The Shift in the REIT Risk Profile

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1. Introduction

The “black swan” events that caused the severe dilution in REIT stock values caused investors to reevaluate the degree of risk associated with commercial real estate mutual funds. Several researchers have found that REITs are cointegrated with the economic and real estate housing markets (He 2000, Glascock, Lu and Su 2000, and Nishigaki 2007). Consequently, REITs experienced stock market devaluation due to excessive leverage and abnormally high defaults within the industry. Although the extended economic cycle downturns could be considered the “new normal,” investors still do not understand how much compensation they should receive for risk bearing when REITs are impacted by hard to predict rare events.

This study reexamines the relationship between REIT returns and economic risk by incorporating housing default into the empirical analysis. It has been predicted that housing defaults are a major determinant of the downturn in the economy and, therefore, indirectly responsible for the decline in REIT returns.

In decades past, previous research on returns to real estate investment trust has considered the impact of stock-market risk as well as interest-rate risk on REIT returns, because of their relatively stable nature historically. Other scholars have analyzed REITs and the respective stock-market and interest-rate risks during prior periods of downturn as summarized:

- **Early 1970s – Late 1970s**: a period of high inflation and unemployment, interest rates soared, oil and energy crisis

- **Early 1980s – Mid 1980s**: recession due to 1970s, bankruptcy prevalent, interest rates continue to rise through 1983, inflation begins to level off by 1983, recovery begins
- **Mid 1980s – Late 1980s**: economy recovers, in 1985 US has 1/3 world GDP, Reaganomics, 1987 Black Monday
- **Early 1990s – Mid 1990s**: began with short recession, boom following in 1992 through the end of the decade, huge economic growth
- **2007-2010** an economic crisis that saw the devaluation of commercial and residential real estate

None of the studies, however, empirically measure importance of default risk during high volatility periods that relate to the recent financial crisis. In an article written by Kim Dixon and Kevin Drawbaugh in December of 2008, John Dugan, then Comptroller of the Currency, was quoted saying, "You have to think that it will get worse before it gets better…One very troubling point is that whether measuring using 30-day or 60-day delinquencies, re-default rates increased each month and showed no signs of leveling off after six months or even eight months." Dugan is speaking on loan modifications and the re-default that occurred despite these bettering of terms for the borrower. These statements indicate that the need for investigation into default risk during high economic volatility.

2. Literature Review:

In this section, I will summarize and discuss current and past studies that in some capacity pertain to my current study. I will highlight the areas in which these studies succeed as well as their shortcomings, which I will attempt to develop within this study.

2.1 Chen and Tzang (1988) evaluate whether REITs, equity and mortgage, are sensitive to IR changes. Based on two periods of time '73-'79 and '80-'85, equity and mortgage REITs were found to be sensitive to changes in long-term IRs and changes in expected inflation from '73-'79. For the '80-'85 period, equity was sensitive to only changes in exp inflation while mortgage was sensitive to both changes in real rates and exp inflation. In both time periods, equity was less sensitive to IR changes than mortgage, which makes sense due to mortgage REIT prices moving in the opposite direction of IRs. This study does not evaluate how sensitive equity and mortgage REITs are to the level of housing default rates. During the great recession, housing defaults created the collapse in the collateralized mortgage obligation market.

2.2 Another study, Liang and Webb (1995) examine mortgage REITs to determine whether IR risk for REITs is diversifiable or systematic. They tested the years '76-'79, '80-'82, and '83-'90, and find that the IR sensitivity of REITs has changed over time. They concluded that IR uncertainty plays a significant role in systematic risk for REITs. They also concluded that IR risk is priced at equilibrium. Lastly, weak evidence exists that IR risk is not taken into account by the equity market, but they did not evaluate whether default rates are priced correctly. The final conclusion they reached was that a two-index model is more appropriate than a single index model when analyzing mortgage REITs.

2.3 Mueller and Pauley (1995) examine REITs from '72-'93. Mueller and Pauley further break this down by identifying the time periods of falling IR and rising IR. They then compare correlations: 1) of IR during rising periods to REIT prices and 2) of IR during falling periods to REIT prices. The two discover that despite the rise or fall of IRs, the correlation between IR and REIT prices is typically negative or very low, which leads them to conclude that REIT movements cannot be explained by IR movements. The two also found that the more leveraged a REIT was, the more IR had an effect on its price. I will analyze whether leverage and general default rates have an interacting effect on REIT returns.

2.4 Allen Madura and Springer (2000) compare REIT prices to movements in the stock market and IRs. Allen, Madura, and Springer are taking previous studies to a more modern time ('92-'97) in order to see what may or may not apply in more current terms. They are taking the comparison to a new level by developing what specific characteristics of REITs actually influence the changes in REIT prices. Specifically, the trio examines REIT asset structure, financial leverage, management strategy, and amount of specialization in the given portfolio. They found that minimal leverage was indicative of minimal exposure to fluctuations in correspondence with the stock market. Self-managed investment portfolios also were found to have minimal correlation with the stock market in relation to externally managed REITs due to the rate of debt as well as internal REIT managers having more of a stake in the REIT's performance. They found that REITs are sensitive to long and short-term IRs, but analysis of the characteristics of individual REITs did not indicate that exposure to IR changes could be affected through asset structure, financial leverage, management strategy, or amount of specialization.

2.5 Campbell, Dodd, Hill, and Kelly (2012), use the Standard and Poors publically available qualitative ratings criteria in order to derive the corporate default risk of various REITs. These criteria include financial obligations, expected financial resources, and variability in these resources. In respect to financial obligations, they hypothesized an inverse relationship between ratings and REIT debt levels and a direct relationship between credit ratings and dividends. In respect to expected financial resources, they hypothesized a direct relationship between credit ratings and credit line borrowing capacity and an inverse relationship between credit ratings and cash. In respect to variability in the resources, less certain cash flows increase default risk, smaller firms will have more volatile operations and higher default risk, and more consistent dividend policies correspond with lower default risk, meaning overall, that higher ratings coincide with reduced volatility. No significance was found between ratings and access to credit lines. Leverage significance was conditional on methodology and the choice of operating performance measure. There is somewhat of a relation between ratings and dividend levels, but more of a relation between ratings and dividend variability; less variability results in higher ratings. It was found that Fitch ratings relate to cash flow based measures while S&P ratings relate to earnings based measures, which in turn indicates that S&P ratings do no necessarily account for the financial wellbeing of the REIT.

2.6 Elul, Souleles, Chomsisengphet, Glennon (2010), and Hunt analyze the importance of negative equity and illiquidity in relation to mortgage default. As a measure of unemployment, they retrieved quarterly data from the Bureau of Labor Statistics. In the methodology section, dynamic logit models for mortgage default are employed. They found that negative equity and illiquidity are significant in relation to default. Unemployment shocks were also found to be associated with higher default risk. It was also found that as combined loan-to-value ratios increased along with unemployment rates, default risk increased substantially.

2.7 Li, Moordian, and Yang (2004), attempt to investigate information efficiency in the REIT market. They found that REITs are efficient in terms of incorporating information from the economy and stock market. They also found that REIT returns show a strong relation to stock market returns, but do not lag the market. It was also found that REIT performance leads economic performance by a minimum of two quarters. Additionally, they found that income return to real estate leads the economy by four quarters. The primary concern with this study is the inclusion of GDP in the regression calculations, which is believed to be an underlying factor for REIT returns.

2.8 In a study by Li and White (2009), bankruptcy and mortgage default are analyzed for their relationship in respect to the recent recession of 2008. The two show that bankruptcy and default are often complimentary in order to reduce the cost of defaulting on a mortgage. For the measure of default, Li and White used monthly data fro LPS Applied

Analytics, which consisted of a large sample of prime and subprime mortgages that originated in 2004-2005 with first liens and 30-year terms. They also used a number of control variables in their regressions including FICO scores, debt-to-income ratio, a dummy variable for missing debt-to-income ratio, whether the homeowner provided full documentation of assets and income at the time the mortgage originated, whether the property is single-family, whether the loan is a jumbo, whether the interest rate is fixed or adjustable, whether the loan is for purchase or refinance, whether the lender is private or is one of the US government agencies, and whether the loan was securitized in the private market or securitized by a US government agency.

2.9 Fogli, Hiil, and Perri (2012), use county level data to analyze the US business cycle over the past 30 years with respect to geographic location. They also argue that geography is an important element of the business cycle with respect to the spread and magnitude of a given economic condition. They found that initially, unemployment occurs in disperse areas, while eventually clustering around those initial areas, similar to the spread of an infection. They then develop a model business cycle that allows them to apply the same shock to different locations, with differing results, depending on the resiliency of the given location. They then introduce two methods of connection between the given locations. The first being that neighboring locations may be contemporaneously correlated, meaning that positive attributes in one location likely have spillover positive effects in a neighboring location. The second being the effect of unemployment in one location today on future unemployment in surrounding locations due to migration and commuting. The paper concludes that local, geographical factors that are not usually used in macro analysis could be quite important in understanding the dynamics of the business cycle. It is also suggested that a better understanding of the local channels through which the economy functions could lead to a better macro understanding.

3. Contribution and Hypothesis

As shown above, previous research analyzes REITs from the early 1970s through the 1990s. My research will focus on the more recent developments in the economy and the effects that those economic changes have had on REITs. More specifically, I will analyze the economic collapse of 2008 as well as housing and collateralized mortgage default rates and their on REIT returns and REIT predicted default rates.

The residential real estate market crashed was due in part to collateralized mortgage obligation purchases by investors who did not truly understand the risk associated with such assets. The uncertainty of risk is due to the lack of transparency in these assets. Many mortgages were bundled together into a single financial asset, where the underlying assets all could have had different risks associated with them. This bundling of mortgages into CMOs and the associated risks due to lack of transparency is also applicable to bundling that occurs in the REIT market.

As shown in the above reviews of journal articles, previous studies have failed to analyze the importance of various underlying affects of financial crises upon REIT returns, specifically default risk. Mortgage REITs can be composed of a variety of underlying assets. For the purposes of this study, I will use various commercial and residential REITs so as to distinguish the affects upon the differing markets. I will analyze whether REIT returns are cointegrated with CMO markets during a financial crisis such as the one in 2008. Additionally, REIT returns are a function of various underlying aspects, some of which have yet to be analyzed in depth:

- Stock Market Risk – risk associated with changes in the stock market
- Interest Rate Risk – risk associated with changes in the real rate
- Financial Leverage – amount of debt relative to equity to finance assets
- Asset Structure – equity vs. mortgage investment in real estate
- Internal/External Management – external management uses above market debt rates, internal management has REITs interests in mind
- Default Risk in Commercial RE – inability to repay debts in commercial real estate
- Economic Risk associated with Unemployment – UE could result in loans/interest not being repaid on mortgages
- Change in GDP – gross domestic product's change and associated change in REIT returns
- Default in Housing – defaulting on housing payments and affect on REITs
- Geographic Location – certain areas may not be as greatly affected by economic crises

Upon analyzing these various contributing factors to REIT returns, I will develop a better understanding of what plays a role in REIT pricing and risk, specifically during times of financial uncertainty and upheaval.

4. Sample

The data that will be used in this study will be comprised of publically traded mortgage REITs, both primarily commercial and residential. Returns will be analyzed from the period prior to the economic collapse in October of 2008 and after the collapse to better understand how default risk plays a role in REIT returns. Daily returns for REITs will be pulled from finance.yahoo.com to analyze the betas of the various REITs prior to and after the economic collapse. The S&P 500 Index will be used as the benchmark for comparison.

5. Proxies: Determinants of REIT Return

The proxies that will be evaluated against REIT returns include interest rate risk, financial leverage, stock market risk, asset structure, the use of internal or external management, default risk in commercial real estate, economic risk associated with unemployment, changes in GDP, default risk in housing, and geographic location. All of the proxies' measurements and descriptions are given below.

5.1 Interest Rate Risk

As measured by Chen and Tzang, interest rate risk is calculated through the following equation. $R_t = B_0 + B_1R_{mt} + B_2\Delta E\pi_t + B_3\Delta Er_t + \varepsilon_t$, where R_t is the return on asset at time t, R_{mt} is the return on the market portfolio at time t, B_1 and B_2 are multiple regression coefficients, ε_t is the error term, $E\pi_t$ is the expected inflation rate at time t, and Er_t is the expected real rate at time t. Equity and mortgage REITs were obtained from the NYSE and AMEX for the period 1973-1985.

5.2 Financial Leverage

As measured by Mueller and Pauley, financial leverage risk was calculated through the comparison to two separate indexes. With these two indexes, Mueleer and Pauley compared correlations in times of rising interest rates to price change and times or falling interest rates to price change. The Wilshire real estate index includes publically traded real estate investment companies that typically have higher leverage than equity REITs. During falling IR periods, the Wilshire had a stronger upward movement, and during rising IR periods, the Wilshire had a stronger downward movement. Monthly changes in IR (3mo T-bill, 10yr bonds, LT government bonds) are compared to monthly changes in S&P 500, S&P 40, NAREIT price index, and Wilshire REI.

5.3 Stock Market Risk

As measured by Allen, Madura, and Springer, stock market and interest rate sensitivity was measured using the following formula. $R_{j,t} = B_0 + B_1R_{m,t} + B_2i_t + w_t$, where $R_{j,t}$ is the monthly return on the jth REIT, B_1 is the sensitivity of the jth REIT's returns to market returns, B_2 is the sensitivity of the jth REIT's returns to IR, and w is the error term. Allen Madura and Springer used the NAREIT publications from 1993-1997 to identify 46 publicly traded REITs, of which 26 were equity and 20 were non-equity. Moody's and

NAREIT were used for balance sheet and asset composition. Monthly stock returns were obtained from the Center for Research in Security Prices files. Historical information on two interest rate variables, the yield on one-year treasury securities, and the yield on ten-year treasury securities were obtained from the Federal Reserve Board publications.

5.4 – 5.6 Asset Structure, Internal/External Management, and Leverage

As measured by Allen, Madura, and Springer, asset structure, internal/external management, and leverage, are defined and measured by the following equations. $B_{1,j} = \gamma_0 + \gamma_1$Assets + γ_2Leverage + γ_3Management + γ_4Specialization + w_t; $B_{2,j} = \gamma_0 + \gamma_1$Assets + γ_2Leverage + γ_3Management + γ_4Specialization + w_t, where B_1 and B_2 are sensitivities to market returns and IR respectively, γ_1 refers to the portion of the REIT invested in equity real estate, γ_2 refers to the degree of financial leverage (debt/debt+equity), γ_3 is a dummy variable (1 if the REIT self manages and 0 if it is externally managed), γ_4 is the sum of the squared proportions of the REIT's portfolio invested in each property type, and w_t is the error term. Allen Madura and Springer used the NAREIT publications from 1993-1997 to identify 46 publicly traded REITs, of which 26 were equity and 20 were non-equity. Moody's and NAREIT were used for balance sheet and asset composition. Monthly stock returns were obtained from the Center for Research in Security Prices files. Historical information on two interest rate variables, the yield on one-year treasury securities, and the yield on ten-year treasury securities were obtained from the Federal Reserve Board publications.

5.7 Default Risk in Commercial RE

As measured by Campbell, Dodd, Hill, and Kelly, default risk is defined and measured by the following equation. $R_{i,t} = B_0 + B_2Div_{i,t-1} + B_3UnusedLOC_{i,t-1} + B_4Cash_{i,t-1}+ B_5OperPerf_{i,t-1}+ B_6OperPerfVol_i+ B_7DivVol_i+ B_8Ln(MktCap)_{i,t-1}+ \sum_1^{10}B_kTimeDummies_{k,t} + \varepsilon_{i,t}$, using a probit model, Rating was a binary variable equal to one if the observation is investment grade, or zero if it is not. Leverage is total liabilities scaled by total assets. Dividends are DPS. UnusedLOC is the ratio of unused lines of credit to total assets. Cash is cash holdings scaled by total assets. OperPerf represents net income, FFO (funds from operations), and free cash flow, all scaled by shares outstanding. OperPerVol and DivVol are calculated by dividing the standard deviation of the variable by its mean. Sources used include SNL Datasource from 1999-2010, S&P, and Fitch.

5.8 Economic Risk associated with Unemployment

Elul, Souleles, Chomsisengphet, Glennon, and Hunt analyze the importance of negative equity and illiquidity in relation to mortgage default. As a measure of unemployment, they retrieved quarterly data from the Bureau of Labor Statistics. In the methodology section, dynamic logit models for mortgage default are employed. The dependent variable is a dummy that designates a mortgage that is more than 60 days late. Independent variables include information from the LPS data including initial loan-to-value ratios and FICO score. From the credit bureau, total balances relative to total limits for all credit cards are obtained as well as total second mortgage balance, or the total of all active home equity installment and home equity revolving mortgage loan balances. Lender

Processing Services, Equifax, the Federal Housing Finance Agency, and the Bureau of Labor Statistics were all used in obtaining data for this paper from years 2005 and 2006. The results are shown below.

Table 1: Mortgage Default - Baseline Results[13]

	Coef.	SE		Marginal (pct.)	SE (pct.)		Variable Means
Interest Rate	0.363	0.010	***	0.301	0.009	***	6.14
Initial FICO	0.020	0.002	***	-0.007	0.000	***	714
$FICO^2$	0.000	0.000	***				
ln(initial loan amt)	0.188	0.015	***	0.156	0.012	***	5.120
Initial LTV	-0.017	0.088		-0.014	0.073		0.715
Initial LTV=80%	0.122	0.020	***	0.105	0.018	***	0.125
Refinancing	0.000	0.018		0.000	0.015		0.519
Cash-out Refi	0.067	0.019	***	0.056	0.016	***	0.258
Loan has PMI	0.187	0.023	***	0.164	0.021	***	0.126
Private Securitized	0.062	0.034	*	0.052	0.029	*	0.174
GSE	-0.123	0.033	***	-0.102	0.028	***	0.715
FHA	-0.048	0.038		-0.039	0.031		0.075
Broker Originated	0.238	0.019	***	0.212	0.018	***	0.161
Correspondent Orig.	0.139	0.017	***	0.119	0.015	***	0.270
Transferred to servicer	0.333	0.021	***	0.309	0.022	***	0.075
Condo	-0.043	0.021	**	-0.035	0.017	**	0.132
Interest Only	0.632	0.033	***	0.688	0.046	***	0.016
Low/no-doc	0.044	0.019	**	0.037	0.017	**	0.154
Unknown doc-type	0.064	0.016	***	0.053	0.013	***	0.458
Term: 15 years	-0.219	0.035	***	-0.166	0.024	***	0.122
Term: 40 years	0.400	0.041	***	0.394	0.047	***	0.007
$CLTV \in [50,70)$	0.415	0.040	***	0.193	0.016	***	0.286
$CLTV \in [70,80)$	0.718	0.044	***	0.390	0.020	***	0.228
$CLTV \in [80,90)$	0.985	0.046	***	0.616	0.023	***	0.160
$CLTV \in [90,100)$	1.226	0.049	***	0.872	0.029	***	0.111
$CLTV \in [100,110)$	1.361	0.053	***	1.042	0.044	***	0.020
$CLTV \in [110,120)$	1.550	0.060	***	1.318	0.066	***	0.008
$CLTV \geq 120$	1.566	0.058	***	1.343	0.064	***	0.010
$Utilization \in [50,70)$	0.470	0.022	***	0.291	0.015	***	0.095
$Util \in [70,80)$	0.713	0.026	***	0.500	0.023	***	0.042
$Util \in [80,100)$	1.090	0.018	***	0.936	0.018	***	0.105
$Util \geq 100$	1.798	0.022	***	2.284	0.046	***	0.025
$\Delta unemployment \in [-0.5,0)$	0.006	0.024		0.004	0.017		0.299
$\Delta unemp \in [0,0.7)$	0.084	0.026	***	0.063	0.019	***	0.266
$\Delta unemp \in [0.7,1.25)$	0.183	0.033	***	0.145	0.027	***	0.100
$\Delta unemp \geq 1.25$	0.400	0.036	***	0.352	0.032	***	0.134

Table 2: Mortgage Default - Interactions[14]

	Coef.	SE		Marginal (pct.)	SE (pct.)	
			Panel A: Utilization ≥ 80 percent			
Utilization≥80	1.314	0.064	***	1.102	0.018	***
Interact: Util ≥ 80 ×						
CLTV<50				0.650	0.049	***
CLTV∈[50,70)	0.005	0.071		0.952	0.033	***
CLTV∈[70,80)	-0.153	0.069	**	1.085	0.035	***
CLTV∈[80,90)	-0.235	0.069	***	1.288	0.039	***
CLTV∈[90,100)	-0.336	0.069	***	1.458	0.050	***
CLTV∈[100,110)	-0.506	0.082	***	1.331	0.100	***
CLTV∈[110,120)	-0.743	0.099	***	1.082	0.160	***
CLTV≥120	-0.762	0.095	***	1.059	0.153	***
			Panel B: Δunemployment ≥ 1.25 percentage points			
Δunemployment ≥1.25	0.076	0.077		0.219	0.022	***
Interact: Δunemp ≥ 1.25 ×						
CLTV<50				0.029	0.030	
CLTV∈[50,70)	0.143	0.085	*	0.130	0.028	***
CLTV∈[70,80)	0.114	0.083		0.149	0.033	***
CLTV∈[80,90)	0.130	0.081		0.208	0.038	***
CLTV∈[90,100)	0.226	0.082	***	0.388	0.051	***
CLTV∈[100,110)	0.266	0.092	***	0.491	0.083	***
CLTV∈[110,120)	0.414	0.110	***	0.808	0.133	***
CLTV≥120	0.586	0.112	***	1.068	0.129	***
			Panel C: Have Second Mortgage			
Have Second Mortgage	0.157	0.061	***	0.224	0.015	***
Interact: Have Second ×						
LTV<50				0.059	0.024	**
LTV∈[50,70)	0.112	0.067	*	0.173	0.019	***
LTV∈[70,80)	0.086	0.066		0.210	0.023	***
LTV∈[80,90)	0.127	0.069	*	0.328	0.042	***
LTV∈[90,100)	0.091	0.076		0.363	0.072	***
LTV∈[100,110)	0.162	0.106		0.535	0.159	***
LTV∈[110,120)	0.102	0.146		0.485	0.264	*
LTV≥120	-0.070	0.155		0.156	0.260	

[14] Regressions also include the other covariates from Table 1. See text for details. * Significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

5.9 Change in GDP

Li, Moordian, and Yang attempt to investigate information efficiency in the REIT market. They found that REITs are efficient in terms of incorporating information from the economy and stock market. They also found that REIT returns show a strong relation to stock market returns, but do not lag the market. It was also found that REIT performance leads economic performance by a minimum of two quarters. Additionally, they found that income return to real estate leads the economy by four quarters. In order to determine whether equity markets predict the economy by more than one quarter, they regressed GDP growth rate on stock return and economic state variables through this model:

$$\Delta gdp_t = \alpha + \beta_1 \Delta p_{t-1} + \beta_1 \Delta p_{t-2} + \gamma_1 CSPREAD_{t-1} + \gamma_2 TSPREAD_{t-1} + \gamma_3 TBIL_{t-1} + \theta\varepsilon_{t-1} + \varepsilon_t$$

where Δp_t denotes the logarithm difference of price, Δgdp_{t+1} is quarterly growth of GDP, CSPREAD is the difference between Moody's BAA rate and 10 year Treasury bond rate, TSPREAD is the difference between 30 year treasury bond rate and 3 month treasury bill rate, and TBIL is the 3-month treasury bill rate. They found that REITs predict changes in the economy by two quarters. The results are given below.

Table 5. Predictability of GDP

$$\Delta gdp_t = \alpha + \beta_1 \Delta p_{t-1} + \beta_1 \Delta p_{t-2} + \gamma_1 CSPREAD_{t-1} + \gamma_2 TSPREAD_{t-1} + \gamma_3 TBIL_{t-1} + \theta\varepsilon_{t-1} + \varepsilon_t$$

	GDP Growth (Δgdp_t)		
	(A)	(B)	(C)
Intercept	0.509 (0.409)	0.638 (0.423)	0.720 (0.438)
S&P500 Return $_{t-1}$	0.031** (0.015)		
S&P500 Return $_{t-2}$	0.025*		

	(0.015)		
REIT Total Return $_{t-1}$		0.022* (0.012)	
REIT Total Return $_{t-2}$		0.033*** (0.012)	
REIT Price Return $_{t-1}$			0.022* (0.012)
REIT Price Return $_{t-2}$			0.028** (0.160)
$CSPREAD_{t-1}$	0.086 (0.157)	0.213 (0.157)	0.211 (0.160)
$TSPREAD_{t-1}$	0.074 (0.091)	-0.014 (0.093)	-0.007 (0.095)
$TBIL_{t-1}$	0.087* (0.045)	0.052 (0.046)	0.056 (0.047)
Δgdp_{t-1}	0.213** (0.108)	0.273*** (0.106)	0.285*** (0.106)
R^2	0.230	0.259	0.241

Also of interest, they tested whether commercial real estate income leads the economy using a vector autoregressive analysis similar to the one below:

$$\begin{pmatrix} \Delta p_t^{SP} \\ \Delta p_t^{REIT} \end{pmatrix} = A_{2,1} + B_{2,3} \begin{pmatrix} \Delta CSPREAD_t \\ \Delta TSPREAD_t \\ \Delta TBIL_t \end{pmatrix} + \sum_{i=1}^{4} \Theta_{2,2}^{i} \zeta_{t-i} + \zeta_t$$

where $\zeta_t \sim N(0_{2,1}, \Sigma_{2,2})$.

Then, based upon this VAR analysis, they conducted the Granger Causality Wald test. The three found that REIT income return leads the economy by four quarters. The results are given below.

Table 9. VAR Analysis on GDP Growth and NAREIT Income Return

Panel A. Granger Causality Wald Test

Test	χ^2	DF	Prob> χ^2
REIT Income not cause GDP	21.85	4	0.000
GDP not cause REIT Income	5.29	4	0.259

Panel B. Regression Estimates

	Δgdp_t	NAREIT Income $_t$
Intercept	0.753 (0.264)	0.694 (0.570)
Δgdp_{t-1}	0.208** (0.102)	0.393* (0.220)
Δgdp_{t-2}	0.047 (0.108)	0.429* (0.233)
Δgdp_{t-3}	0.150 (0.101)	-0.018 (0.218)
Δgdp_{t-4}	-0.081 (0.096)	-0.080 (0.208)
REIT Income $_{t-1}$	0.012 (0.052)	0.007 (0.112)
REIT Income $_{t-2}$	0.085 (0.061)	0.256* (0.131)
REIT Income $_{t-3}$	0.161*** (0.051)	-0.028 (0.110)
REIT Income $_{t-4}$	-0.109** (0.052)	-0.147 (0.113)
$\Delta CSPREAD_t$	-0.428** (0.205)	0.459 (0.443)
$\Delta TSPREAD_t$	0.263* (0.158)	0.012 (0.342)
$\Delta TBIL_t$	0.432*** (0.155)	-0.713** (0.334)
Univariate R^2	0.513	0.281

Note: Estimation errors are reported in the parentheses below parameters.
* : Significant at the 10% level.
** : Significant at the 5% level.
***: Significant at the 1% level.

5.10 Default Risk in Housing

In a study by Li and White, bankruptcy and mortgage default are analyzed for their relationship in respect to the recent recession of 2008. The two show that bankruptcy and default are often complimentary in order to reduce the cost of defaulting on a mortgage. For the measure of default, Li and White used monthly data fro LPS Applied Analytics, which consisted of a large sample of prime and subprime mortgages that originated in

2004-2005 with first liens and 30-year terms. They also used a number of control variables in their regressions including FICO scores, debt-to-income ratio, a dummy variable for missing debt-to-income ratio, whether the homeowner provided full documentation of assets and income at the time the mortgage originated, whether the property is single-family, whether the loan is a jumbo, whether the interest rate is fixed or adjustable, whether the loan is for purchase or refinance, whether the lender is private or is one of the US government agencies, and whether the loan was securitized in the private market or securitized by a US government agency. In order to calculate regressions, they used the Cox proportional hazard model with all regressions run separately for prime and subprime mortgages. Statistics are shown below.

Table 2: Summary Statistics

	Bankruptcy Sample		Default Sample		Foreclosure Sample	
	Prime	Subprime	Prime	Subprime	Prime	Subprime
Average bankruptcy/default/foreclosure rate per month	0.00046	0.00185	0.0060	0.0274	0.0011	0.0074
State allows deficiency judgments	0.7263	0.7393	0.7206	0.7229	0.7264	0.7391
FICO (at origination) between 350 and 550	0.0092	0.1236	0.0055	0.0964	0.0089	0.1181
FICO (at origination) between 550 and 650	0.1374	0.6215	0.1157	0.5966	0.1357	0.6178
FICO (at origination) between 650 and 750	0.5139	0.2319	0.5164	0.2761	0.5146	0.24397
Houses with negative equity	0.0019	0.0013	0.0018	0.0006	0.0018	0.0009
If non-exempt home equity is positive	0.7238	0.6396	0.7303	0.6404	0.7265	0.6404
Debt-to-income ratio (%,at origination)	21.8910	19.2501	21.7224	18.5816	21.9049	0.1919
Missing debt-to-income ratio at origination	0.3946	0.5129	0.3946	0.5301	0.3942	0.5143
If full documentation	0.3531	0.5555	0.3556	0.5292	0.3537	0.5508
Missing documentation	0.1696	0.1193	0.1700	0.1386	0.1702	0.1239
If single-family house	0.7531	0.8136	0.7506	0.8067	0.7535	0.8125
If fixed rate mortgage	0.6416	0.2861	0.6443	0.3106	0.6431	0.2962
If jumbo loan	0.1388	0.0948	0.1408	0.1001	0.1384	0.0948
If loan was for purchase	0.5615	0.4418	0.5598	0.4356	0.5609	0.4357
If loan was privately securitized	0.2550	0.8586	0.2499	0.8371	0.2530	0.8533
If loan originated by retail	0.5059	0.4374	0.5173	0.4600	0.5071	0.4433
If loan originated by wholesale	0.1874	0.1815	0.1853	0.1816	0.1872	0.1804
If loan originated by correspondent	0.2203	0.1034	0.2172	0.1041	0.2207	0.1037
Lagged local bankruptcy rate/delinquency /foreclosure rate (zipcode)	0.0004	0.0016	0.0055	0.0247	0.0010	0.0068
Lagged local unemployment rate (%,county)	4.7636	4.9514	4.7458	4.8894	4.7601	4.9233
Lagged local income growth rate (state)	0.0013	0.0012	0.0012	0.0010	0.0013	0.0011
Lagged local house price growth rate (msa)	0.0014	0.0014	0.0016	0.0016	0.0010	0.0015
Benefit of refinancing (value of existing mortgage / value of new mortgage at current interest rate)	1.0801	0.8456	1.0859	0.8647	1.0811	0.8501
Age of loan (months)	21.4998	18.0530	20.7656	15.0354	21.4490	17.2725
Number of observations	3,054,564	2,540,699	2,754,555	1,743,846	3,039,341	2,367,860

Table 3:
Hazard Model Results Explaining Bankruptcy as a Function of Past Mortgage Default

	Prime mortgages	Subprime mortgages
Default 1-3 months before	16.57***	14.17***
Default 4-6 months before	4.50***	1.92***
Default 7-24 months before	1.50*	1.42**
Bankruptcy reform dummy	0.50***	0.52***
If no non-exempt home equity	1.92***	1.39***
FICO 350-450	3.89***	2.32***
FICO 550-650	4.40***	2.28***
FICO 650-750	4.60***	2.71***
If full documentation	0.79***	0.77***
Benefit of refinancing	0.45**	0.99
If mortgage securitized	1.08	1.22**
Lagged growth of house prices (zipcode)	0.002	0.008**
Lagged unemployment rate (county)	1.08**	1.03*
Lagged income growth (state)	0.40*	0.98
Lagged avg bankruptcy rate (zipcode)	224**	32.85***
Deficiency judgments allowed	4.79	1.39
State and year dummies?	Y	Y

Notes: The dependent variable is whether homeowners filed for bankruptcy. *, **, and *** indicate statistical significance at the 5%, 1% and 0.1% levels, respectively.

5.11 Geographic Location

Fogli, Hiil, and Perri use county level data to analyze the US business cycle over the past 30 years with respect to geographic location. They also argue that geography is an important element of the business cycle with respect to the spread and magnitude of a given economic condition. They found that initially, unemployment occurs in disperse areas, while eventually clustering around those initial areas, similar to the spread of an infection. They then develop a model business cycle that allows them to apply the same shock to different locations, with differing results, depending on the resiliency of the given location. They then introduce two methods of connection between the given locations. The first being that neighboring locations may be contemporaneously correlated, meaning that positive attributes in one location likely have spillover positive effects in a neighboring location. The second being the effect of unemployment in one location today on future unemployment in surrounding locations due to migration and commuting.

First they give maps of the United States for various time periods from June 2007 to June 2009, each with accompanying aggregate unemployment from the Bureau of Labor Statistics, the standard deviation of unemployment across counties, and the spatial autoregressive coefficient which is explained below.

A The Spatial Autoregressive Model

To measure the association between unemployment in one county and its neighbors we use the following so-called spatial lag model. [10]

$$u_{it} = \rho_t \frac{1}{N_i} \sum_{j \neq i} w_{ij} u_{jt} + X_{it}\beta_t + \varepsilon_{it}$$
$$\epsilon_{it} \sim N(0, \sigma^2 I_n)$$

where u_{it} represents the de-meaned unemployment rate for county i in period t and ρ_t is called the spatial autoregressive coefficient and describes the overall association between unemployment in each county and unemployment in all nearby counties. Here w_{ij} is an element of a spatial weights matrix W in which the element in column j of row i equals 1 if counties j and i share a border and 0 otherwise, note that $w_{ii} = 0$ for all i. X_{it} is a standard matrix of (optional) control variables and ε_{it} is assumed to be a normally distributed error term.

As demonstrated in LeSage (1999), the inclusion of a spatially lagged dependent variable introduces an endogeneity which biases the standard OLS estimation of ρ_t. To help further illustrate this endogeneity, consider a large positive shock in ε_{it}. This shock increases the unemployment rate u_{jt} of bordering county j by the amount $\rho_t \frac{1}{N_j} w_{ji} \varepsilon_{it}$ which in turn reflects a portion back to county i. This transmission across counties violates the strict exogeneity assumption required by OLS (i.e. $E\left[\varepsilon_{it} | \frac{1}{N_i} \sum_{j \neq i} w_{ij} u_{jt}\right] \neq 0$). In order to correct for this bias we employ the maximum likelihood procedure outlined in Anselin (1988). Note we slightly modify the use of W here in that the rows have been normalized to sum to 1 (i.e. rows have already been multiplied by $\frac{1}{N_i}$). The steps of the procedure are as follows:

1. perform OLS for the model: $u = X\beta_0 + \varepsilon_0$
2. perform OLS for the model $Wu = X\beta_L + \varepsilon_L$
3. compute residuals $\varepsilon_0 = u - X\hat{\beta}_0$ and $\varepsilon_L = Wu - X\hat{\beta}_L$
4. given ε_0 and ε_L, find ρ that maximizes the concentrated likelihood function: $L_c = -(n/2)ln(\pi) - (n/2)ln(1/n)(\varepsilon_0 - \rho\varepsilon_L)'(\varepsilon_0 - \rho\varepsilon_L) + ln|I - \rho W|$
5. given $\hat{\rho}$ that maximizes L_c, compute $\hat{\beta} = (\hat{\beta}_0 - \rho\hat{\beta}_L)$ and $\hat{\sigma}^2_\varepsilon = (1/\eta)(\varepsilon_0 - \rho\varepsilon_L)'(\varepsilon_0 - \rho\varepsilon_L)$

which provides an unbiased estimate of the spatial autoregressive coefficient ρ.

The paper concludes that local, geographical factors that are not usually used in macro analysis could be quite important in understanding the dynamics of the business cycle. It is also suggested that a better understanding of the local channels through which the economy functions could lead to a better macro understanding.

6. Methodology

In addition to the REIT and S&P returns that were obtained from finance.yahoo.com, data was pulled from numerous sources in order to regress the given proxies against REIT returns for the period 2006-2012. These sources include the Bureau of Labor Statistics for unemployment figures, the Bureau of Economic Analysis for GDP figures, the US Treasury for interest rate figures, the Wilshire index for comparison to determine financial leverage effects as well determining a list of REITs to analyze, and the SEC filings to determine asset structure. Multiple regression was implemented through Excel in order to determine the relationships between REIT returns and the underlying variables that affect the returns.

All REIT returns, GDP data, S&P data, Wilshire returns, t-bill rates, t-bond rates, and unemployment figures were pulled on a monthly basis for regression purposes. Three month t-bills as well as one year, five year, and ten year t-bonds were used as proxies for analyzing interest rate effects. From the Bureau of Labor Statistics, unemployment figures were pulled for nine regions of the United States: Pacific, Mountain, West South Central, East South Central, South Atlantic, West North Central, East North Central, Middle Atlantic, and New England. Not only does this allow for analyzing the effects from an unemployment perspective, but it also allows for geographic effects of the recession to be analyzed.

Transformation was used with GDP by taking the natural log of the figures in order to eliminate issues with residuals.

REITs were divided based upon asset structure for further analyzing. The primary REIT compositions included office, retail, health, residential, hotel, apartment, industrial and other REITs. Residential was distinguished from apartment due to the volatile nature of occupancy and turnover in apartment operations. Other included REITs that were composed of a number of the listed properties or ones that did not fall into any category. For purposes of analyzing, REIT returns were regressed against the proxies by both REIT asset composition group as well as all analyzed REITs pooled together. This allows for comparison between the affects of the proxies on individual asset structures compared to the array of REITs within the Wilshire Index. In order to demonstrate the effects of the recession upon REIT proxies and the REIT returns themselves, the years 2008-2010 were also analyzed apart from the entire data set of 2006-2012.

First, all REITs were analyzed against the Wilshire Index returns. All REITs were then analyzed against the Wilshire along with all of the other proxies. REIT asset classes were analyzed individually against all of the proxies. REIT returns and proxies were also analyzed separately for the years 2008-2010 in order to determine the recession's affect upon the relationship between the returns and proxies.

7. Regression Results and Analysis

While all of the REITs used are within the Wilshire Index, not all of the REITs have been in the index over the period analyzed nor do the REITs analyzed necessarily reflect the composition of the Wilshire over the 2006-2012 period. First, the REIT returns over the 2006-2012 period were regressed against the Wilshire Index. The results are shown below.

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.067966506							
R Square	0.004619446							
Adjusted R Square	0.004410244							
Standard Error	0.124337546							
Observations	4760							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	0.341373464	0.341373464	22.08132732	2.68711E-06			
Residual	4758	73.5578491	0.015459825					
Total	4759	73.89922256						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.010774108	0.001810458	5.95104139	2.85544E-09	0.007224774	0.014323443	0.007224774	0.014323443
Wilshire	0.098495073	0.020960514	4.699077284	2.68711E-06	0.057402768	0.139587378	0.057402768	0.139587378

Here, it is seen that the coefficient of Wilshire, in this case shows minimal positive relationship despite the REITs being with in the index itself. Additionally, the low R-squared value indicates that this model explains very little of the variation of the dependent variable. In order to better understand this, the returns are later broken into categories that differentiate the REITs based upon asset composition.

Next, the REIT returns were regressed against all of the proxies including the Wilshire returns. The results are shown below.

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.322692401							
R Square	0.104130386							
Adjusted R Square	0.101108266							
Standard Error	0.118145117							
Observations	4760							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	16	7.695154546	0.480947159	34.45607565	6.4652E-101			
Residual	4743	66.20406802	0.013958269					
Total	4759	73.89922256						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	5.289022502	2.059204662	2.568478306	0.010244941	1.252025331	9.326019673	1.252025331	9.326019673
Wilshire	0.21414378	0.022872669	9.362430864	1.17319E-20	0.16930273	0.258984829	0.16930273	0.258984829
GDP	-0.566808887	0.215256825	-2.633174981	0.00848652	-0.988812203	-0.144805571	-0.988812203	-0.144805571
S&P	0.207274253	0.042185962	4.913346582	9.25492E-07	0.124570181	0.289978325	0.124570181	0.289978325
3 Mo T bill	0.136967103	0.018622567	7.354899019	2.23933E-13	0.100458225	0.173475982	0.100458225	0.173475982
1 Yr T Bond	-0.096841981	0.022853781	-4.237459852	2.30354E-05	-0.141646003	-0.052037959	-0.141646003	-0.052037959
5 Yr T Bond	-0.115463842	0.025687515	-4.494940157	7.12474E-06	-0.165823297	-0.065104387	-0.165823297	-0.065104387
10 Yr T Bond	0.112045782	0.021154542	5.296535405	1.23357E-07	0.070573058	0.153518506	0.070573058	0.153518506
Pacific	-0.105635354	0.026160588	-4.037957927	5.47696E-05	-0.156922252	-0.054348455	-0.156922252	-0.054348455
Mountain	0.017421052	0.028356833	0.614351135	0.539012786	-0.038171505	0.073013609	-0.038171505	0.073013609
West South Central	-0.047390088	0.02666254	-1.777403357	0.075565964	-0.099661045	0.004880869	-0.099661045	0.004880869
East South Central	0.047516668	0.014699814	3.232467375	0.001235657	0.018698208	0.076335127	0.018698208	0.076335127
South Atlantic	0.132035361	0.036638705	3.603712537	0.000316923	0.060206488	0.203864233	0.060206488	0.203864233
West North Central	0.008675243	0.013332998	0.650659604	0.515297763	-0.017463623	0.034814109	-0.017463623	0.034814109
East North Central	-0.01319423	0.012341467	-1.06909735	0.285080211	-0.037389235	0.011000776	-0.037389235	0.011000776
Middle Atlantic	0.089169215	0.013785244	6.468453976	1.08996E-10	0.062143737	0.116194693	0.062143737	0.116194693
New England	-0.118709836	0.030432701	-3.900732884	9.72291E-05	-0.178372058	-0.059047614	-0.178372058	-0.059047614

As can be seen above, a number of p-values were significant including the Wilshire index, GDP, S&P, 3 month T-bill, 1 year T-bond, 5 year T-bond, 10 year T-bond, and a number of unemployment proxies. The slightly higher F statistic and R-squared values indicate that this test does a better job of explaining the variation in the dependent variable, REIT returns. The coefficients of the Wilshire, interest proxies, and unemployment proxies indicate there is minimal correlation between the respective proxies and the dependent variable.

In order to better understand the reasoning for the low coefficient and R-squared values, the regression was run again, this time with the REITs divided by asset composition. The regressions are shown below.

Office

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.149404718
R Square	0.02232177
Adjusted R Square	0.020397206
Standard Error	0.119926225
Observations	510

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.166811013	0.166811013	11.59835	0.000712377
Residual	508	7.306208119	0.014382299		
Total	509	7.473019133			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.007622382	0.005334806	1.428802032	0.153676	-0.002858617	0.01810338	-0.002858617	0.018103
Wilshire	0.21034412	0.06176354	3.405635757	0.000712	0.089000704	0.331687535	0.089000704	0.331688

Retail

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.097922532
R Square	0.009588822
Adjusted R Square	0.007639194
Standard Error	0.19660711
Observations	510

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.19011303	0.19011303	4.918282	0.027015582
Residual	508	19.63641275	0.038654356		
Total	509	19.82652578			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.017560584	0.008745883	2.007868547	0.045186	0.00037803	0.034743139	0.00037803	0.034743
Wilshire	0.224555635	0.101255176	2.217720046	0.027016	0.025625182	0.423486087	0.025625182	0.423486

Health/Science

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.032091769
R Square	0.001029882
Adjusted R Square	-0.000654722
Standard Error	0.092006419
Observations	595

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.005175184	0.005175184	0.611349	0.434592253
Residual	593	5.0198524	0.008465181		
Total	594	5.025027583			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.012990422	0.003789215	3.428262381	0.00065	0.005548509	0.020432335	0.005548509	0.020432
Wilshire	0.034301057	0.043869506	0.781888371	0.434592	-0.051857446	0.12045956	-0.051857446	0.12046

Residential

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.048897742
R Square	0.002390989
Adjusted R Square	0.000708681
Standard Error	0.091798126
Observations	595

ANOVA

	df	SS	MS	F	Significance F
Regression	1	0.011976766	0.011976766	1.421255	0.233673834
Residual	593	4.997149254	0.008426896		
Total	594	5.00912602			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.010854132	0.003780636	2.870980367	0.004238	0.003429067	0.018279198	0.003429067	0.018279
Wilshire	0.052181241	0.04377019	1.192163908	0.233674	-0.033782208	0.13814469	-0.033782208	0.138145

Industrial

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.067321841
R Square	0.00453223
Adjusted R Square	0.002178879
Standard Error	0.105280744
Observations	425

ANOVA

	df	SS	MS	F	Significance F
Regression	1	0.02134632	0.02134632	1.925862	0.165942459
Residual	423	4.688546834	0.011084035		
Total	424	4.709893154			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.007080394	0.005130315	1.380109016	0.168282	-0.003003692	0.01716448	-0.003003692	0.017164
Wilshire	0.082427124	0.059396053	1.387754239	0.165942	-0.034321044	0.199175292	-0.034321044	0.199175

College

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.000562533
R Square	3.16443E-07
Adjusted R Square	-0.001686024
Standard Error	0.675939521
Observations	595

ANOVA

	df	SS	MS	F	Significance F
Regression	1	8.57366E-05	8.57366E-05	0.000188	0.989075073
Residual	593	270.9382823	0.456894237		
Total	594	270.938368			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-0.023060253	0.027838057	-0.828371514	0.407793	-0.07773343	0.031612924	-0.07773343	0.031613
Wilshire	-0.004414969	0.322294178	-0.013698568	0.989075	-0.637391864	0.628561927	-0.637391864	0.628562

Hotel

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.083078428
R Square	0.006902025
Adjusted R Square	0.005437279
Standard Error	0.153552029
Observations	680

ANOVA

	df	SS	MS	F	Significance F
Regression	1	0.111102866	0.111102866	4.712096	0.030297407
Residual	678	15.98603699	0.023578226		
Total	679	16.09713985			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.011366267	0.005915489	1.921441654	0.055095	-0.000248613	0.022981147	-0.000248613	0.022981
Wilshire	0.14866587	0.068486379	2.170736313	0.030297	0.014194984	0.283136757	0.014194984	0.283137

Other

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.018568332
R Square	0.000344783
Adjusted R Square	-0.000834056
Standard Error	0.116030774
Observations	850

ANOVA

	df	SS	MS	F	Significance F
Regression	1	0.003937656	0.003937656	0.292477	0.588779716
Residual	848	11.41674324	0.013463141		
Total	849	11.42068089			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.00798548	0.003998097	1.997320402	0.04611	0.000138154	0.015832806	0.000138154	0.015833
Wilshire	0.025032979	0.046287831	0.540811243	0.58878	-0.065819174	0.115885133	-0.065819174	0.115885

While the above tables only take into account the Wilshire as a proxy, they allow for the different asset compositions to be analyzed. While hotel, residential, industrial, and retail had similar R-squared values, college, office, health, and other all deviated from the previous combined REIT return regression. Additionally, the F statistic was significantly lower on all of the individual asset structures as compared to the combined REIT returns regression.

Each asset class was also regressed using a dummy variable that indicated recessionary years, 2008-2010. Years within the recession were given a value of 1 and years outside of the recession were given a value of 0. The dummy variable was used in combination with both the Wilshire and the S&P to better understand the effect that the recession had on the respective proxies and as a result, REIT returns. In order to integrate the dummy variable into the proxies along with the Wilshire and S&P, the dummy variable was multiplied by each of the two proxies respectively. Upon completing of the regression, the coefficient associated with the dummy and the respective proxy indicates an incremental value over the proxy alone. The table for each asset class is shown below.

Office

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.67403
R Square	0.45432
Adjusted R Square	0.43661
Standard Error	0.09095
Observations	510

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	16	3.39514	0.2122	25.6538	7.3E-55
Residual	493	4.07788	0.00827		
Total	509	7.47302			

	Coefficients	*tandard Erro*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Jpper 95.0%*
Intercept	0.18254	0.14015	1.30243	0.19338	-0.0928	0.45792	-0.0928	0.45792
Wilshire	-0.0696	0.11057	-0.6298	0.52912	-0.2869	0.14762	-0.2869	0.14762
Dummy Recession	0.01263	0.02372	0.53268	0.5945	-0.034	0.05923	-0.034	0.05923
Dummy*Wilshire	0.42495	0.12591	3.37505	0.0008	0.17757	0.67234	0.17757	0.67234
Dummy*S&P	0.53239	0.20352	2.61596	0.00917	0.13253	0.93226	0.13253	0.93226
S&P	1.24969	0.17149	7.28703	1.3E-12	0.91274	1.58664	0.91274	1.58664
1 Yr T Bond	-0.0099	0.02506	-0.3945	0.69342	-0.0591	0.03936	-0.0591	0.03936
5 Yr T Bond	0.0224	0.01871	1.19726	0.23178	-0.0144	0.05915	-0.0144	0.05915
Pacific	-0.0437	0.05865	-0.7452	0.4565	-0.159	0.07153	-0.159	0.07153
West South Central	-0.0434	0.05638	-0.7698	0.44177	-0.1542	0.06737	-0.1542	0.06737
South Atlantic	0.04337	0.07933	0.54674	0.58481	-0.1125	0.19923	-0.1125	0.19923
West North Central	-0.0587	0.02955	-1.9865	0.04753	-0.1168	-0.0006	-0.1168	-0.0006
East North Central	0.02351	0.02467	0.95309	0.34101	-0.025	0.07199	-0.025	0.07199
Middle Atlantic	0.03027	0.02869	1.05477	0.29205	-0.0261	0.08665	-0.0261	0.08665
New England	-0.0928	0.06764	-1.3721	0.17065	-0.2257	0.04009	-0.2257	0.04009
Mountain	0.05224	0.0657	0.79504	0.42697	-0.0769	0.18133	-0.0769	0.18133
East South Central	0.03878	0.03141	1.23454	0.21759	-0.0229	0.10049	-0.0229	0.10049

Retail

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.55548
R Square	0.30856
Adjusted R Square	0.28612
Standard Error	0.16675
Observations	510

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	16	6.11764	0.38235	13.7502	1.1E-30
Residual	493	13.7089	0.02781		
Total	509	19.8265			

	Coefficients	*tandard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Upper 95.0%*
Intercept	0.458	0.27284	1.67864	0.09386	-0.0781	0.99408	-0.0781	0.99408
Wilshire	-0.139	0.20265	-0.6857	0.49323	-0.5371	0.25921	-0.5371	0.25921
S&P	1.65847	0.3287	5.04557	6.4E-07	1.01265	2.30429	1.01265	2.30429
Dummy Recession	-0.0375	0.0436	-0.8605	0.38996	-0.1232	0.04815	-0.1232	0.04815
Dummy*Wilshire	0.55967	0.2302	2.43124	0.0154	0.10738	1.01196	0.10738	1.01196
Dummy*S&P	0.6453	0.39614	1.62897	0.10396	-0.133	1.42362	-0.133	1.42362
5 Yr T Bond	0.03582	0.07533	0.4755	0.63464	-0.1122	0.18382	-0.1122	0.18382
10 Yr T Bond	-0.0345	0.07519	-0.4592	0.6463	-0.1822	0.1132	-0.1822	0.1132
Pacific	-0.0695	0.10364	-0.6705	0.50287	-0.2731	0.13414	-0.2731	0.13414
Mountain	0.18263	0.11155	1.6371	0.10225	-0.0366	0.40181	-0.0366	0.40181
West South Central	-0.1278	0.07811	-1.6362	0.10244	-0.2813	0.02567	-0.2813	0.02567
East South Central	0.0574	0.04575	1.25451	0.21025	-0.0325	0.1473	-0.0325	0.1473
South Atlantic	0.03142	0.14364	0.21877	0.82692	-0.2508	0.31364	-0.2508	0.31364
West North Central	-0.0218	0.05333	-0.409	0.68272	-0.1266	0.08297	-0.1266	0.08297
East North Central	0.07314	0.04556	1.60525	0.10908	-0.0164	0.16266	-0.0164	0.16266
Middle Atlantic	0.00012	0.05405	0.00217	0.99827	-0.1061	0.10632	-0.1061	0.10632
New England	-0.211	0.11941	-1.767	0.07785	-0.4456	0.02362	-0.4456	0.02362

Health

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.6208
R Square	0.38539
Adjusted R Square	0.36838
Standard Error	0.0731
Observations	595

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	16	1.93659	0.12104	22.652	3.9E-51
Residual	578	3.08844	0.00534		
Total	594	5.02503			

	Coefficients	*tandard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Upper 95.0%*
Intercept	0.1044	0.11073	0.94286	0.34615	-0.1131	0.32188	-0.1131	0.32188
Wilshire	-0.0021	0.08224	-0.0257	0.97951	-0.1636	0.15942	-0.1636	0.15942
S&P	1.12913	0.1334	8.46434	2.1E-16	0.86713	1.39114	0.86713	1.39114
Dummy Recession	0.00367	0.01769	0.20726	0.83588	-0.0311	0.03842	-0.0311	0.03842
Dummy*Wilshire	0.07579	0.09342	0.81124	0.41756	-0.1077	0.25928	-0.1077	0.25928
Dummy*S&P	0.15162	0.16077	0.94312	0.34601	-0.1641	0.46739	-0.1641	0.46739
5 Yr T Bond	-0.0576	0.03057	-1.8836	0.06013	-0.1176	0.00246	-0.1176	0.00246
10 Yr T Bond	0.08568	0.03051	2.80796	0.00515	0.02575	0.14561	0.02575	0.14561
Pacific	-0.0319	0.04206	-0.7581	0.44872	-0.1145	0.05073	-0.1145	0.05073
Mountain	0.02125	0.04527	0.46933	0.63901	-0.0677	0.11017	-0.0677	0.11017
West South Central	-0.0234	0.0317	-0.7394	0.45998	-0.0857	0.03882	-0.0857	0.03882
East South Central	0.02254	0.01857	1.21366	0.22537	-0.0139	0.05901	-0.0139	0.05901
South Atlantic	0.04926	0.05829	0.84509	0.39841	-0.0652	0.16376	-0.0652	0.16376
West North Central	-0.0741	0.02164	-3.4226	0.00066	-0.1166	-0.0316	-0.1166	-0.0316
East North Central	0.03598	0.01849	1.94584	0.05216	-0.0003	0.0723	-0.0003	0.0723
Middle Atlantic	0.02351	0.02194	1.07175	0.28428	-0.0196	0.06659	-0.0196	0.06659
New England	-0.0793	0.04846	-1.6373	0.1021	-0.1745	0.01583	-0.1745	0.01583

Hotel

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.69241
R Square	0.47943
Adjusted R Square	0.46686
Standard Error	0.11242
Observations	680

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	16	7.71742	0.48234	38.1624	5.8E-83
Residual	663	8.37972	0.01264		
Total	679	16.0971			

	Coefficients	*tandard Erro*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Upper 95.0%*
Intercept	0.44623	0.1593	2.80117	0.00524	0.13343	0.75903	0.13343	0.75903
Wilshire	-0.0326	0.11832	-0.2754	0.78306	-0.2649	0.19974	-0.2649	0.19974
S&P	1.55156	0.19191	8.08462	3E-15	1.17472	1.92839	1.17472	1.92839
Dummy Recession	0.00511	0.02546	0.20076	0.84095	-0.0449	0.0551	-0.0449	0.0551
Dummy*Wilshire	0.34388	0.1344	2.55856	0.01073	0.07997	0.60779	0.07997	0.60779
Dummy*S&P	0.79667	0.23129	3.44446	0.00061	0.34252	1.25082	0.34252	1.25082
5 Yr T Bond	0.09742	0.04398	2.21511	0.02709	0.01106	0.18378	0.01106	0.18378
10 Yr T Bond	-0.118	0.0439	-2.6886	0.00735	-0.2042	-0.0318	-0.2042	-0.0318
Pacific	-0.026	0.06051	-0.4293	0.66787	-0.1448	0.09284	-0.1448	0.09284
Mountain	0.11257	0.06513	1.72836	0.08439	-0.0153	0.24046	-0.0153	0.24046
West South Central	-0.0797	0.04561	-1.7477	0.08098	-0.1693	0.00984	-0.1693	0.00984
East South Central	0.05952	0.02671	2.22811	0.02621	0.00707	0.11198	0.00707	0.11198
South Atlantic	0.01788	0.08386	0.21323	0.83122	-0.1468	0.18255	-0.1468	0.18255
West North Central	-0.0634	0.03114	-2.0367	0.04208	-0.1246	-0.0023	-0.1246	-0.0023
East North Central	0.06214	0.0266	2.33581	0.0198	0.0099	0.11437	0.0099	0.11437
Middle Atlantic	-0.0235	0.03156	-0.744	0.45715	-0.0854	0.03849	-0.0854	0.03849
New England	-0.1364	0.06972	-1.9558	0.05091	-0.2732	0.00054	-0.2732	0.00054

College

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.14092
R Square	0.01986
Adjusted R Square	-0.0073
Standard Error	0.67782
Observations	595

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	16	5.3802	0.33626	0.73189	0.76215
Residual	578	265.558	0.45944		
Total	594	270.938			

	Coefficients	*tandard Erro*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Upper 95.0%*
Intercept	-0.8467	1.02677	-0.8246	0.40994	-2.8633	1.16999	-2.8633	1.16999
Wilshire	-0.2945	0.76262	-0.3861	0.69956	-1.7923	1.20339	-1.7923	1.20339
S&P	-1.3681	1.23698	-1.106	0.26918	-3.7976	1.06141	-3.7976	1.06141
Dummy Recession	0.01626	0.16408	0.0991	0.92109	-0.306	0.33853	-0.306	0.33853
Dummy*Wilshire	0.48071	0.8663	0.5549	0.57918	-1.2208	2.1822	-1.2208	2.1822
Dummy*S&P	2.30545	1.49077	1.54648	0.12254	-0.6225	5.23345	-0.6225	5.23345
5 Yr T Bond	-0.1399	0.28348	-0.4935	0.62182	-0.6967	0.41687	-0.6967	0.41687
10 Yr T Bond	0.11849	0.28294	0.41879	0.67553	-0.4372	0.67422	-0.4372	0.67422
Pacific	-0.099	0.39003	-0.2538	0.79974	-0.865	0.66705	-0.865	0.66705
Mountain	-0.2272	0.41981	-0.5412	0.58857	-1.0517	0.59734	-1.0517	0.59734
West South Central	0.18707	0.29395	0.63642	0.52476	-0.3903	0.7644	-0.3903	0.7644
East South Central	0.03705	0.17219	0.21517	0.82971	-0.3011	0.37524	-0.3011	0.37524
South Atlantic	-0.0301	0.54055	-0.0557	0.95557	-1.0918	1.03155	-1.0918	1.03155
West North Central	0.01295	0.2007	0.06455	0.94856	-0.3812	0.40715	-0.3812	0.40715
East North Central	-0.0861	0.17146	-0.5022	0.61575	-0.4229	0.25066	-0.4229	0.25066
Middle Atlantic	-0.1396	0.20341	-0.6865	0.49268	-0.5391	0.25987	-0.5391	0.25987
New England	0.53724	0.44936	1.19556	0.23236	-0.3453	1.41982	-0.3453	1.41982

Industrial

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.65435
R Square	0.42818
Adjusted R Square	0.40575
Standard Error	0.08125
Observations	425

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	16	2.01666	0.12604	19.0941464	2.7981E-40
Residual	408	2.69323	0.0066		
Total	424	4.70989			

	Coefficients	*tandard Errc*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Jpper 95.0%*
Intercept	0.03492	0.14562	0.23982	0.81058784	-0.2513405	0.32119	-0.2513	0.32119
Wilshire	-0.0399	0.10816	-0.3694	0.71205273	-0.2525685	0.17267	-0.2526	0.17267
S&P	1.04042	0.17544	5.93052	6.4435E-09	0.69555157	1.38529	0.69555	1.38529
Dummy Recession	0.00448	0.02327	0.19238	0.84754349	-0.0412693	0.05022	-0.0413	0.05022
Dummy*Wilshire	0.22107	0.12286	1.79934	0.07270444	-0.0204519	0.4626	-0.0205	0.4626
Dummy*S&P	0.51842	0.21143	2.45197	0.01462594	0.10279128	0.93405	0.10279	0.93405
5 Yr T Bond	-0.008	0.0402	-0.199	0.84239046	-0.0870336	0.07104	-0.087	0.07104
10 Yr T Bond	0.02221	0.04013	0.55347	0.58024504	-0.0566746	0.10109	-0.0567	0.10109
Pacific	0.00583	0.05532	0.10546	0.91606336	-0.1029055	0.11457	-0.1029	0.11457
Mountain	0.04264	0.05954	0.71622	0.47426776	-0.0743999	0.15969	-0.0744	0.15969
West South Central	-0.0384	0.04169	-0.9222	0.35699495	-0.1203955	0.04351	-0.1204	0.04351
East South Central	0.02883	0.02442	1.18064	0.23843312	-0.019174	0.07684	-0.0192	0.07684
South Atlantic	-0.0295	0.07666	-0.385	0.70040692	-0.1802231	0.12119	-0.1802	0.12119
West North Central	-0.0243	0.02846	-0.8553	0.39289475	-0.0803009	0.03161	-0.0803	0.03161
East North Central	0.01018	0.02432	0.41849	0.67581231	-0.0376271	0.05798	-0.0376	0.05798
Middle Atlantic	0.02429	0.02885	0.84188	0.40034768	-0.0324233	0.081	-0.0324	0.081
New England	-0.0469	0.06373	-0.7364	0.46194074	-0.1722098	0.07835	-0.1722	0.07835

Residential

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.64986
R Square	0.42232
Adjusted R Square	0.40357
Standard Error	0.0726
Observations	510

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	16	1.89942	0.11871	22.526	5.5E-49
Residual	493	2.59815	0.00527		
Total	509	4.49756			

	Coefficients	*tandard Errc*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*.ower 95.0%*	*Jpper 95.0%*
Intercept	-0.19	0.11878	-1.5999	0.11026	-0.4234	0.04334	-0.4234	0.04334
Wilshire	-0.0174	0.08822	-0.1976	0.84345	-0.1908	0.15591	-0.1908	0.15591
S&P	1.14495	0.1431	8.0013	8.9E-15	0.8638	1.42611	0.8638	1.42611
Dummy Recession	0.02154	0.01898	1.13486	0.25698	-0.0158	0.05884	-0.0158	0.05884
Dummy*Wilshire	0.17609	0.10022	1.75708	0.07952	-0.0208	0.37299	-0.0208	0.37299
Dummy*S&P	0.10149	0.17246	0.58849	0.55648	-0.2374	0.44033	-0.2374	0.44033
5 Yr T Bond	-0.0839	0.03279	-2.5582	0.01082	-0.1483	-0.0195	-0.1483	-0.0195
10 Yr T Bond	0.10893	0.03273	3.32802	0.00094	0.04462	0.17324	0.04462	0.17324
Pacific	0.00618	0.04512	0.13692	0.89115	-0.0825	0.09483	-0.0825	0.09483
Mountain	-0.0238	0.04856	-0.4895	0.62472	-0.1192	0.07165	-0.1192	0.07165
West South Central	0.02618	0.034	0.76985	0.44176	-0.0406	0.09299	-0.0406	0.09299
East South Central	0.04321	0.01992	2.16934	0.03053	0.00407	0.08235	0.00407	0.08235
South Atlantic	-0.0641	0.06253	-1.0247	0.30602	-0.1869	0.05879	-0.1869	0.05879
West North Central	-0.0685	0.02322	-2.951	0.00332	-0.1141	-0.0229	-0.1141	-0.0229
East North Central	0.02029	0.01984	1.02315	0.30674	-0.0187	0.05927	-0.0187	0.05927
Middle Atlantic	0.03288	0.02353	1.39753	0.16288	-0.0133	0.07912	-0.0133	0.07912
New England	0.0175	0.05198	0.33668	0.7365	-0.0846	0.11964	-0.0846	0.11964

Other

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.59733
R Square	0.3568
Adjusted R Square	0.34444
Standard Error	0.09391
Observations	850

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	16	4.07488	0.25468	28.88028042	5.25548E-69
Residual	833	7.3458	0.00882		
Total	849	11.4207			

	Coefficients	*Standard Erro*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.10705	0.11902	0.89947	0.368664951	-0.1265554	0.34066	-0.1266	0.34066
Wilshire	0.01267	0.0884	0.14335	0.886044819	-0.16083554	0.18618	-0.1608	0.18618
S&P	1.37389	0.14338	9.5821	1.05906E-20	1.092461309	1.65532	1.09246	1.65532
Dummy Recession	0.0003	0.01902	0.01555	0.987594417	-0.03703525	0.03763	-0.037	0.03763
Dummy*Wilshire	0.07238	0.10042	0.72084	0.471207653	-0.12471278	0.26948	-0.1247	0.26948
Dummy*S&P	0.12227	0.1728	0.70761	0.479385958	-0.21689876	0.46145	-0.2169	0.46145
5 Yr T Bond	-0.0496	0.03286	-1.5081	0.131904356	-0.11405096	0.01494	-0.1141	0.01494
10 Yr T Bond	0.06066	0.0328	1.84958	0.064728494	-0.00371383	0.12503	-0.0037	0.12503
Pacific	-0.0499	0.04521	-1.1039	0.269941619	-0.13864383	0.03883	-0.1386	0.03883
Mountain	0.07846	0.04866	1.61232	0.107270857	-0.01705554	0.17397	-0.0171	0.17397
West South Central	-0.0402	0.03407	-1.1789	0.238780863	-0.10704375	0.02671	-0.107	0.02671
East South Central	0.03748	0.01996	1.87772	0.060768051	-0.00169831	0.07665	-0.0017	0.07665
South Atlantic	-0.0154	0.06266	-0.2462	0.805553407	-0.13841106	0.10755	-0.1384	0.10755
West North Central	-0.0058	0.02326	-0.2505	0.802287194	-0.05148932	0.03984	-0.0515	0.03984
East North Central	0.01359	0.01987	0.68378	0.494302683	-0.02542031	0.0526	-0.0254	0.0526
Middle Atlantic	0.02924	0.02358	1.24002	0.215317609	-0.01704179	0.07552	-0.017	0.07552
New England	-0.0748	0.05209	-1.4357	0.151471416	-0.17701499	0.02746	-0.177	0.02746

As seen in office, retail, hotel, and industrial, when the dummy variable is multiplied by the Wilshire or the S&P, a significant effect occurs as a result of the recession. As seen above in office, retail, and industrial, when the dummy is combined with the Wilshire or S&P, a substantial coefficient along with a significant p-value results. This indicates that during the recessionary times, the given asset class was more correlated with the market than during non-recessionary times. This is the essence of the black swan. In normal markets, the asset class behaves outside of the market norms, but during the recessionary time periods, the asset class moves much more heavily with the market. With the exception of college, also notice how much higher the R-squared values are. This indicates that the independent variables are explaining substantially more of the variability in the REIT returns.

Finally, the recessionary years' data were pulled and regressed against the proxies without 2006-2007 or 2011-2012 years being included. The results are shown below.

Linear Regression							
Regression Statistics							
R	0.63442						
R Square	0.40249						
Adjusted R Square	0.39861						
Standard Error	0.1332						
Total Number Of Cases	2479						
T Bond - 0.4693 * 10 Yr T Bond - 1.4604 * Pacific + 0.4766 * Mountain + 0.6287 * West South Central - 3.4305 * East South Central - 0.5607 *							
ANOVA							
	d.f.	*SS*	*MS*	*F*	*p-level*		
Regression	16.	29.42372	1.83898	103.6528	0.E+0		
Residual	2,462.	43.6802	0.01774				
Total	2,478.	73.10392					
	Coefficients	*Standard Error*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%) rejected?*
Intercept	-7.73363	2.37873	-12.39816	-3.06911	-3.25116	0.00116	Yes
Wilshire	0.16866	0.0363	0.09747	0.23984	4.64613	0.	Yes
GDP	0.90313	0.27746	0.35905	1.44722	3.25498	0.00115	Yes
S&P	1.70489	0.06239	1.58256	1.82723	27.32725	0.E+0	Yes
3 Mo T bill	0.02174	0.01182	-0.00145	0.04492	1.83845	0.06612	No
1 Yr T Bond	-0.1326	0.03303	-0.19736	-0.06784	-4.01501	0.00006	Yes
5 Yr T Bond	0.31504	0.0729	0.17208	0.458	4.3213	0.00002	Yes
10 Yr T Bond	-0.46933	0.11374	-0.69236	-0.2463	-4.12645	0.00004	Yes
Pacific	-1.46042	0.563	-2.56442	-0.35642	-2.594	0.00954	Yes
Mountain	0.47655	0.44297	-0.39207	1.34518	1.07582	0.28211	No
West South Central	0.62873	0.36393	-0.08492	1.34238	1.72759	0.08419	No
East South Central	-3.43049	0.35966	-4.13576	-2.72522	-9.5381	0.E+0	Yes
South Atlantic	-0.56071	0.41214	-1.36888	0.24746	-1.36049	0.1738	No
West North Central	0.14062	0.15394	-0.16123	0.44248	0.91352	0.36106	No
East North Central	0.47794	0.56671	-0.63334	1.58921	0.84335	0.39911	No
Middle Atlantic	0.86213	0.61501	-0.34387	2.06812	1.4018	0.1611	No
New England	3.96837	0.50504	2.97803	4.95871	7.85759	5.77316E-15	Yes
T (5%)	1.96093						
LCL - Lower value of a reliable interval (LCL)							
UCL - Upper value of a reliable interval (UCL)							

As seen above, the R-squared value, F statistic, and several of the coefficients are more substantial as compared to the original regression of REIT returns with all of the proxies. This indicates that during recessionary times, REIT returns are substantially more explainable through these proxies. Additionally, with the exception of the unemployment data, all but one of the proxies are significant, further indicating the role of these proxies in determining REIT returns during recessionary periods. This again is evidence of the black swan. While REIT returns are not normally as highly correlated with the given proxies, during times of economic recession, and the proxies become more significant and give further insight as to the variability of the dependent variable.

8. Conclusion

Black swan events are those that are very difficult to predict due to a special set of unforeseeable circumstances from which they arise. The theory itself contends that it is very difficult if not impossible to look at the outcomes of a given event in hindsight and determine the underlying aspects that led to the unforeseeable event so as to make it predictable in the future. While this is true to a certain extent, what has been shown through the analyzing of recessionary periods as well as differing asset classes is that in the months leading up to events such as the recession of 2008, proxies for REITs may indeed be able to predict black swans in the short run.

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