Integrating Regional Economic Indicators with the Real Estate Cycle

*Jacques Gordon**
*Paige Mosbaugh**
*Todd Canter**

***Abstract*. Previous literature has followed an evolutionary path in the examination of office market volatility. Where initial models were designed to show the close relationship between economic fundamentals and volatility at the national level, more recent models have focused on metro-level volatility. This study quantifies the volatility associated with metropolitan markets in terms of vacancy rates and identifies those economic factors that underlie this risk. The analysis suggests that movements in vacancy rates are likely to be affected by different factors at different stages of the cycle. In the long run, this analysis shows that the availability of capital had the strongest effect on the volatility of office vacancy rates. In periods that follow excess construction, market-specific, demand-side factors appear to be the dominant influence.**

Introduction

Reliable measures of real estate risk are notoriously hard to come by. Financial measures of real estate volatility suffer from either appraisal-based "smoothing," in the case of privately held assets, or stock market "noise," in the case of publicly traded companies. Yet, fluctuations in the underlying supply-demand dynamics of office markets are readily observable. Moreover, previous research suggests that these underlying fundamentals are key determinants of financial performance (Wheaton, 1987; Pyhrr, Webb and Born, 1990; Mueller and Laposa, 1994).

This paper attempts to enhance our understanding of movements in these underlying fundamentals and to build an explanatory model that identifies economic factors likely to be associated with fluctuations in the office market. For the last ninety years, office markets in the U.S. have moved through cycles in which periods of scarcity have been followed by over-supply. Our analysis suggests that measures of office market volatility, such as movements in vacancy rates, are likely to be affected by different factors at different stages of the cycle. An improved understanding of these factors should help practitioners reach a better understanding of the amplitude and duration of the office market cycle in American cities.

Literature Review

A review of previous literature shows a steady evolutionary path in the examination of office market volatility. Where initial studies modeled office market behavior based on a homogenous national market; more recent models explored intermarket distinctions.

*LaSalle Advisors, Ltd., 200 East Randolph Drive, Chicago, Illinois 60601.

Analysis of market-level factors is important in order to identify the cause of volatility or risk levels associated with specific office markets.

Wheaton, in his early research (1987), examined the national office market and studied the causes of market movement that make the office market cyclical. He determined that both supply and demand variables respond directly to expected office employment changes, although noting that supply responds more quickly than demand.

Pollakowski, Wachter and Lynford (1992) thought it inappropriate to impose a single structure on all markets for demand and supply relationships; instead they tested for structural differences across metropolitan areas by office market size. Using data for twenty-one metropolitan areas for a period of ten years, they concluded that the stage of the real estate cycle is clearly not uniform across markets.

Voith and Crone (1988) evaluated office vacancy rates in seventeen metro areas for the period June 1980 to June 1987. They discovered significant differences in natural vacancy rates between the markets both in terms of cycle frequency and amplitude. They concluded that inter-market variation was significant and called for additional research on the relationship between the so-called natural vacancy rate and market conditions.

Downs (1993) addressed this call for additional research by showing that differences in market equilibrium vacancy rates exist due to fundamental differences in market conditions (supply and demand fundamentals). Stating that some markets contain a higher fraction of rapidly growing firms or are experiencing faster population growth, he concluded that dynamic markets will have higher vacancy rates than more static markets. Thus, his research demonstrates the relationship of real estate cycles to general economic cycles.

Pyhrr et al. (1990) created an empirical discounted cash flow cycle model to illustrate the quantitative relationships between key economic variables and real estate performance. Pyhrr and Born (1993) later expanded the study to include supply and demand cycles, property life cycles and urban economic cycles on real estate valuation analysis.

Mueller and Laposa (1994) investigated the cyclical movements of fifty-two office markets around the country. By examining average vacancy and the deviations from this average as an indication of market risk or volatility, they classified and captured the nature of cyclical risks inherent in these markets. They found that markets cycle differently and that by examining the duration, amplitude and timing of a market's cycle, one could better understand the market forces that add to the risks of real estate investing.

Shilton (1995) also examined office market cycles by providing a framework for understanding the characteristics of office employment demand. His research found that the economic base of a city influenced the rate of overall growth in office employment. He also showed the link between office employment and market volatility and stated that markets experiencing higher volatility in office employment are more likely to experience higher levels of office vacancy.

The evidence is compelling that office markets in different metro areas behave differently over time and that some markets have longer cycles or less volatility than others. Where previous studies have focused their sights on demonstrating market cyclicality, this study seeks to eye the underlying causes of this cyclicality. This study moves beyond the previous paradigms and identifies other economic factors that underlie this volatility by examining different stages of the real estate market cycle. It is essential that investors consider these factors in order to understand the market and the forces that add to the risks of real estate investing.

Data and Methodology

A Full Cycle: 1978 to 1995

The following methodology uses semiannual data from thirty-one metropolitan areas over the time period 1978 through 1995. Unless otherwise noted, real estate data from C.B. Commercial/Torto-Wheaton were used. Although the Torto-Wheaton data currently cover fifty-four metro areas, data was limited to those areas for which data was available over the entire eighteen-year time period to avoid inconsistencies in data due to timing factors. This data set was used because it provides a consistent analysis of multiple metropolitan areas over a long time period. Local reports, while sometimes more comprehensive, are difficult to compare because of differences in collection methodologies, e.g., treatment of sublease space, leased but available space, and owner-occupied and government-occupied space.

Volatility in the market was measured by the change in vacancy from the average vacancy over the entire time period. The average vacancy rate was used as a measure of the 'equilibrium' rate at which point vacancies in a particular market would be expected to oscillate above and below. Although several methods have been used to calculate an equilibrium rate (Downs, 1993; Voith and Crone, 1988; Wheaton, 1987), Mueller and Laposa (1994) illustrated that little difference results from the various methodologies. We have therefore chosen to use an average vacancy rate as a measure of the equilibrium rate from which to measure deviation. Voith and Crone (1988) also suggested that the equilibrium rate for a particular market may change over time as the market itself changes due to structural changes in the base economy, growth and other factors. While we agree with this theory, we did not attempt to adjust the equilibrium rate over time because the focus of this paper is to measure volatility and not the timing of a market cycle. Each market's cycle has been individually graphed along with its deviation in absorption and construction in the Appendix.

Exhibit 1 illustrates the variance in vacancy rates across the different metropolitan areas. Because of the high volumes of data needed to formally measure a cycle, we did not attempt to scientifically measure the length of each market cycle. However, at least one peak and valley exists for each market over the eighteen-year time period with low vacancies often appearing in the 1979–81 time period and high vacancies often appearing in the late 1980s. (Wheaton estimated a ten-to-twelve-year national office market cycle. Turning points in ten sample cities were within one or two years of the combined average series. Furthermore, Shilton suggested seven-year cycles.) See the Appendix for vacancy trend graphs of each metro area.

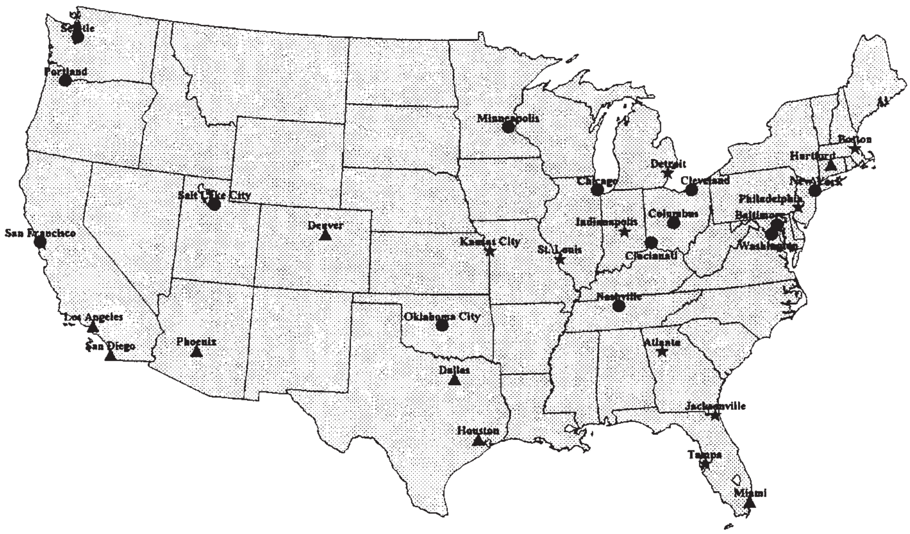
As seen in Exhibit 1, significant differences seem to exist between vacancy trends in different metro areas. Vacancies over the eighteen-year time period average from a low of 9.9% in Washington D.C. to a high of 19.3% in Dallas. Some trends begin to become apparent in this initial chart. With the exceptions of Atlanta, Tampa and Indianapolis, metros with high average vacancy rates also seem to have high standard deviations or volatility in vacancy rates. Highly volatile markets also seem to be more concentrated in the fast-growth southern areas and the 'oil patch' cities of the 1970s and 1980s (see Exhibit 2).

Exhibit 1
Vacancies, Metro Areas, 1978–1995

Cities	Avg. Rate %		Std Dev. %		Min. %		Max. %	
Atlanta	16.8	(24)	4.2	(5)	9.0	(30)	27.4	(27)
Baltimore	13.2	(13)	4.7	(12)	3.7	(19)	21.9	(17)
Boston	11.3	(4)	4.4	(9)	2.7	(15)	17.9	(3)
Chicago	13.3	(15)	4.5	(11)	4.1	(20)	19.3	(8)
Cincinnati	13.1	(12)	4.8	(14)	2.2	(9)	19.9	(10)
Cleveland	12.2	(7)	5.4	(19)	2.2	(9)	21.2	(15)
Columbus	11.9	(5)	5.3	(17)	2.1	(8)	21.0	(14)
Dallas	19.3	(31)	7.8	(27)	4.7	(22)	28.3	(28)
Denver	17.4	(26)	7.9	(28)	2.6	(13)	26.9	(26)
Detroit	13.2	(14)	4.2	(6)	6.3	(27)	19.8	(9)
Hartford	13.6	(17)	8.1	(29)	1.9	(7)	24.7	(22)
Houston	18.8	(30)	9.0	(31)	5.6	(25)	31.4	(31)
Indianapolis	16.1	(23)	4.0	(3)	9.7	(31)	25.2	(23)
Jacksonville	13.5	(16)	4.3	(7)	4.7	(22)	21.4	(16)
Kansas	14.6	(19)	3.8	(1)	7.4	(28)	20.6	(11)
Los Angeles	14.4	(18)	6.4	(24)	2.3	(12)	22.9	(18)
Miami	15.7	(22)	7.8	(26)	1.4	(5)	25.2	(23)
Minneapolis	12.3	(8)	6.0	(22)	1.2	(3)	20.6	(11)
Nashville	15.4	(21)	5.8	(21)	3.0	(17)	23.2	(19)
New York	10.3	(3)	5.0	(15)	1.3	(4)	17.0	(1)
Oklahoma City	18.1	(27)	8.8	(30)	1.5	(6)	29.3	(30)
Philadelphia	12.9	(10)	3.9	(2)	3.0	(17)	17.9	(3)
Phoenix	18.2	(28)	7.0	(25)	6.0	(26)	28.5	(29)
Portland	12.6	(9)	5.4	(18)	2.6	(13)	20.8	(13)
Salt Lake City	14.9	(20)	5.5	(20)	5.3	(24)	24.0	(21)
San Diego	17.3	(25)	6.1	(23)	2.7	(15)	23.6	(20)
Seattle	12.1	(6)	4.5	(10)	2.2	(9)	18.6	(6)
San Francisco	10.2	(2)	4.8	(13)	1.0	(1)	18.1	(5)
St. Louis	12.9	(11)	4.1	(4)	4.5	(21)	19.0	(7)
Tampa	18.7	(29)	4.3	(8)	9.0	(29)	26.3	(25)
Washington D.C.	9.9	(1)	5.2	(16)	1.0	(1)	17.4	(2)
U.S.	**13.7**		**4.8**		**4.3**		**19.1**	
Average	14.3		5.6		3.8		22.6	
Minimum	9.9		3.8		1.0		17.0	
Maximum	19.3		9.0		9.7		31.4	

One might initially conclude that volatile markets are primarily the result of too much construction in bust-boom cities. However, Exhibit 3 shows that the standard deviation (volatility) of absorption in these markets was almost as high as the volatility of new construction (supply). Correlations between the three variables (Exhibit 4) are high, suggesting that markets with volatile vacancy rates also experience volatility in supply and absorption. Although absorption is not always a true measure of demand, some demand-side interaction is suggested (low absorption may result from a lack of available space in markets with low vacancy rates, even though demand is high). Additionally, some highly volatile markets such as Oklahoma City also experienced very low vacancy

Exhibit 2
Office Market Volatility: 1996



▲ High Change in Vacancy
● Average Change in Vacancy
★ Low Change in Vacancy

Sources: LaSalle Advisors Investment Research, RFA

rates over this time period (1.5%), suggesting that unexpected demand as well as extra supply plays a large role in causing volatile markets.

A model was developed using both cross-sectional and time series data over the time period 1978 to 1995 to analyze economic variables that affect volatility in vacancy rates. The following model was estimated using ordinary least squares:

$$v_{mt} = \alpha_{mt} + \beta_1 empl_{mt} + \beta_2 dens_{mt} + \beta_3 stock_{mt} + \beta_4 cost_{mt} + \beta_5 div_{mt} + \beta_6 mfg_{mt} + \beta_7 tax81_t + \beta_8 tax86_t + \beta_9 uxemp_{mt} + \beta_{10} debt_{mt} + \varepsilon_{mt}\,, \quad (1)$$

where:

v = difference between the current vacancy and the average vacancy for market m and time period t.

$empl$ = the employment growth rate over the six-month time period. Total employment was used. Office employment would have been a preferable variable, but historic data was not available for all years and metros. The combination of FIRE and Service employment was used as a proxy. Not unexpectedly, this measure did not provide significant results as several non-office businesses are included in the broad Service SIC code.

Exhibit 3
Metro Area Volatility and Absorption

	Standard Deviation			
	Vacancy %	Construction %	Absorption %	Average Vacancy %
Dallas	7.8	4.5	3.4	19.3
Houston	9.0	4.2	3.6	18.8
Tampa	4.3	4.0	2.7	18.7
Phoenix	7.0	3.9	3.0	18.2
Oklahoma City	8.8	5.3	4.4	18.1
Denver	7.9	4.4	4.2	17.4
San Diego	6.1	3.3	2.9	17.3
Atlanta	4.2	2.3	2.2	16.8
Indianapolis	4.0	2.3	2.6	16.1
Miami	7.8	2.6	2.0	15.7
Nashville	5.8	2.8	2.6	15.4
Salt Lake City	5.5	2.9	2.9	14.9
Kansas City	3.8	2.3	2.0	14.6
Los Angeles	6.4	2.0	1.8	14.4
Hartford	8.1	2.4	2.6	13.6
Jacksonville	4.3	3.1	2.8	13.5
Chicago	4.5	1.6	1.5	13.3
Detroit	4.2	2.3	1.6	13.2
Baltimore	4.7	2.2	2.4	13.2
Cincinnati	4.8	2.5	2.0	13.1
St. Louis	4.1	2.4	1.6	12.9
Philadelphia	3.9	1.6	1.6	12.9
Portland	5.4	2.1	1.9	12.6
Minneapolis	6.0	2.6	2.3	12.3
Cleveland	5.4	1.6	1.9	12.2
Seattle	4.5	2.6	2.0	12.1
Columbus	5.3	2.3	1.8	11.9
Boston	4.4	2.1	1.5	11.3
New York	5.0	0.5	1.0	10.3
San Francisco	4.8	1.7	1.5	10.2
Washington D.C.	5.2	2.0	1.7	9.9
Maximum	9.0	5.3	4.4	19.3
Minimum	3.8	0.5	1.0	9.9
Average	5.6	2.7	2.3	14.3

dens = population density of the metropolitan area, measured as the population per square mile. Because the availability of land is difficult to measure, particularly over a long time period, this variable was used as a substitute for the availability of land; the thought being that in general, the less densely populated an area is, the more land should be available for new construction. Although there are always exceptions because of zoning, regulations, environmental issues, and

Exhibit 4
Correlation Coefficients

	Avg. Vacancy	Std Dev. Abs.	Std Dev. Const.	Std Dev. Vac.
Avg. Vacancy	1.000			
Std Dev. Abs.	0.7946 $p = 0.000$	1.000		
Std Dev. Const.	0.8226 $p = 0.000$	0.9229 $p = 0.000$	1.000	
Std Dev. Vac.	0.5257 $p = 0.002$	0.6859 $p = 0.000$	0.6353 $p = 0.000$	1.000

other factors, most areas should adhere somewhat loosely to this principle.

stock = the office stock measured in billions of square feet in the six-month time period.

cost = the cost of doing business as provided by Regional Financial Associates. This factor is the weighted average of energy costs in dollars per kWh, tax revenue per capita, hourly earnings and office rents per square foot as provided by the National Real Estate Index. The U.S. average is indexed to 100. This factor was not changed over the time period.

*tax*81 = a dummy variable to identify time periods after the Economic Recovery Tax Act of 1981 (ERTA) act of 1981. Because office construction takes at least twelve to eighteen months to finish, a one-year lag was used for this variable. Therefore, any records occurring in 1982 or after equaled 1 and those before 1982 equaled 0.

*tax*86 = a dummy variable to identify time periods after the Tax Reform Act of 1986 (TRA). A one-year lag was also used for this variable. Therefore, any records occurring in 1987 or after equaled 1 and those before 1987 equaled 0.

uxemp = a measure of unexpected employment growth. The variable measured the current semiannual growth rate minus the average of the previous three years' semiannual growth rates.

mfg = a dummy variable indicating the metro area's economic base was dominated by manufacturing industries as identified by SIC codes 20 to 39, except as included in other categories. All economic base classifications were measured and changed every five years.

div = the economic diversity of the metro area. The diversity measure was provided by Regional Financial Associates and was measured as the Hachman Index (HI) which measures how closely the employment distribution of a metro resembles that of the nation. The index measures economic diversification through the following formula:

$$HI_t = 1/(\Sigma_j (EMP_{Mjt} / EMP_{USjt}) \times (EMP_{Mjt})) ,$$

where: EMP_{Mjt} is the share of the metro area's employment in industry *j* in year *t* and EMP_{USjt} is the share of U.S. employment in industry *j* in year *t*. Because the economic base of metropolitan areas change over time, this variable was calculated and changed every five years from 1978 to 1995. In general, most of the markets become slightly more diverse over the time period. Metros that exhibited the biggest increase in diversity include: Salt Lake City, Indianapolis, Atlanta, Phoenix, and Portland.

debt = the total debt flow to U.S. commercial real estate measured in millions of dollars from insurance companies, banks and savings & loans. Although this factor does not include equity flows, it was used as a proxy for capital flows to real estate.

The following variables did not load into the model:

govt = a dummy variable indicating the metro area's economic base was dominated by government employment as identified by government SIC codes and codes 91 to 97. All economic base classifications were measured and changed every five years.

energy = a dummy variable indicating the metro area's economic base was dominated by the energy industry as identified by SIC codes 10 to 14 and 29. All economic base classifications were measured and changed every five years. All economic base classifications were measured against a diversified economy, e.g., a diversified economy would have a 0 in all economic base fields. None of the metros used in this study fell into the following economic base classifications over the time period: services - tourism, services - health, and farm. Thus, although we include these classifications in diversity studies, they were not used in this paper.

fire = a dummy variable indicating the metro area's economic base was dominated by finance, insurance and real estate industries as identified by SIC codes 60 to 67. All economic base classifications were measured and changed every five years.

distrib = a dummy variable indicating the metro area's economic base was dominated by distribution of goods as identified by SIC codes 42, 50 and 51. All economic base classifications were measured and changed every five years.

hitech = a dummy variable indicating the metro area's economic base was dominated by high tech industries as identified by SIC codes 36, 38, 737, 357, and 873. All economic base classifications were measured and changed every five years.

service = a dummy variable indicating the metro area's economic base was dominated by service companies as identified by SIC codes 79 to 89. All economic base classifications were measured and changed every five years.

rest = a development restrictiveness measure for each MSA as measured by Godschalk and Hartzell (1993). For each city and its outlying areas, the factor measured approval rates for new development projects, land supply expansion willingness and length of review period. The study showed the most restrictive MSA in California, while the least restrictive was in Texas. Midwest and southern MSAs were mixed in terms of restrictiveness. We were not able to change this variable over time.

ent = an entrepreneurial index as measured by Cognetics. This index measures the ability of a metropolitan area to foster and support growth of new businesses. The index measures for each metro area: the number of firms started in the last ten years that employ at least five people today as a percent of all firms, and the percent of firms ten years old or less, four years ago that had a high growth index over the past four years.

unemp = the unemployment rate as of the beginning of the six-month time period.

tbond = the real current interest rate of a ten-year *t*-bond as of the first month of the six-month time period.

Several interesting factors result from the regression. First, employment growth appears to reduce volatility in vacancy rates (Exhibit 5). If employment growth boosts absorption, then higher absorption rates should reduce vacancy rates or slow increases in vacancy if excess construction is present. However, the model also shows that unexpected employment growth increases volatility. This may be indicative of markets such as Miami and Minneapolis in which vacancy rates dipped to unusually low levels (below 2%) during the eighteen-year time period. In this case, unexpected demand could cause vacancy rates to drop lower if new construction was not anticipated to meet the extra demand. It also means that volatility may not necessarily be a bad phenomenon, but instead indicates a higher risk that demand and supply are swinging further in either direction out of balance.

The manufacturing economic base classification loaded into the model. Although other economic base classifications did not load into the model, it does not mean that these classifications are unimportant. In fact, the diversity index loaded into the model, suggesting that more diverse metros are less volatile.

Three highly correlated variables describing the size and costs of the market loaded: cost of doing business, size of the office stock and population density. Because high-cost cities tend to be larger and more densely populated (Exhibit 6), a significant amount of multicollinearity exists between these variables. A factor analysis model (discussed next) was developed to better analyze these factors.

The cost of doing business had a negative coefficient in the model, indicating that high-cost cities had lower volatility. With some exceptions, new construction measured as a percent of the market has occurred to a greater extent in low-cost cities (correlation coefficient of –0.541) such as Tampa, Phoenix, Dallas, Houston, Denver, and Salt Lake City. Our conclusion is that the higher construction in these low-cost cities is more likely to cause higher vacancy rates, at least on a short-term basis.

Population density loaded into the model with a negative coefficient, indicating that less dense areas experienced more volatility. This fits with our theory that construction will occur in areas where land is more available and excess construction will increase

Exhibit 5
Regression Results – Volatility and Economic Factors

Multiple *R*	.77859
R^2	.60621
Adj. R^2	.60265
Std Error	3.68024

Analysis of Variance

	DF	Sum of	Mean Sq.
Regression	10	23039.28820	2303.93882
Residual	1105	14966.28080	13.54415

F = 170.10588 Signif. F = .0000

Variables in the Equation

Variable	*B*	SE VB	*Beta*	*T*	Sig. *T*
COST_BUS	–3.832752	.944856	–.116379	–4.056	.0001
EMPLGRO	–100.627722	10.687553	–.450951	–9.415	.0000
POP_DENS	–.721561	.154018	–.161568	–4.685	.0000
STOCK	1.39206E-05	3.2816E-06	.142307	4.242	.0000
TAXLAWC1	3.327882	.309818	.285132	10.741	.0000
TAXLAWCH	6.850320	.365424	.488023	18.746	.0000
UNEXPEMP	74.321963	10.276388	.343765	7.232	.0000
DIVERS	–2.578498	1.027810	–.053511	–2.509	.0123
DEBTFLOW	4.57935E-05	4.0576E-06	.262616	11.286	.0000
MFG	–1.171119	.409019	–.058086	–2.863	.0043
Constant	–.454270	1.266560		–.359	.7199

Variables Not in the Equation

Variable	*Beta* In	Partial	Min Toler	*T*	Sig. *T*
GOVT	.031881	.045919	.155353	1.527	.1270
ENERGY	.006464	.009027	.155206	.300	.7643
FIRE	.009231	.013501	.155322	.449	.6538
DISTRIB	–.008598	–.013161	.154392	–.437	.6620
HI_TECH	–.013368	–.021139	.155343	–.703	.4825
@0YR_TBO	–.051160	–.034646	.141200	–1.152	.2496
SERVICE	.022938	.034732	.151604	1.155	.2485
UNEMPL	–.008898	–.009392	.105982	–.312	.7550
RESTRICT	.020947	.026927	.155298	.895	.3710

volatility rates. In fact, the correlation coefficient between population density and new construction measured as a percentage of the total stock in the market was -0.538.

The size of the office market (stock) also loaded into the model. However, the coefficient was positive, indicating that, if anything, larger markets are more volatile. With large metros such as Dallas and Houston included in the model, it is easy to see how large metros appeared more volatile over the 1978 to 1995 time period. The factor analysis (discussed next) illustrates that the traditional large, high-cost, financial-oriented metros do exhibit less volatility. It should also be noted that office markets in this sample ranged from 12.7 million square feet (msf) to 310 msf. It may be that markets or submarkets smaller than 12.7 msf do experience more volatility, but we did not consider extremely small markets or submarkets in this sample.

Both of the tax law variables loaded into the model with positive coefficients. While we do know that construction increased considerably in the late 1980s and vacancy rates were highest from 1986 to 1992, we cannot make a definite assumption based on this analysis that the increased construction and volatility was solely caused by changes in tax laws.

The Economic Recovery Tax Act of 1981 (ERTA) dramatically increased the attractiveness of real estate's after-tax return by effectively creating a federal subsidy to the real estate market through shortened depreciation schedules (fifteen years), capital gains exclusions and interest write-off provisions. This allowed syndicators to allocate deductions to incoming partners that related to periods prior to their entry into the partnership. Combined public and private syndication investments jumped from $1.9 billion prior to the passage of the Act to $8.3 billion just two years later. Thus we would expect a positive coefficient for this variable.

Under the Tax Reform Act of 1986 (TRA), depreciation schedules were lengthened from 15 to 27.5 years for residential and 31 years for nonresidential, and the 60% exclusion from capital gains taxes was eliminated, causing the full capital gain to be taxed at the same rate as ordinary income. Interest write-off provisions were also eliminated, undermining the tax-driven viability of the syndication business. Thus, we would expect a negative coefficient for the second tax variable. However, although we allowed a one-year lag on the variable, some of these reforms did not take place until later, e.g., the capital gains tax was not fully enacted until 1988. Given the other investment trends occurring during this time period and with a slowing economy beginning in 1989, it took longer than a year for the markets to begin to recover from the excesses of the 1980s, even with the assistance of the more development-restrictive TRA laws. Thus, we suspect that this variable is still picking up the cumulative affects of the overbuilding of the 1980s.

Finally, the debt variable loaded into the model, indicating that as more capital becomes available, market volatility increases. This variable picks up the effects of several occurrences that increased capital to real estate over the 1978 to 1995 time period. Foreign investment, at $7.3 billion in 1980, increased five-fold to $40 billion by 1988 due partly to the sharp devaluation of the dollar relative to the Japanese yen, the German deutsche mark, and the British pound. Between 1980 and 1989 (the peak year for foreign investment in U.S. real estate), forty-five foreign investment institutions invested nearly $39 billion of new capital in U.S. property. Added to this background were the U.S. pension funds. Partly in response to ERISA's "prudent man rule," pension funds entered the real estate arena. Pension fund investments increased from $19 billion to nearly $90 billion from 1980 to 1987. Although many of these factors were equity flows, debt flows followed a similar pattern of rising in the 1980s and falling significantly in the very late 1980s and early 1990s.

A few other factors did not load into the model. The development restrictiveness index was deemed unimportant in estimating vacancy volatility. It could be that this variable should have been changed over time. However, we did not have the data to determine if or by how much the restrictiveness index changed. The entrepreneurial index was another factor that did not load into the model and that we were not able to change over time. The final factors that did not load were unemployment and T-bond rates.

Exhibit 6
Correlation Matrix of Regression Variables, 1978–1995

	Vacancy	T-Bond	Debt Flow	Tax 86	Tax 81	COB	Stock	Div. Index
Vacancy	1.0000							
	N=1116							
	p=–							
T-Bond	0.5055	1.000						
	N=1116	N=1116						
	p=.000	*p*=–						
DebtFlow	0.1129	0.3324	1.000					
	N=1116	N=1116	N=1116					
	p=.000	*p*=.000	*p*=–					
Tax 86	0.4833	0.0135	0.0424	1.000				
	N=1116	N=1116	N=1116	N=1116				
	p=.000	*p*=.652	*p*=.157	*p*=–				
Tax 81	0.7171	0.7625	–0.3664	0.5345	1.000			
	N=1116	N=1116	N=1116	N=1116	N=1116			
	p=.000	*p*=.000	*p*=.000	*p*=.000	*p*=–			
COB	–0.0736	0.0000	0.0000	0.0000	0.0000	1.0000		
	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116		
	p=.014	*p*=1.000	*p*=1.000	*p*=1.000	*p*=1.000	*p*=–		
Stock	0.1359	0.0709	–0.0750	0.2056	0.1801	0.6546	1.000	
	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	
	p=.000	*p*=.018	*p*=.011	*p*=.000	*p*=.000	*p*=.000	*p*=–	
Div.Index	0.1216	0.0484	–0.1129	0.2178	0.1746	–0.2770	–0.1326	1.0000
	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116
	p=.000	*p*=.106	*p*=.000	*p*=.000	*p*=.000	*p*=.000	*p*=.000	*p*=–
Distrib	0.0695	0.0100	–0.0594	0.0961	0.0672	–0.1621	–0.0880	–0.0317
	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116
	p=.020	*p*=.739	*p*=.047	*p*=.001	*p*=.025	*p*=.000	*p*=.003	*p*=.290
Energy	0.0141	–0.0097	0.0579	–0.0936	–0.0654	–0.1555	0.1201	–0.1478
	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116
	p=.638	*p*=.746	*p*=.053	*p*=.002	*p*=.029	*p*=.000	*p*=.000	*p*=.000
FIRE	–0.0199	0.0155	0.0565	–0.0406	–0.0108	–0.1633	0.0816	–0.1821
	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116
	p=.506	*p*=.606	*p*=.059	*p*=.175	*p*=.717	*p*=.000	*p*=.006	*p*=.000
Govt	0.0203	–0.0108	0.0064	–0.0402	–0.0338	0.0983	0.0115	–0.2670
	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116
	p=.499	*p*=.719	*p*=.831	*p*=.180	*p*=.260	*p*=.001	*p*=.700	*p*=.000
HiTech	–0.0068	0.0000	0.0000	0.0000	0.0000	–0.0352	–0.0439	0.0807
	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116
	p=.820	*p*=1.000	*p*=1.000	*p*=1.000	*p*=1.000	*p*=.240	*p*=.142	*p*=.007
MFG	–0.0272	0.0024	0.0144	–0.0155	–0.0083	–0.0413	–0.1123	–0.2365
	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116
	p=.365	*p*=.936	*p*=.630	*p*=.605	*p*=.782	*p*=.168	*p*=.000	*p*=.000
Service	–0.0067	0.0000	0.0000	0.0000	0.0000	–0.1795	–0.1062	0.1687
	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116
	p=.824	*p*=1.000	*p*=1.000	*p*=1.000	*p*=1.000	*p*=.000	*p*=.000	*p*=.000
EmplGro	–0.0992	0.0465	0.1375	–0.0168	0.0004	–0.1038	–0.1129	–0.0027
	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116
	p=.001	*p*=.120	*p*=.000	*p*=.576	*p*=.991	*p*=.001	*p*=.000	*p*=.929
UnexEmp	0.0333	0.1937	–0.0039	0.0495	0.1536	0.0010	0.0139	0.0228
	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116

Exhibit 6
(Continued)

Distrib.	Energy	FIRE	Govt	HiTech	MFG	Service	EmplGro	Unex Emp
1.0000								
N=1116								
p=.–								
–0.689	1.0000							
N=1116	N=1116							
p=.021	*p*=.-							
-0.1554	–0.1601	1.000						
N=1116	N=1116	N=1116						
p=.000	*p*=.000	*p*=.–						
–0.0906	–0.0934	–0.2105	1.0000					
N=1116	N=1116	N=1116	N=1116					
p=.002	*p*=.002	*p*=.000	*p*=–					
–0.0472	–0.0487	–0.1097	–0.0640	1.0000				
N=1116	N=1116	N=1116	N=1116	N=1116				
p=.115	*p*=.104	*p*=.000	*p*=.033	*p*=–				
–0.0825	–0.0850	–0.1916	–0.1117	–0.0582	1.0000			
N=1116	N=1116	N=1116	N=1116	N=1116	N=1116			
p=.006	*p*=.005	*p*=.000	*p*=.000	*p*=.052	*p*=–			
–0.0472	–0.0487	–0.1097	–0.0640	–0.0333	–0.0582	1.0000		
N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116		
p=.115	*p*=.104	*p*=.000	*p*=.033	*p*=.266	*p*=.052	*p*=–		
–0.0079	0.0158	0.0173	0.0120	0.0034	–0.0561	0.0718	1.0000	
N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	
p=.791	*p*=.598	*p*=.563	*p*=.690	*p*=.909	*p*=.061	*p*=.016	*p*=–	
0.0104	–0.0121	0.0064	–0.0189	–0.0036	0.0108	0.0012	0.8795	1.0000
N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116	N=1116

Because of the multicollinearity existing in the regression model, a factor analysis was next conducted to analyze the economic factors that affect the volatility of office markets while diminishing the effects of highly correlated independent variables. Although multicollinearity does not affect the explanation power of the model, it may affect the selection process of variables that are loaded into the model. In other words, variables that were not loaded into the model may actually be important in explaining the variation in vacancy rates.

The following factor model was used to investigate the relationship between the variables in our study:

$$F_j = \sum_{i=1}^{p} W_{ji} X_i = W_{j1} X_1 + W_{j2} X_2 + \ldots + W_{jp} X_p \,, \qquad (1)$$

where W_i's are known as factor score coefficients, and p is the number of variables.

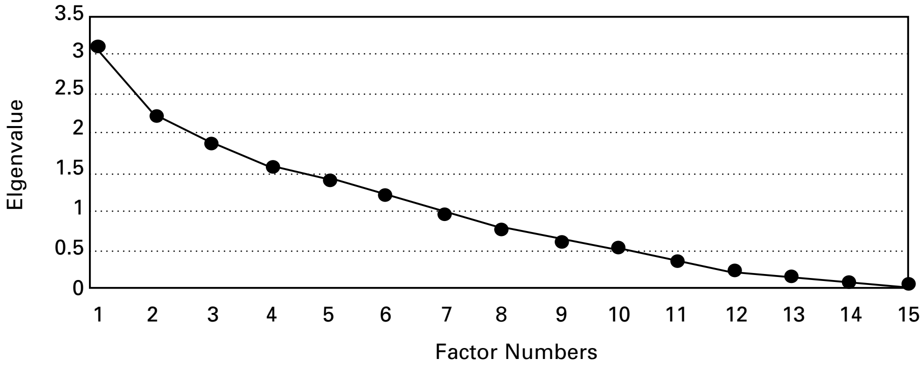
To help determine the number of factors needed to represent the data, two steps were taken. In the first we examined the amount of variance explained by each factor. Although the analysis gave us fifteen factors, Exhibit 7 shows that 67.2% of the total variance is attributable to the first five. The remaining ten factors account for the other 32.8% of the variance. Thus, a model of five factors may be adequate to represent the data. In the second step, we examined the eigenvalues as illustrated in the scree plot in Exhibit 8. One accepted criterion suggests that only those factors with eigenvalues over 1 should be included. The plot shows a distinct break between the steep slope of the large factors and the gradual trailing off of the remaining factors with eigenvalues over 1. It becomes apparent that five factors are sufficient to represent the data.

An orthogonal rotation was performed on the factor matrix and the coefficients that relate the variables to the five factors were determined. The coefficients or factor loadings indicate how much weight is assigned to each factor, thus the strength of the relationship between the factor and the underlying variable(s). Several interesting findings are worth noting.

Exhibit 7
Variance Explained by Each Factor

Variable	Communality	*	Factor	Eigenvalue	Pct of Var.	Cum. Pct
T-Bond	1.00000	*	1	3.07986	20.5	20.5
DebtFlow	1.00000	*	2	2.18353	14.6	35.1
Tax 86	1.00000	*	3	1.85423	12.4	47.5
Tax 81	1.00000	*	4	1.53438	10.2	57.7
UnexEmp	1.00000	*	5	1.42584	9.5	67.2
COB	1.00000	*	6	1.19690	8.0	75.2
FIRE	1.00000	*	7	.94919	6.3	81.5
Stock	1.00000	*	8	.77130	5.1	86.6
Mfg	1.00000	*	9	.64093	4.3	90.9
Govt	1.00000	*	10	.52109	3.5	94.4
Div.Index	1.00000	*	11	.35857	2.4	96.8
Entrepren.	1.00000	*	12	.21838	1.5	98.2
Pop_Dens	1.00000	*	13	.12022	.8	99.0
Restrict.	1.00000	*	14	.07826	.5	99.6
EmplGrowth	1.00000	*	15	.06732	.4	100.0

Exhibit 8
Scree Plot



In the previous regression analysis, interest rates (as proxied by T-bonds) did not load into the equation. As mentioned earlier, problems arising from multicollinearity may have prevented them from doing so. In this analysis however, we found that factors 2 and 4 capture not only the interest rate but the two tax laws and debt flows as well, suggesting that these factors characterize those variables that help to explain the availability of capital.

Expected employment as well as unexpected employment load highly on factor 3, making this factor employment based. Factor 1 appears to represent large, high-cost metros with a strong entrepreneurial base. This becomes clearer with a closer look at the variables underlying the factor. The size of the office market, as measured by the amount of stock, loaded very highly (.805). It is not surprising to find the cost of doing business variable loading onto this factor (.897) as high-cost cities are highly correlated to larger cities. It is also not surprising to find population density with a strong loading (.889) as population density is synonymous with large metros.

The degree of economic concentration was measured by factor 5 with three economic base variables, FIRE, manufacturing and government, loading strongly on this factor. These variables show the degree to which cities are respectively dominated by economic base categories. The variable measuring the economic diversity of each market (the Hachman Diversity Measure) loaded most strongly on this factor but negative to the economic variables. Thus, it appears as though this factor is a measure of economic concentration.

It should be noted that not all variables used in the onset of this factor analysis could be sufficiently explained by this five-factor model. The economic-based variables of distribution, energy, hitech and service had minimal variance explained (see Exhibit 9) by the 5 factor model and therefore were removed from further consideration.

We have now derived five factors that illustrate the relationships among the sets of many interrelated variables (Exhibit 9). To test if these factors affect the volatility of office markets, factor scores were derived and used in the following step-wise regression model:

$$v_{mt} = \alpha_{mt} + \beta_1 FAC1_{mt} + \beta_2 FAC2_{mt} + \beta_3 FAC3_{mt} + \beta_4 FAC4_{mt} + \beta_5 FAC5_{mt} + \varepsilon_{mt}, \quad (3)$$

where $v_{m,t}$ is the difference between the current vacancy and the average vacancy for market *m* and time period *t*, *FAC*1 through *FAC*5 are the five factors, as previously described, that were derived from the factor model, and ε_{mt} is a random error term.

The results from equation 3 are shown in Exhibit 10. The results show that factors 2 and 4, or interest rates and capital availability, dominate the model. The amount of variance explained by these factors (nearly 52%) relative to the remaining three, illustrates the strength of these factors in explaining the volatility in vacancy rates. However, this model measures a time period (early to late 80s) that saw an overwhelming amount of capital pour into the market which may exaggerate the significance of this factor.

Exhibit 9
Factor Matrix

Variable	Communality	*	Factor	Eigenvalue	Pct of Var.	Cum. Pct
T-Bond	.88958	*	1	3.07986	20.5	20.5
Tax 86	.93804	*	2	2.18353	14.6	35.1
Tax 81	.73118	*	3	1.85423	12.4	47.5
COB	.81493	*	4	1.53438	10.2	57.7
Stock	.73059	*	5	1.42584	9.5	67.2
EmplGro	.95422	*				
UnexEmp	.94052	*				
Div. Index	.50866	*				
FIRE	.42126	*				
Govt	.57789	*				
Mfg.	.21774	*				
Entrepreneur	.37922	*				
Pop_Dens.	.84464	*				
Restrict.	.52232					
DebtFlow	.68660	*				

Exhibit 10
Step-Wise Regression Model (of Factor Coefficients)

R^2 0.51976

Adj. R^2 0.51846
Depend. Variable: Vacancy - Average Vacancy (Volatility in Vacancy Rates)

	B	*t*	Sig. *T*
Independent Variables			
Factor 2	3.962118	32.656	.0000
Factor 3	–.372777	–3.072	.0022
Factor 4	1.370777	11.298	.0000
Constant	.762246	6.285	.0000

Factors Not in the Model:

Factor 1 – Metro Condition
Factor 5 – Economic Base Concentration

Nevertheless, the coefficient suggests that as capital becomes more available, the more volatile a market. This certainly was experienced in the 1980s when capital flooded the market and real estate construction was driven primarily by the availability of this capital.

The only other factor to load into the model, factor 3, deemed the employment factor, has a negative coefficient, suggesting that expected employment growth appears to lessen volatility. This is consistent with the results of the first regression analysis. In the first regression analysis, however, the unexpected component of employment had a positive coefficient, suggesting that it contributed to increased volatility. It appears that when both components are combined, and not held in isolation of each other as they were in the first analysis, the added volatility associated with the unexpected component is negated.

Factors 1 and 5, measuring metro condition (size, cost and ability to foster and support growth of new business) and economic concentration, respectively, did not load into the model. This model is clearly dominated by the supply of capital.

Real Estate Recovery: 1991 to 1995

Because the national variables, including the availability of capital influence on the market, so dominated the model, an analysis of the data was run from 1991 to 1995. The attempt was to isolate the availability of capital influence on the market and to examine the recovery period of the office market cycle (Exhibit 11) and the variables that characterize this stage. The 1991 to 1995 time period was characterized by little new supply on the market and in general, decreasing vacancy rates, indicating a demand-side response (Exhibit 12). The theory now being explored is that without a supply response in the market, demand-side variables should have a stronger influence on the volatility of vacancy rates.

The step-wise regression estimated in equation 1 was recalculated using only data from 1991 to 1995 for the thirty-one metro areas. Without the effects of the debt (capital

Exhibit 11
Office Market Cycle

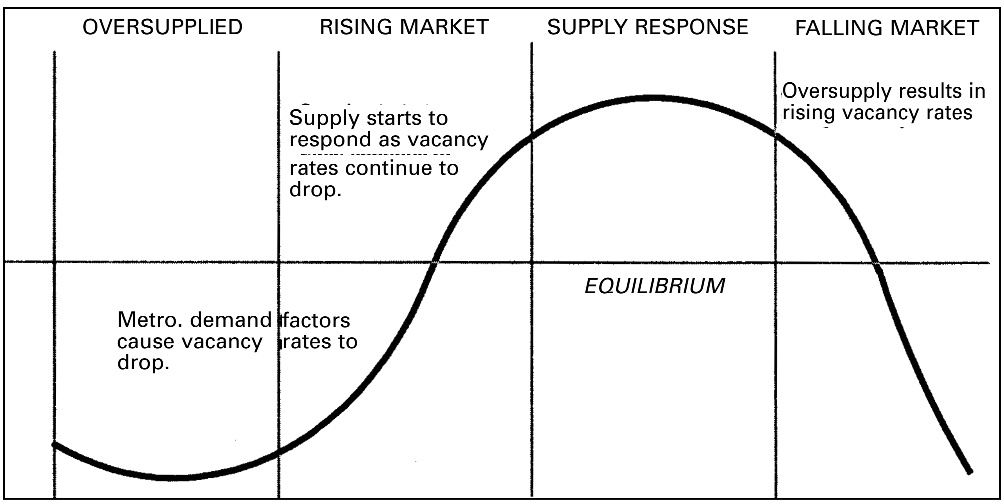
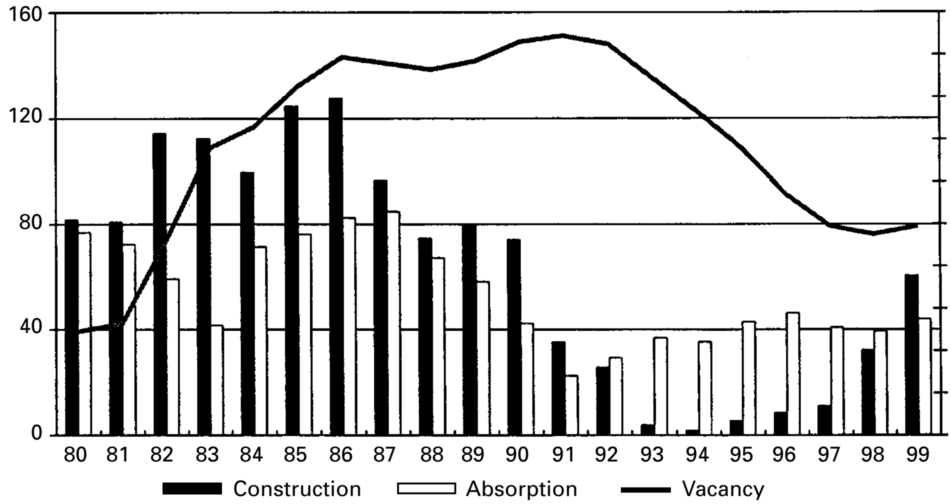


Exhibit 12
U.S. Office Market, 1980s–1990s



availability) and tax law variables, the demand-side variables now explain 55% of the variance (Exhibit 13) in office vacancy rates (compared to an R^2 of 6% without the debt and tax law variables but using the 1978 to 1995 time period). One national variable, the T-bond rate, did load into the model, but only explains 2% of the variance. Five other variables now load into the model that did not previously load: the restrictiveness index, unemployment rates and economic base classifications of service, government and distribution. Service and distribution economic base variables have negative coefficients indicating that service and distribution-oriented metros recovered faster over this time period; whereas government-oriented economies recovered more slowly. Additionally, the negative coefficient on the restrictiveness index indicates that less restrictive areas are more volatile. The variables having the largest effect on recovery in a step-wise regression include in order of importance: unemployment rate, employment growth, unexpected employment growth, and cost of doing business.

Further Analysis of the Effects of High Volatility

Further analysis of the effects of high volatility rates on office markets was then undertaken. Exhibit 14 illustrates for each market, the standard deviation of the vacancy rate over the eighteen-year time period, the average vacancy rate and the average rent growth over the time period. Both the average vacancy rate and the average rent growth are highly correlated to the volatility of the market. The exhibit also shows that highly volatile markets tend to have high average vacancy rates and lower rent growth than other markets. One exception to this is Atlanta, which experienced high average vacancy rates but relatively low volatility and high rent growth. Other exceptions are Tampa and Indianapolis which experienced high average vacancy rates, but low volatility, indicating that these markets tend to have high vacancy rates that stayed high over the time period. Further analysis of the causes for these outliers is warranted.

Exhibit 13
Regression Model 1991–95

Multiple *R*	.74176
R^2	.55020
Adj. R^2	.53516
Std Error	2.59298

Analysis of Variance

	DF	Sum of Sq.	Mean Sq.
Regression	10	2459.11212	245.91121
Residual	299	2010.34067	6.72355

F = 36.57462 Signif. F = .0000

Variables in the Equation

Variable	*B*	SE *B*	*Beta*	*T*	Sig. *T*
DISTRIB	–1.288074	.523546	–.100293	–2.460	.0144
@YR_TBO	–82.047585	20.786658	–.155303	–3.947	.0001
SERVICE	–1.823875	.864521	–.084869	–2.110	.0357
EMPLGRO	–201.571828	27.852282	–1.050897	–7.237	.0000
MFG	1.106505	.552967	.082171	2.001	.0463
GOVT	2.345280	.536751	.182619	4.370	.0000
RESTRICT	–.244353	.060602	–.201331	–4.032	.0001
UNEMPL	.721067	.142051	.299353	5.076	.0000
UNEXPEMP	161.932720	27.879736	.785518	5.808	.0000
COST_BUS	–3.300311	1.267732	–.154015	–2.603	.0097
Constant	8.645433	1.686395		5.127	.0000

Variables Not in the Equation

Variable	*Beta* In	Partial	Min Toler	*T*	Sig. *T*
ALLDEBT	–.029748	–.036405	.061583	–.629	.5299
HI_TECH	.025106	.036090	.070741	.623	.5335
ENERGY	.004223	.005838	.067162	.101	.9198
POP_DENS	–.075667	–.067346	.064859	–1.165	.2449
FIRE	.054022	.073201	.071018	1.267	.2061
ENTREP	–.037970	–.041533	.067645	–.718	.4736
DIVERS	–.085704	–.101176	.070872	–1.756	.0802
STOCK	.012351	.011382	.058766	.197	.8444

Conclusion

This analysis attempted to quantify real estate risk, as measured by volatility in office vacancy rates, by examining various metropolitan areas at different stages of the real estate cycle. Previous research has demonstrated that the volatility of metropolitan office markets can be tied to a wide variety of economic factors from both the supply and demand side. This research suggests that, depending on the stage of the real estate cycle,

Exhibit 14
Volatile Markets and Vacancy Rates, 1978–1995

Cities	Avg. Vacancy %	Rank	Std Dev. Vacancy %	Rank	Avg. Rent Growth %	Rank
Dallas	19.3	(31)	7.8	(27)	–2.1	(29)
Houston	18.8	(30)	9.0	(31)	–2.0	(28)
Tampa	18.7	(29)	4.3	(8)	–1.4	(20)
Phoenix	18.2	(28)	7.0	(25)	–1.2	(19)
Oklahoma City	18.1	(27)	8.8	(30)	–2.5	(31)
Denver	17.4	(26)	7.9	(28)	–1.9	(25)
San Diego	17.3	(25)	6.1	(23)	–1.7	(22)
Atlanta	16.8	(24)	4.2	(5)	–0.1	(2)
Indianapolis	16.1	(23)	4.0	(3)	–1.0	(16)
Miami	15.7	(22)	7.8	(26)	–1.1	(18)
Nashville	15.4	(21)	5.8	(21)	–1.0	(15)
Salt Lake City	14.9	(20)	5.5	(20)	–0.6	(9)
Kansas City	14.6	(19)	3.8	(1)	–0.4	(3)
Los Angeles	14.4	(18)	6.4	(24)	–1.7	(23)
Hartford	13.6	(17)	8.1	(29)	–2.0	(26)
Jacksonville	13.5	(16)	4.3	(7)	0.0	(1)
Chicago	13.3	(15)	4.5	(11)	–0.9	(13)
Detroit	13.2	(14)	4.2	(6)	–0.5	(4)
Baltimore	13.2	(13)	4.7	(12)	–1.0	(14)
Cincinnati	13.1	(12)	4.8	(14)	–0.5	(5)
St. Louis	12.9	(11)	4.1	(4)	–1.1	(17)
Philadelphia	12.9	(10)	3.9	(2)	–0.8	(11)
Portland	12.6	(9)	5.4	(18)	–0.7	(10)
Minneapolis	12.3	(8)	6.0	(22)	–0.6	(8)
Cleveland	12.2	(7)	5.4	(19)	–2.2	(30)
Seattle	12.1	(6)	4.5	(10)	–0.9	(12)
Columbus	11.9	(5)	5.3	(17)	–0.5	(6)
Boston	11.3	(4)	4.4	(9)	–2.0	(27)
New York	10.3	(3)	5.0	(15)	–1.5	(21)
San Francisco	10.2	(2)	4.8	(13)	–1.8	(24)
Washington D.C.	9.9	(1)	5.2	(16)	–0.6	(7)

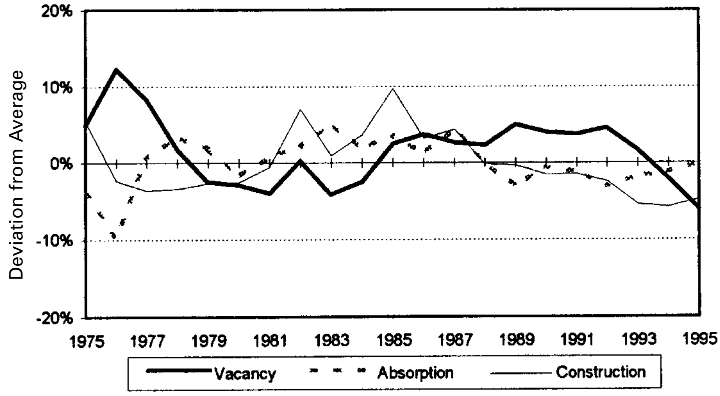
Correlation to Std Dev. of Vacancy is: Avg. Vacancy, 0.5257; Avg. Rent Growth, –0.6247

these factors vary in their ability to influence the market. Specifically, over the eighteen-year period studied, the availability of capital had the strongest effect on the volatility of office vacancy rates. Although capital flows may not be spread evenly among different metros, this factor appears to be strongly tied to a national trend with few, if any, markets escaping its influence. The regression results and the factor analysis both indicated that further study into the availability of capital to a particular market is warranted. On the other hand, when periods that follow excess construction were studied, market-specific, demand-side factors appeared to be the dominant influence. These factors include expected and unexpected employment growth, the economic base of the area, the cost of doing business, and the development restrictiveness of the area.

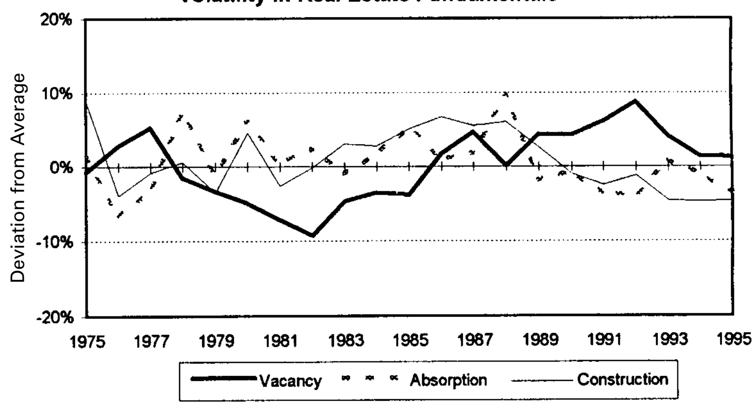
This study analyzed thirty-one office markets on a semiannual basis over the eighteen-year time period from 1978 to 1995. Using the absolute difference of the vacancy rate in

Appendix

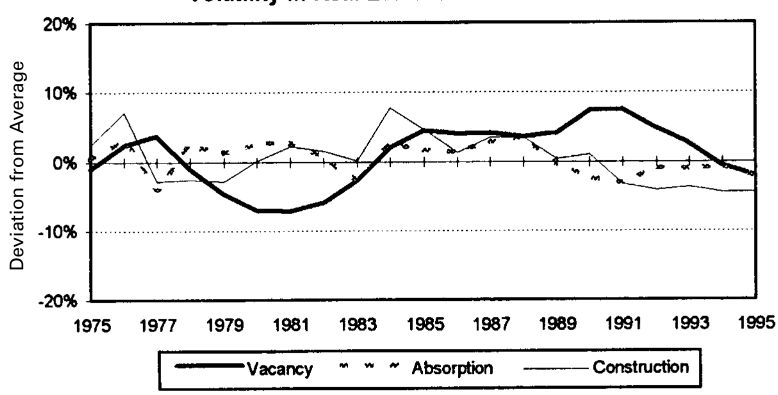
Atlanta
Volatility in Real Estate Fundamentals

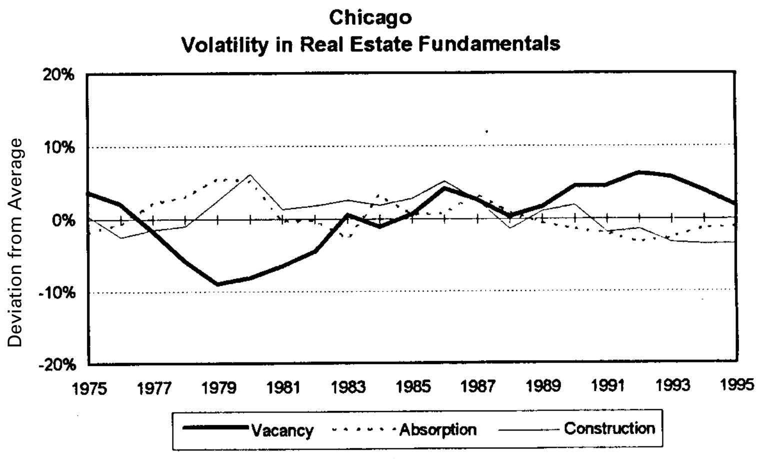


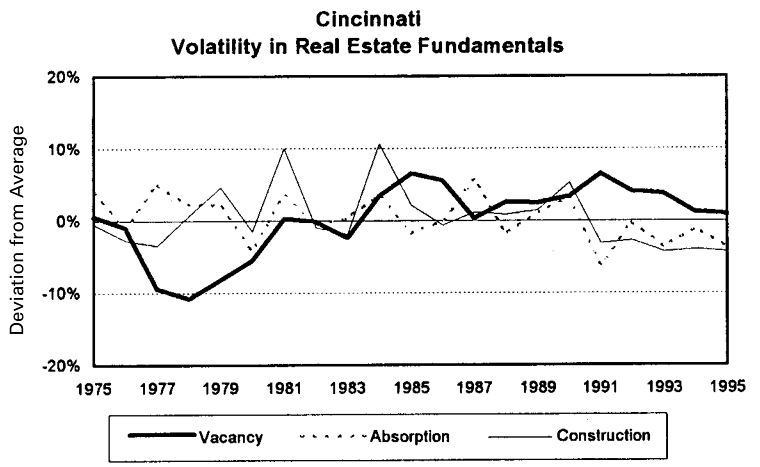
Baltimore
Volatility in Real Estate Fundamentals

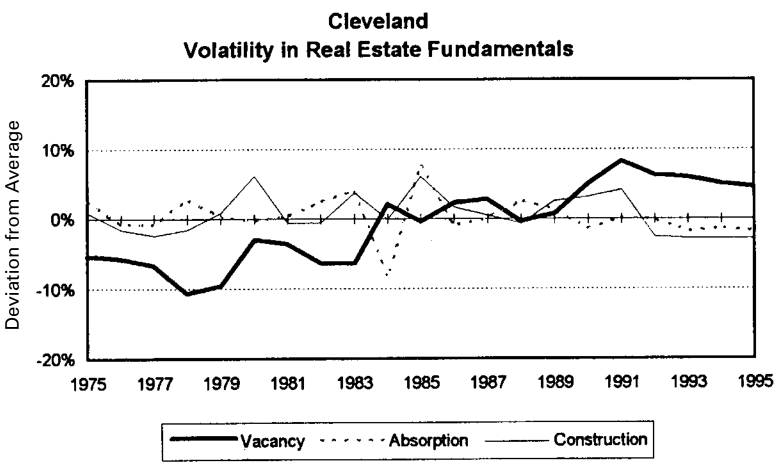


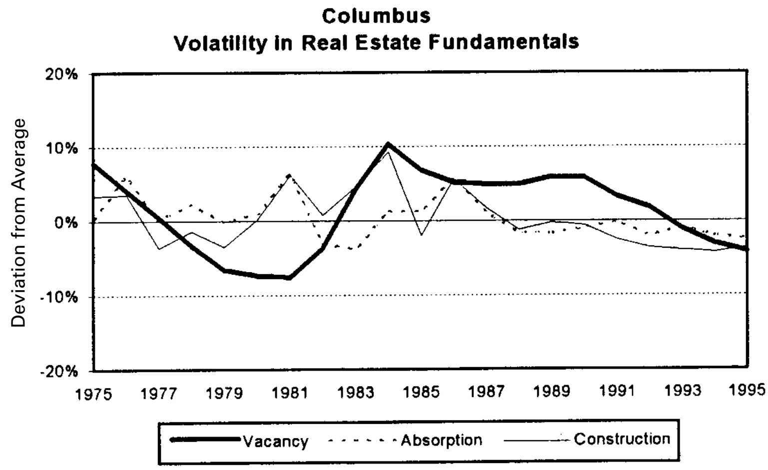
Boston
Volatility in Real Estate Fundamentals

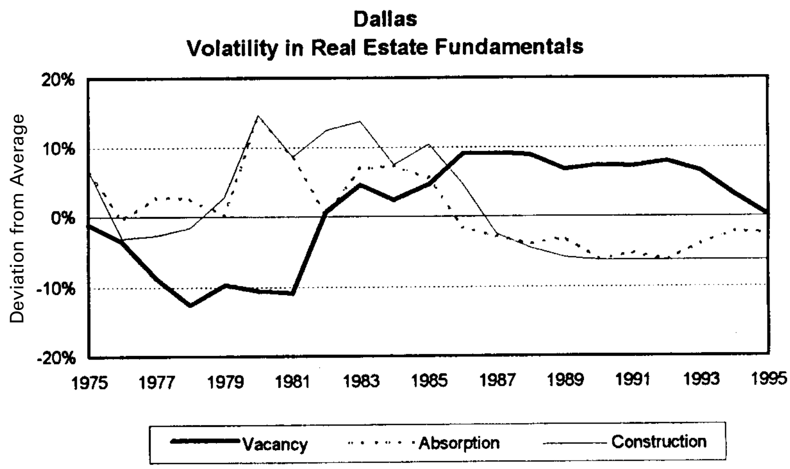


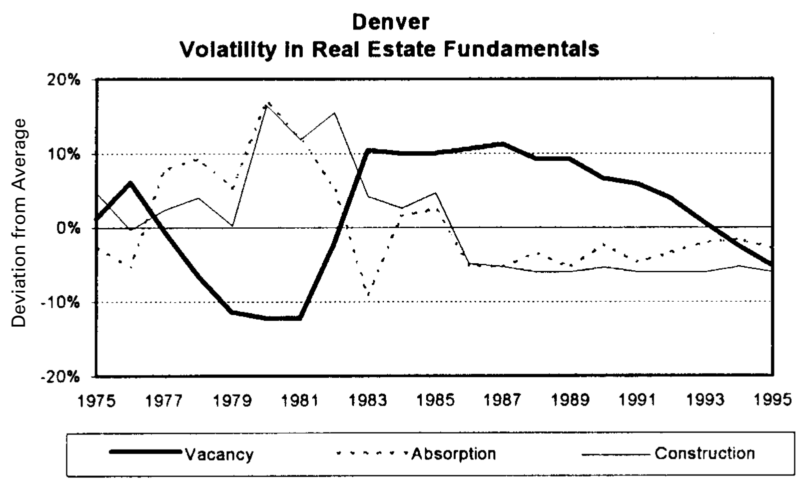

Chicago
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
Vacancy
Absorption
Construction

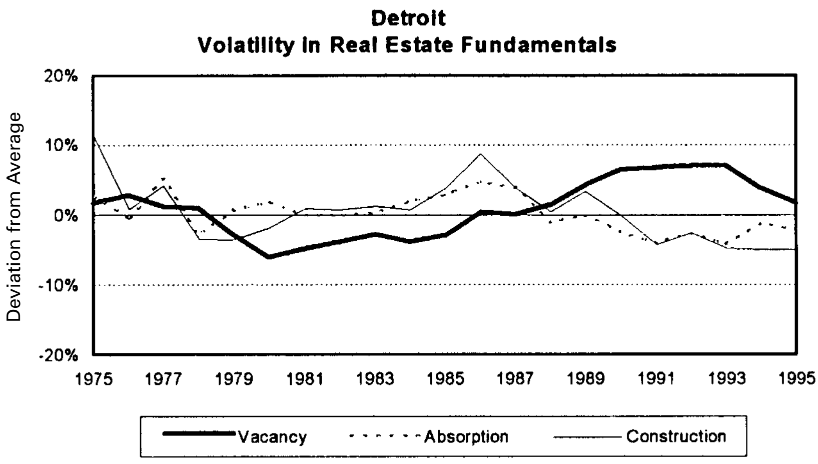

Cincinnati
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
Vacancy
Absorption
Construction

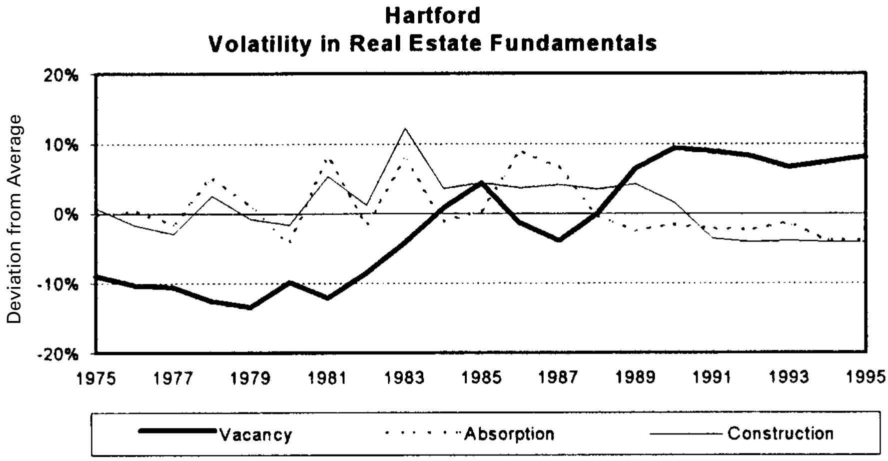

Cleveland
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
Vacancy
Absorption
Construction

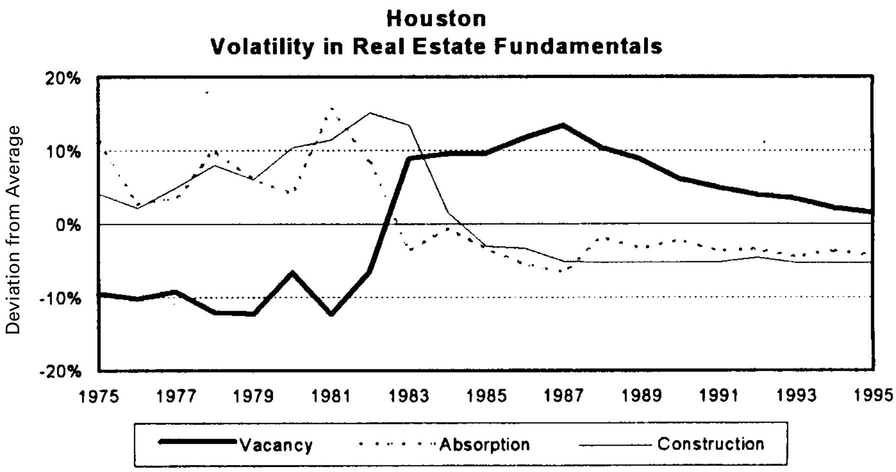

Columbus
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995
Vacancy
Absorption
Construction


Dallas
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995
Vacancy
Absorption
Construction

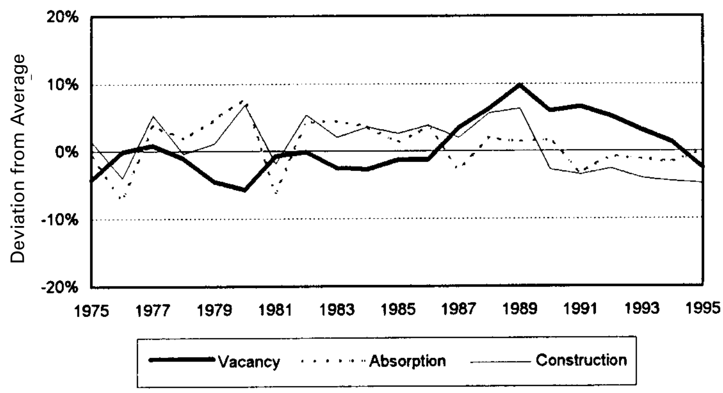

Denver
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995
Vacancy
Absorption
Construction


Detroit
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
Vacancy
Absorption
Construction

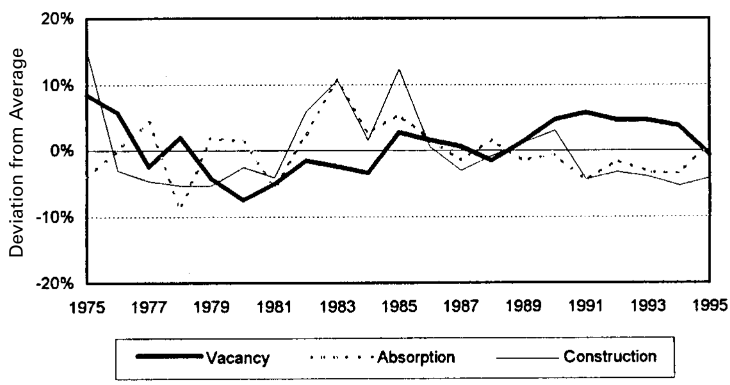

Hartford
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
Vacancy
Absorption
Construction


Houston
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
Vacancy
Absorption
Construction

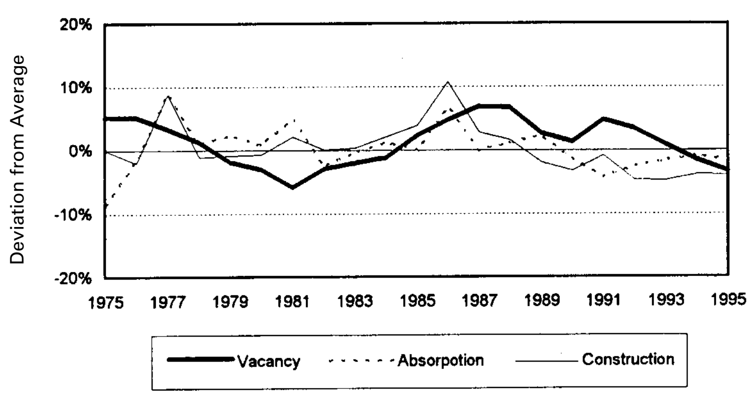
Indianapolis
Volatility in Real Estate Fundamentals

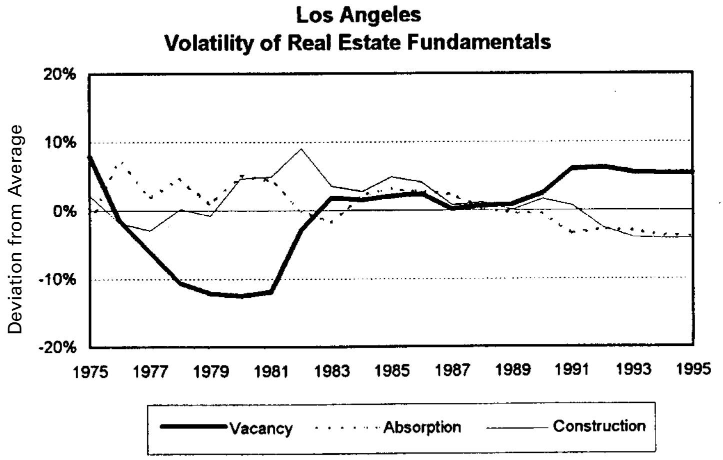


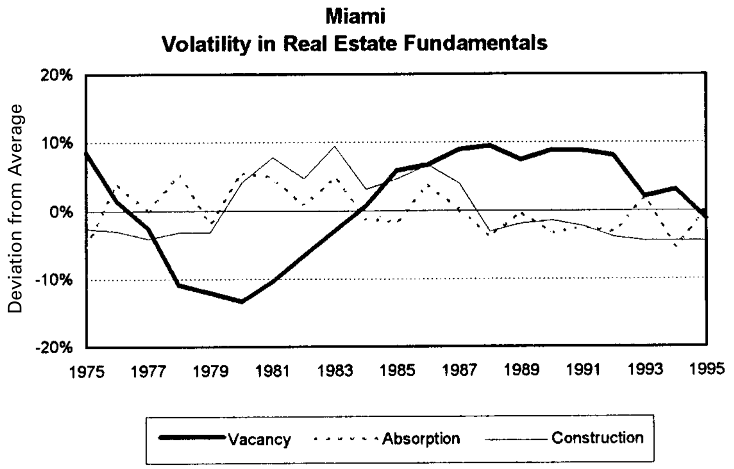
Jacksonville
Volatility in Real Estate Fundamentals

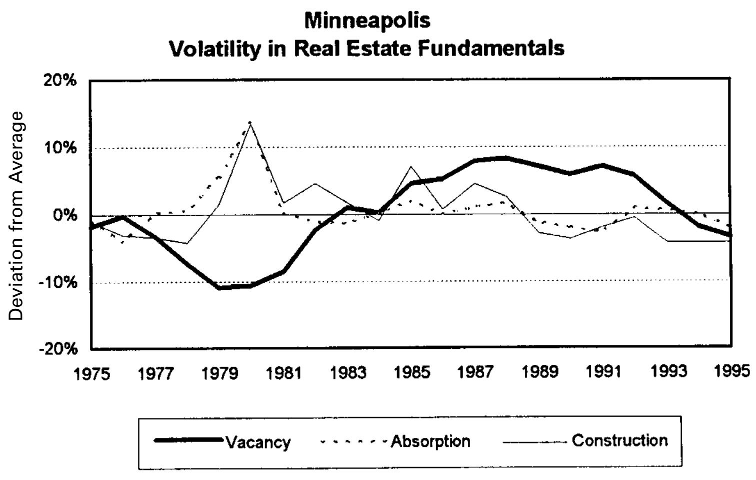


Kansas City
Volatility in Real Estate Fundamentals

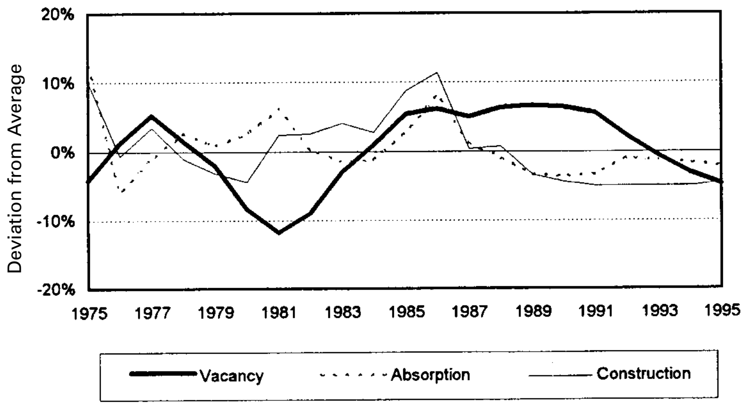



Los Angeles
Volatility of Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995
Vacancy
Absorption
Construction

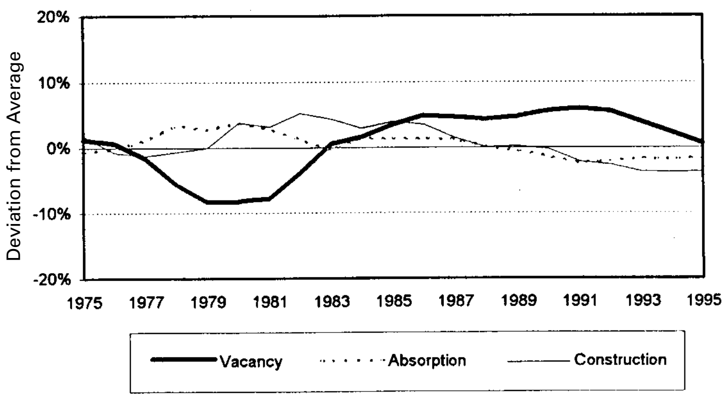

Miami
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995
Vacancy
Absorption
Construction


Minneapolis
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995
Vacancy
Absorption
Construction

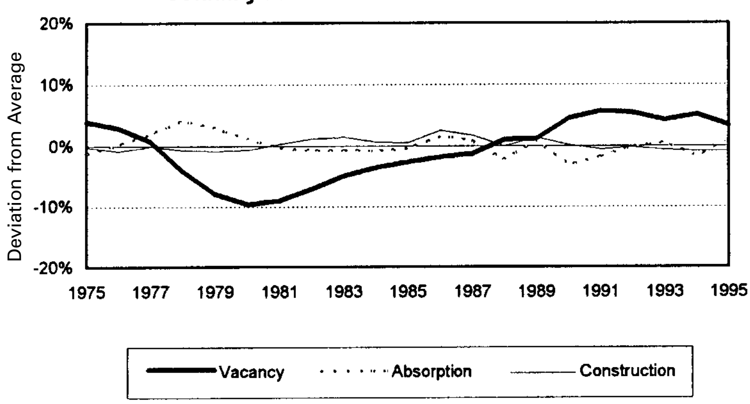
Nashville
Volatility in Real Estate Fundamentals

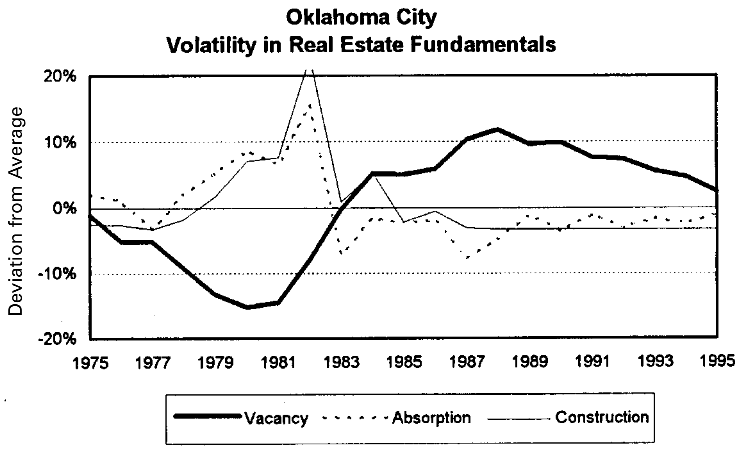


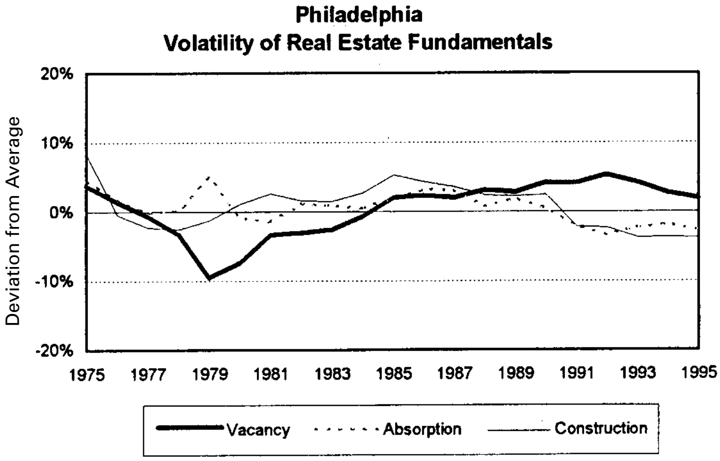
Nation
Volatility in Real Estate Fundamentals

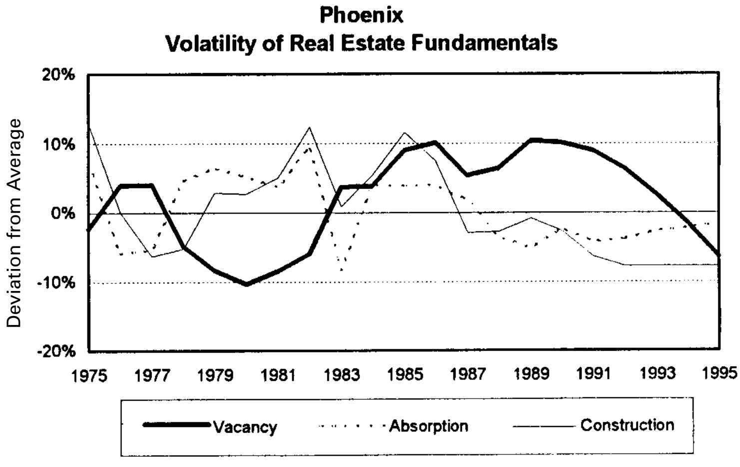


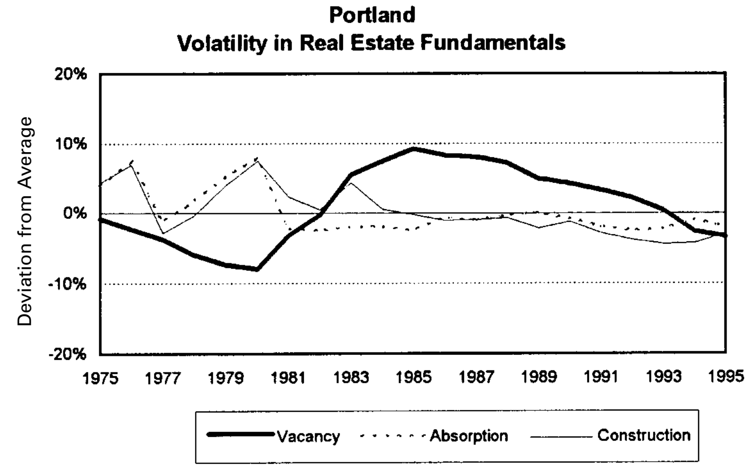
New York
Volatility in Real Estate Fundamentals

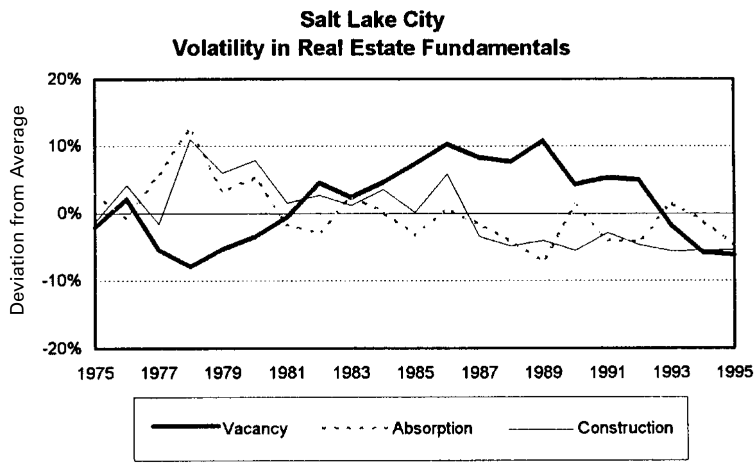


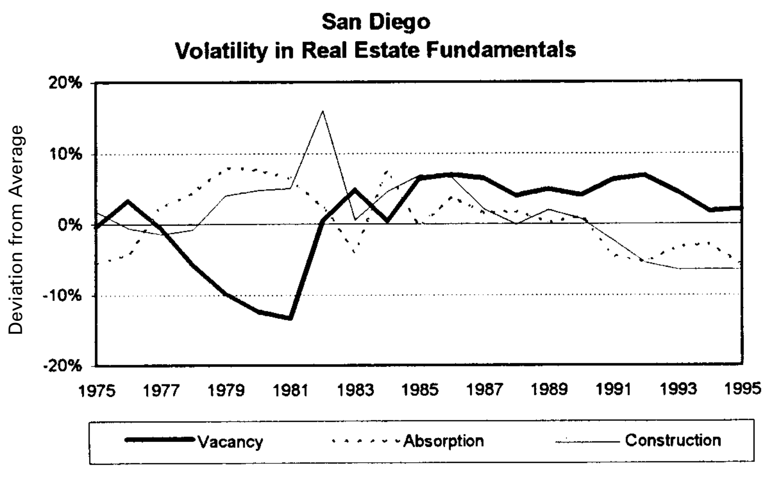

Oklahoma City
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
Vacancy
Absorption
Construction

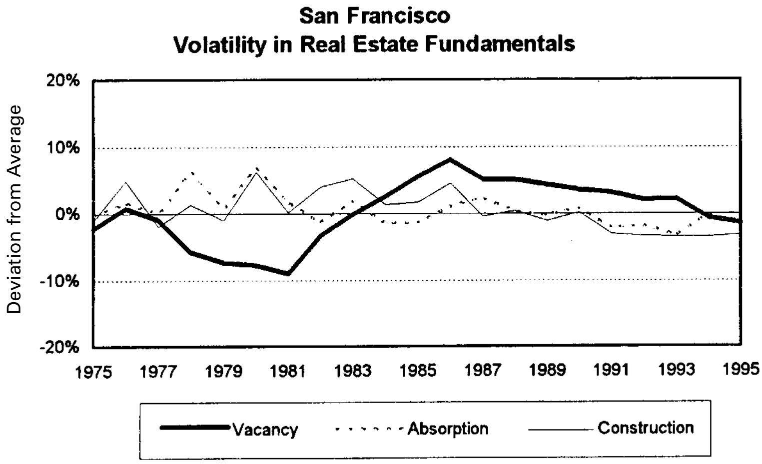

Philadelphia
Volatility of Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
Vacancy
Absorption
Construction

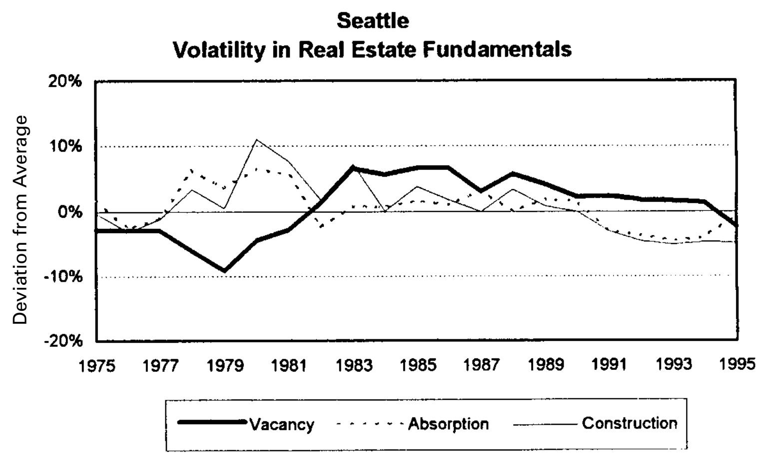

Phoenix
Volatility of Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
Vacancy
Absorption
Construction

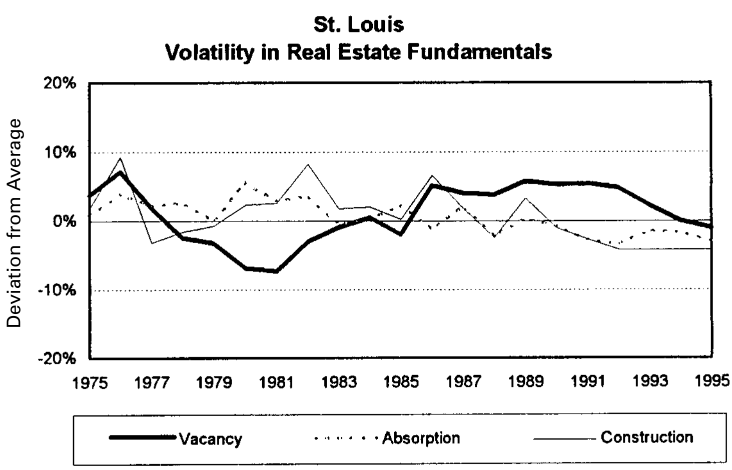

Portland
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
Vacancy
Absorption
Construction

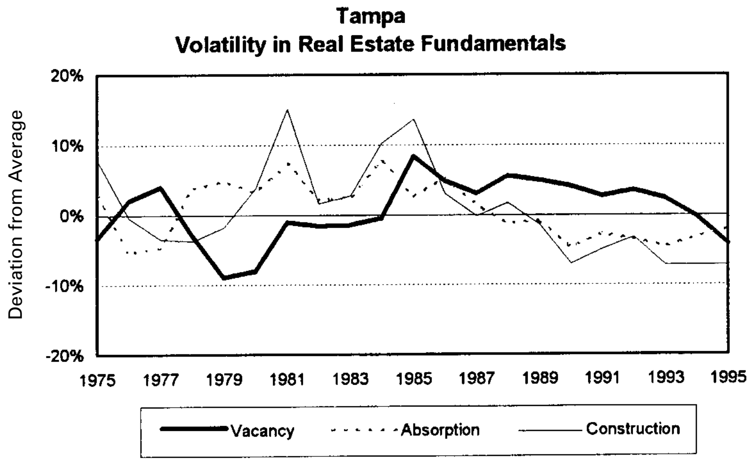

Salt Lake City
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
Vacancy
Absorption
Construction

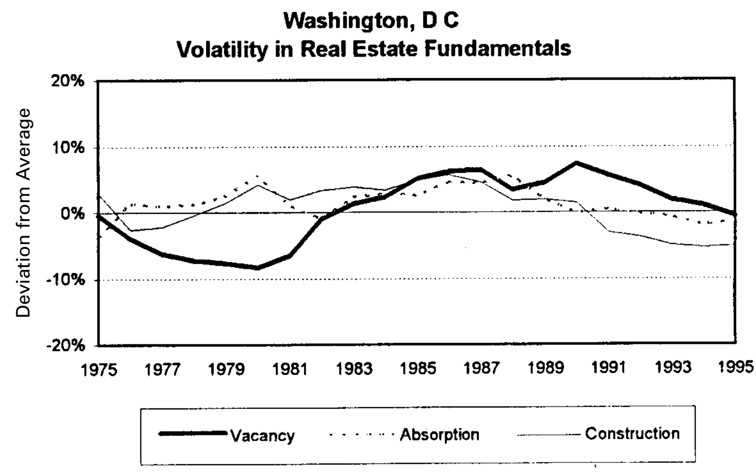

San Diego
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
Vacancy
Absorption
Construction


San Francisco
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995
Vacancy
Absorption
Construction


Seattle
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995
Vacancy
Absorption
Construction


St. Louis
Volatility in Real Estate Fundamentals
Deviation from Average
20%
10%
0%
-10%
-20%
1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995
Vacancy
Absorption
Construction





each time period from the average vacancy rate for the metro area over the entire time period as a measure of market volatility, the study found that employment growth, availability of capital, and market conditions, such as size of the market and economic diversification of the metropolitan area, affected vacancy rates. The availability of capital dominated the model in the time period from 1978 to 1995. However, metropolitan effects appear to dominate in the most recent time period (1991 to 1995) due to the lack of new supply and the retreat of capital. While markets seem to depend much more on demand-side variables during the recovery phase of the cycle, the model also suggests that the rapid return of capital currently underway will, in time, lead to a "national" effect. Thus, this research concludes that the determinants of vacancy rate risk, and hence financial risk, vary depending on the stage of the real estate cycle.

References

Born, W. and S.A. Phyrr, Real Estate Valuation: The Effect of Market and Property Cycles, *Journal of Real Estate Research*, 1994, 9:4, 455–485.

Brueggeman, W.B. and J.D. Fisher, *Real Estate Finance and Investments*, Boston, Mass.: Irwin, ninth edition 1993.

Clapp, J., H.O. Pollakowski and L. Lynford, Intrametropolitan Location and Office Market Dynamics, *Journal of the American Real Estate and Urban Economics Association*, 1992, 20:1, 229–57.

Corgel, J.B. and G.D. Gay, Local Economic Base, Geographic Diversification, and Risk Management of Mortgage Portfolios, *AREUEA Journal*, 1987, 15:3, 256–67.

Dohrmann, G., The Evolution of Institutional Investment in Real Estate, *The Handbook of Real Estate Portfolio Management*, Boston, Mass.: Irwin, 1995.

Downs, A., Cycles in Office Space Markets, in J. R. White, editor, *The Office Building: From Concept to Investment Reality*, A Joint Publication of the Counselors of Real Estate (American Society of Real Estate Counselors), Appraisal Institute, Society of Industrial and Office REALTORS, 1993.

Fisher, J. and R.B. Webb, Development of an Effective Lease Index, working paper.

Gabriel, S.A. and F.E. Nothaft, Rental Housing Markets and the Natural Vacancy Rate, *AREUEA Journal*, 1988, 16:4, 419–29.

———, Rental Housing Markets and the Natural Vacancy Rate, *AREUEA Journal*, 1988, 16:4, 419–29.

Godschalk, D.R. and D.J. Hartzell, Development Supply Constraints from Government Growth Management in Major MSAs, working paper prepared for The Prudential Real Estate Investment Strategy Conference, Pinehurst, North Carolina, 1993.

Goetzmann, W.N. and S.M. Wachter, Clustering Methods for Real Estate Portfolios, *Real Estate Economics*, 1995, 23:3, 271–310.

Hachman, F., memorandum on the Hachman Index, Bureau of Business and Economic Research, University of Utah, Salt Lake City, 1994.

Hekman, J.S., Rental Price Adjustment and Investment in the Office Market, *AREUEA Journal*, 1985, 13:1, 32–47.

Howland, M. and D.S. Wessel, Projecting Suburban Office Space Demand: Alternative Estimates of Employment in Offices, *Journal of Real Estate Research*, 1994, 9:3, 369–90.

Janssen, J., B. Kruijt and B. Needham, The Honeycomb Cycle in Real Estate, *Journal of Real Estate Research*, 1994, 9:2, 237–52.

Kawaller, I.G., Macroeconomic Determinants of Multifamily Housing Starts: A Descriptive Analysis, *AREUEA Journal*, 1979, 7:1, 45–62.

Kling, J.L. and T.E. McCue, Office Building Investment and the Macroeconomy: Empirical Evidence, 1973–1985, *AREUEA Journal*, 1987, 15:3, 234–55.

Mueller, G. and S. Laposa, Evaluating Real Estate Markets Using Cycle Analysis, working paper, 1994.

Pollakowski, H.O., S.M. Wachter and L. Lynford, Did Office Market Size Matter in the 1980s? A Time-Series Cross-Sectional Analysis of Metropolitan Area Office Markets, *Journal of the American Real Estate and Urban Economics Association*, 1992, 20:1, 303–324.

Pritchett, C.P., The Effect of Regional Growth Characteristics on Regional Housing Prices, *AREUEA Journal*, 1977, 5, 189–208.

Pyhrr, S.A., J.R. Webb and W.L. Born, Analyzing Real Estate Asset Performance During Periods of Market Disequilibrium Under Cyclical Economic Conditions: A Framework for Analysis, *Research in Real Estate*, 1990, 3, 75–106.

Royal Institution of Chartered Surveyors, The, Understanding the Property Cycle, Main Report: Economic Cycles and Property Cycles, 1994.

Shilton, L., Patterns of Office Space Demand Cycles, Real Estate Research Institute working paper, 1995.

Voith, R. and T. Crone, National Vacancy Rates and the Persistence of Shocks in the U.S. Office Markets, *AREUEA Journal*, 1988, 16:4, 437–58.

Wheaton, W.C. and R.G. Torto, An Investment Model of the Demand and Supply For Industrial Real Estate, *AREUEA Journal*, 1990, 18:4, 530–47.

——— Vacancy Rates and the Future of Office Rents, *AREUEA Journal*, 1988, 16:4, 430–36.

Wheaton, W.C., The Cyclic Behavior of The National Office Market, *AREUEA Journal*, 1987, 15:4, 281–99.