Greater Than 5% (log)	-0.045 (-0.75)	-0.906 (-1.33)	-4.75 E-3 (-0.27)
Income Growth Greater than 20% (log)	-0.112 (-1.41)	-1.368 (-1.53)	-0.028 (-1.20)
Income Growth Less than 10% (log)	0.142 (1.78*)	1.427 (1.59)	0.037 (1.62)
Adjusted R^2	0.405	0.475	0.330
F value	4.01***	4.63***	3.18***
N	54	54	54

(*t*-statistics in parentheses)

Table 5, Panel C. Daily return data over a 4-year period (2000-2003).

	Risk Measure (Dependent Variable)		
	Std. Dev.	Log of Std. Dev.	Variance
Intercept	0.028 (4.24***)	-4.048 (-18.20***)	1.74 E-3 (2.93***)
Incomplete Data Dummy	-3.55 E-3 (-0.74)	-0.099 (-0.61)	-3.65 E-4 (-0.85)
Property Type Herfindahl Index (log)	8.22 E-3 (2.27**)	0.208 (1.71*)	7.71 E-4 (2.38**)
Geographic Herfindahl Index (log)	-6.32 E-3 (-2.11**)	-0.195 (-1.93*)	-5.21 E-4 (-1.94*)
Relative Portfolio Size (log)	-3.71 E-3 (-2.70***)	-0.169 (-3.66***)	-2.23 E-4 (-1.81*)
Net Leased	-0.010 (-2.13**)	-0.369 (-2.24**)	-7.71 E-4 (-1.75*)
Self Managed	-0.017 (-3.93***)	-0.486 (-3.32***)	-1.53 E-3 (-3.93***)
Effective Age (log)	1.22 E-3 (0.64)	0.064 (1.01)	4.89 E-5 (0.29)
Percent Retail (log)	-0.022 (-1.79*)	-0.546 (-1.34)	-2.17 E-3 (-2.00*)
Negative Population Growth (log)	0.023 (0.95)	0.333 (0.41)	2.87 E-3 (1.32)

Table 5, Panel C. (continued)

	Risk Measure (Dependent Variable)		
	Std. Dev.	Log of Std. Dev.	Variance
Population Growth Greater Than 5% (log)	-4.61 E-3 (-0.25)	-0.318 (-0.52)	1.27 E-5 (0.01)
Income Growth Greater than 20% (log)	-0.032 (-1.38)	-0.996 (-1.29)	-2.58 E-3 (-1.26)
Income Growth Less than 10% (log)	0.037 (1.61)	1.431 (1.84*)	2.81 E-3 (1.36)
Adjusted R^2	0.360	0.425	0.283
F value	3.48***	4.26***	2.75***
N	54	54	54

(*t*-statistics in parentheses)

Table 5, Panel D. Monthly return data over a 4-year period (2000-2003)..

	Risk Measure (Dependent Variable)		
	Std. Dev.	Log of Std. Dev.	Variance
Intercept	0.103 (4.94***)	-2.549 (-10.38***)	0.017 (3.29***)
Incomplete Data Dummy	-4.13 E-3 (-0.27)	-0.018 (-0.10)	-2.06 E-3 (-0.53)
Property Type Herfindahl Index (log)	0.024 (2.12**)	0.204 (1.52)	6.85 E-3 (2.36**)
Geographic Herfindahl Index (log)	-0.023 (-2.49**)	-0.268 (-2.41**)	-5.38 E-3 (-2.24**)
Relative Portfolio Size (log)	-0.011 (-2.58**)	-0.134 (-2.64**)	-2.30 E-3 (-2.08**)
Net Leased	-0.041 (-2.66**)	-0.478 (-2.63**)	-8.80 E-3 (-2.23**)
Self Managed	-0.056 (-4.09***)	-0.530 (-3.28***)	-0.015 (-4.24***)
Effective Age (log)	2.47 E-3 (0.42)	0.024 (0.34)	-4.89 E-4 (-0.32)
Percent Retail (log)	-0.068 (-1.78*)	-0.451 (-1.00)	-0.021 (-2.18**)
Negative Population Growth (log)	0.072 (0.95)	0.459 (0.51)	0.025 (1.31)
Population Growth Greater Than 5% (log)	-0.021 (-0.36)	-0.482 (-0.71)	-3.82 E-4 (-0.03)
Income Growth Greater than 20% (log)	-0.093 (-1.29)	-1.216 (-1.43)	-0.021 (-1.13)
Income Growth Less than 10% (log)	0.095 (1.31)	0.852 (0.99)	0.026 (1.37)
Adjusted R^2	0.345	0.274	0.325
F value	3.33***	2.66***	3.13***
(*t*-statistics in parentheses)	54	54	54

** Significant at the 10% level.* *** Significant at the 5% level.* **** Significant at the 1% level.*

Section III. Results

Results are presented in Table 5. Panel A shows the results for risk measures calculated with daily return data over a three-year period (1/2001 through 12/2003). Panel B presents monthly results over the same period. Panel C has the results for risk measures calculated with daily return data over a four-year period (1/2000 through 12/2003). Panel D shows the monthly results over the same period. All of the *F*-statistics are significant at minimally a .05 level, with most significant at the .01 level. Explanatory power of the models, as measured by adjusted R^2, ranges from 0.239 to 0.461. An analysis of variance inflation factors shows no evidence of multicollinearity.

In all cases, significant coefficients, at a significance level of 0.10 or better, are shown for the following variables: the Geographic Herfindahl Index, Net Leased REITs, and Self-Managed REITs. For at least three-fourths of the estimated models, the following variables had significant coefficients: the Property Type Herfindahl Index, Relative Portfolio Size, and Percent Retail. The effective age variable and the demographic trend variables were, for the most part, insignificant. Thus, the results show that retail portfolio risk in REITs increases with increased diversification into different geographic regions. Conversely, retail portfolio risk in REITs decreases with self-management, property type diversification, net leased properties, and increased portfolio size. Presumably, the risk associated with projected demographic changes and property obsolescence has been diversified away or otherwise accounted for by proxy with one of the other risk factors.

As expected, the diversification metrics have opposing impacts. However, in contrast to other REIT studies, increased geographic diversification induces risk, whereas increased property type diversification seems to decrease risk as measured by the variability of returns. The result for property type diversification is interesting because it considers diversifying across retail property sub-types, whereas for other REIT studies the measure considers the broader definitions of property type. Intuitively, it makes sense that owning a variety of center types would lower the variability of returns as different center types perform differently and operate in different market niches. The result for geographic diversification may be a result of using too broad of a regional classification. This result may differ if the index was calculated by state, MSA, or by an economics-based classification system such as those proposed by Smith et al. (2004) or Anderson and Shain (2001).

Table 6 shows the results of a sensitivity analysis where the model is estimated at the variable means and then re-estimated after shocking one variable. For property type diversification, using an estimated model from Table 5, Panel C, a 10% increase in the property type Herfindahl index, an action resulting in a less diversified portfolio, shows an increase in the standard deviation of daily returns of between 2% and 3.2%. A decrease of 10% in the index shows a decrease of between 2% and 3.5% in the standard deviation of daily returns. Similar changes to the geographic Herfindahl index show smaller changes to the standard deviation of returns, but in opposite directions.

Table 6. Sensitivity (% change) of selected variables to shocks from their mean value.

Table 6, Panel A. Using the results of the standard deviation model using 4 years of daily data.

	Percentage Change from the Mean					
Variable	+50%	+25%	+10%	-10%	-25%	-50%
Property Type Herfindahl Index	NA	NA	3.15	-3.48	-9.51	-22.92
Geographic Herfindahl Index	-10.31	-5.67	-2.42	2.68	7.32	17.63
Effective Age	1.99	1.10	0.47	-0.52	-1.41	-3.40
Relative Portfolio Size	-6.05	-3.33	-1.42	1.57	4.29	10.35
Percent Retail	-35.89	-19.75	-8.44	9.33	25.46	61.35
Negative Population Growth	37.52	20.65	8.82	-9.75	-26.62	-64.14
Population Growth Greater Than 5%	-7.52	-4.14	-1.77	1.95	5.34	12.86
Income Growth Less than 10%	60.36	33.22	14.19	-15.68	-42.83	-103.19
Income Growth Greater than 20%	-52.20	-28.73	-12.27	13.57	37.04	89.24

Table 6, Panel B. Using the results of the log standard deviation model using 4 years of daily data.

	Percentage Change from the Mean					
Variable	+50%	+25%	+10%	-10%	-25%	-50%
Property Type Herfindahl Index	NA	NA	2.00	-2.17	-5.81	-13.43
Geographic Herfindahl Index	-7.61	-4.26	-1.84	2.08	5.77	14.47
Effective Age	2.63	1.44	0.61	-0.67	-1.82	-4.34
Relative Portfolio Size	-6.62	-3.70	-1.60	1.80	4.98	12.43
Percent Retail	-19.86	-11.47	-5.07	5.92	17.01	46.00
Negative Population Growth	14.46	7.71	3.22	-3.45	-9.14	-20.61
Population Growth Greater Than 5%	-12.10	-6.85	-2.99	3.41	9.58	24.66
Income Growth Less than 10%	78.64	37.62	14.61	-14.00	-33.75	-62.91
Income Growth Greater than 20%	-33.23	-19.93	-9.06	11.06	33.18	99.45

The obsolescence effect was insignificant in all models. This result is surprising given the competitive disadvantages faced by older centers. However, if the REIT is able to effectively buy these properties at the appropriate prices and has the expertise in handling the capital expenditures, there is no a priori reason why an older property portfolio should under-perform.

The relative portfolio size variable was insignificant in only one case. In all cases, having a significant coefficient, the results show that larger portfolios reduce risk. As shown in Table 6, a 25% increase in the relative size of the retail portfolio results in a decrease in the standard deviation of daily returns of about 2.5%. A similar reduction in portfolio size shows about a 4% to 5% increase in the standard deviation. This result strongly parallels results from the REIT efficiency literature that shows scale economies exist for most categories of REITs, including retail REITs.

The "percent retail" variable is used primarily as a control variable to account for retail properties not held by retail REITs. The estimated coefficients for this variable, except for one case of insignificance, are consistently significant and negative. The results suggest that as a REIT focuses more of its investment into retail, thus diversifying less across other non-retail property types, its total risk, as measured by the variability of returns, decreases. This result is consistent with the property type diversification results from the literature. Thus, our results show that risk is reduced through more focus into a property type (retail) combined with more diversification within the property type (e.g., malls, power centers, shopping centers, etc.).

The results show self-managed REITs holding retail properties to have lower total risk compared to those that are managed by third parties or affiliates. Using the same models from which Table 6 was derived, the estimated standard deviation is 64% to 74% larger for REITs that are not self-managed. The results further show that REITs holding primarily net-leased properties and holding retail properties also have lower total risk. Again using the same models from which Table 6 was derived, the estimated standard deviation for net-leased REITs is 48% to 63% larger than the standard deviation for REITs that are not invested primarily in net-leased properties.

The demographic variables were, for the most part, insignificant. This result is somewhat surprising in an intuitive sense. One possible explanation is that the demographic effect is proxied for or overwhelmed by one of the other effects. Given the dramatic difference in demographic characteristics of retail REITs compared to non-retail REITs holding retail property (Table 4), it is of interest to split the sample to see the differences in the results. If we drop all REITs holding less than 60% of their square footage in retail and rerun the models, three of four demographic trend variables are statistically significant with the high expected growth variables showing risk-reducing effects. Unfortunately, although these models have over 50% explanatory power and significant *F* values, there is only a sample size of 24. However, there is evidence that demographic trends are important, particularly if the REIT specializes in retail properties.

Section IV. Conclusions

Previous research has shown that REITs diversifying across property types do not perform as well as REITs that are focused into one property type. The results of this study provide evidence that REITs diversifying within a property type, that is across property sub-types, have less total risk than REITs focusing into one property sub-type. For geographic diversification, previous research has shown that geographically-diverse REITs outperform geographically-focused REITs. However, this study shows that, within the retail property type, geographic diversification increases total risk. Thus, the effects of geographic and property type diversification within a single property type are opposite those for the REIT in the aggregate. Although the results of this study apply to REIT retail portfolios and cannot be generalized, they do provide insight to the risk behaviors of a retail real estate portfolio. While many retail REITs are focused, concentrating their investment into a single sub-type such as malls or outlet centers, risk reduction may be gained by crossing over into other sub-types within the same geographic market.

Further, the results provide additional evidence of economies of scale within the REIT industry. The results show that larger retail portfolios are less risky. Also, total risk decreases as the percentage of retail property held by a REIT increases. Perhaps the perceived benefits of property subtype diversification can be explained by the apparent motivations for the REIT to expand. For a retail REIT to expand within the same market, it may be prudent to invest in diverse retail property types to take advantage of crossing over into other market niches while still remaining in the retail category to benefit from potential operating efficiencies.

Concentrating investment into properties that are net leased and "self" managing, the REITs portfolio are both associated with reduced total risk. In the case of net leasing, expense risk is borne by the tenants, making the cash flows to the REIT more stable. In the case of self-management, total risk is controlled, perhaps because of management's direct involvement in property level decision-making. Finally, the results offer weak evidence that a REITs presence in strong growth markets reduce total risk.

There remain many unanswered questions. Other factors may affect retail portfolio risk. Major lease expirations and financially-distressed tenants can have a major impact on the cash flows, capitalization rates or discount rates. The results are not conclusive that property obsolescence has no impact on total risk. Also, demographics seemingly should play a larger role in the risk factor of a portfolio. Perhaps, more study into the specifics of these unanswered questions will serve to fit more pieces to the risk puzzle.

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