

The Relationship between REIT Property Types and Economic Risk Factors

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Abstract

This study examines the influence of macroeconomic risk factors upon Real Estate Investment Trusts (REITs) that invest in distinct types of properties that represent different economic sectors. Although several studies have explored the impact that economic risk factors have upon Equity REITs, the focus was solely on REITs as a single group. The findings from this analysis reveal strong differences across property types in the influence that macroeconomic risk factors have upon REIT returns. These property-based variations also appear in the pattern of behavior between REIT returns and information shocks originating from changes in the economic risk factors. Test results also show evidence of size-based differences across and within property types in both overall sensitivity and in dynamic responses to changes in the economic risk factors. These findings provide additional insight into the risk exposures of real estate investments and the behavior of REIT returns that may have important implications for portfolio formation and risk management practices.

Introduction

There are strongly held beliefs that changes in macroeconomic conditions generate broad responses in equity returns. These market-wide variables, if they represent non-diversifiable risk factors, should then be priced within security returns as required compensation in a risk-averse environment. Yet research has provided relatively little empirical evidence identifying strong links between changes in macroeconomic variables and general equity returns. This study explores new terrain by examining how changes in economic risk factors impact Equity REITs that invest in distinct types of properties that represent different economic sectors. An underlying reason for studying REITs is that the federal government requires REITs to have at least 75 percent of their assets invested in real properties and payout at least 90 percent of taxable earnings as dividends. Given the unique structure of REITs, their returns may respond differently to changes in economic activity that may impact the cash flows Equity REITs derive from their properties that would subsequently affect their dividends. We hypothesize that the sensitivity of Equity REITs to macroeconomic factors will vary across property types and that these differences will offer implications for portfolio construction and risk management strategies.

Much of the theoretical framework emphasizing the role economic risk factors play in the equity markets has not been consistently supported by empirical studies. Chen, Roll, and Ross (1986) (CRR) examine five potential economic factors: expected inflation; unexpected inflation; the growth rate of industrial production; a bond default risk premium; and a term structure spread. Their study of the general equity market finds that the term structure and default premiums are priced in security returns. The authors also observed that industrial production had the potential to be a priced economic risk factor while the inflation measures had a weaker effect upon returns. Flannery and Protopapadakis (2002) examine 17 macroeconomic series and find that inflation and money growth are the primary variables that are significantly correlated with aggregate equity returns.

The pattern of inconsistent findings from studies of the general equity market is replicated in studies focusing upon real estate returns. Ling and Naranjo (1997) examine the links between real estate returns and several macroeconomic risk factors and find that only real per capita consumption and the real Treasury bill rate were priced consistently in their sample of real estate firms. Other state variables with less significant impact were changes in the term structure and unanticipated inflation. Chen, Hsieh, Vines and Chiou (1998) find that the economic risk factors of the CRR (1986) study do not impact Equity REIT returns except for relatively modest effects from an unexpected change in the term structure. Allen, Madura and Springer (2000) focus only on interest rate risk and observe that Equity REIT returns are sensitive to changes in long- and short-term interest rates.

The findings of earlier studies may help investors understand the economic drivers of real estate returns, yet research that examines REITs and macroeconomic risk factors produce mixed results while focusing on Equity REITs as a single group. This paper provides an alternative to earlier research by subdividing Equity REITs by property type since such funds invest in properties that are based in different sectors of the economy. The limited analysis of REIT property types suggests different economic and financial characteristics may exist across property types, as noted by Gyourko and Nelling (1996) who observe variations in systematic risk across property types.

The primary analytical tool we use is a vector autoregression (VAR) model in which the REIT returns and economic risk factors are endogenous variables. This model allows us to quantify the relation between REIT returns from different property types and changes in macroeconomic variables. We also use this methodology to estimate the impulse response functions among the REIT returns and macroeconomic variables. The impulse response functions identify the dynamic, short-term relationships that emerge with a shock to the variables within the system.

Our findings reveal strong differences across property types in the relationships between REIT returns and the economic risk factors. These property-based variations revealed in the VAR analysis also appear in the impulse response functions. We observe significant differences across property types in the pattern of behavior between REIT returns and information shocks originating from changes in the economic risk factors. Size-based differences also appear within property types in both overall sensitivity and in dynamic

responses to changes in the economic risk factors. These findings provide additional insight into the risk exposures of real estate investments and the behavior of REIT returns that may have important implications for portfolio formation and risk management practices.

The remainder of our paper is organized as follows. The following section, data and methodology framework, presents the data and methodological framework. The empirical analysis of REIT property types section describes the test results from the overall sample and size-based analyses. We present our concluding comments in the final section.

Data and Methodological Framework

REIT property data and economic risk variables

We examine the impact of economic risk factors upon the REIT sector and focus upon four major property types within Equity REITs: Apartments, Office, Industrial, and Retail. We also include an Equity REIT index that includes firms from all property types, including the four groups emphasized in this study; this index serves as a relative benchmark for analysis.¹ The REIT monthly data come from the CRSP/Ziman Real Estate Data Series and span 1989 through 2006.² We use the excess returns for the equally-weighted portfolios, and Table 1 presents the summary statistics for each REIT group. We follow the example of Hou (2007) and construct size-based portfolios that comprise the smallest and largest firms at the 30th percentile of each distribution tail. The economic variables presented in this paper are: inflation (CPI); real personal consumption expenditures of non-durable goods (CONSUM), industrial production (IND), real Treasury bill rate (RTBL), and the term structure spread (TERM). The monthly data for these variables were obtained from the Federal Reserve Bank of St. Louis Economic Database (FRED). The economic justification for these economic risk factors are presented in CRR (1986); Chen et al. (1997); and Flannery and Protopapadakis (2002). We also include the excess return of the CRSP equally weighted portfolio (MKT) to control for systematic market risk.³

The consumption variable (CONSUM) reflects the monthly change in real personal consumption expenditures of non-durable goods. The inflation measure (CPI) is the change in the month-end consumer price index for all urban consumers, not seasonally adjusted.⁴ The growth in industrial production (IND) is measured as the change in the

¹ The Equity REIT index from the CRSP/Ziman Real Estate Data Series includes the following property types: diversified; health care; industrials; office; lodging/resorts; residential (with apartments being a subset); retail; and self-storage.

² While available return data precedes 1989, the beginning date reflects a time when the REIT sample increased sufficiently to accommodate the empirical methodology.

³ We follow the example of Ling and Naranjo (1997) and use only those economic risk factors that are priced in at least two of the groups. It is for this reason that we do not use the default risk premium that was highlighted in CRR (1986).

⁴ We follow the example of Flannery and Protopapadakis (2002) and use the consumer price index as the measure of inflation. Thus, we did not use measures representing decompositions to capture anticipated and unexpected inflation.

month-end growth rates for industrial production. We measure the real Treasury bill rate (RTBL) as the month-end difference between the annualized yield of a three-month U.S. Treasury bill and inflation rate measured from the consumer price index for all urban consumers. The term structure spread (TERM) represents the change in the slope of the yield curve. This economic risk factor is the monthly change in the difference between the annualized yield of a 10-year U.S. Treasury bond and a 3-month Treasury

**Table 1: Summary Statistics for Excess Monthly Returns:
Mean and Standard Deviation 1989 – 2006**

REIT	(x100)	All REITs	Small Firms	Large Firms
Equity Index	Mean	0.79	0.39	1.10
	Std dev	3.39	4.07	3.82
Industrial	Mean	0.78	0.25	1.45
	Std dev	3.95	6.11	5.12
Office	Mean	0.72	0.58	0.78
	Std dev	5.56	10.16	5.56
Apartment	Mean	1.16	1.61	1.30
	Std dev	4.57	12.63	4.21
Retail	Mean	0.75	0.35	1.19
	Std dev	3.52	3.67	4.15

All mean returns within each REIT property type are statistically different at $p=0.001$. All standard deviations within each REIT property type are statistically different at $p=0.001$ except for the Office REITs (All firms vs. Large firms).

Table 2: Summary Statistics of Economic Risk Factors 1989 – 2006

	CONSUM	CPI	IND	RTBL	TERM	MKT
Mean x100	0.228	0.239	0.226	0.816	-0.005	0.943
Std Dev x 100	0.221	0.221	0.539	0.465	0.228	5.115

bill. The market portfolio (MKT) is the excess return of the equal-weighted CRSP portfolio. Table 2 presents summary statistics of the economic risk factors while Table 3 contains the correlations between these macroeconomic variables.

Table 3: Contemporaneous Correlations 1989 – 2006

	CPI	IND	RTBL	TERM	MKT
CONSUM	-0.11	0.15	-0.04	-0.08	0.08
CPI		-0.11	-0.26	0.06	-0.04
IND			0.00	-0.06	0.08
RTBL				-0.04	-0.11
TERM					0.06

The VAR Methodology

This study uses vector autoregressions (VARs) to characterize the relationship between REIT property returns and macroeconomic risk factors. The VAR methodology, at its core, represents a system of regressions where dependent variables are expressed as linear functions of their own and each other's lagged values. Ling and Naranjo (2006) observe that VARs are particularly beneficial for forecasting systems of interrelated time series variables such as security returns and economic variables. The results from the VAR model provide evidence of the varying influences that macroeconomic variables have upon REITs of different property types.

The theoretical relationship among these variables may be difficult to determine, given the different findings in earlier studies. This study does not attempt to provide a theoretical model but strives to provide evidence on how economic variables interact differently across REIT property types.⁵ The VAR model that analyzes the interrelationships among REIT returns and the six economic and market variables is expressed as:

$$Y_t = c + \sum_{k=1}^L a_k Y_{t-k} + e_t, \quad (1)$$

where Y_t is an 7 x 1 column vector for the REIT return and the six economic and market variables at time t ; c is a 7 x 1 vector of intercepts and a_k is a 7 x 7 matrix of coefficients; L is the lag length; and e_t is the 7 x 1 column vector of serially uncorrelated error terms. We use the Akaike Information Criterion to identify the number of lags for each economic variable, and the tests reveal that one lag is optimal for each of the monthly economic variables. Additionally, the forecast errors in the VAR model are typically serially correlated since they are a linear combination of the fundamental shocks. We

⁵ The standard methodology requires an *a priori* ordering of variables within the VAR model, thus we establish the sequence of economic variables based upon their levels of statistical significance in a standard OLS regression using the REIT return as the dependent variable and the macroeconomic risk factors as independent variables.

observe from Table 3 that the correlations among the economic risk factors are low, but we eliminate any residual contemporaneous correlation by using the Choleski orthogonalization transformation method in the VAR analysis.

We later use the estimates of a_k to compute impulse response functions (IRFs) that depict the dynamic, short-term relationship between variables that emerges when a one standard deviation shock occurs to a variable in the system. This test allows us to estimate the speed, magnitude, and direction of movement in REIT returns when changes occur to the macroeconomic risk factors.

Empirical Analysis of REIT Property Types

VAR estimates – Equity Index and Property REITs

The relation between the REIT returns and economic variables is initially presented in the regression output from equation (1). Table 4 presents the VAR estimates for the four property REITs and the Equity REIT index for the sample period, 1989-2006. The results reveal considerable differences across property types in the relationship between REIT returns and the economic risk factors. We first observe that the five economic risk factors significantly impact the returns of the Equity REIT index. The macroeconomic variables may have greater influence upon the returns of the equity REIT index since the index spans all property types and represents broader integration across the economy sectors. The real Treasury bill rate is the only economic risk factor that is priced in the returns across all REIT property types, a finding that emphasizes the broad influence of the core short-term interest rate. The market portfolio does not exhibit explanatory power for Equity REIT returns, nor in those of three property types. This finding supports Allen et al. (2000) who observe a diminishing effect from systematic risk upon REIT returns across time.

The test results show that the influence of economic risk factors impacting the Equity REIT index does not hold across the four property types. The VAR results show that the four property REITs exhibit reduced and varying levels of sensitivity to the macroeconomic factors, which has implications for portfolio risk management. The Industrial and Office REITs respond to three risk factors with only one macroeconomic variable shared by both property types, the real Treasury bill rate. The Industrial REIT returns demonstrate sensitivity to the consumer spending; real Treasury bill; and the term structure metrics.⁶ These findings suggest that REITs in this property type are significantly affected by changes in short- and long-term interest rates as well as changes in spending patterns among consumers that eventually drives the level of industrial production within the economy. Thus the cash flows from REITs emphasizing industrial properties appear to be sensitive to the cost of financing and the changes in economic conditions that correspond to non-discretionary spending patterns. Industrial REIT

⁶ Chen et al. (1986) assert that the term structure metric represents unanticipated changes in returns on long bonds.

returns are impacted by only half of the economic risk factors that influence the returns of Equity REITs; a finding that may prove useful to portfolio managers.

Table 4: VAR Estimates for all REITs 1989 – 2006

REITs	CONSUM	CPI	IND	RTBL	TERM	MKT
Equity	0.66 (0.08)	-2.94 (0.01)	-1.03 (0.01)	-1.29 (0.01)	-1.74 (0.07)	0.06 (0.23)
Industrial	0.81 (0.07)	-1.60 (0.21)	-0.78 (0.12)	-1.40 (0.02)	-3.07 (0.01)	0.06 (0.35)
Office	0.37 (0.56)	-3.28 (0.07)	-0.46 (0.51)	-1.51 (0.07)	-2.25 (0.17)	0.19 (0.02)
Apartment	0.23 (0.67)	-2.07 (0.17)	-0.53 (0.37)	-1.60 (0.07)	-1.55 (0.26)	0.09 (0.16)
Retail	0.67 (0.09)	-3.52 (0.00)	-1.27 (0.00)	-1.67 (0.00)	-1.95 (0.05)	0.06 (0.25)

While Office REITs are impacted by the real Treasury bill rate, they also react to inflation (CPI) and market risks. The test results indicate that changes in short-term interest rates and in inflation affect the behavior of interest rates. The significance of inflation, measured by the CPI, differs from earlier studies that find a weak relationship between changes in the overall inflation and equity returns. Interestingly, only Office REITs show sensitivity to market risk. These results suggest that market risk as well as interest rate variables impact the cash flow associated with office properties. Importantly, these REIT returns are not significantly influenced by four of the economic factors that affect the broader Equity REIT returns, a finding that offers additional opportunities for risk management.

Apartment REITs demonstrate a notable lack of sensitivity to all but one of the economic risk factors that influence returns of the Equity REIT index. Returns from this property type are impacted by changes in the real Treasury bill rate, which often reflects anticipated changes in broad, financial conditions. The resistance of Apartment REITs to the other risk factors that impact the Equity Index and other REIT categories corresponds to other studies that note the counter-cyclical nature of this property type.⁷

The Retail REITs share the greatest similarity with Equity REITs with sensitivity to five of the economic risk factors. The return behavior from REITs in retail properties suggests that cash flows from the consumer markets fluctuate more readily with changes in the economic climate that are reflected in the economic and financial risk factors. The lack of

⁷ See Patterson (2008) and Hines (2001).

differentiation suggests that Retail REITs may offer smaller benefits of risk management to broad movements in the economy.

We observe from the VAR estimates presented in Table 4 that macroeconomic variables have significant differences in influence across REIT property types. While the Equity Index and Retail REIT returns are significantly impacted by the five economic variables, the REITs from the Industrial, Office, and Apartment property types display varying levels of sensitivity to different subsets of these risk factors. These findings may provide significant implications for risk management and portfolio construction practices.

Impulse responses – Equity Index and Property REITs

This section focuses upon the pattern of return behavior that emerges from changes in the macroeconomic variables. The VAR estimates identify those risk factors that significantly impact REIT returns, as shown in Table 4, but subsequent return behavior may differ across property types to information shocks from these economic variables. We conduct impulse response analyses that measure the reactions of REIT returns to one standard deviation changes in the economic risk factors. This analysis provides the time path of the dynamic relations that result within REIT returns from a shock to the macroeconomic variables. We present the responses only when the VAR estimates reveal a statistically significant interaction.⁸

In Panel A of Figure 1, we plot the impulse responses of REIT returns to a one standard deviation change in the real Treasury bill rate.⁹ This risk factor, as shown in Table 4, is the only macroeconomic variable that has a significant influence upon all REIT groups. We observe sharp differences across the REIT groups in the magnitude and persistence of responses to changes in this risk factor. Initially, all REIT groups respond positively to a shock in the real Treasury bill rate. Yet the magnitude of response varies from a minor movement among Industrial and Equity REITs to a sizable 0.40 among Retail firms. The responses of Equity and Office REITs become negative in the second month, and the returns never fully recover their prior positions within the first year. We also observe persistence with both REITs when their responses become increasingly negative after the second month. The return pattern suggests that returns from these REITs do not quickly absorb the information content from a shock in the real Treasury bills. The return patterns provide a strong contrast with the remaining three REITs: Industrial; Apartment; and Retail. The returns from these property types all recover fully from the information shock within the first three months, regardless of the magnitude of their initial movements.

⁸ We based the sequence among variables for the impulse response analysis by the level of significance in the VAR estimates. Changes in the sequence of variables did not affect the resulting impulse responses among any of the significant risk factors.

⁹ The figures reflect the average pattern of return movement with a single one-standard deviation change in this risk factor, depicted by the center line. The two outside lines reflect the one-standard error confidence bands. For example, when the real Treasury Bill rate changes by one standard deviation, the figure captures how much the average return moves in its initial response (Time =1) and how quickly it absorbs the impact of the change and returns to its previous equilibrium at 0.0 on the horizontal axis. The impact of a second shock is not depicted because the figures reflect the average response to shock from the economic risk factor.

The impulse responses from a one-standard deviation change in inflation (CPI) are presented in Figure 1, Panel B for the three REIT groups that displayed sensitivity to changes in inflation. The Office and Retail REITs as well as the Equity REIT index all demonstrate negative responses to inflationary shocks, but the magnitude and resulting movements vary across property types. The Equity and Office REITs react sharply but recover fully within four months of the initial shock. Retail REITs display a small, negative response in the first month with increasingly negative movement in the second month, suggesting that these REIT returns do not fully absorb to the information contained in the inflationary shock. Importantly, these REIT returns do not recover fully within the twelve months following a shock in the rate of inflation.

The responses of REIT returns to shocks in the Term structure spread are presented in Panel C for the Industrial, Retail, and Equity Index groups. The noticeable difference across these groups is the magnitude of initial response with approximate responses from a negative 0.30 percent in the Equity index to more than negative 0.60 percent among Industrial REITs. While the magnitude of initial response varies considerably, all three REIT groups display quick adjustment to the news shock and recover fully within three months.

The impulse responses of the REIT returns to changes in the consumption and industrial production variables elicited similar behavioral patterns in returns among the property groups. While the figures are not presented, the commonality of responses to shocks in these economic risk factors suggests that the property types do not provide sufficient differentiation in risk exposure to these macroeconomic variables.

**Figure 1, Panel A: Response of REIT returns to Shocks
in the real Treasury bill rate, 1998-2006**

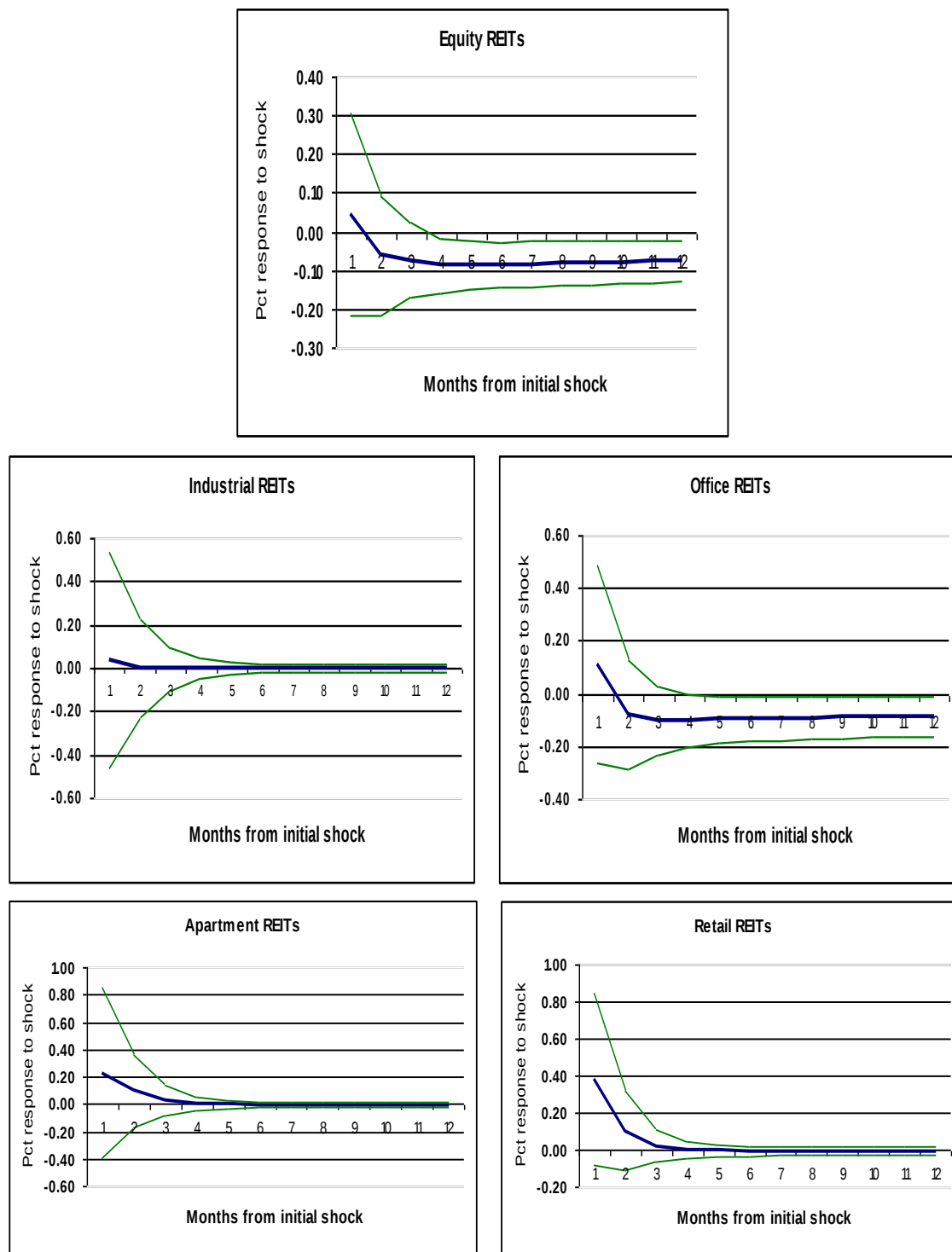
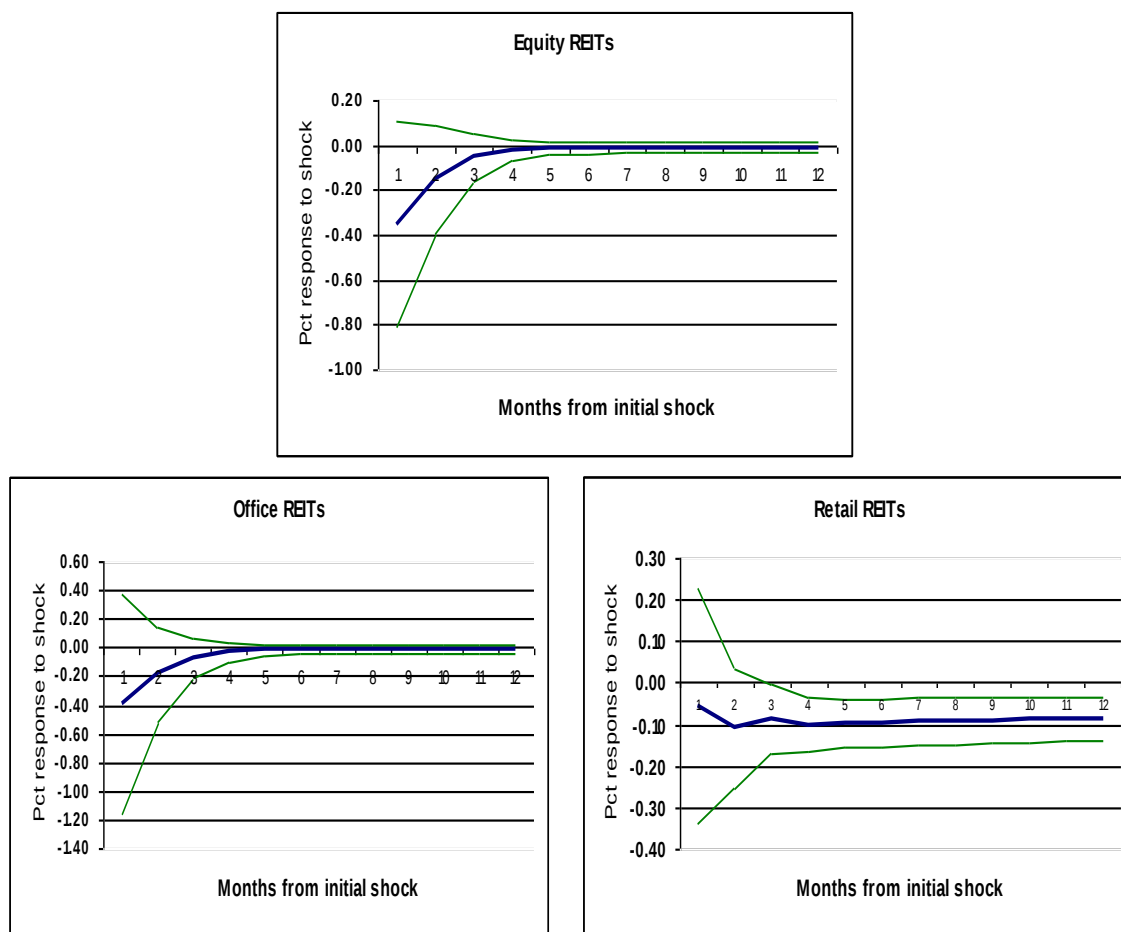


Figure 1, Panel B: Response of REIT returns to Inflation (CPI) Shock, 1998-2006

VAR estimates – Size-based Analysis of REITs

We examine the REIT sample for evidence of size-based differences across and within property types in the interaction of REIT returns and the economic risk factors. Research frequently identifies different behaviors and levels of risk exposure between large and small firms, thus we conduct tests to determine different levels of sensitivity to the economic risk factors. We follow the example of Hou (2007) and identify within each property type the firms in the lowest and highest 30 percent of the REIT distribution based upon market capitalization. Equally weighted portfolios of large and small REITs are rebalanced at the beginning of each year.

Table 5 presents the VAR estimates for the large and small firms from the four property REITs and the Equity REIT index. The results show that large and small REITs often have different relationships with the economic risk factors; we present the VAR estimates for large firms in Panel A while Panel B provides the test results for the portfolios of

Table 5 VAR Estimates for Size-based REIT Portfolios, 1989 – 2006

Panel A: Large Firms						
	CONSUM	CPI	IND	RTBL	TERM	MKT
Equity	0.83 (0.06)	-2.60 (0.04)	-0.98 (0.05)	-0.93 (0.11)	-2.32 (0.04)	0.08 (0.18)
Industrial	1.16 (0.05)	-1.58 (0.40)	-0.24 (0.73)	-1.37 (0.11)	-3.83 (0.02)	0.05 (0.49)
Office	0.81 (0.20)	-3.37 (0.06)	-0.71 (0.31)	-1.02 (0.22)	-4.81 (0.00)	0.16 (0.05)
Apartment	0.88 (0.08)	-0.89 (0.52)	-0.83 (0.13)	-0.05 (0.94)	-1.19 (0.35)	0.06 (0.28)
Retail	1.06 (0.02)	-4.31 (0.00)	-1.31 (0.01)	-1.60 (0.01)	-2.91 (0.01)	0.04 (0.45)
Panel B: Small Firms						
	CONSUM	CPI	IND	RTBL	TERM	MKT
Equity	0.87 (0.05)	-3.06 (0.02)	-1.26 (0.01)	0.10 (0.09)	-1.49 (0.01)	-1.12 0.32
Industrial	-0.31 (0.67)	-0.09 (0.97)	0.24 (0.77)	-1.03 (0.27)	-2.34 (0.21)	0.11 0.21
Office	1.11 (0.35)	-5.42 (0.10)	-1.17 (0.38)	-0.95 (0.54)	1.62 (0.60)	0.28 0.05
Apartment	-1.35 (0.36)	-3.84 (0.35)	-0.66 (0.68)	-2.68 (0.17)	-3.87 (0.31)	0.39 0.02
Retail	0.14 (0.73)	-2.28 (0.05)	-1.05 (0.02)	-1.84 (0.00)	-1.76 (0.10)	0.09 0.08

small REITs. The findings show that CONSUM is priced in the returns of large REITs in four of the five groups while this economic variable significantly impacts only the small firms within the Equity REIT index. This result suggests that larger firms are significantly more responsive to changes in the consumer spending for non-discretionary goods. The results also show that the term structure spread (TERM) has a significant impact upon the returns in four of the large REIT portfolios whereas the returns of only two small portfolios are similarly influenced. This finding suggests that larger firms are more sensitive to changes in the spread between short- and long-term interest rates. We also observe that market risk (MKT) is priced the returns of small REITs in Office, Apartment and Retail property types while only large Office REIT returns are

significantly impacted. Smaller REITs appear to be more sensitive than large REITs to changes in the general equity market. All these size-based differences may offer implications for risk management strategies.

The test results also show that inflation (CPI) and industrial production (IND) demonstrate similar influence in the returns of small and large REIT returns. Interestingly, these economic risk factors exhibit the same significant influence on the size-based portfolio returns as they did for the entire sample that was presented earlier. The CPI variable significantly impacts all portfolios of the Equity Index, Office, and Retail groups, which is similar to the earlier findings for the entire sample of REITs. The IND variable is consistently priced in the returns of large and small REITs within the Equity Index and Retail groups. The overall findings of the size-based analysis reveal strong differences in the levels of sensitivity of REIT returns to the economic risk factors, both across and within property types.

Impulse responses – Size-based Analysis of REITs

The results presented earlier reveal that differences exist across property types in the dynamic relationship between REIT return movement and information shocks in macroeconomic risk factors. The tests presented in this section focus on responses of size-based portfolio returns to determine if differences in return behavior exist within property types. We examine the impulse responses only when the VAR estimates in Table 5 show significant explanatory power on the returns of both large and small REITs within the same property type.

Inflation (CPI) was a significant risk factor for large and small REITs across three groups: Equity Index; Office; and Retail, and Figure 2, Panel A presents their impulse responses. We observe significant size-based differences within the Equity Index and Retail REITs. The returns of large firms respond sharply and negatively to the inflationary shock yet recover fully within three months, a pattern of behavior that contrasts sharply with the returns of small firms. The returns of small REITs initially display a modest, positive reaction that turns into a negative response in the second month with an increasingly negative movement in the third month. The response pattern, with increasingly negative responses for the first three months, suggests that the returns of the small REITs are adjusting slowly to the information from the inflation shock. The returns for the small Equity Index and Retail REITs do not recover within twelve months from the initial shock from inflation risk factor. The responses from the Office REIT portfolios show a strong difference in magnitude of the initial response. The returns of small Office REITs respond almost twice as negatively as the larger firms in this property type, yet both portfolio returns recover within five months of the initial shock.

Other size-based differences exist with economic risk factors such as the real Treasury bill rate (RTBL) and Industrial Production (IND). We observe from Panel B of Figure 2 that Retail REIT returns of both portfolios react positively in the first month after a shock from this core interest rate but differ in their subsequent behavior. The returns of large firms respond negatively in the following months and never recover within the first year

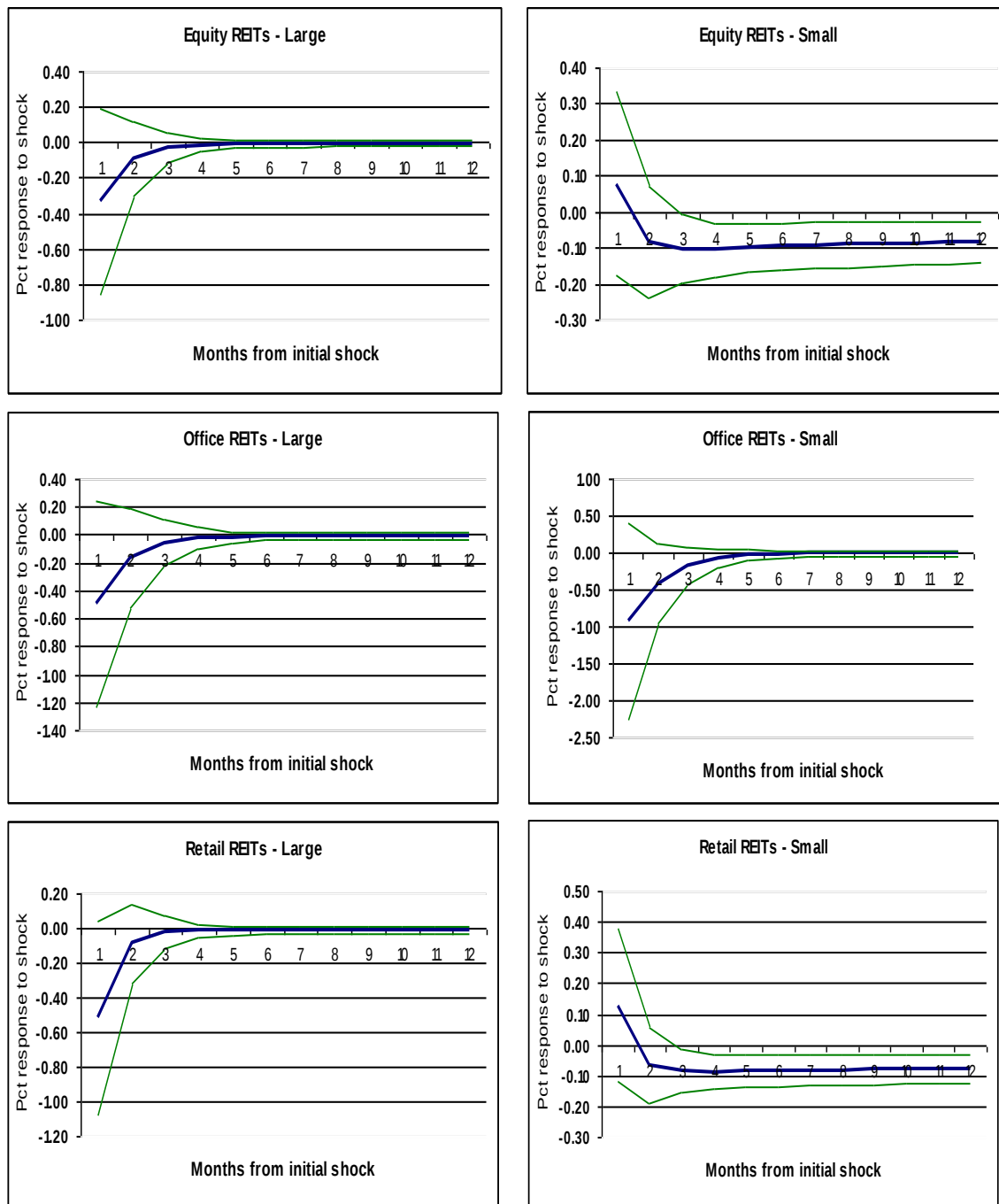
Figure 2, Panel A: Response of REIT returns to Shocks in Inflation, 1998-2006

Figure 2, Panel B: Response of REIT returns to Shocks in Treasury Bills, 1998-2006

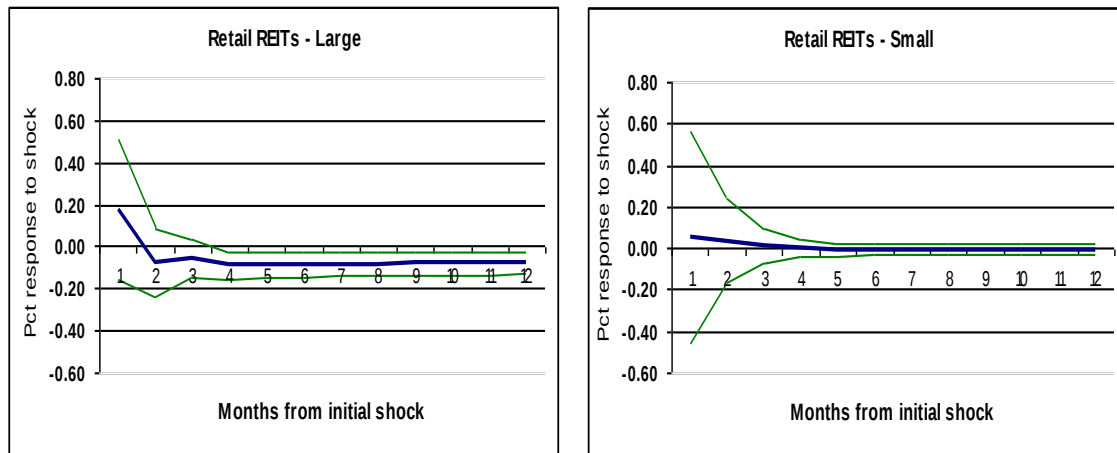
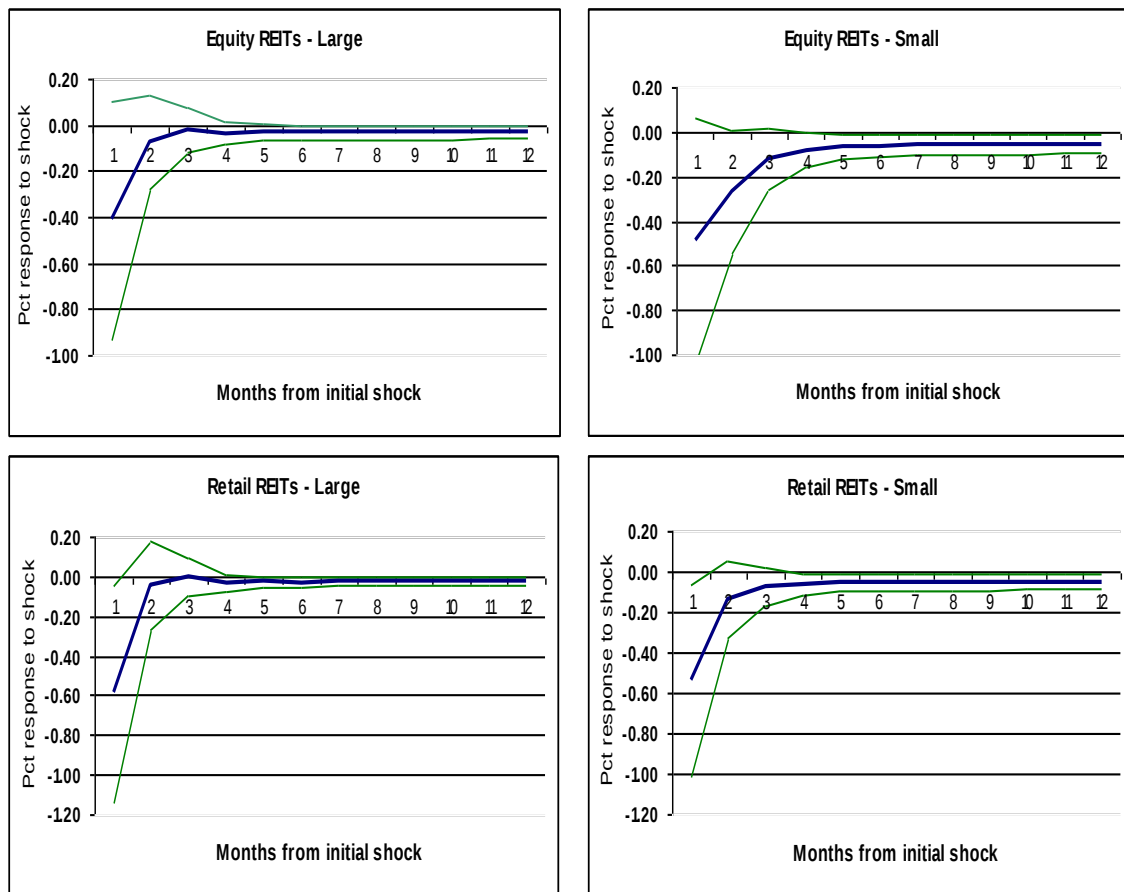


Figure 2, Panel C: Response of REIT returns to Shocks in Industrial Production 1998-2006



after a one-standard deviation change in this risk factor. The returns of small Retail REITs exhibit a smooth recovery within three months of the initial shock. These findings suggest that the larger Retail REITs have a longer termed interaction than smaller firms to changes in this short-term interest rate.

An opposite pattern of recovery appears in Panel C of Figure 2 where a shock from Industrial Production (IND) affects the return behavior of Equity Index and Retail portfolios. Large and small firms have comparable, initial reactions to a one-standard deviation change in this economic variable, but the recovery response varies by size. The larger firms in both REIT groups recover fully within three months whereas the smaller firms recover more slowly and never reestablish their initial equilibrium position within the next twelve months.

The dynamic relation between REIT returns and the economic risk factors presented in Figure 2 shows evidence of size-based differences within property types. The VAR estimates also show that the consumer spending (CONSUM) and market portfolio (MKT) variables were priced in the returns of large and small portfolios within the same property type. These results are not presented since the impulse responses for these macroeconomic variables did not reveal significant size-based differences.

Conclusion

This study provides several contributions in the understanding of how macroeconomic risk factors influence the returns of Equity REITs. First, the paper examines Equity REITs from different property types since such funds would reflect concentrations in real estate properties that benefit from the rents and business activities from different sectors of the economy. Our study observes significant differences across the four REIT property types and the Equity REIT index in the interaction of returns and the economic risk factors. We observe that all the economic risk factors are priced in the returns of the broad Equity REIT index. Yet the four property REITs demonstrate less sensitivity to the macroeconomic variables, and the returns across the property types are influenced by different subsets of the risk factors. The study also observes that the dynamic responses to shocks from these risk factors varied across property types even when the REIT returns were significantly influenced by the same risk factors.

Test results of large and small REITs also reveals that the economic risk factors exhibit different interactions across property types of large and small REITs, which provide support for the overall findings. We also observe size-based differences within property types in the dynamic responses of REIT returns to information shocks from the economic risk factors. These findings provide additional insight into the risk exposures of real estate investments with implications for portfolio construction and risk management.

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Biography



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