Estimation of NOI Growth, Volatility and Clustering by MSA

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Draft: February 2003.

1. INTRODUCTION

Returns for commercial real estate are determined by the interaction between the market for space or "space market" and the market for capital or "capital market." In the space market, tenants lease space and short run rental rates are determined by the supply and demand for space. Discount and capitalization (cap) rates for rental real estate are determined in the capital market where real estate competes with other investment alternatives for capital. Uncertainty as to what rental rates and the resulting net operating income (NOI) will be for a property affect risk premiums that are included in the discount rate (See Fisher, Hudson-Wilson and Wurtzebach, 1993; and Fisher, 1992). The space market tends to be local in nature as supply and demand for space can vary considerably across locations. The capital market tends to be more national and little variation in discount rates from location to location (although capitalization (cap) rates will vary due to differences in expected growth in NOI).[1]

This study measures and analyzes differences in the performance of the space market by focusing on how NOI varies across Metropolitan Statistical Areas (MSAs) and over time. Indices of NOI growth are calculated for the major MSAs in the U.S. based on quarterly NOI data over the past 20 years from the National Council of Real Estate Investment Fiduciaries (NCREIF) database. The indices are estimated using a repeated measure regression model specified with a log normal diffusion process analogous to the Deng, Quigley, Van Order (1996) WRS estimator which uses observations on repeat sales of houses whose economic characteristics are unchanged. In this application, we rely on repeated observations on the NOI of properties whose characteristics are unchanged.

The repeated observations of NOI at the individual property level over time permit us to calculate much more accurate growth trends by accounting for more

[1] In general, a cap rate is equal to the discount rate for a property less its expected growth in NOI.

realistic risk measures through the variance-covariance structure for each pre-specified sub-market (for example, by MSA and property types) than is possible using aggregate NOI changes from quarter to quarter as currently used by the industry.[2]

After the NOI indices are constructed, we will analyze how the NOI indices vary across MSAs as well as analyze which MSAs tend to cluster together based on common economic drivers. The geographic theory of diffusion assumes that neighbors are geographically proximate. Economic diffusion, however, can occur on two levels, either by adjacency as in the example or "leapfrog" from city to city through an infrastructure of economic ties. In the latter case economic neighbors, as we will refer to them, are defined as locales linked on a plane with similar dominating economic sectors and dependence on like industries that results in closely correlated market activities. Our focus will be on identifying real estate risk and performance similarities between economic neighbors as identified by the common economic sectors that dominate in the MSAs studied.

The ability to identify commonalities among MSAs is critical in the development of diversified real estate portfolio strategies as well as identifying the underlying risk of commercial loan portfolios. The clustering approach allows us to create a risk measure for investing in commercial property that can identify the extent to which a particular MSA is vulnerable to market downturns (such as the loss of one major industry). In this study we develop an analysis that illustrates how variations in individual property income growth, observed over time, can be related to economic events in specific economic sectors. The research will expand the knowledge of the nature of economic diversification by separating out the effects of economic fundamentals on the space market in each economic area and analyzing the

[2] Unlike hedonic model estimation, a repeated measure regression typically does not control for changes in the composition of properties in order to capture the market trends with more generosity. Opponents of the hedonic price index models often criticize their lack of theoretical foundation as well as their limitation in generalization.

performance of clustered communities on the basis of economic sector dominance. In the pages that follow we will provide a background discussion in the area of cluster analysis. Then a description of the data, methods and analysis will follow. We conclude with the implications of the results to inform investors and property managers alike.

2. BACKGROUND

A cluster is a set of one or more objects that can be considered similar to each other. Cluster analysis is a generic name for a variety of mathematical methods that can be used to determine subsets of similar objects in a larger dataset. A *k*-means method of the cluster analysis technique is employed, where the resemblance coefficient of interest is the variance measure for NOI by metropolitan statistical area (MSA). The goal is to categorize those MSAs with similar NOI performance over the period of observation and then to identify economic characteristics that can serve to explain the similar performances.

Cluster analysis has been frequently employed in the study of real estate and urban economic issues over the last decade, and many of those efforts were made in an attempt to identify meaningful similarity measures on which to confirm the existence of MSA or regionally based economic clusters that can be used to predict real estate investment performance. Rudolph and Topping (1991) developed a cluster study relating management strategy and performance in the thrift industry over the period 1979 through 1987 (encompassing the point when thrifts were deregulated). They found clusters of thrifts that exhibited a strategy of maintaining the real estate mortgage focus rather than venturing into other product lines available through deregulation had superior performance when compared to thrifts with more diverse product lines. Hartzell, Schulman and Wurtzebach (1987); Hartzell, Heckman and

Miles (1986); Corgel and Gay (1987); Cole, Guilkey, Miles and Webb (1989) all attempt to identify groups of regions with similar economic characteristics. Cole et.al.'s findings support the notion that geographic diversification of portfolios should take economic similarities into consideration rather than focus exclusively on locational differences. Frank Russell Company, Moody's Investor Service and other research firms have also begun to shift attention from purely locational geographic diversification to consideration of locations with similar economic regions. Anderson and Shain (2001) prepared a cluster analysis on identified economic characteristics (demographics, employment structure, economic growth patterns, and space distribution of property sector market) to the 100 top MSAs. They identified six distinctive clusters based on core economic characteristics.

A second line of clustering research focuses on identifying clusters based on real estate performance figures. Goetzmann and Wachter (1995) apply a clustering algorithm, to effective rents for twenty-one MSA office markets in an attempt to confirm the existence of distinctive geographic markets. The findings suggest that there are major "families," as they refer to them, of cities that have similar performance in the apartment markets. For example, there is evidence of the bicoastal city associations between Boston and Los Angeles, an industrial Northeast group and an extractive industries group in the southwest and south-central states.

Utilizing return data from the NCREIF database, Fisher and Liang (2000) compare two commercial real estate portfolio diversification strategies, by property sector (apartment, industrial, office, and retail) and by region (East, Midwest, South, and West). The authors' contend that diversification is not a cost free strategy and they sought to identify which of the two options was more efficient. The conclusion, based on comparing sector and regional returns with pure return indices, is that the more efficient diversification strategy for portfolio managers is to diversify by sectors.

The geographic regions that were utilized, however, were broad and encompassed multiple economic sectors within a single region.

By using regional data, these studies may have understated the impact of industry-specific shocks on regional economic activity. The law of large numbers suggests that positive shocks to an industry in one area of a broadly defined region are likely to be offset by negative shocks to that industry in another area of that region. Thus, the apparent impacts from shocks will be dampened by the aggregation (Carlino, DeFina and Sill, 2001). As a result, studies using data at the Metropolitan Statistical Area (MSA) are more likely to reflect the importance of shocks to local economies than would be the case if regions were studied. This concern was recently addressed in a study by Carlino et al. (2001) where the authors studied the source of employment growth or change in five MSAs. Their findings reveal that within-MSA industry shocks explain considerably more of the forecast error variance in industry employment growth than does more regional analysis.

Using NOI per square foot aggregated at the MSA level for multifamily properties in forty MSAs Ping and Black (1998) provide evidence to suggest that cities with different dominant industries exhibit similar asset performances in the apartment markets. This suggests that industrial dominance, which is the primary classification criterion used by several previous studies for classifying the office and industrial property markets, may not be the dominant factor that dictates the relationships of asset performances in the apartment markets (Mueller and Ziering, 1992; Mueller, 1993: Ziering and Hess, 1995; Williams, 1996). The goals of this analysis are similar to those of Ping and Black; the clustering analysis is applied to real estate performance data, the variance in NOI over time and by MSA in an attempt to identify regional clusters and to go one additional step compare the clusters in search of the cluster combinations that offer the greatest potential for diversification.

A study by Cheng and Black (1998) explore the diversification opportunities across MSA apartment markets with the goal of identifying crucial economic factors for determining the relationship of asset-performance among different MSAs. The authors perform a cluster analysis to identify homogeneous groupings of metropolitan apartment markets. The findings from a cross-section of property performance data provide strong evidence of the existence of economic variables that distinguish specific clusters and are likewise related to property performance.

The results from this study will allow the identification of clusters of properties with similar net operating income (NOI) performance and relating those clusters to the local economic influences.

3. METHODOLOGY

We employ a two-step procedure to analyze commercial property cash flows. The first step is to create net operating income (NOI) indices by property type and metropolitan areas using repeat observations of NOI cash flows of commercial properties. The second step is to create a cluster mapping of properties which demonstrates the relationship between metropolitan areas in terms of property types.

3a. Temporal Patterns of NOI

The first step in our analysis involves identifying temporal patterns of NOI for individual properties at the MSA level. The indices will be estimated using a repeated measure regression specified with a log normal diffusion process analogous to the Deng, Quigley, Van Order (1996) WRS estimator which used observations on repeat sales of houses whose economic characteristics are unchanged. In this application, we rely upon repeated observations on the NOI of properties whose characteristics are unchanged. This enables us to create indices which reflect intertemporal variations in

NOI by property type and metropolitan which are superior to simply creating an index by aggregating changes from raw NCREIF NOI data from quarter to quarter.

More concretely, the repeated measure regression model is specified as

$$noi_{i,s,t} = \sum_{j=1}^{q_i} y_{i,j} + \varepsilon_i, \tag{1}$$

where $noi_{i,s,t} = \log\left(NOI_{i,s+t} / NOI_{i,s}\right)$ is the natural log value of the NOI ratio for property i between the second measure in period $(s+t)$ and the first measure in period s; $y_{i,j}$ is an indicator variable takes value of -1 if $j = s$, and +1 if $j = s+t$, and 0, otherwise; q_i is the total number of measure of NOI for property i; and ε_i is unobserved risk measure that follows a normal distribution with zero mean and a variance-covariance matrix of Σ. We further specified the variance-covariance matrix following a diffusion process such that

$$\Sigma = \sigma_1^2 + \sigma_2^2 t + \sigma_3^2 t^2 + \sigma_4^2 \ln\left(MV_0\right), \tag{2}$$

where MV_0 is the market value of the property measured at the beginning period.

Following Case and Shiller (1987), we adopt a three-stage estimation approach to estimate the repeated measure NOI indices. In the first stage, we estimate equation (1) by OLS approach. In the second stage, we estimate the diffusion process of the variance-covariance matrix specified by equation (2) by regressing the residuals from the first stage OLS regression to the number of periods between two measures of NOI as well as the log of market value of the property. In the third stage, we re-estimate equation (1) using a weighted least square (WLS) approach where the weighting matrix is the expected variance-covariance matrix obtained from the second stage estimation.

3b. Cluster Analysis

We employ a cluster analysis technique known as non-hierarchical clustering based on the k-median method where closeness or distance is a function of the euclidean distance between the mean of each cluster. The non-hierarchical approach requires first that the desired number of clusters, (k), is identified then assign each case (object) to one of

The k-median algorithm starts with an initial partition of the cases into k clusters. Subsequent steps modify the partition to reduce the sum of the distances for each case from the mean of the cluster to which the case belongs. The modification consists of allocating individual area units and successively merges similar units to the nearest of the k means of the previous partition in an iterative process until viable groups are formed. The inputs used in the cluster model include the temporal NOI performance and variation in an attempt to distinguish MSAs markets. No objective method exists for determining the optimal number of clusters for a given set of data, and the number of "true" clusters in the data is not known. Therefore, the algorithm is run with different values for k that are near the number of clusters one expects from the data to see how the sum of distances reduces with increasing values of k. The size of the data set (19 MSAs) dictates a relatively small number for this study (between 3 and 8 were tested), and testing indicated that using six groups provided the most representative result for all the tests.

The objective of the cluster analysis is to group the MSAs into relatively homogeneous markets on the basis of NOI performance, then identify those elements in the dominant industry sectors that exhibit significant influence on local real estate markets. Consideration is then given to the economic clustering divisions that have developed over time. For example, Anderson and Shain (2001) identified six

economic clusters, manufacturing, financial, government, distribution, high growth, and small scale MSAs that will be considered in organizing our clusters.

4. DATA

We examine a panel data set representing the relationship between variations over time in net operating income (NOI) clustered by MSA and economic events that occur in localized economic sectors. Individual property level return data is aggregated and analyzed as a function of those economic factors.

Data for the analysis will be obtained from the NCREIF database providing information at the MSA level for each property owned by member organizations.[3] The data include the individual property information over the period 1978 to 2002 and includes the structural information as well as quarterly NOI data for each property. Individual property data will be used to estimate the NOI indices through cooperation of NCREIF's Consulting Director of Research. This allows for more accurate estimates of NOI indices and variances than possible with aggregate data.

5. FINDINGS

5a. NOI Indices

The results of the first step, the identification of temporal patterns of NOI for individual properties at the MSA level, are presented in Tables 1-4. We examine 19 metropolitan areas with the indices starting at 100 in January 1990 (1990:1 = 100). [4] These indices can serve as proxies for unidentifiable NOI indices by property type and metropolitan area and have an advantage over simply creating an index based on

[3]The NCREIF database includes quarterly data on the performance of properties that have been acquired on behalf of tax-exempt institutions and held in a fiduciary environment. See www.NCREIF.org for further information.

[4] We used as many MSAs as possible where we had sufficient data to estimate indices for each MSA for all four property types starting in 1990.

existing NCREIF indices given that the data is repeat sales of commercial properties (rather than appraisals).

The growth rates in NOI for selected metropolitan areas are represented in Figures 1-4. The graphs document the growth rates as well as the changes in the growth rates over time. Clearly, the changes in growth rates (or volatility of growth rates) vary considerably across metropolitan areas. In addition, we can see that the volatility of growth rates in NOI is lowest for multifamily (and industrial) and highest for office and retail.

In addition to growth rates in NOI, we present graphs of the diffusion process of the variance over time for five of the largest metropolitan areas. The variance measure of the estimated NOI indices allows us to predict a firm's future NOI growth in probability measure with a statistical confidence interval. As we can see from Figure 5-8 that there is significant variation in the risk measure of estimated NOI indices across metropolitan areas and across property types. This implies that even if two metropolitan areas have similar NOI growth rate indices (as measured by the mean level of growth rate), the actual NOI growth rates may still be different if the risk measures are different. Therefore, the mean (NOI Index) plus the variance provides a more precise measure of the NOI growth path.

An example of the diffusion process of the variance over time would be useful. In Figure 5, we examine the diffusion process of the variance for apartments. Dallas has the higher variance of the markets examined and the variance actually rises over time before it falls (demonstrating that the apartment market in Dallas is volatile and exhibits time variation in its volatility). Atlanta, on the other hand, has a lower level of volatility and has time variation in volatility as well; however, the difference between the two markets is that Atlanta has declining volatility over time then a gradual increase in volatility. The ability to understand the volatility of NOI indices

allows us to better understand how these space markets behave across property markets and over time.

Figures 11 and 12 show how the risk measures differ by property type for two selected MSAs, Los Angeles and Chicago. Apartments have the lowest volatility in both MSAs whereas industrial and office properties have the highest volatility. It is interesting that over this time period apartment properties also had the lowest volatility of vacancy rates whereas the volatility of vacancy rates was highest for office and retail properties. This is illustrated in Figure 13. Higher volatility of vacancy rates would obviously contribute to higher volatility in NOI. For example, as vacancy rates increase there is a direct impact on NOI because it is income on occupied space and an indirect impact due to the pressure on rents to fall when vacancy rates increase. Volatility of NOI is an indication of the riskiness of the tenant (space) markets and also has implications for default risk on mortgages since the more volatile the NOI stream the more likely NOI will fall below debt service. Thus both the NOI indices and NOI volatility measures developed in this paper could be incorporated into mortgage default models.

5b. Clustering

The results of the second step, the clustering of properties with similar characteristics, are presented in Tables 5-9. The clustering results can be interpreted as the commonality between metropolitan areas segregated by property types. Cities within a cluster have greater commonality in temporal performance as measured by the indices. Tables 5 through 8 present the results from running the clustering algorithm with six clusters. The groups are in no particular order other than in the case when a metropolitan area does not fit into a cluster. Those individual cases populate the last of the groupings to illustrate where the fit (recognizing an individual

observation does not constitute a group). There are two initial observations from the results presented in those tables. First, there are examples supporting the current views regarding economic sectors and the similarity of property market performance. Consider the retail group for example. The group identified as group 1 is comprised of three communities that are homes to numerous retail corporations. Group 4 is comprised or communities representing the information economy and two cities in group 5 are often referred to as new economy cities of the south. Similar interpretations are possible for all four property types.

The second observation that can be taken from the data is that there are diversification possibilities available between property types in the same MSA. In table 9 each of the cluster associations observed in tables 5 through 8 have been aggregated into a single half matrix. For example, column three shows the cluster associations for Dallas. Dallas is in the same industrial cluster as Orange County, Phoenix, San Diego Seattle, and San Francisco and the same office cluster as Denver. Note further that of the eleven MSAs that Dallas is in one way or another associated through the cluster analysis only three communities have more than one property type that is tied to Dallas' and only one has three property type associations, San Diego. Few multiple property type associations exist in the data suggesting that return similarities, between MSAs, in one market sector do not guarantee there are similar returns for other property types in the same MSAs.

The bottom line of the clustering model is that it is not sufficient to clump properties together by region of the country (e.g., west coast) in that there can be significant difference within any region. Furthermore, the property market in a metropolitan area in one region could have more in common with a property market in a different region. This leads to the conclusion that interactions between regions are important in understanding how commercial markets behave and evolve.

6. Summary and Conclusions

In this paper, we examine the creation of metropolitan and property type indices of NOI using repeat sales data from NCREIF. The advantage of creating such indices is that it allows investors and other market participants to understand the general trend in NOI that is often not observable (such as with commercial mortgage-backed securities and REITs).

In addition, the clustering of properties revealed that with many metropolitan areas, there may be substantial clustering (or commonality) within a single property type, but not for another. For example, two metropolitan economies may seem different because of the element of distance (space) between the areas, but the residential property market has commonality in terms of NOI, and the office market has a completely different historical return. .

The clustering analysis indicates MSA regions that are clustered by NOI performance. The findings from this analysis assist investors, and property managers, in identifying the composition of locations that will reduce risk to their portfolios by considering how the dominant economic sectors influence localized performance, how locations are connected through similar economic structures. This same information will be valuable to investors in commercial mortgages (such as life insurance companies and commercial mortgage-backed securities) allowing them to better calibrate the risk exposure of their loan portfolios.

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Table 1. NOI Index by MSAs ─ Apartment

yyyy:q	DC Washington	IL Chicago	CA Los Angeles	OH Cincinnati	CA San Francisco	MA Boston	GA Atlanta	TX Dallas	CA San Diego	CA San Jose
NOI Index (1990:1 = 100)										
1989:4	155	99*	125	100	98*	102*	89	98*	142	85
1990:1	100	100	100	100	100	100	100	100	100	100
1990:2	142	92*	94*	94*	102*	111	100*	109*	102*	90
1990:3	133	93*	112	99*	87	97*	90	110*	95*	72
1990:4	126	112	87	411	93*	101*	91	97*	108*	89
1991:1	127	125	93	104*	98*	99*	87	112*	84	82
1991:2	128	126	95*	47	102*	98*	87	111*	100*	95
1991:3	136	122	92	101*	107*	91	89	106*	111	92
1991:4	138	118	105*	162	109*	97*	101*	104*	118	93
1992:1	142	132	93	100*	81	84	94	102*	106*	87
1992:2	146	124	96*	116*	114	97*	91	102*	108*	94
1992:3	149	80	95*	105*	116	103*	94	104*	108*	99*
1992:4	147	116	67	139*	122	101*	104	115*	93*	92
1993:1	148	120	82	85*	110	103*	107	114*	72	92
1993:2	158	122	78	104*	115	96	105	116*	93*	92
1993:3	125	125	72	124*	127	103*	108	111*	89	97*
1993:4	124	139	81	118*	112	115	108	122	110	97*
1994:1	155	113	74	89*	127	103*	113	118	100*	86
1994:2	156	135	74	108*	123	107	110	124	108*	79
1994:3	160	143	86	136*	131	105	104	116	94*	110
1994:4	156	166	66	154	138	103*	116	117	105*	77
1995:1	166	150	78	103*	134	109	120	113*	105*	99*
1995:2	171	156	82	103*	133	117	120	116	115	100*
1995:3	171	149	100*	33	151	119	122	122	112	108
1995:4	175	194	104*	131*	130	116	125	113*	107*	109
1996:1	155	149	76	103*	134	96*	126	126	110	110
1996:2	153	157	69	110*	160	116	127	140	103*	127
1996:3	160	189	84	116*	144	125	127	132	93*	121
1996:4	181	184	60	111*	151	126	121	140	91	103*
1997:1	176	157	49	115*	158	121	110	96*	118	101*
1997:2	184	179	47	124*	168	126	117	136	112	143
1997:3	157	197	54	101*	158	129	125	142	109*	191
1997:4	190	184	56	159	112	146	125	134	129	156
1998:1	196	178	51	10	149	149	134	98*	130	164
1998:2	194	176	54	164	199	160	131	136	129	158
1998:3	179	208	58	120*	192	160	134	143	133	166
1998:4	199	190	51	15	173	141	131	142	139	182
1999:1	199	189	55	205	192	153	140	106*	152	174
1999:2	195	188	53	119*	205	153	141	130	122	173
1999:3	194	196	62	163	214	149	143	135	131	178
1999:4	196	217	62	146	201	171	141	136	138	174
2000:1	212	204	67	125*	199	176	142	105*	134	182
2000:2	204	215	70	127*	217	193	142	143	139	206
2000:3	202	215	72	147	239	190	151	140	143	195
2000:4	226	240	64	153	240	197	141	143	142	245
2001:1	233	243	78	154	230	201	145	113*	144	256
2001:2	236	246	82	145	243	213	142	155	141	234
2001:3	240	230	79	147	249	205	134	150	145	209
2001:4	225	225	77	148	274	194	123	138	128	194
2002:1	228	224	77	145	218	202	122	89*	146	189
2002:2	225	200	86	120*	223	195	107	130	138	179
2002:3	231	217	85	138*	213	212	98*	121	140	159
2002:4	210	208	86	135*	200	212	83	114*	93*	155
Variance-Covariance Parameters ($\Sigma = \sigma^2_0 + q\,\sigma^2_q + q^2\,\sigma^2_{q2} + \ln(MV_0)\,\sigma^2_{mv}$)										
σ^2_0	2.58015	-0.74087	0.28965	-45.2188	-0.17271*	0.07429	-0.48351	-3.76314	-2.94695	-0.21121
σ^2_q	0.01092	0.00663	-0.00257*	0.04845	0.00439	-5.5E-08*	-0.00279	0.00540*	0.00970	0.00088
σ^2_{q2}	-0.00033*	-0.00025	0.00014*	-0.00107	-0.00011	8.5E-06*	8.84E-05	-0.00016	-0.00027	-1.9E-05
σ^2_{mv}	-0.14293	0.04656	-0.01351	2.81092	0.01193*	-0.00299	0.03381	0.23740	0.17604	0.01311

Table 1. NOI Index by MSAs ─ Apartment (continued)

yyyy:q	WA Seattle	CA Orange County	TX Houston	CO Denver	AZ Phoenix	MO Saint Louis	MN Minneapolis	FL Miami	PA Philadelphia
NOI Index (1990:1 = 100)									
1989:4	84	111*	97*	149	103*	100	153	98*	100*
1990:1	100	100	100	100	100	100	100	100	100
1990:2	129	97*	96*	126	102*	100	114	122	117
1990:3	121	100*	101*	172	89	100	126	191	124
1990:4	115	84	98*	136	110	100	232	162	114
1991:1	108	26	98*	129	106*	100	147	163	121
1991:2	108	83	100*	150	124	100	100*	135	124
1991:3	113	86	87*	318	97*	100	115	153	127
1991:4	112	88*	63	180	110	58	138	154	141
1992:1	114	41	118*	207	128	71	147	164	124
1992:2	118	73	121	237	118	100*	79	170	194
1992:3	116	92*	136	255	111	72	181	188	143
1992:4	118	88	119	187	121	85	156	151	160
1993:1	126	111*	96*	255	138	89	176	201	165
1993:2	123	105*	112*	252	125	81	116	191	159
1993:3	114	100*	117	252	127	80	189	195	161
1993:4	116	104*	141	277	144	80	153	229	148
1994:1	127	100*	120	286	148	113	193	206	156
1994:2	119	107*	131	273	148	89	152	176	128
1994:3	108	91*	129	247	134	67	176	186	181
1994:4	107	116	113*	313	135	82	151	178	126
1995:1	121	113*	123	304	169	83	176	181	110*
1995:2	130	116	133	268	138	87	151	176	135
1995:3	118	103*	131	290	142	100*	199	192	125
1995:4	127	126	88*	314	155	138	150	219	155
1996:1	130	129	107*	301	159	100*	202	198	150
1996:2	129	128	72	315	152	107*	157	188	193
1996:3	140	117	113*	304	139	103*	188	185	179
1996:4	137	128	90*	315	158	112	160	167	202
1997:1	147	151	57	310	167	101*	169	199	189
1997:2	158	169	55	307	174	106*	164	186	200
1997:3	157	167	130	300	159	102*	192	151	205
1997:4	156	167	122	298	168	107*	174	170	193
1998:1	166	180	127	320	199	120	211	178	232
1998:2	182	183	140	327	172	112	209	167	230
1998:3	176	173	143	340	159	105*	227	155	239
1998:4	178	203	133	344	168	111	210	174	238
1999:1	178	202	98*	358	192	106*	225	190	248
1999:2	167	181	130	356	161	113	169	178	235
1999:3	192	210	125	366	149	104*	236	176	239
1999:4	183	191	129	364	161	112	205	180	269
2000:1	193	198	103*	387	190	116	224	203	258
2000:2	195	265	121	382	167	115	222	219	273
2000:3	222	269	117	391	161	112	256	204	192
2000:4	206	247	142	406	163	103*	223	216	280
2001:1	223	294	146	414	189	113	234	223	278
2001:2	207	262	152	414	178	111	236	234	275
2001:3	207	271	166	400	144	115	225	232	292
2001:4	181	281	171	356	142	117	176	234	298
2002:1	178	302	153	345	165	119	230	251	302
2002:2	174	298	154	337	156	120	200	227	290
2002:3	178	264	157	322	135	102*	199	237	281
2002:4	125	280	151	308	144	175	177	195	273
Variance-Covariance Parameters ($\Sigma = \sigma^2_0 + q\,\sigma^2_q + q^2\,\sigma^2_{q2} + \ln(MV_0)\,\sigma^2_{mv}$)									
σ^2_0	-0.10569*	0.05701*	-1.43993	0.54212	0.99256	1.11148	-1.22596	0.70223	-1.98975
σ^2_q	0.00397*	-0.01790	0.02373	-0.00124*	-0.00366	-0.00246	0.00813	0.00123*	-0.01269
σ^2_{q2}	-0.00016*	0.00112	-0.00074	1.5E-05*	4.5E-05*	1.0E-05*	-0.00022	-6.2E-05	0.00163
σ^2_{mv}	0.01236*	0.00639*	0.09505	-0.02976	-0.05272	-0.06214	0.08138	-0.03865	0.12762

* Statistically insignificant at 95% confidence level.

Table 2. NOI Index by MSAs ─ Office

yyyy:q	DC Washington	IL Chicago	CA Los Angeles	OH Cincinnati	CA San Francisco	MA Boston	GA Atlanta	TX Dallas	CA San Diego	CA San Jose
NOI Index (1990:1 = 100)										
1983:1	60	133	206	124	177	105*	130	350	63	71
1983:2	56	150	147	130	198	113	138	323	63	73
1983:3	60	137	159	127	159	111	147	307	56	74
1983:4	40	126	156	117	142	115	162	291	57	75
1984:1	56	130	152	125	183	106*	139	293	66	74
1984:2	77	155	152	121	191	120	126	259	69	75
1984:3	73	143	191	128	172	117	113*	260	65	87*
1984:4	66	164	182	132	225	122	105*	227	41	88*
1985:1	68	162	191	131	135	114	92*	274	66	94*
1985:2	76	160	186	121	155	122	121	243	59	96*
1985:3	65	147	189	128	134	123	114	209	60	87
1985:4	84	163	139	125	134	133	110*	226	69	86
1986:1	91	196	147	122	152	132	130	198	77	84
1986:2	64	174	140	119	164	129	122	193	87	66
1986:3	61	147	140	115*	173	117	110*	197	86	54
1986:4	100*	185	80	115*	172	123	108*	182	76	56
1987:1	74	169	121	113*	171	123	120	131	84	62
1987:2	74	198	139	119	154	118	112	131	99*	61
1987:3	71	166	141	115*	149	105*	94*	132	96*	74
1987:4	78	154	134	115*	143	87	108*	175	103*	26
1988:1	88	141	131	99*	128	109	106*	154	118	56
1988:2	96*	122	123	109*	153	104*	101*	154	99*	43
1988:3	111	117	109	129	124	110	109*	143	90*	80
1988:4	100*	113	94*	120	117	99*	74	157	95*	80
1989:1	99*	141	125	58	128	105*	102*	164	108*	108*
1989:2	79	122	117	115	83	104*	114	91	117	85
1989:3	94	90	135	112*	79	105*	68	137	91*	93*
1989:4	85	128	129	111*	78	79	82	163	86	89*
1990:1	100	100	100	100	100	100	100	100	100	100
1990:2	104*	120	110	106*	91	92	95*	169	100*	106*
1990:3	92	104*	118	81	80	105*	62	134	89	105*
1990:4	74	124	112	81	93	100*	67	119	131	98*
1991:1	88	87	91	103*	102*	92	48	124	88	120
1991:2	67	115	108	99*	105*	85	67	136	66	134
1991:3	69	101*	87	95*	92	77	49	111	75	125
1991:4	94	107*	79	88	108	82	68	131	81	88
1992:1	77	91	78	121	115	89	73	167	80	115
1992:2	67	125	89	113	109	81	68	208	83	85
1992:3	65	88	79	125	114	104*	71	144	58	90*
1992:4	74	104*	91	84	107	100*	79	113	69	67
1993:1	81	100*	91	90*	121	119	88	197	67	72
1993:2	66	111	94*	114	109	82	98*	156	70	51
1993:3	79	109	80	119	108	86	81	155	65	45
1993:4	83	123	95*	118	121	73	94*	149	70	50
1994:1	77	105*	92	109*	112	66	99*	157	68	84
1994:2	58	143	96*	110*	109	66	103*	170	71	98*
1994:3	79	133	84	122	104*	79	131	164	59	100*
1994:4	87	139	107	121	117	78	109*	181	60	76
1995:1	82	133	101*	124	120	103*	112	175	70	97*
1995:2	87	120	105*	127	123	84	109*	182	65	81
1995:3	91	110	80	130	124	88	98*	156	64	95*
1995:4	86	126	96*	98*	129	80	108*	154	61	87
1996:1	79	126	93	104*	129	74	101*	159	66	94*
1996:2	93	127	109	109*	138	77	105*	149	34	96*
1996:3	86	121	103*	57	127	83	111	160	60	97*
1996:4	85	130	78	100*	125	86	99*	184	39	97*

Table 2. NOI Index by MSAs ─ Office (continued)

yyyy:q	DC Washington	IL Chicago	CA Los Angeles	OH Cincinnati	CA San Francisco	MA Boston	GA Atlanta	TX Dallas	CA San Diego	CA San Jose
1997:1	90	109	97*	119	126	103*	101*	192	57	98*
1997:2	96*	129	79	107*	128	105*	98*	198	58	99*
1997:3	92	136	107*	82	116	92	120	205	54	94*
1997:4	94	121	106*	130	121	95*	103*	191	64	100*
1998:1	97*	133	123	111*	120	109	121	209	61	106*
1998:2	102*	137	104*	116	130	108	116	220	61	109*
1998:3	99*	137	107*	120	134	115	126	200	50	113
1998:4	110	124	92	86	124	106*	126	213	66	108*
1999:1	115	127	106*	79	131	99*	113	252	63	113
1999:2	111	134	91	88	145	104*	94*	281	69	121
1999:3	108	128	104*	90*	147	101*	91	262	72	126
1999:4	111	141	108	100*	150	115	103*	236	69	124
2000:1	108	144	118	119	155	111	113	309	70	136
2000:2	117	143	124	119	163	127	114	310	85	144
2000:3	115	148	124	128	177	139	98*	306	87	152
2000:4	113	130	115	118	156	140	131	291	90*	148
2001:1	120	137	128	124	202	131	128	310	94*	155
2001:2	129	141	123	104*	192	144	134	285	106*	173
2001:3	122	107*	128	105*	193	143	137	266	95*	167
2001:4	122	115	118	126	188	140	129	262	93*	158
2002:1	121	129	129	99*	204	144	132	264	93*	151
2002:2	120	125	137	106*	195	154	133	257	98*	102*
2002:3	102*	114	136	110*	192	140	136	269	82	132
2002:4	110	120	120	100*	167	131	104*	254	82	121
Variance-Covariance Parameters ($\Sigma = \sigma^2_0 + q\,\sigma^2_q + q^2\,\sigma^2_{q2} + \ln(MV_0)\,\sigma^2_{mv}$)										
σ^2_0	4.78390	3.83713	3.82591	-0.26800*	-0.22120	0.81838	2.05257	2.41682	1.54330	0.25394*
σ^2_q	0.03438	0.03276	0.02770	2.78000	0.01571	0.01090	0.01683	0.03111	0.01069	0.01467
σ^2_{q2}	-0.00052	-0.00068	-0.00052	-3.71000	-0.00038	-6.3E-06*	-0.00025*	-0.00054	-0.00018*	-10.00090
σ^2_{mv}	-0.27186	-0.20792	-0.20524	1.36000*	0.01846	-0.03891	-0.10856	-0.11803	-0.07880	-0.00558*

Table 2. NOI Index by MSAs – Office (continued)

yyyy:q	WA Seattle	CA Orange County	TX Houston	CO Denver	AZ Phoenix	MO Saint Louis	MN Minneapolis	FL Miami	PA Philadelphia
				NOI Index (1990:1 = 100)					
1983:1	63	83	291	277	126	132	125	110*	243
1983:2	56	75	303	222	123	72	133	65	253
1983:3	66	78	268	236	131	126	135	75	249
1983:4	58	75	254	205	122	130	147	107*	96*
1984:1	65	81	188	198	136	138	119	105*	226
1984:2	57	80	232	281	133	137	125	110*	233
1984:3	67	64	208	236	138	107*	123	126	187
1984:4	68	69	188	262	161	123	113	126	204
1985:1	60	76	192	190	155	119	118	135	119*
1985:2	60	58	222	272	141	128	99*	132	190
1985:3	66	77	253	174	134	131	70	132	241
1985:4	67	94*	184	123	109*	154	118	121	269
1986:1	67	69	114	148	136	131	107*	127	255
1986:2	116	90	121	242	129	113	107*	131	198
1986:3	69	87	139	165	107*	64	77	122	209
1986:4	72	69	135	133	106*	104*	116	89	174
1987:1	72	97*	98*	121	115	119	117	113	195
1987:2	77	103*	137	131	99*	92*	124	123	194
1987:3	83	102*	89	108*	135	143	98*	69	191
1987:4	76	99*	100*	105*	122	146	117	56	188
1988:1	75	101*	112	175	96*	128	104*	88	153
1988:2	78	101*	96*	158	112	129	112	60	130
1988:3	113*	96*	109*	153	121	129	128	93*	176
1988:4	86	84	118	136	103*	95*	116	78	98*
1989:1	60	102*	140	109*	130	78	114	91*	160
1989:2	80	96*	115	116	109	89	122	102*	154
1989:3	92*	78	98*	53	115	116	111	99*	166
1989:4	85	77	85	153	103*	119	103*	65	112*
1990:1	100	100	100	100	100	100	100	100	100
1990:2	81	76	100*	116	84	135	88	97*	120
1990:3	88	86	88	118	68	132	94*	131	131
1990:4	99*	75	92*	122	64	105*	90	118	134
1991:1	85	96*	110*	126	80	83	93*	126	134
1991:2	64	86	100*	122	68	129	96*	78	134
1991:3	83	82	133	134	82	130	82	107*	123
1991:4	67	69	84	111	73	131	87	75	114*
1992:1	87	80	119	109*	123	109*	98*	117	128
1992:2	81	73	98*	129	86	140	108*	110*	121
1992:3	134	74	97*	120	111	111	98*	112*	109*
1992:4	119	69	122	142	76	141	59	105*	89*
1993:1	106*	78	108*	136	100*	88	75	97*	127
1993:2	105*	74	105*	117	103*	117	89	77	115
1993:3	121	77	79	112	98*	81	102*	89*	116
1993:4	87	59	93*	129	102*	126	87	160	130
1994:1	91*	74	98*	133	113	113	83	90*	77
1994:2	79	76	90	162	94*	131	89	70	75
1994:3	108*	70	104*	260	90*	107*	87	86	81
1994:4	74	73	99*	180	107*	120	94*	70	101*
1995:1	113	64	102*	193	80	134	95*	132	90*
1995:2	107*	63	124	210	119	146	96*	71	114*
1995:3	107*	56	130	188	86	122	97*	65	95*
1995:4	99*	78	106*	161	84	143	95*	88	98*
1996:1	100*	82	109*	164	40	172	100*	97*	73
1996:2	92*	90	95*	191	149	115	94*	93*	112*
1996:3	82	94*	119	198	175	149	94*	85	101*
1996:4	100*	72	104*	207	166	156	104*	99*	95*

Table 2. NOI Index by MSAs ─ Office (continued)

yyyy:q	WA Seattle	CA Orange County	TX Houston	CO Denver	AZ Phoenix	MO Saint Louis	MN Minneapolis	FL Miami	PA Philadelphia
1997:1	96*	92*	88	178	180	164	84	95*	108*
1997:2	99*	84	111*	208	165	165	103*	103*	108*
1997:3	108*	78	116	225	147	158	116	122	101*
1997:4	108*	87	108*	210	156	163	107*	112*	103*
1998:1	120	90	160	232	212	178	100*	113*	121
1998:2	114	100*	156	234	192	173	105*	116	159
1998:3	118	101*	168	246	199	164	96*	130	125
1998:4	117	86	147	234	194	203	101*	111*	131
1999:1	105*	108*	154	264	200	193	109*	105*	73
1999:2	124	117	186	262	224	200	114	118	131
1999:3	130	107*	194	250	225	201	111*	108*	136
1999:4	133	118	183	221	232	168	111*	96*	158
2000:1	139	109*	176	245	226	201	118	108*	131
2000:2	144	128	162	254	245	217	102*	115	144
2000:3	148	125	191	268	227	200	108*	120	164
2000:4	161	121	185	274	244	202	111	117	134
2001:1	151	119	174	258	252	204	116	141	130
2001:2	153	128	225	279	259	206	119	145	158
2001:3	148	126	175	258	257	208	119	128	154
2001:4	143	129	175	226	248	200	114	132	145
2002:1	152	137	188	234	251	202	125	164	115*
2002:2	159	135	183	197	256	207	104*	131	130
2002:3	150	141	199	195	213	159	96*	131	133
2002:4	146	134	196	174	213	175	105*	116	148
Variance-Covariance Parameters ($\Sigma = \sigma^2_0 + q\,\sigma^2_q + q^2\,\sigma^2_{q2} + \ln(MV_0)\,\sigma^2_{mv}$)									
σ^2_0	2.17838	2.19880	2.07843	2.85804	2.07887	2.32946	2.03735	2.01759	4.12166
σ^2_q	0.01803	0.01793	0.03454	0.01753	0.03213	0.01772	0.01937	0.01181	0.04108
σ^2_{q2}	-0.00033	-0.00048	-0.00050	-0.00041	-0.00074	-0.00013*	-0.00022	-0.00026	-0.00104
σ^2_{mv}	-0.12214	-0.11915	-0.09754	-0.14022	-0.10688	-0.12567	-0.10798	-0.10708	-0.22728

* Statistically insignificant at 95% confidence level.

Table 3. NOI Index by MSAs – Retail

yyyy:q	DC Washington	IL Chicago	CA Los Angeles	OH Cincinnati	CA San Francisco	MA Boston	GA Atlanta	TX Dallas	CA San Diego	CA San Jose
NOI Index (1990:1 = 100)										
1983:1	41	63	46	75	101*	86*	94*	50	71	81
1983:2	66	56	51	90*	101*	55	92	43	65	93*
1983:3	70	71	41	91*	103*	87*	96*	47	59	96*
1983:4	40	61	39	92*	105*	81*	103*	64	67	79
1984:1	90	77	45	79	100	72	104*	66	70	80
1984:2	44	63	50	79	100	84*	114	65	89	87
1984:3	57	71	47	76	60	55	93*	75	54	94*
1984:4	37	72	57	73	61	107*	89	63	75	83
1985:1	76	69	58	72	117	82*	109	70	92	107*
1985:2	114	74	58	83	86	85*	63	86	81	105*
1985:3	79	81	65	94*	89	90*	114	76	79	96*
1985:4	79	71	54	79	85	80*	103*	71	56	109*
1986:1	92	70	64	96*	87	82*	101*	89	82	87
1986:2	87	77	68	78	88	78*	91	77	84	117
1986:3	78	63	65	89*	86	88*	77	74	68	105*
1986:4	93	75	69	78	83	75*	115	60	85	117
1987:1	91	73	76	106*	84	86*	127	81	62	92
1987:2	86	73	75	63	82	87*	109	103*	64	91
1987:3	80	72	79	101*	80	61	128	101*	71	86
1987:4	90	83	75	156	80	105*	112	112	73	89
1988:1	100*	72	82	95*	81	80*	104*	92*	77	111
1988:2	88	80	84	99*	226	92*	70	107*	90	110
1988:3	85	78	87	98*	107*	93*	129	87	96*	117
1988:4	92	66	86	159	101*	123*	119	82	100*	107*
1989:1	109	92	89	126	113	85*	105*	108*	85	126
1989:2	136	86	84	106*	88	100	97*	98*	92	117
1989:3	97*	84	73	122	108*	100	91	90	97*	122
1989:4	106*	97*	93	105*	107*	103*	79	94*	93	127
1990:1	100	100	100	100	100	100	100	100	100	100
1990:2	112	83	97*	156	110*	115*	96*	111	91	119
1990:3	84	90	103*	191	105*	124	100*	92*	102*	123
1990:4	91	99*	97*	287	99*	136	106*	76	105*	101*
1991:1	81	88	102*	185	105*	119	98*	80	106	112
1991:2	83	94*	102*	181	115	117*	87	80	88	131
1991:3	61	86	94	186	114	51	85	80	101*	118
1991:4	101*	82	92	163	69	102*	65	99*	100*	129
1992:1	103*	84	97*	241	43	104*	75	75	99*	97*
1992:2	110	83	98*	204	115	104*	80	86	101*	117
1992:3	95*	86	87	213	115	96*	78	73	91	126
1992:4	115	72	87	188*	115	110*	74	96*	97*	124
1993:1	103*	72	89	231	111	103*	87	93*	91	117
1993:2	109	84	88	258	112	115*	74	95*	96*	82
1993:3	102*	86	88	226	107*	104*	70	77	95*	123
1993:4	100*	84	87	266	103*	125	65	102*	95*	122
1994:1	106*	87	93	217	108*	112*	78	57	90	78
1994:2	105*	84	93	293	111	119	58	88	89	153
1994:3	110	88	90	187*	111	110*	76	91	87	137
1994:4	120	94	87	272	120	96*	86	97*	86	137
1995:1	141	96*	94	324	120	118	91	97*	87	145
1995:2	136	90	83	248	115	52	78	98*	98*	132
1995:3	130	94	95	336	118	58	87	90	57	135
1995:4	128	87	97*	340	120	111*	85	105*	86	158
1996:1	126	96*	94	317	120	109*	96*	110	91	110
1996:2	141	105*	98*	376	115	75	59	123	67	114
1996:3	135	85	90	318	100*	110*	98*	105*	79	102*
1996:4	132	95*	96*	373	121	122	91	120	88	134

Table 3. NOI Index by MSAs – Retail (continued)

yyyy:q	DC Washington	IL Chicago	CA Los Angeles	OH Cincinnati	CA San Francisco	MA Boston	GA Atlanta	TX Dallas	CA San Diego	CA San Jose
1997:1	142	87	103*	265	115	127	93	109	88	115
1997:2	132	65	103*	237	123	141	84	105*	100*	143
1997:3	115	81	95*	219	121	149	90	104*	96*	101*
1997:4	134	89	100*	268	143	114*	92	101*	100*	111
1998:1	145	77	102*	337	105*	171	90	116	108	120
1998:2	142	89	99*	353	117	147	91	107*	95*	128
1998:3	135	81	99*	301	100*	174	91	108*	98*	135
1998:4	138	109	107	343	127	152	90	107*	89	158
1999:1	141	87	111	344	96*	169	94*	114	91	174
1999:2	149	105*	116	306	118	186	94*	113	90	181
1999:3	144	89	105*	314	120	257	99*	111	101*	175
1999:4	160	102*	111	324	127	254	93*	90	68	159
2000:1	148	89	118	285	115	201	99*	102*	101*	172
2000:2	147	108	118	287	139	257	93*	111	98*	162
2000:3	162	92	110	339	145	256	100*	103*	96*	170
2000:4	163	118	95*	289	146	341	90	103*	99*	189
2001:1	168	93*	129	273	140	329	92	117	117	167
2001:2	160	96*	120	237	136	389	93*	119	118	168
2001:3	169	96*	120	204*	140	316	89	107*	110	166
2001:4	157	97*	127	323	140	344	84	109	111	198
2002:1	161	103*	132	224	146	322	91	115	126	214
2002:2	152	109	125	249	157	356	95*	107*	113	191
2002:3	152	79	134	302	145	350	91	110	117	213
2002:4	168	89	131	258	151	379	90	99*	119	201
Variance-Covariance Parameters ($\Sigma = \sigma^2_0 + q\,\sigma^2_q + q^2\,\sigma^2_{q2} + \ln(MV_0)\,\sigma^2_{mv}$)										
σ^2_0	0.55321	2.60471	-0.43483	-0.33244	2.24829	1.23021	1.88910	0.54809	-0.05077*	0.45626
σ^2_q	0.00769	-0.01088	0.00500	-0.00370	0.00470	0.03134	0.00750	0.00860	0.00475	0.00920
σ^2_{q2}	-8.6E-05	0.00033	-4.8E-05*	8.2E-06	-3.0E-05*	-0.00067	-0.00014	-0.00020	-6.7E-05	-0.00024
σ^2_{mv}	-0.02407	-0.13245	0.03667	0.02597	-0.11640	-0.06296	-0.10803	-0.02712	0.00794*	-0.01861*

Table 3. NOI Index by MSAs – Retail (continued)

yyyy:q	WA Seattle	CA Orange County	TX Houston	CO Denver	AZ Phoenix	MO Saint Louis	MN Minneapolis	FL Miami	PA Philadelphia
				NOI Index (1990:1 = 100)					
1983:1	43	57	157	139	81	70	120	56	23
1983:2	44	57	204	75	84	78	108	65	30
1983:3	46	52	196	123	89	64	129	66	21
1983:4	81	72	136	97*	91	88	127	37	30
1984:1	54	65	186	130	98*	74	106*	54	60*
1984:2	46	75	162	130	96*	71	106*	27	51*
1984:3	65	75	155	108*	80	78	117	61	41
1984:4	59	69	149	107*	89	68	123	55	42
1985:1	59	72	74	119	90	81	114	77	63*
1985:2	56	74	138	94*	98*	92	126	61	43
1985:3	60	68	153	92*	96*	65	115	71	62
1985:4	56	72	133	125	93*	75	108	55	47
1986:1	57	71	128	134	106*	83	119	71	34
1986:2	64	87	177	139	88	74	133	58	151
1986:3	57	73	135	200	84	64	126	80	67
1986:4	61	79	49	124	96*	57	151	64	74
1987:1	57	87	123	119	100*	79	101*	82	69
1987:2	59	89	115	92*	114	57	92	83	13
1987:3	61	95*	113	128	93*	107	111	75	59
1987:4	42	90	110*	159	87	73	126	81	60
1988:1	57	97*	118	124	99*	102*	123	86*	69
1988:2	56	93*	146	109*	104*	85	108	82	64
1988:3	61	102*	130	122	94*	92	125	84	61
1988:4	91*	88	174	126	82	90	118	85	74
1989:1	91	101*	82	119	101*	97*	140	100*	81
1989:2	86	51	124	119	91	88	133	97*	58
1989:3	55	86	119	104*	89	99*	121	92*	41
1989:4	90	69	111*	146	68	98*	104*	91*	57
1990:1	100	100	100	100	100	100	100	100	100
1990:2	105*	99*	144	98*	78	108	147	79	95*
1990:3	75	86	112*	115	82	92	111	89*	51
1990:4	96*	106*	136	90	83	94	156	84	67
1991:1	83	79	99*	129	88	86	163	75	105*
1991:2	92	97*	132	117	88	90	133	79	102*
1991:3	88	87	103*	122	79	86	145	92*	84
1991:4	73	90	118	109	90	102*	165	50	95*
1992:1	77	104*	123	114	83	94	148	79	102*
1992:2	89	81	121	128	68	93	163	90*	109*
1992:3	88	80	111*	136	87	100*	122	91*	82
1992:4	92	77	152	143	83	89	166	53	111*
1993:1	86	86	104*	133	77	92	159	83	114*
1993:2	94*	81	150	138	72	86	147	95*	82
1993:3	104*	77	104*	135	90	87	149	86	83*
1993:4	109	83	121	123	70	100*	155	98*	80
1994:1	91	87	140	140	77	84	164	108*	77
1994:2	86	92	126	142	116	94	159	104*	103*
1994:3	90	79	139	108*	80	104*	180	89*	94*
1994:4	95*	92	150	145	63	98*	174	93*	85
1995:1	97*	82	166	156	88	99*	175	60	110*
1995:2	103*	89	133	155	80	100*	171	79	176
1995:3	95*	71	132	135	72	91	187	106*	85*
1995:4	104*	77	135	130	72	91	188	120	74
1996:1	92	76	136	124	69	100*	189	121	85
1996:2	107	82	144	119	56	95	173	118	118
1996:3	101*	76	136	130	83	82	187	140	95*
1996:4	91	92	126	124	77	89	197	129	98*

Table 3. NOI Index by MSAs – Retail (continued)

yyyy:q	WA Seattle	CA Orange County	TX Houston	CO Denver	AZ Phoenix	MO Saint Louis	MN Minneapolis	FL Miami	PA Philadelphia
1997:1	88	100*	144	130	103*	96*	172	130	129
1997:2	104*	103*	128	114	86	102*	208	129	105*
1997:3	94*	97*	127	127	39	95*	194	117*	127
1997:4	94*	81	130	128	84	97*	208	103*	91*
1998:1	86	105*	141	116	82	104*	187	111*	147
1998:2	76	92	129	99*	89	81	166	114*	75
1998:3	97*	89	135	129	91	84	174	115*	88*
1998:4	89	99*	129	116	83	79	197	99*	81
1999:1	99*	111	117	103*	92	59	156	91*	66
1999:2	111	121	113*	98*	84	81	236	97*	115*
1999:3	88	94*	134	110*	76	67	172	105*	71
1999:4	72	114	129	82	78	79	207	100*	122
2000:1	103*	108	125	94*	98*	100*	218	111*	95*
2000:2	85	101*	109*	96*	99*	118	209	128	148
2000:3	101*	103*	124	97*	103*	87	203	139	114*
2000:4	77	96*	134	96*	95*	70	239	118	151
2001:1	112	100*	115	75	106*	104*	207	126	138
2001:2	107*	98*	103*	110*	100*	83	206	112*	137
2001:3	124	113	96*	99*	99*	80	204	134	154
2001:4	127	91*	121	107*	96*	79	214	109*	168
2002:1	116	120	99*	106*	102*	115	225	144	167
2002:2	127	101*	109*	101*	103*	79	173	123	131
2002:3	131	122	108*	120	78	79	231	99*	135
2002:4	131	98*	46	111*	67	82	195	84	163
Variance-Covariance Parameters ($\Sigma = \sigma^2_0 + q\,\sigma^2_q + q^2\,\sigma^2_{q2} + \ln(MV_0)\,\sigma^2_{mv}$)									
σ^2_0	-0.07638*	0.55842	1.07002	-0.48565	0.72946	0.40868	0.86491	1.67174	-1.29850
σ^2_q	0.00579	0.00572	0.02258	0.01695	0.01103	0.00163	0.00215	0.00206*	0.00624*
σ^2_{q2}	1.4E-05*	-0.00016	-0.00050	-0.00036	-0.00018	-5.0E-05	-3.3E-05	-0.00025*	0.00036
σ^2_{mv}	0.00954	-0.02552	-0.05766	0.03983	-0.03324	-0.01927	-0.04686	-0.08354	0.09717

* Statistically insignificant at 95% confidence level.

Table 4. NOI Index by MSAs – Industrial

yyyy:q	DC Washington	IL Chicago	CA Los Angeles	OH Cincinnati	CA San Francisco	MA Boston	GA Atlanta	TX Dallas	CA San Diego	CA San Jose
					NOI Index (1990:1 = 100)					
1983:1	53	64	56	151	52	78	100*	116	74	64
1983:2	33	56	64	106*	66	80	84	119	80	63
1983:3	59	54	55	154	97*	67	93	109	77	69
1983:4	22	65	52	128	117	109*	87	110	74	73
1984:1	62	60	68	135	52	88	118	113	85	78
1984:2	30	60	73	137	79	85	126	113	92*	84
1984:3	44	68	68	132	73	87	96*	108	89	89
1984:4	84	76	74	155	76	82	91	112	86	84
1985:1	18	75	83	168	48	82	89	110	97*	92
1985:2	68	79	81	33	19	100*	142	131	90	96*
1985:3	64	77	81	232	77	90	99*	109	93	96*
1985:4	69	84	83	195	70	90	133	108	96*	98*
1986:1	79	75	81	159	35	34	154	100*	95*	100*
1986:2	87	84	75	205	47	85	143	112	87	94
1986:3	72	77	91	167	31	77	149	105*	86	90
1986:4	78	90	88	139	65	71	147	96*	96*	88
1987:1	97*	86	96	141	86	89	151	85	86	85
1987:2	100*	100*	101*	107*	82	89	143	101*	82	80
1987:3	59	83	99*	155	74	89	132	90	90	77
1987:4	84	99*	99*	170	110*	88	134	89	107*	70
1988:1	118	103*	90	129	79	90	132	72	97*	71
1988:2	73	96*	92	147	94*	90	140	97*	110	79
1988:3	97*	91	96	118	80	102*	144	88	103*	84
1988:4	97*	104*	99*	113*	78	100*	137	89	99*	81
1989:1	83	107	92	134	83	102*	145	85	98*	90
1989:2	90	102*	96	104*	80	98*	119	91	101*	81
1989:3	83	96*	91	115	91*	105*	120	98*	105*	105
1989:4	99*	118	90	100*	94*	90	115	98*	102*	91
1990:1	100	100	100	100	100	100	100	100	100	100
1990:2	101*	103*	101*	104*	103*	92	114	106	112	105
1990:3	93*	97*	98*	95*	91*	83	113	100*	113	102*
1990:4	97*	107	114	95*	94*	110	120	88	116	109
1991:1	72	96*	93	81	99*	103*	117	85	104*	98*
1991:2	90	103*	102*	75	64	78	120	83	114	104*
1991:3	86	96	96	61	91*	85	102*	82	118	104*
1991:4	42	108	103*	78	80	74	124	87	98*	93
1992:1	85	101*	110	76	88	84	112	83	112	108
1992:2	94*	101*	112	81	81	75	108	89	107	109
1992:3	94*	95	103*	85	100*	84	123	71	97*	101*
1992:4	99*	100*	95	83	96*	58	127	110	91	97*
1993:1	109*	98*	100*	79	88	81	129	101*	107	111
1993:2	88	90	103*	76	73	74	133	103*	80	109
1993:3	95*	96*	90	75	71	62	130	98*	107	97*
1993:4	80	95	88	86	86	62	139	93	109	98*
1994:1	89	81	88	92	90*	65	127	86	97*	107
1994:2	87	85	92	75	91*	53	144	103*	114	105*
1994:3	86	101*	88	96*	102*	79	151	99*	112	87
1994:4	94*	108	94	94*	94*	69	154	86	113	99*
1995:1	86	101*	93	85	78	65	145	98*	108	97*
1995:2	96*	106	94	78	92*	65	148	107	99*	107
1995:3	105*	107	90	82	95*	88	160	110	109	113
1995:4	111	109	93	84	106*	76	134	90	99*	111
1996:1	104*	104*	92	77	108*	73	140	101*	101*	123
1996:2	114	84	95	76	104*	79	144	108	104*	122
1996:3	134	95	71	87	23	85	143	118	103*	113
1996:4	146	90	83	85	40	81	134	99*	97*	120

Table 4. NOI Index by MSAs ─ Industrial (continued)

yyyy:q	DC Washington	IL Chicago	CA Los Angeles	OH Cincinnati	CA San Francisco	MA Boston	GA Atlanta	TX Dallas	CA San Diego	CA San Jose
1997:1	141	100*	85	86	94*	85	150	89	115	121
1997:2	155	98*	77	80	107*	85	115	109	94*	129
1997:3	158	103*	86	86	122	80	120	104*	97*	127
1997:4	159	120	97*	85	108*	111	129	115	105*	129
1998:1	177	103*	100*	88	112*	44	151	116	119	133
1998:2	188	107	98*	94*	121	102*	157	124	114	123
1998:3	182	100*	98*	89	121	83	161	107	118	146
1998:4	138	118	99*	102*	114*	67	161	113	119	140
1999:1	108*	102*	103*	96*	127	83	175	125	128	152
1999:2	152	111	101*	80	119	88	158	121	126	155
1999:3	130	101*	106	99*	121	87	158	121	132	144
1999:4	98*	111	98*	101*	139	94*	172	118	113	145
2000:1	134	106	95	97*	135	93*	172	126	113	173
2000:2	153	107	110	84	154	79	177	129	123	177
2000:3	133	105	111	96*	132	86	179	111	125	190
2000:4	165	109	113	81	123	97*	159	123	123	173
2001:1	175	119	114	85	125	93*	164	133	119	188
2001:2	211	112	116	91	128	95*	157	126	126	192
2001:3	160	111	118	86	124	102*	166	130	123	227
2001:4	174	96*	114	85	135	106*	173	125	125	170
2002:1	203	106	102*	61	150	107*	172	129	129	197
2002:2	206	98*	112	69	139	103*	165	117	131	217
2002:3	170	95*	110	66	137	102*	164	111	131	218
2002:4	182	106	118	81	160	100*	149	111	126	202
Variance-Covariance Parameters ($\Sigma = \sigma^2_0 + q\,\sigma^2_q + q^2\,\sigma^2_{q2} + \ln(MV_0)\,\sigma^2_{mv}$)										
σ^2_0	0.92564*	0.70126	1.21635	-0.04841*	-1.61271	1.43846	2.16898	4.48656	3.37011	-0.11537*
σ^2_q	0.03374	0.01552	0.01368	-0.00018*	0.03731	0.02053	0.00595	0.01306	0.00268*	0.02255
σ^2_{q2}	0.00014*	-0.00021	-0.00020	0.00022	-0.00055	-0.00024	-0.00011	-0.00020	-5.6E-05*	-0.00050
σ^2_{mv}	-0.02993*	-0.02154	-0.06140	0.01530*	0.10995	-0.07153	-0.12232	-0.26603	-0.19582	0.03157

Table 4. NOI Index by MSAs – Industrial (continued)

yyyy:q	WA Seattle	CA Orange County	TX Houston	CO Denver	AZ Phoenix	MO Saint Louis	MN Minneapolis	FL Miami	PA Philadelphia
				NOI Index (1990:1 = 100)					
1983:1	53	63	106*	154	107*	97*	83	145	93*
1983:2	64	60	143	128	87	97*	64	145	126
1983:3	38	55	64	161	122	109	100*	100	125
1983:4	62	51	122	174	94*	116	84	91*	121
1984:1	62	59	100*	143	137	79	74	76	124
1984:2	72	58	132	142	93*	111	87	86*	132
1984:3	55	63	109*	148	97*	91	106*	78	111
1984:4	66	62	127	156	83	81	106*	51	137
1985:1	62	68	120	180	130	106*	93	58	117
1985:2	69	62	122	165	117	107*	101*	39	136
1985:3	68	70	120	178	99*	59	93	37	136
1985:4	56	67	103*	197	105*	92	81	72	139
1986:1	77	75	122	185	118	81	76	119	122
1986:2	78	76	94*	196	63	78	94*	74	126
1986:3	82	67	60	185	112	103*	90	143	113
1986:4	80	75	99*	180	106*	104*	89	111*	117
1987:1	87	83	66	133	125	117	79	97*	121
1987:2	81	89	79	160	118	111	90	120	142
1987:3	73	75	101*	121	120	150	76	129	145
1987:4	87	86	86	159	114	118	88	123	164
1988:1	98*	94	107*	125	121	135	91	143	132
1988:2	97*	85	118	151	102*	151	79	86	131
1988:3	90	90	108*	151	136	176	88	76	143
1988:4	98*	93	100*	156	107*	151	95*	62	141
1989:1	93	95	110*	162	111	141	85	145	138
1989:2	96*	94	93*	121	72	142	98*	114*	109
1989:3	96*	100*	98*	145	89	129	78	96*	107
1989:4	99*	97*	127	134	86	119	111	105*	147
1990:1	100	100	100	100	100	100	100	100	100
1990:2	88	101*	156	148	87	112	106*	98*	105*
1990:3	87	104*	112*	122	97*	121	89	105*	119
1990:4	96*	97*	142	171	80	120	110	134	119
1991:1	94	89	120	133	107*	110	82	84	109
1991:2	97*	86	166	122	97*	121	100*	84	122
1991:3	97*	74	156	160	96*	117	93	133	116
1991:4	79	80	163	119	95*	133	98*	102*	133
1992:1	99*	98*	130	141	116	116	89	96*	120
1992:2	101*	71	154	105*	87	112	113	103*	139
1992:3	102*	73	161	143	98*	141	127	179	147
1992:4	106*	89	158	144	87	109	105*	183	119
1993:1	97*	78	136	186	104*	119	111	86	101*
1993:2	86	84	163	111	99*	112	122	202	97*
1993:3	72	83	162	219	99*	128	106	231	97*
1993:4	98*	87	152	111*	69	122	138	273	112
1994:1	90	74	173	213	91	118	132	223	96*
1994:2	100*	83	150	158	85	145	125	211	110
1994:3	103*	80	172	143	84	134	129	247	125
1994:4	100*	80	154	145	93*	131	115	220	138
1995:1	91	83	155	138	118	114	129	207	108
1995:2	98*	84	113*	149	95*	113	139	214	139
1995:3	105*	83	152	158	104*	134	138	140	137
1995:4	104*	81	153	139	83	134	139	218	142
1996:1	114	87	120	174	104*	114	146	160	132
1996:2	108	84	159	119	76	117	144	125	125
1996:3	111	91	172	175	109*	153	149	197	145
1996:4	119	67	182	196	103*	160	142	121	163

Table 4. NOI Index by MSAs ─ Industrial (continued)

yyyy:q	WA Seattle	CA Orange County	TX Houston	CO Denver	AZ Phoenix	MO Saint Louis	MN Minneapolis	FL Miami	PA Philadelphia
1997:1	115	84	166	189	109*	148	135	164	143
1997:2	117	86	189	185	111	139	149	145	149
1997:3	116	96*	165	192	110	151	149	144	167
1997:4	123	91	179	148	112	142	147	129	164
1998:1	130	95	206	196	119	142	140	162	160
1998:2	125	101*	177	190	123	143	143	151	148
1998:3	135	103*	234	192	126	131	122	171	134
1998:4	115	102*	210	195	128	135	133	194	113
1999:1	138	103*	207	183	136	140	122	119	116
1999:2	145	106	234	165	129	152	130	195	156
1999:3	146	107	207	181	121	158	126	182	142
1999:4	155	80	207	182	135	153	132	175	129
2000:1	153	105*	227	183	129	152	159	158	144
2000:2	157	105*	223	161	131	150	168	159	146
2000:3	138	110	247	198	114	151	164	162	162
2000:4	163	113	199	190	105*	134	152	165	147
2001:1	155	122	237	112	132	129	144	132	126
2001:2	146	126	236	181	111*	120	147	152	168
2001:3	169	124	234	190	117	129	144	158	171
2001:4	156	123	224	169	133	126	146	112*	176
2002:1	148	155	218	257	110*	151	113	137	163
2002:2	148	126	222	196	116	147	134	129	168
2002:3	123	126	206	215	99*	154	148	141	147
2002:4	130	120	212	218	97*	120	87	151	140
Variance-Covariance Parameters ($\Sigma = \sigma^2_0 + q\,\sigma^2_q + q^2\,\sigma^2_{q2} + \ln(MV_0)\,\sigma^2_{mv}$)									
σ^2_0	-0.26841*	3.39991	1.82706	0.91668	2.66147	4.54076	0.80912	1.42638	2.61802
σ^2_q	0.01817	0.01495	0.00525*	0.00789	0.03888	-0.00191*	0.01055	0.00186*	0.01795
σ^2_{q2}	-0.00031	-0.00030	-8.5E-07*	-0.00013	-0.00090	-9.2E-05	-0.00010	-0.00018*	-0.00045
σ^2_{mv}	0.03127	-0.19690	-0.09344	-0.03686	-0.15430	-0.26945	-0.02979	-0.07642	-0.15193

* Statistically insignificant at 95% confidence level.

Figure 1. NOI Growth -- Apartment

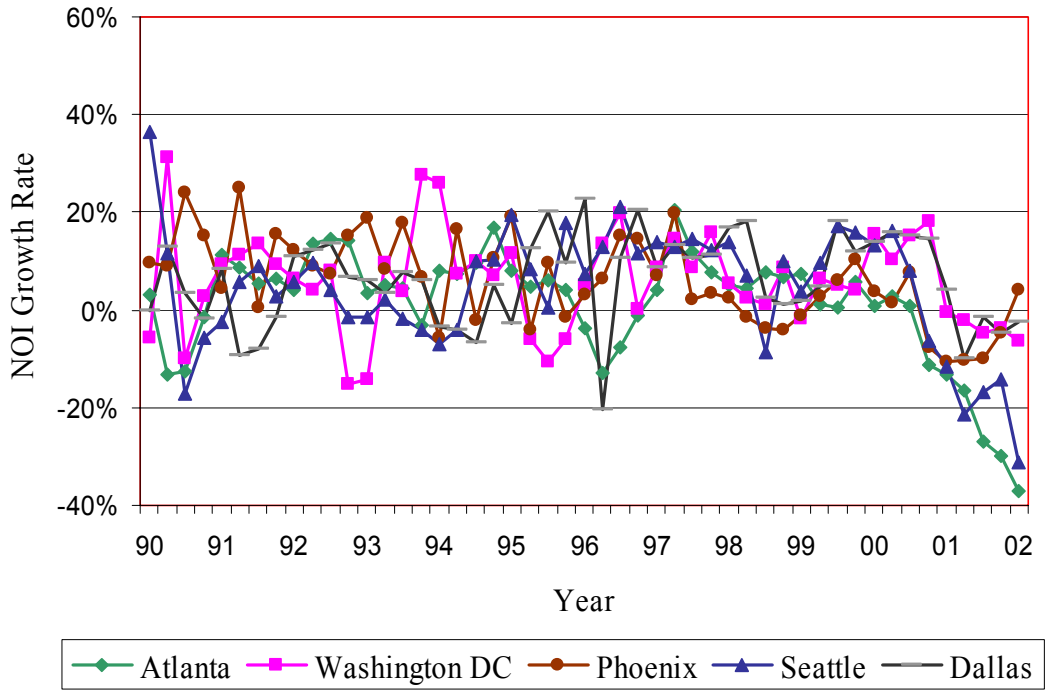

Figure 2. NOI Growth -- Office

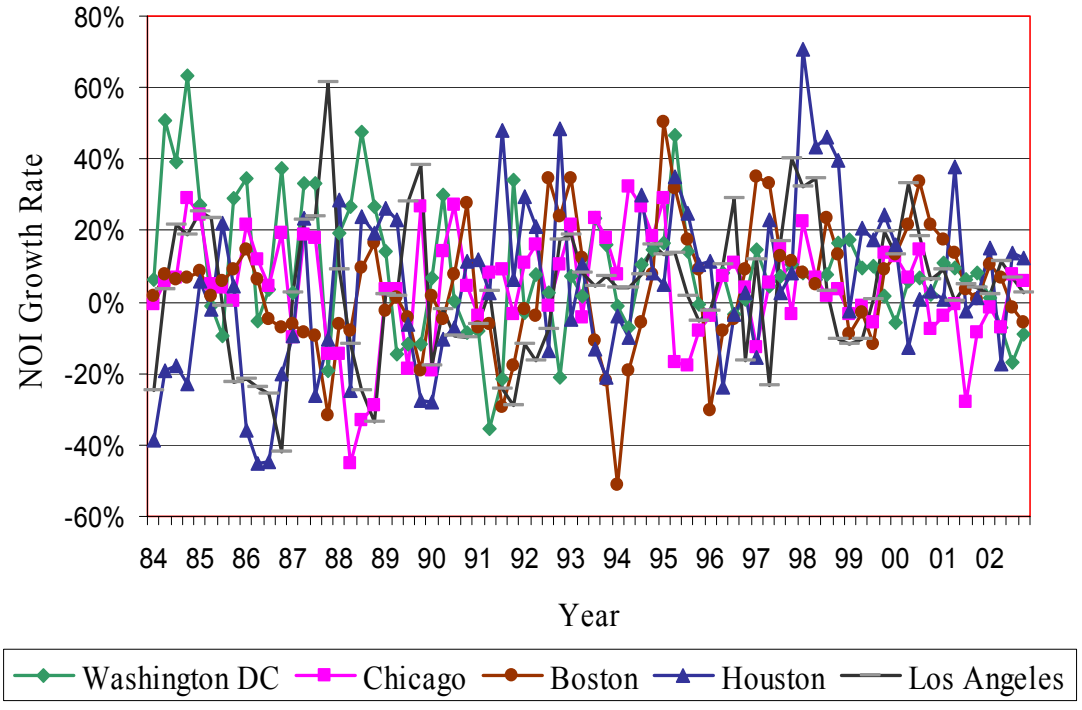

Figure 3. NOI Growth -- Retail

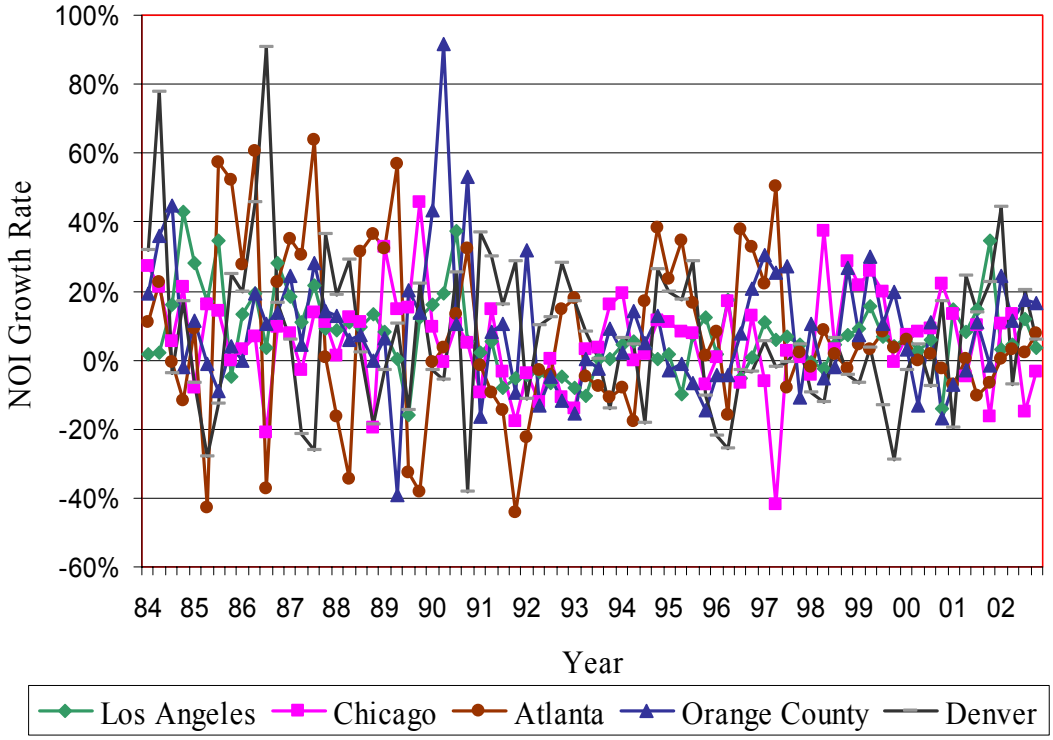

Figure. 4 NOI Growth -- Industrial

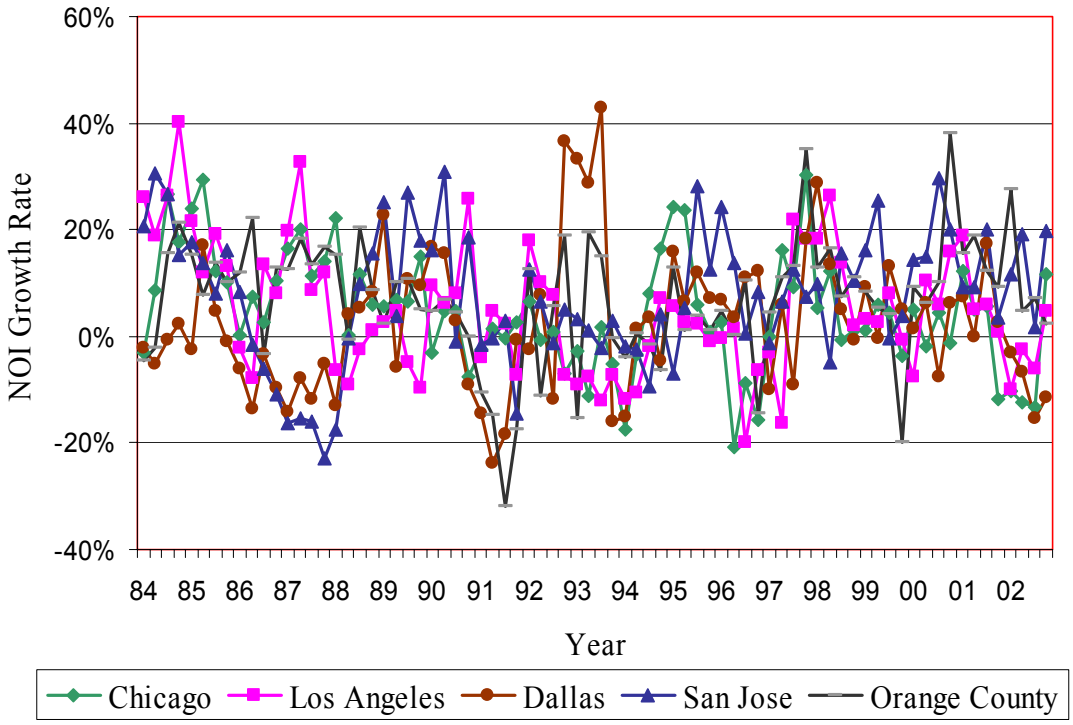

Figure 5. Risk Measure of NOI Indices Over Time
Apartment

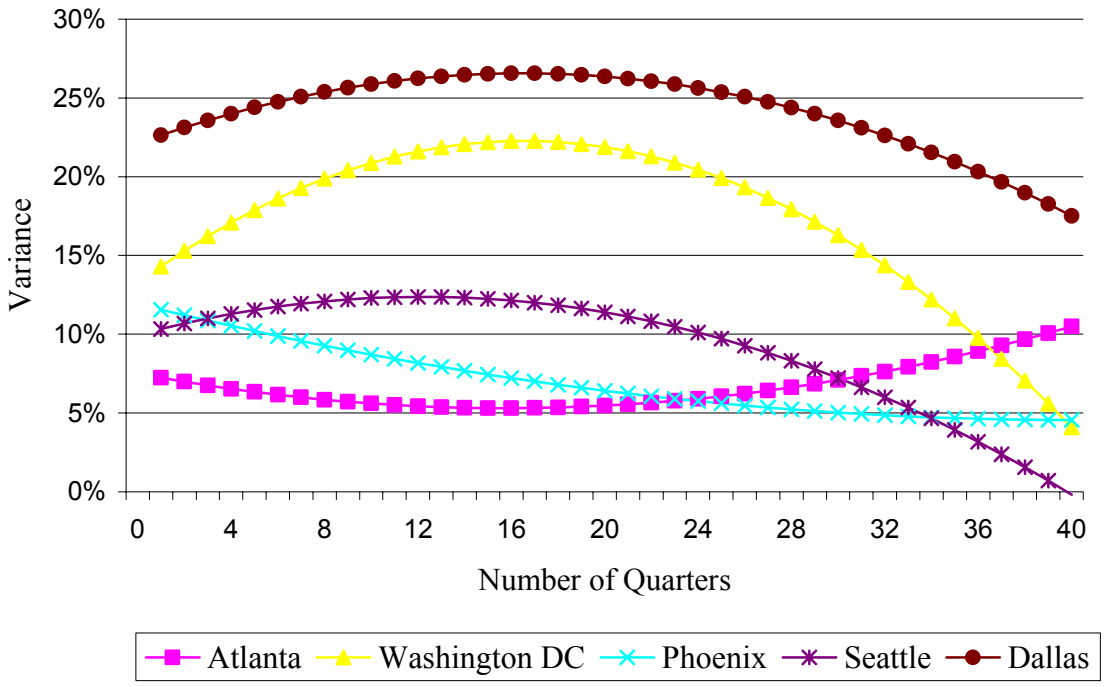

Figure 6. Risk Measure of NOI Indices Over Time
Office

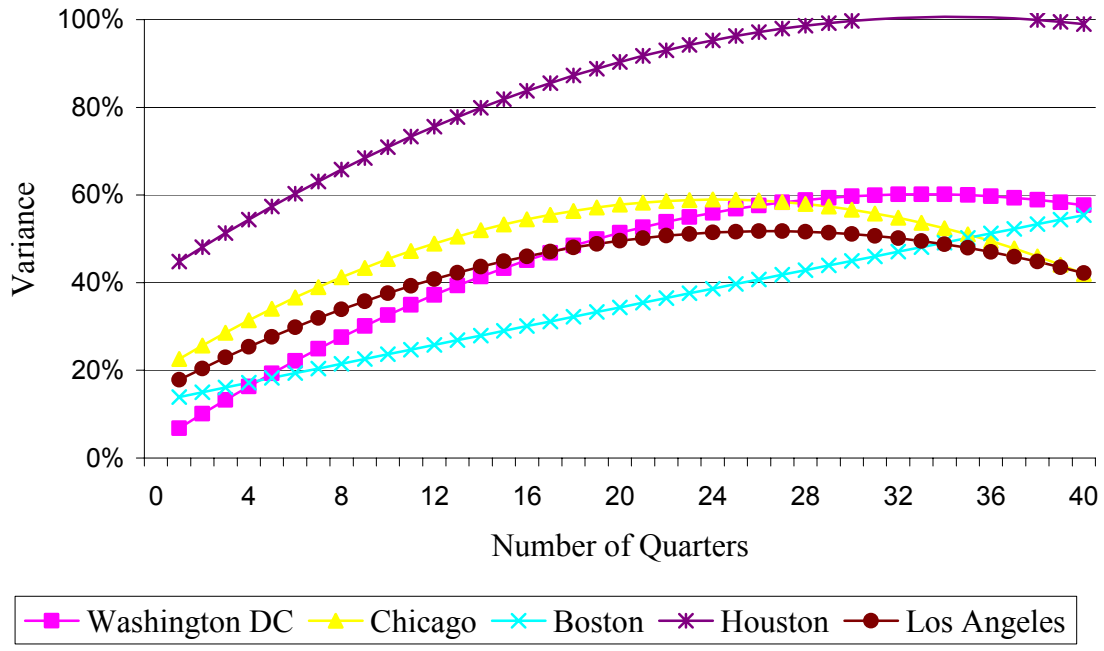

Figure 7. Risk Measure of NOI Indices Over Time
Retail

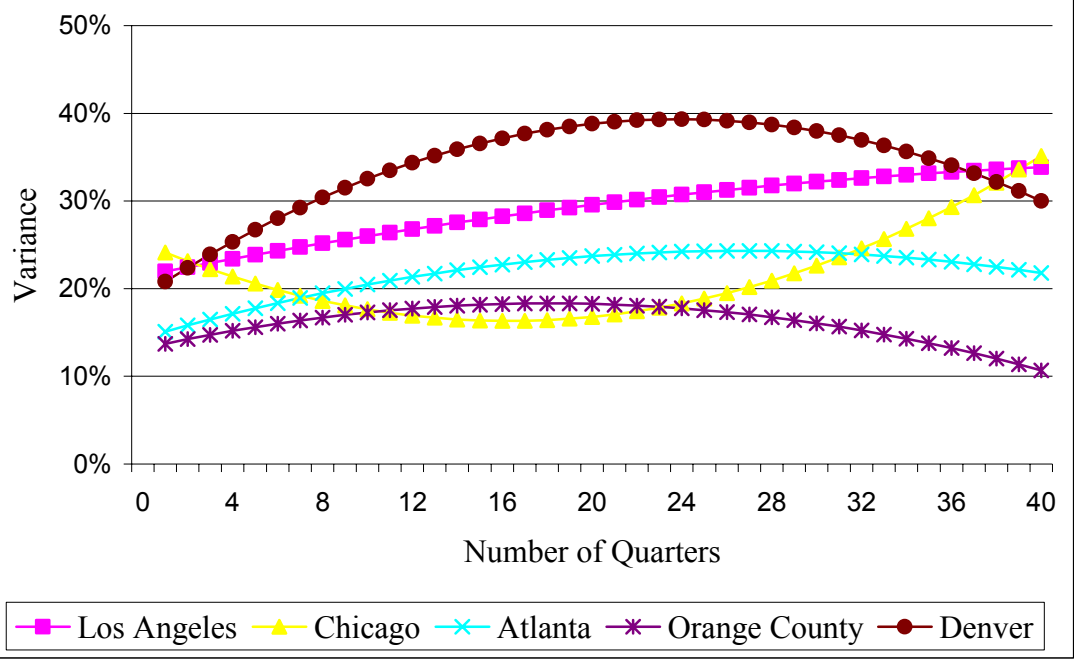

Figure 8. Risk Measure of NOI Indices Over Time
Industrial

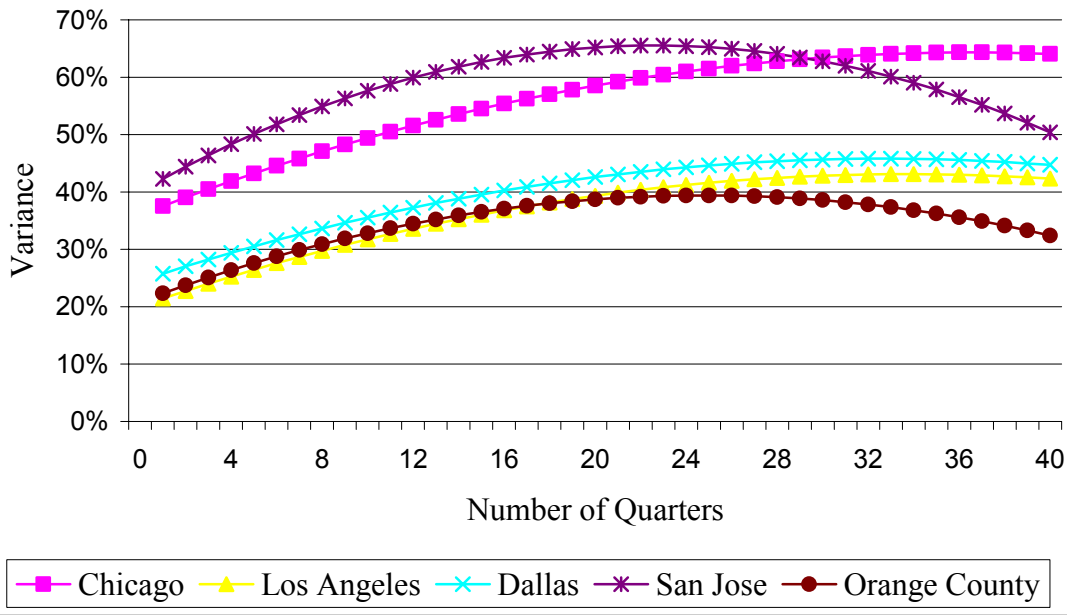

Figure 9. Risk Measure of NOI Indices Over Time
Atlanta

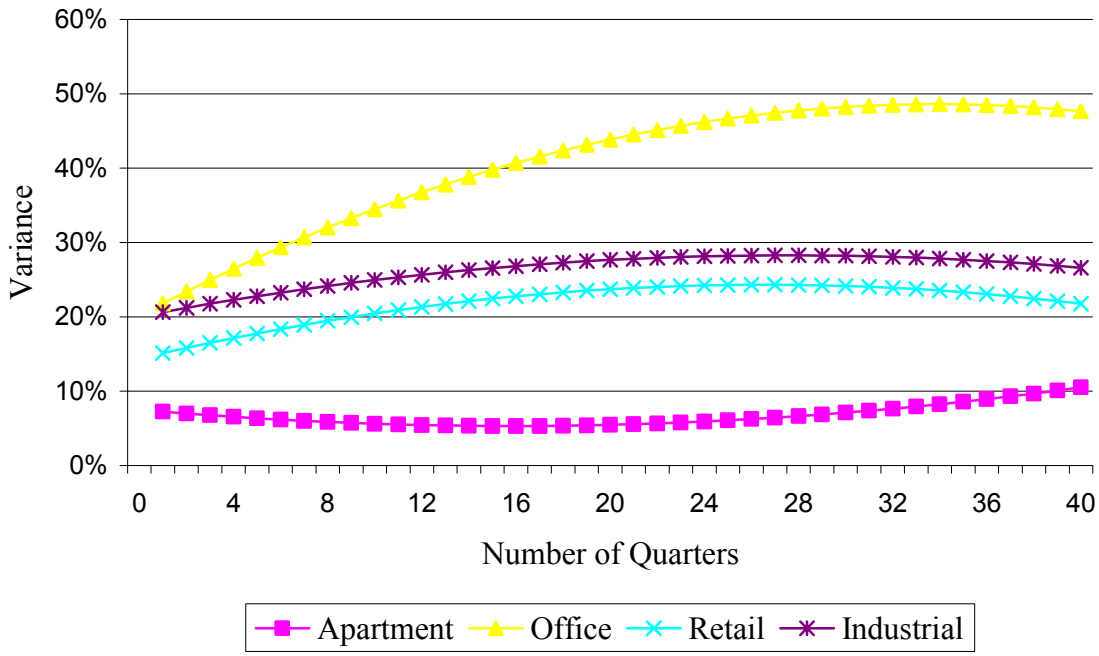

Figure 10. Risk Measure of NOI Indices Over Time
Dallas

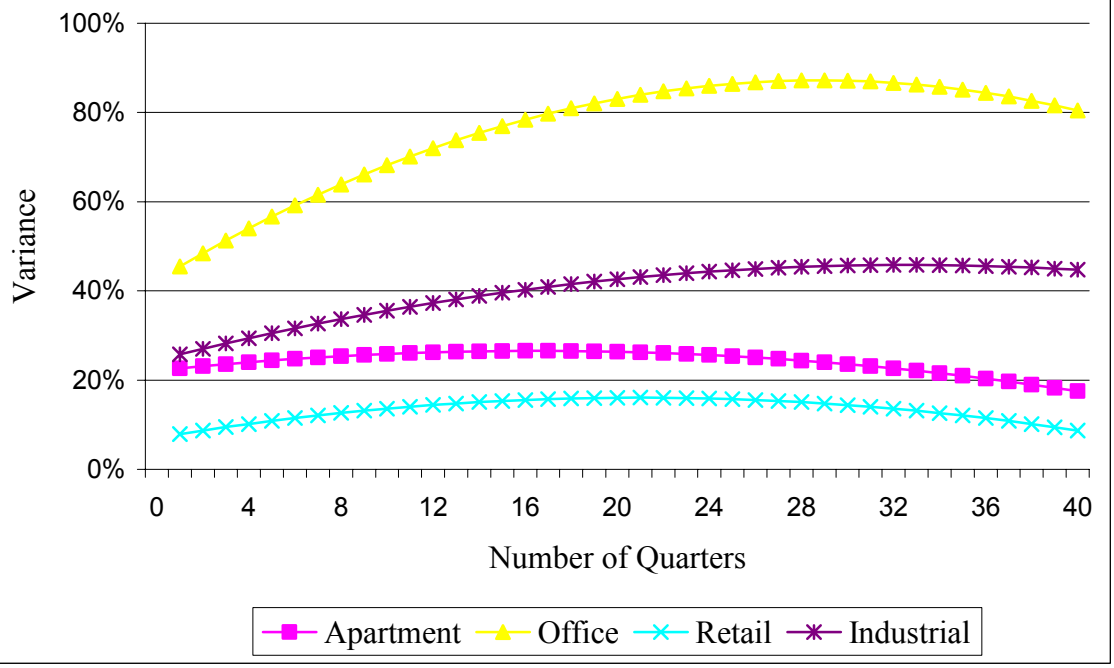

Figure 11. Risk Measure of NOI Indices Over Time
Los Angeles

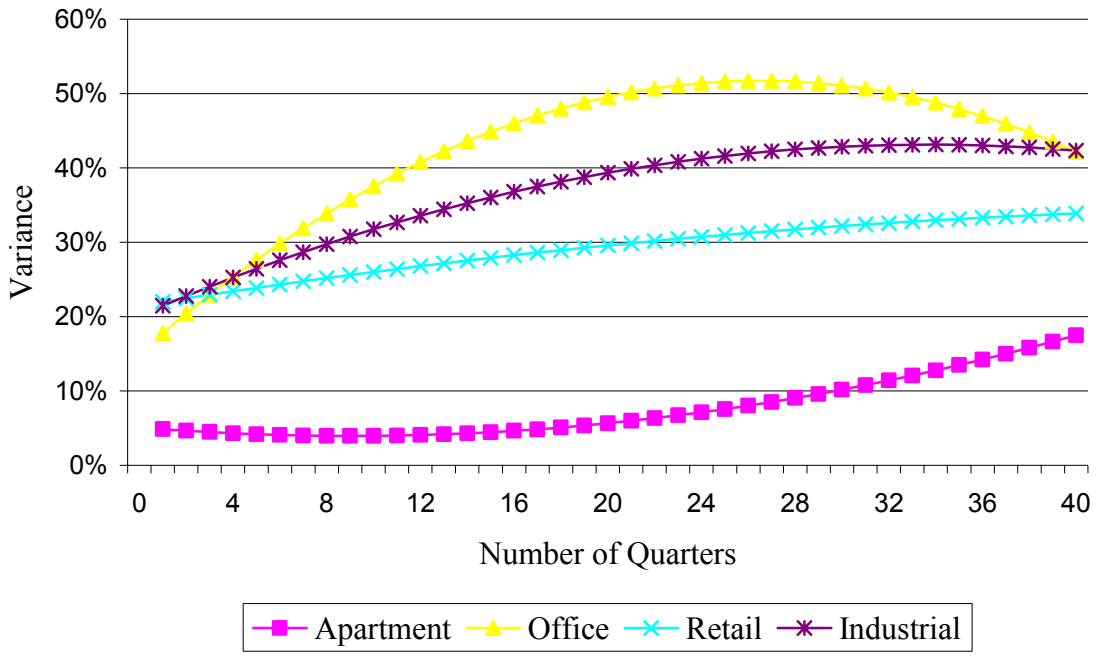

Figure 12. Risk Measure of NOI Indices Over Time
Chicago

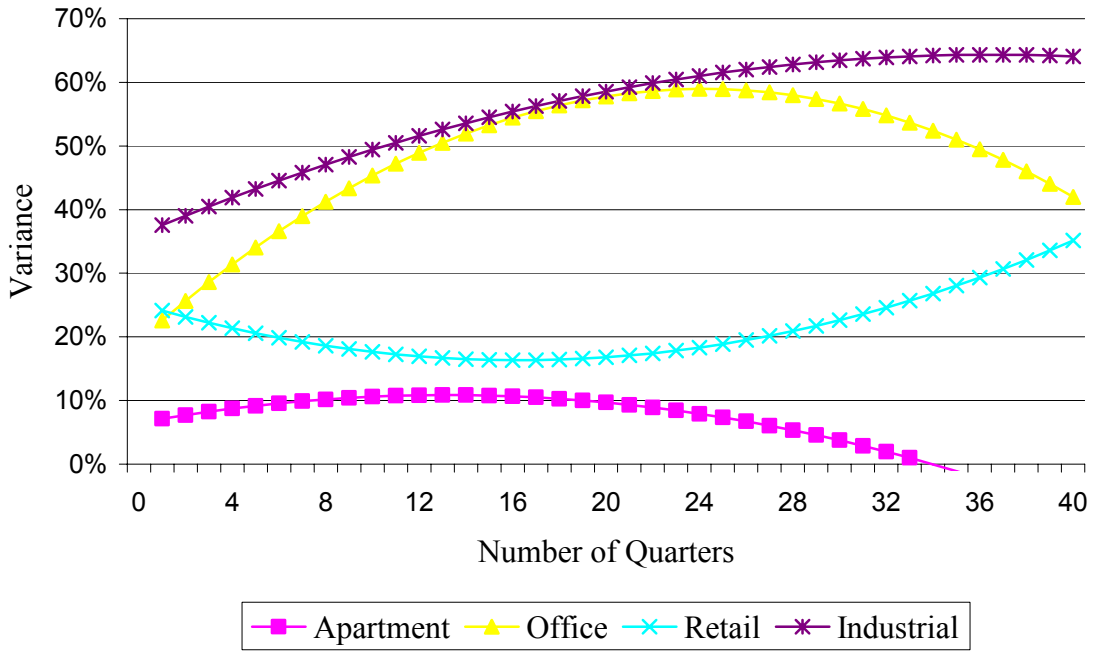

Figure 13. Vacancy by property type

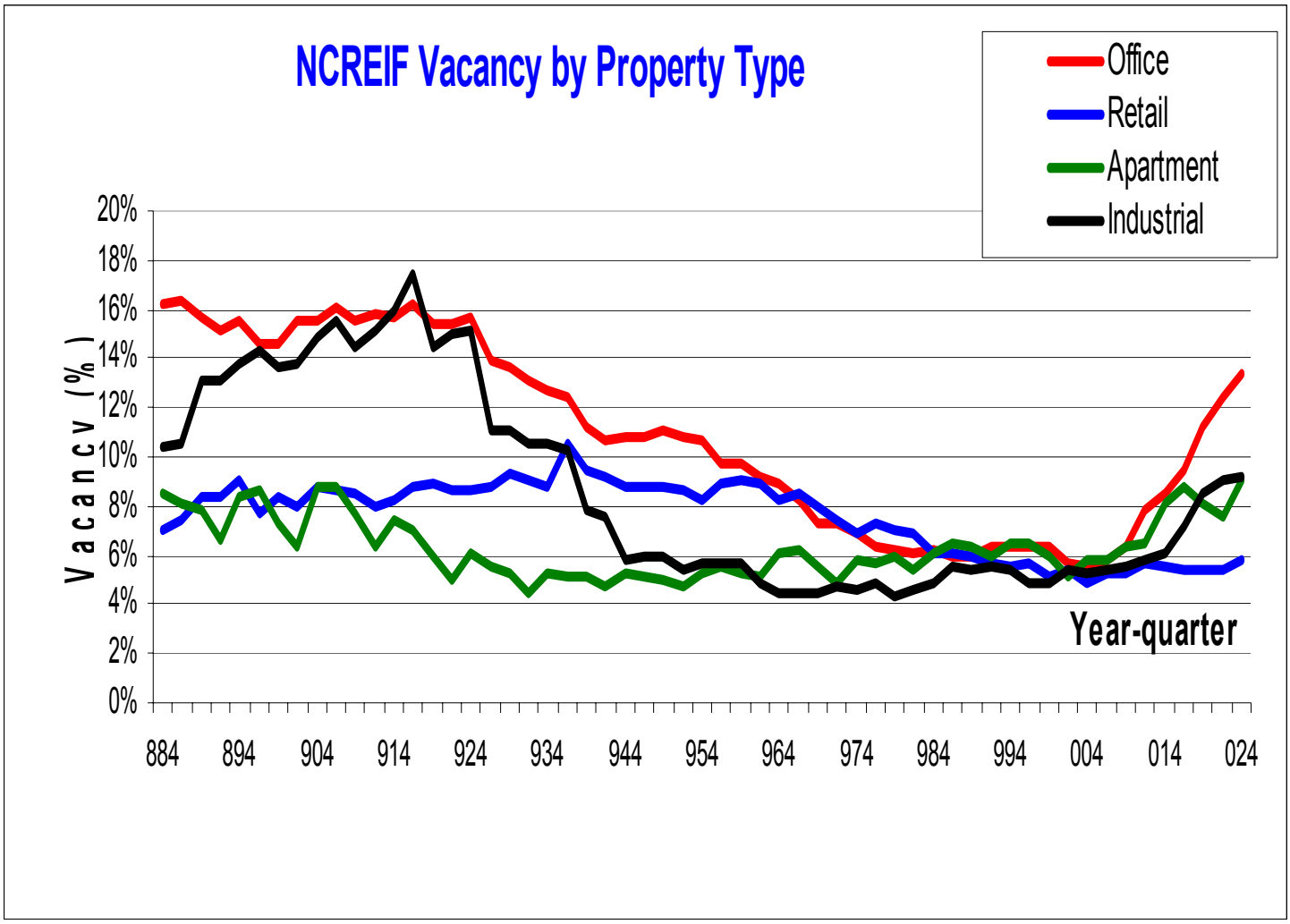

Table 5 Retail Groups

Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**	*Group 6*
Chicago	Dallas	Denver	Boston	Atlanta	Cincinnati
Seattle	Los Angeles	Houston	Minneapolis	Phoenix	
St. Louis	Miami		San Francisco		
	Orange Co.		San Jose		
	Philadelphia		Washington DC		
	San Diego				

Table 6 Multi-family

Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**	*Group 6*
Boston	Atlanta	Los Angeles	Chicago	Denver	Philadelphia
San Jose	Cincinnati	St Louis	Miami		
Seattle	Dallas		Minneapolis		
	Houston		Orange Co.		
	Phoenix		San Francisco		
	San Diego		Washington DC		

Table 7 Office Markets

Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**	*Group 6*
Miami	Dallas	Orange Co.	Atlanta	Philadelphia	San Jose
Phoenix	Denver	San Diego	Boston	Houston	
St. Louis		Seattle	Los Angeles	Chicago	
		Washington	Minneapolis	San Francisco	
			Cincinnati		

Table 8 Industrial

Group 1	**Group 2**	**Group 3**	**Group 4**	*Group 5*	*Group 6*
Atlanta	Houston	Boston	Chicago	Washington	Denver
Miami	San Jose	Cincinnati	Dallas		
Minneapolis			Los Angeles		
Philadelphia			Orange Co.		
St. Louis			Phoenix		
			San Diego		
			San Francisco		
			Seattle		

Table 9 Summary of Cluster Associations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Atlanta	-														
2. Chicago		-													
3. Dallas	M	I	-												
4. Los Angeles	O	I	R	-											
5. Miami	I	M	R	R	-										
6. Orange Co.		M,I	R,I	R,I	R,M	-									
7. Phoenix	R,M	I	M,I	I	O	I	-								
8. Philadelphia	I		R	R	R,I	R		-							
9. San Diego	M	I	R,M,I	R,I	R	R,O,I	M,I	R	-						
10. Seattle		R,I	I	I		O,I			O	-					
11. St. Louis	I	R		R,M	O,I		O,I	I		R	-				
12. Cincinnati	M,O		M	O			M		M			-			
13.Denver			O										-		
14. Houston	M	O	M				M	O	M			M	R	-	
15. Minneapolis	O,I	M		O	M,I	M	I	I			I	O			-
16. Boston	O			O						M		O			R,O
17. San Francisco		M,O,I	I	I	M	M,I	I	O	I	I				O	R,M
18. San Jose										M				I	R
19.Washington DC		M			M	M,O			O	O					R,M

R= Retail, M= Multi-family, O= Office, I= Industrial