Real Estate Rental Growth Rates at Different Points in the Physical Market Cycle

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Abstract. **Real estate markets go through both physical cycles (demand and supply) that affect rental growth rates and financial cycles (capital flows to real estate) that affect property Prices (Mueller, 1995). This study develops a rental growth rate hypothesis based on a market's position in the physical (demand–supply) market cycle. Using data from fifty-four office and industrial markets in the United States over a thirty-year period, an aggregated national average rental growth rate was calculated for each point in the cycle. An ANOVA test for differences of means found that the national average rental growth rates at each point in the cycle were statistically different. The results show local demand and supply, which interact to affect occupancy, are major determinants in rental growth rates. This research should help investors move from using a single rental growth rate for multiple year forecasts, to using yearly cycle driven rental growth rate estimates in their discounted cash flow projections.**

Introduction

Occupancy rates (the physical market cycle) indicate the interaction and balance between demand and supply in a real estate market. Occupancy levels affect rental growth rates and these two factors are the major determinants of property income over the long term. This research examines rental growth rates in fifty-four different markets across the United States over a thirty-year period, in both office and industrial properties at different points in their physical real estate market cycles. Asking rents as collected by CB Commercial are the only consistent data source available as effective rents have complex contractual changes that are difficult to calculate and private in nature. Asking rents are the public method used by building owners to signal to renters their desired terms. The percentage growth rate of asking rents from one year to the next may also help to determine investment pricing over the long run as asking rents are the only publicly known index available to investors.

This research is only a first step at understanding the localized nature of demand and supply interaction basics and the impacts they have on rental growth, which is the beginning of a complex process of understanding price movements and ultimately investment returns. History has also shown that capital flows create a different

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''financial market cycle'' that also has a major impact on property pricing and therefore total investment returns. This research does not examine capital flows or total property returns, as the complex set of interdependencies between the physical markets and the financial (capital) markets is not yet well understood and the capital flow variables for real estate have not been well defined or measured to date.

Literature Review

Real estate cycles were first discussed by Homer Hoyt in 1933 in his analysis of the Chicago marketplace, since that time market cycles have received scattered attention over the years. Pritchett (1984) theorized that there is a national real estate market cycle, but the cycles for each property type were not coincident. He stated that supply growth and decline always lagged demand growth and decline and that turning points in the top and bottom of any cycle could be determined when the supply growth and demand growth were moving in opposite directions, however recognition of turning points was less useful to investors than anticipation of such points. He applied these ideas by stating that the most advantageous buying opportunities generally exist during late declining, bottom and early rising portions of the real estate market cycle.

Witten (1987) stated that every city had its own property cycles that were unique in length (time) and degree of change (magnitude) and depend on the internal dynamics of each market. He also stated that new supply while being cyclical is somewhat more volatile than demand, since supply is often determined by the availability of financing rather than by market need. He also observed that markets seldom move as smoothly as the classically drawn curves, but instead move in ''fits and starts'' causing investors to hesitate and wait for clear signs of market changes.

Brown (1984) described cycle modeling as a simplification of the complexities of reality, which hopefully capture the crucial features of the economic sector or system being studied. He believed that time series should be used to determine the length and magnitude of cycles as it seeks to measure movement over time. Also, the longer the length of time studied, the better the understanding of the cycle movement. A key to cycle research is the identification and removal of trend and seasonal components inherent in time-series data. He concluded that if feasibility analysts, investment advisors and principals or lenders are to give credibility to market cycle analysis, much more research needs to be done. There are currently no uniform measurement procedures available, making it difficult to agree on the length and magnitude of cycle movements. He concluded that the downside of market cycles creates extreme economic obsolescence, thus real estate professionals need to maintain the perspective of cyclical timing in their decision making.

Wheaton (1987), using a sample of ten cities, estimated the national office market cycle to have a length of between ten and twelve years. He found that each city had a turning point (peak or trough) in its own market cycle that was within one or two years of the combined average of the ten cities. He studied the causes of market movement that made the office market cyclical. One of his findings was that the tenure structure of office leases was usually long term (*e.g.*, ten to fifteen years).

His explanatory model found that expected employment growth was significant in determining cycle behavior, thus creating an adaptive demand model (supply will react to increased demand with a lag) and concluded that supply responds more readily to the state of the economy (as developers adjust their expectations to general economic indicators such as GDP growth and interest rates) than to actual local demand. This adjustment can actually help curtail the magnitude of a cycle as GDP growth is more moderate than local demand growth. He concluded that both supply and demand respond to changes in the economy, although supply is more responsive than demand.

Wheaton and Torto (1988) studied rent and vacancy rate cycles and found that there was a market rental adjustment mechanism that caused real office rents to drop approximately 2% annually for every percentage point of excess vacancy above the long term average in the market. They also found that the average office vacancy rate was trending upward over the 1968 to 1986 period.

Pyhrr, Webb and Born (1990) in two different articles compare typical trend models for real estate analysis with a theoretical cycle model based on demand, supply and inflation inputs. They conclude that the timing of acquisition and disposition in the cycle can be very important to the overall return received from real estate investments. Pyhrr, Born, Robinson and Lucas (1996) compare traditional valuation methods against a model using cyclical assumptions including demand, supply, absorption, occupancy rates and rental rate differences between newly constructed and existing properties. They conclude that valuations with cyclical assumptions can dramatically alter valuation conclusions, but that a cyclical model may be a better indicator of investment value (long term), than market value (one point in time).

Mueller and Laposa (1994a,b, 1995) discussed the difference between overall market and submarket cycles. Their research found that submarkets can move differently from the overall market cycle in the short run, but submarkets will typically trend with overall market movements in the long run because the locational advantages of a submarket become appropriately priced in the marketplace over time.

Mueller (1995) stratified real estate market cycles into two distinct cycle types: (1) a physical cycle that described only the demand, supply and occupancy of physical space in a local market; and (2) a financial cycle that examined the capital flows into real estate for both existing properties and new construction. This separation between physical and financial cycles helps to clarify earlier work that mixed many definitions and helps explain the lag that appears to exist between market occupancy and rental movements versus real estate prices.

Grenadier (1995) developed a theoretical option-pricing model of how vacancy rates and rental rates interact. He hypothesized that there is considerable inertia from existing building owners to adjust rents and occupancy levels in reaction to changing economic environments (the owner's option to rent). He also attempted to explain the recurrence of overbuilding during periods of low occupancy by proposing that the costs of re-leasing can make vacancy ''sticky'' because landlords may choose to wait for higher rental rates before leasing space, and that long construction times coupled

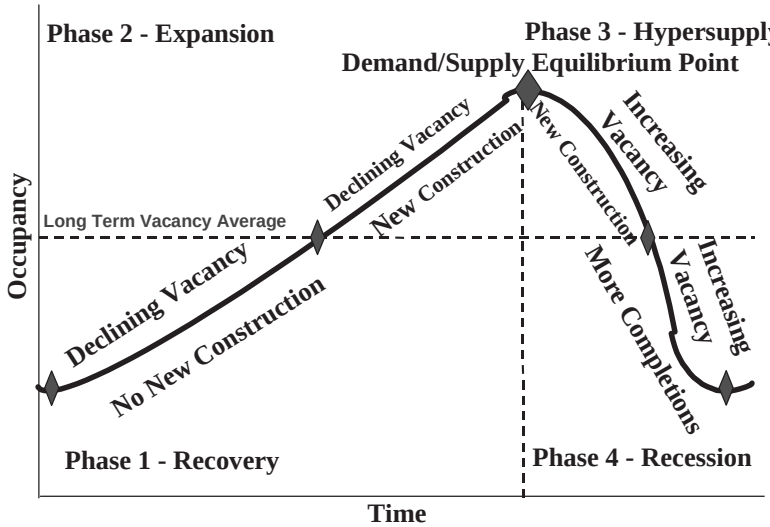
with the inability to reverse a construction start decision can cause too much new supply. He also modeled demand volatility and theorized that markets with greater demand volatility had a higher propensity to overbuild.

The economic literature addresses price dispersion under various search models. Butters (1977) postulated that a consumer's imperfect information is insufficient to support price dispersion. Others have shown that heterogeneity among producers explains price dispersion (MacMinn, 1980; and Carlson and McAfee, 1983). Nitzan and Tzur (1991) show that price dispersion can exist even when fully rational economic agents on both sides are homogeneous. Fershyman and Fishman (1992) present a dynamic search model that accounts for cyclical patterns of prices and demand. Thus, the behavior, strategies and expectations of landlords and search behavior of tenants at various points in the real estate cycle may be explained by search theory models and price dispersion theory when we examine the rent price distributions in real estate markets.

Physical Market Cycle Theory

Real estate physical market cycles are separated into four distinct phases based upon the rate of change in both demand and supply (Mueller, 1995). Exhibit 1 depicts the physical market cycle as an occupancy cycle. Occupancy is the difference between total supply (including newly constructed space) and effective demand as measured by absorption. Occupancy is also equal to one minus the vacancy rate. Markets are defined with two up-cycle phases (recovery and expansion) when demand growth rates are higher than supply growth rates and two down-cycle phases (hyper-supply and recession) when demand growth rates are lower than supply growth rates. Markets

Exhibit 1
Market Cycle Quadrants



are always in a state of either demand growing faster than supply or supply growing faster than demand. The demand and supply growth rates are equal (dg = sg) at the peak and trough of the market cycle (thus existing space plus new construction exactly matches new demand). Because the trough point is a time of oversupply ending and low demand growth turning positive Pyhrr and Born (1990) suggest that the only real demand/supply equilibrium point is at the peak of the market cycle where supply growth finally catches up to demand growth. (Equilibrium is normally used in economics for prices, but in this case is applied to rental growth rates.) After this peak point, either the demand growth rate begins to slow and/or the supply growth rate accelerates, thus dg $<$ sg. This peak point may also occur numerous times as a market moves between growth and hyper-supply phases, as future demand can not be accurately predicted and supply is not able to react instantaneously to demand changes.

The long term average occupancy (LTAO) [also called the normalized occupancy or normalized vacancy level by some and formerly called the equilibrium level by Mueller (1995)] for each market is also a significant point in the cycle as the market goes through this LTAO both during an up cycle and a down cycle. However, the interaction between supply and demand above and below the LTAO point is very different. While impossible to forecast accurately, the historic midpoint in the cycle can be identified by a LTAO rate calculated over a number of historic cycles. Looking forward, the forecast LTAO must be adjusted for current demand and supply characteristics (*i.e.*, faster demand growth produces a lower LTAO, as more space must be available to meet the higher level of demand). Thus, exact determination of the changing LTAO requires further research. The LTAO is also different for each property type and each market. Additionally, the historic data shows that cycle lengths measured in years and magnitudes measured in occupancy levels are different for each market and each property type.

Rental Growth Theory

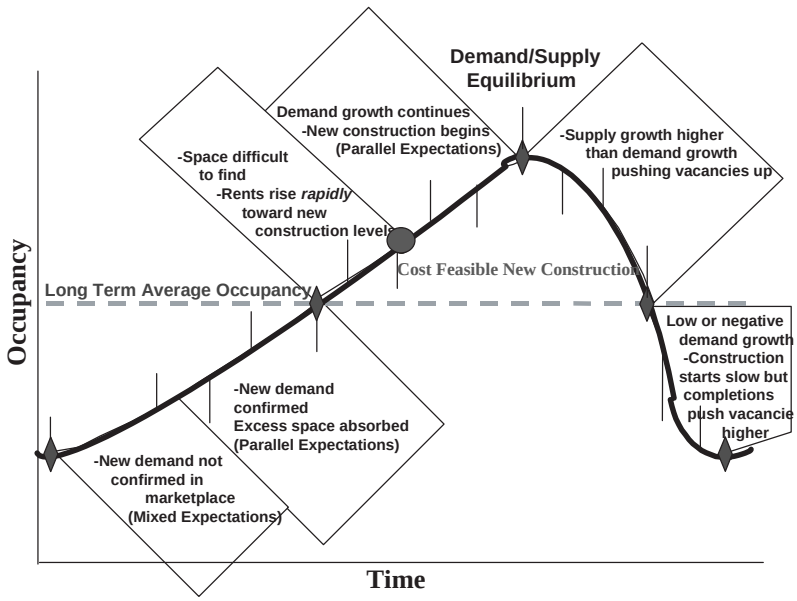
This cycle theory assumes that growth rates for asking rents are a function of the market's position in the physical real estate cycle phase as indicated by market occupancy. This theory assumes that rental growth will be below inflation when market occupancies are below their LTAO and rental growth rates will be higher than inflation when market occupancy is above the LTAO. Additionally, the theory assumes that the rental growth rates will steadily increase in up-cycles (trough to peak) and rental growth rates will steadily decrease during down-cycles (peak to trough). Thus, during the recovery phase of the cycle, rental growth rates should be negative near the bottom and increase as the cycle moves toward the long run occupancy average. They should approximately equal inflation at the LTAO. In the growth phase of the cycle, rental growth should steadily increase and be higher than the inflation rate, reaching the highest growth rate at the market peak (highest occupancy or lowest vacancy) where demand and supply are in equilibrium. In the hypersupply phase, rental growth should continue to be positive and above inflation, but at declining rates (the marginal growth rate is now negative) as market occupancy moves back toward its long-term average. In the recession phase rental growth rates should be below

inflation levels and continue to decline or be negative as the trough of the cycle is reached. Exhibit 2 presents the occupancy to rental growth relationship assumptions at different phases of the cycle.

Because supply and demand determine occupancy the supply, demand and rent growth interaction is also explained. Starting with Phase 1 (recovery) at the trough of a cycle, the marketplace is in a state of oversupply, due to previous oversupply (new construction) or negative demand growth. At this trough, point occupancy is at its lowest level in the cycle (vacancy rates hit their peak). Typically, the market trough is also the point when the excess construction from the previous cycle is completed and stops. As the cycle trough is passed, positive demand growth begins to slowly absorb the existing oversupply of space and new supply growth is usually non-existent or very low. Negative rental growth occurs at points near the cycle trough. As the excess space is absorbed and the recovery phase continues, increased occupancy and positive feelings about the market allow landlords to increase rents at a slow pace, but still below inflation. Eventually the market reaches its long-term average occupancy level. At this point rental growth rates should be similar to the rate of inflation.

As occupancy rates rise above the long term occupancy average, signaling that supply is becoming tight in the marketplace, rents begin to rise rapidly at growth rates above inflation until they reach ''cost feasible'' rent levels that allow profitable new construction to commence. In this period of growing demand and tight supply, the market experiences rapid rental growth, which some observers call rent spikes (as

Exhibit 2
Physical Market Cycle Characteristics



landlords demand higher prices and tenants agree to pay them due to lack of alternative space availability). In Phase 2, the expansion phase of the cycle, demand growth continues causing the need for additional space, yet new supply growth has not yet started because rents must grow enough to reach ''cost feasible'' new construction rent levels (cost feasible rent levels are defined to be a level that is high enough to produce a profitable income return on investment that creates a new building value that is at or above the cost to build that new building). Some developers may also begin speculative construction in anticipation of ''cost feasible'' rents being reached upon completion of their building, if they are able to obtain construction financing. Once cost feasible rents are achieved in the marketplace, the demand growth rate continues to outpace the supply growth rate (dg $>$ sg). In the mid-1990s, demand growth averaged about 3%, while supply growth averaged less than 2%. This supply lag happens because new construction cannot catch up to demand instantly and thus rental growth rates will continue to increase. Long expansionary periods are possible and many historic real estate cycles show that the overall up cycle is a long, slow uphill climb.

The next major transition point is the peak or equilibrium point in the cycle where demand and supply growth rates (dg = sg) are the same (*e.g.*, demand and supply both growing at 3%). At the peak, the space market is usually at its tightest level (occupancy rates highest) and the rental growth rate should also be at its highest point.

The hyper-supply phase of the real estate cycle commences after the peak/equilibrium point. The peak is passed when the supply growth rate moves higher than the demand growth rate or when the demand growth rate drops below the supply growth rate (dg $<$ sg). However, many participants do not recognize this peak turning point as occupancy rates are high and the market is still above its LTAO. Rental growth begins this phase very strong but not as high as at the market peak. As the hypersupply phase progresses the demand growth rate continues to be lower than the supply growth rate and the resulting occupancy decrease moves the market back toward the long-term market average occupancy. While there is no perceived oversupply during the beginning of this period, due to high occupancy rates, new completions compete for tenants in the marketplace and the rental growth rate continues to decline from its highest rate at the peak of the cycle when space was most difficult to find. When the market reaches LTAO again, rental growth rates should have slowed back to inflation levels again. At some point in the hypersupply phase, market participants realize that the market has turned down due to lower occupancy rates. When this realization occurs, commitments to new construction should slow or stop.

The recession phase begins when the market occupancy declines below the LTAO point. This phase has historically been driven by the oversupply of new product (most coming from completions that were started in the hypersupply phase), but can also occur from rapidly declining demand (such as a recession) that reduces occupancy. The extent of the market down-cycle will be determined by the difference (excess) between the market supply growth rate and demand growth rate. Massive oversupply, with growth rates as high as 8% per year coupled with lower demand growth rates in the late 1980s, sent most U.S. office markets into the largest down-cycle ever

experienced. During this recession phase landlords realize that they will quickly lose tenants if their rental rates are not competitive and they lower rents to retain existing tenants whose leases are expiring and to capture new tenants, even if rents only cover their building's fixed expenses. Thus, rental growth is below inflation or negative. Market liquidity is also low or non-existent in this phase as the bid-ask spread in property prices is too wide. The cycle eventually reaches its trough as new construction and completions cease or as demand increases at growth rates higher than supply growth rates in the marketplace.

Financial Market Cycle

A separate step in cycle research (not undertaken in this study) is to look at the correlation of prices to rental growth rates to determine how much influence rental growth has on prices. However, separate research on cyclical price movements must be done using this physical market cycle research along with research on the financial capital market factors (interest rates and capital flows) and their impacts on real estate prices. The financial market cycle (capital flows to real estate and especially to new construction) have historically lagged the physical market cycle, because investors and suppliers can not forecast demand levels accurately and are not able to react instantly with new supply when they realize demand is strong and rents have risen far enough to justify profitable new construction. The financial cycle peak lagged the physical cycle peak by five years in the 1980s, while 1998 saw the public debt and equity markets stop capital flows to real estate even though real estate fundamentals were good (see Exhibit 3).

Placing Rental Growth Rates at Different Points in the Physical Market Cycle

Exhibit 4 divides the market cycle into sixteen points for analysis. Each of fifty-four markets are analyzed individually and their yearly occupancy cycle position and

Exhibit 3
National Office Physical Market Cycle vs. Financial Cycle—
New Permit Values

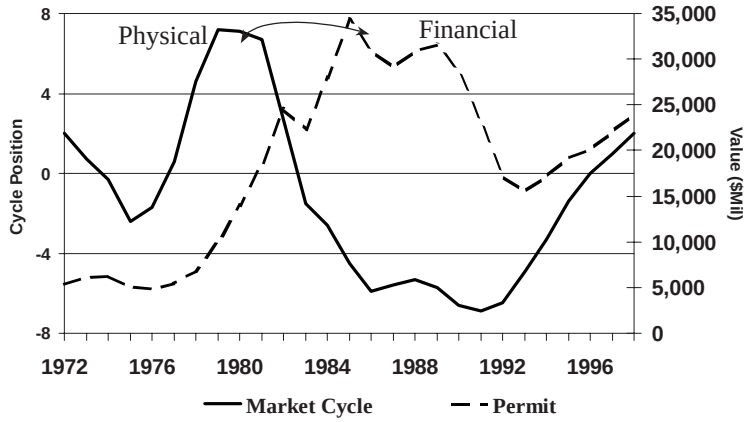
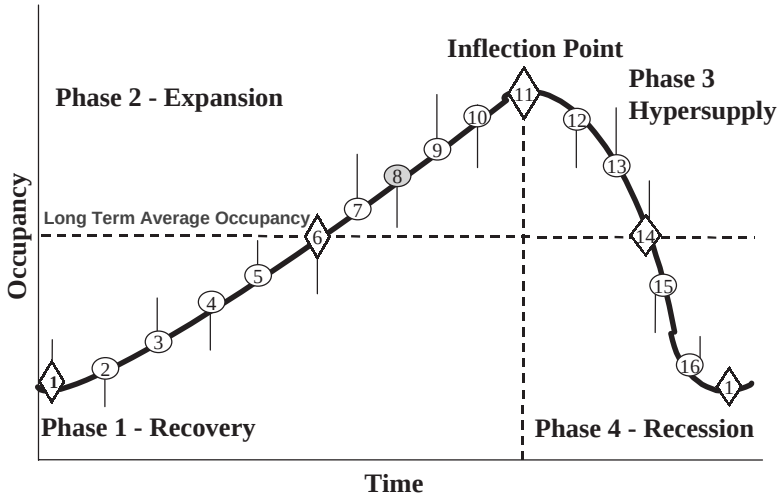


Exhibit 4
Cycle Position Labels



historic percentage rental growth rate are placed in a database. The cycle theory also assumes that rental growth rates will not be the same in all markets and property types, therefore the rental growth rate for a particular point on the occupancy cycle will have different rental growth rates for different cities.

Data

Market data came from CB Richard Ellis–Torto Wheaton Research[1] including market demand, supply, absorption, vacancy, gross asking rent and rent growth rate data for fifty-four office markets and fifty-four industrial markets. The time period for data available in each market varied and began as early as 1967 or as late as 1980 and concluded with the fourth quarter of 1997. Each rental growth rate is the average rental growth rate for all buildings available in a given market. Thus, if one building has three spaces available at $15, $16 and $ 17, respectively, the average gross asking rental rate of that building will be $16—not size weighted or value weighted. The rental growth rate (shown in percentage terms) is determined by the difference between the previous year and current year gross asking rental rate.

Methodology

The following analytical steps were completed for each market:

1. A long-term average occupancy rate (LTAO) was calculated for each market over the full thirty-year cycle. In some markets, the LTAO was adjusted to reflect changes in the most current cycle market demand growth. Higher demand growth rate markets were adjusted to reflect a lower long term occupancy average (because more vacant space is needed

in a fast growing market) and lower current demand growth markets were occasionally given higher long term occupancy averages (as slow growth markets did not need additional space as quickly).

2. The market cycle for each of the fifty-four markets was broken into sixteen points within the four phases, and each year of each market was assigned to one of the market cycle points—one through sixteen. The year of lowest historic occupancy was assigned point 1. The historic long term average was assigned either point 6 or point 14 depending on upward or downward trends in surrounding years and the year of highest historic occupancy is assigned point 11. Other years were placed at appropriate points based on their relative distance from the trough, long term average and peak occupancy points.
3. The sixteen individual market cycle points for all fifty-four markets were connected to the actual market rental growth rates for each year in that market, then an average of the numerous individual market rental growth rates was calculated. Thus, market rental growth rates are combined to calculate a national average growth rate from all fifty-four markets during the year that they fall at each point on the market cycle chart. Exhibits 5 and 6 show the occupancy and rental growth results for office and Exhibits 7 and 8 show the results for industrial properties.

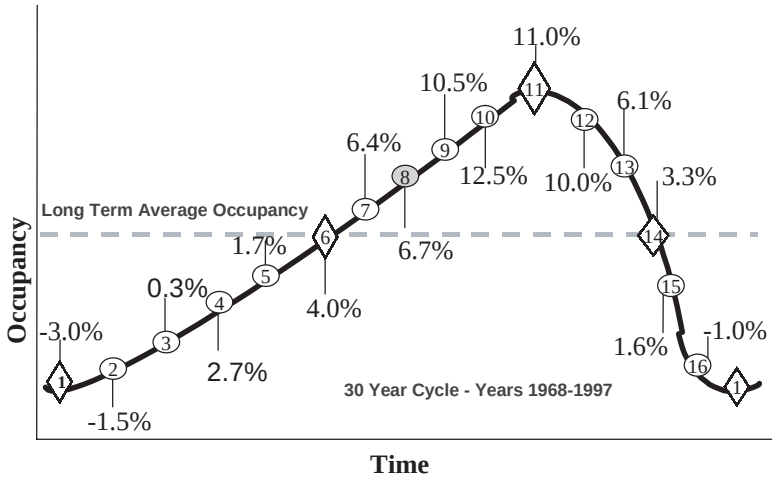
Office Occupancy and Rental Growth Rates

Exhibit 5 shows the average occupancy rate for each position in the office cycle. Office occupancy rates started at a low average occupancy of 77.2% (a 22.8% vacancy

Exhibit 5
Office Occupancy and Rental Growth Rates

Cycle Position	Observations	Occupancy Avg. (%)	Occupancy Std. Dev. (%)	Rental Growth Rate (%)	Rental Growth Rate Std. Dev. (%)
1	100	77.2	4.8	−3.0	5.8
2	94	78.1	4.6	−1.5	6.1
3	90	81.2	3.9	0.3	6.7
4	96	82.6	3.8	2.7	7.2
5	73	84.8	3.4	1.7	7.7
6 LTAO	56	86.5	3.6	4.0	7.8
7	50	88.4	2.8	6.4	6.2
8	63	90.2	2.4	6.7	6.1
9	53	92.3	2.7	10.5	13.9
10	43	94.3	2.5	12.5	9.6
11	93	95.5	2.9	11.0	10.3
12	89	93.9	2.7	10.0	9.0
13	86	90.5	2.4	6.1	7.1
14 LTAO	59	87.7	2.7	3.3	6.8
15	114	84.2	3.5	1.6	7.6
16	97	80.7	4.3	−1.0	7.1
Average	79	86.8	3.3	4.5	7.8

Exhibit 6
Historic National Office Rental Growth

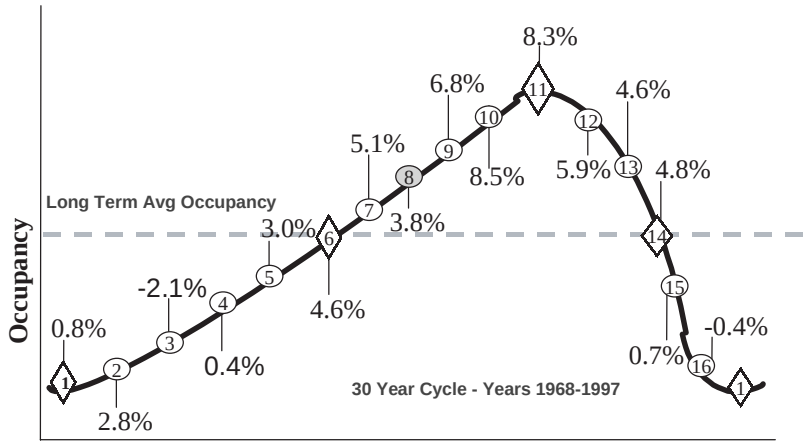


rate) at the trough of the cycle (point 1) and the standard deviation of the rates in different markets was 4.8%. The average occupancy was 86.5% at LTAO point 6 and 87.7% at LTAO point 14, and the average for all fifty-four markets was 86.8%, thus point 6 and point 14 are closely related to the long term average occupancy rate. Office occupancy rates reached their highest occupancy of 95.5% (vacancy equal to

Exhibit 7
Industrial Occupancy and Rental Growth Rates

Cycle Position	Observations	Occupancy Avg. (%)	Occupancy Std. Dev. (%)	Rental Growth Rate (%)	Rental Growth Rate Std. Dev. (%)
1	40	87.6	4.2	0.8	11.8
2	19	87.2	4.3	2.8	11.3
3	30	88.5	3.1	−2.1	12.2
4	22	88.8	2.4	0.4	8.1
5	16	89.8	2.7	3.0	12.3
6 LTAO	20	91.6	2.0	4.6	8.9
7	22	92.4	2.3	5.1	8.6
8	26	92.5	1.9	3.8	7.7
9	23	93.9	1.8	6.8	8.3
10	32	94.2	1.7	8.5	7.6
11	73	95.2	2.1	8.3	9.3
12	86	94.0	2.2	5.9	9.5
13	83	93.0	2.0	4.6	7.9
14 LTAO	63	92.0	2.2	4.8	9.4
15	79	91.0	2.5	0.7	8.3
16	63	89.5	3.1	−0.4	8.8
Average	44	91.3	2.5	4.9	9.4

Exhibit 8
Historic National Industrial Rental Growth %



4.5%) at point 11, the peak of the cycle. The standard deviation of occupancy rates steadily declined throughout the up cycle to a low of 2.5% at point 10, although the standard deviation at the peak point 11 was 2.9%. Occupancy rates declined during the down-cycle back to 70.7% (or 19.3% vacancy) in point 16 and standard deviations grew back to 4.3%. Thus, occupancy levels at different points in the cycle appear to be distinct and well defined across markets nationally by the methodology developed.

The rental growth rate average for the fifty-four office markets in Exhibit 6 was negative at cycle points 1 and 2, then was low but positive through the rest of the recovery phase of the cycle. Beginning at the long term average (point 6), rental growth jumped to 4% (approximately equal to long term average inflation levels) and increased to a high of 13.8% in point 10 (just one position before the cycle peak/ equilibrium point 11). Rental growth then steadily declined from the peak through the hypersupply and recession phases of the down cycle. The growth rate was again near inflation rates at 3.3% at point 14, the LTAO on the way down. Finally average rental growth rates dropped below inflation in the recession phase and became negative again at point 16. Thus, the theory of rental growth rates increasing in an up-cycle and decreasing in a down cycle is confirmed in general, on a national average basis.

Additionally, the national averages support the theory that rental growth rates will be above inflation when markets have occupancy levels above their LTAO and below inflation when markets have occupancies below LTAO. It is also interesting to note that the highest growth rate was not at the peak of the cycle (point 11), but one point before the peak. This is possibly due to the market looking forward from the peak year and reacting to the strong additional supply coming into the market. It could also be that the new higher rental rate base at pre-peak point 10 causes a lower percentage increase going forward even though the actual dollar increase in rent may

have been the same at point 11 as at point 10 (for example a $1.25 rent increase on a $10 base equals 12.5% for point 10, but the same $1.25 increase the next year on a $11.25 base equals an 11% increase). Thus, the rental growth equilibrium point (marginal rate of change going from positive to negative) may precede the demand/supply equilibrium point.

Industrial Occupancy and Rental Growth Rates

Exhibit 7 shows the national average industrial occupancy and rental growth rates plus standard deviations for each position in the cycle. Industrial occupancy rates averaged a low of 87.2% (vacancy of 12.8%) near the trough of the cycle (point 2 instead of point 1) and the standard deviation of occupancy rates was 4.2%. Industrial occupancy rates reached their highest rate of 95.2% (vacancy of 4.5%) at point 11, the peak of the cycle. The standard deviation of occupancy rates steadily declined throughout the up cycle to a low of 1.7% at point 10. The standard deviation rose slightly at the peak to 2.1%. Occupancy rates declined during the down cycle back to 89.5% (vacancy of 10.5%) at point 16 and standard deviations grew back to 3.1.

The average industrial rental growth rate for each cycle point are graphically shown in Exhibit 8. The industrial rental growth rate averages for fifty-four markets were low at the trough, but the growth pattern was erratic in the recovery phase averaging positive growth rates at cycle points 1 and 2, then negative at cycle point 3 (due to some strong outliers). Rental growth became strong and positive in position 5 and through the rest of the growth phase of the cycle. The 4.6% growth at point 6 is somewhat higher than inflation. The decrease at point 8 is unique and then a major jump with the highest growth rate at point 10 of 8.5%. This is a more erratic growth pattern than the office cycle. Rental growth then declined from point 10 to peak point 11 of the cycle just like office markets, then steadily declined during the hypersupply and recession phases of the down cycle. Rental growth at the LTAO point 14 was similar to LTAO point 6 at 4.6% and 4.8%, respectively. Growth dropped below inflation after point 14 and became negative again at point 16. Thus, the rental growth rate hypothesis is given moderate support in industrial markets, with some mixed results in the recovery phase where unexpected growth averages may be attributed to some outlier observations.

Test for Difference in Means in Rental Growth Rate Averages

Next, a test for difference in means was undertaken to see if the national averages were significantly different for each point in the cycle. ANOVA tests for differences of means were performed on rental growth rates. An *F*-Statistic of 15.78 (significant at 0.000) with 15 degrees of freedom was found for office and an *F*-Statistic of 5.08 (significant 0.000) for industrial, confirming that rental growth rates were different at each point in the cycle. However, in post hoc tests using Bonferroni multiple comparisons between cycle points, the results showed that the rental growth averages were not statistically distinguishable between one cycle point to the neighboring point, but were significantly different two cycle points apart. Part of this lack of differentiation between points may be due to the fact that each point was the national

average of up to fifty-four different markets and in some cases individual markets were found to be in the same point for more than one year. Thus, the distribution of rental growth rates was examined next.

Rental Growth Rate Distributions at Different Points

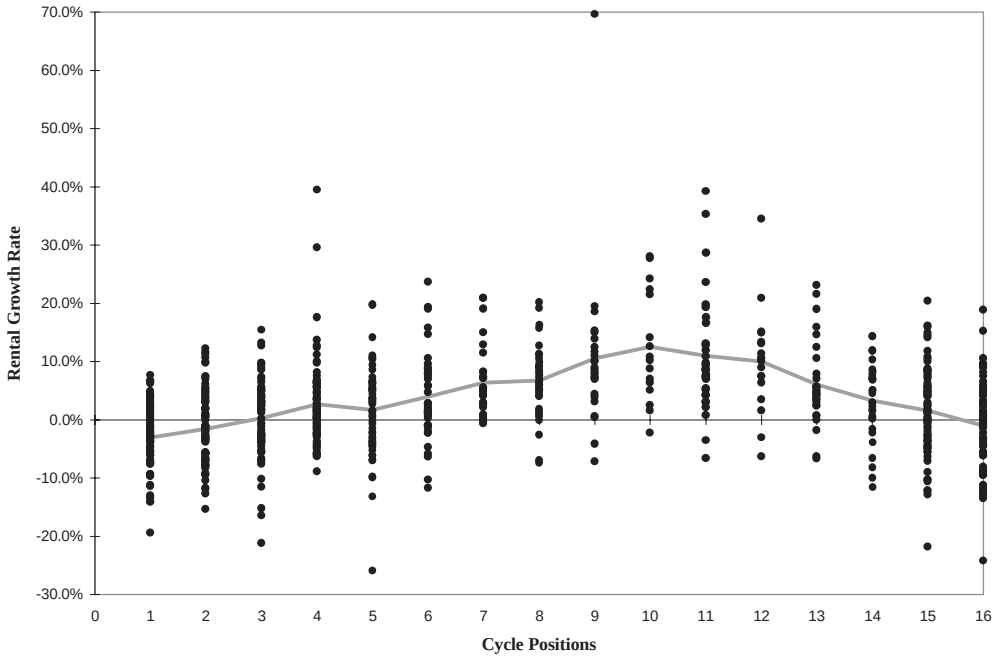
The additional hypothesis was developed and tested that states: Rental growth rate distributions among markets vary by cycle position, with distributions(measured by standard deviation) narrowing during an up cycle and widening during a down cycle. This theory assumes that variance in asking rents should be very wide at the bottom of the cycle and narrow as the market moves through the up cycle toward the cycle peak. This distribution tightening is the result of the market becoming more efficient as landlords take control from tenants and look to their competition for pricing—thus the bid-ask spread should narrow as the market improves. As the market goes through a down cycle, the rental growth rate distributions should steadily increase as the market becomes more chaotic, because some landlords hold fast to their asking rents while others fight for tenants by lowering rents to obtain tenants at any cost, causing the bid-ask spread or distribution of asking rents to widen until the market reaches the cycle trough. Then the cycle starts all over again. Thus, the a priori expected distribution in rent growth rates is one of narrowing as the market improves in an up cycle through recovery and expansion to the market peak, then widening through the down cycle (hypersupply and recession phases).

Distribution Results Office

Exhibits 5 and 9 show the distribution of rental growth rates of all fifty-four markets for each position in the cycle. Each dot in Exhibit 9 represents a different market's rental growth rate when it was at that defined point (1 through 16) in its market cycle. The line connects the average growth rate of all markets at that point in the cycle. While we cannot characterize each position as normally distributed, they are well clustered around the mean at most points. Thus, the mean is a reasonable representation for the national average rental growth rate. Exhibit 5 shows that the standard deviation of rental growth rates actually increased in the up cycle to point 9 and generally decreased in the down cycle from peak point 11, but Exhibit 9 shows that going past one standard deviation, the full range of growth rates widened in the up cycle and narrowed only slightly in the down cycle. Thus, the distribution theory does not hold generally for office markets.

Because this market cycle theory depends on the interaction of supply and demand factors, the data on these two factors was also analyzed. Office supply (new completions) is shown in Exhibit 10. Supply was high at the trough point of the cycle, averaging 7.7%, then dropped to 3%, on average, at cycle point 2 and stayed low through the recovery phase and into the first point of the expansion phase (point 7) just before the cost feasible rent level point. From the ''cost feasible rents'' cycle point 8, completion rates rose to a peak of 8.9% at point 13 (already over the top and through the hypersupply phase) and stayed strong through the rest of the down cycle. This confirms the fundamental relationship of supply growth being a major driver of

Exhibit 9
Office Rental Growth Distributions



market cycles and that supply growth is strongest after cost feasible rent levels are achieved at point 8 in the cycle. The amount of completion's varied widely by market, but smaller markets can easily have a higher percentage of completion's with just a few new buildings on a small size base. Further study of completion rates by market size is warranted.

Demand growth, which is characterized by average office absorption (Exhibit 11), also followed the fundamental cycle theory. Demand grew during the up cycle from a low of 2.2% at cycle point 1 to a high of 8.7% at cycle point 11 the peak, and then fell during the down cycle back to 4.4% at point 16. The standard deviation of absorption increased in the up cycle and remained stable in the down cycle. Thus, demand growth became more variable by market (some hot growth, some no growth markets) in the up cycle.

Distribution Results Industrial

Exhibit 12 shows the distribution of industrial rental growth rates for each position in the cycle. While these distributions can not be characterized as normal, they are again well clustered around the mean, such that the mean should be a fair representation of the growth rate during that point in the cycle. Unlike office, the standard deviation of industrial growth rates decreased generally in the up cycle to point 10, then decreased slightly in the down cycle only slightly (Exhibit 7).

Exhibit 10
Office Completions Distribution

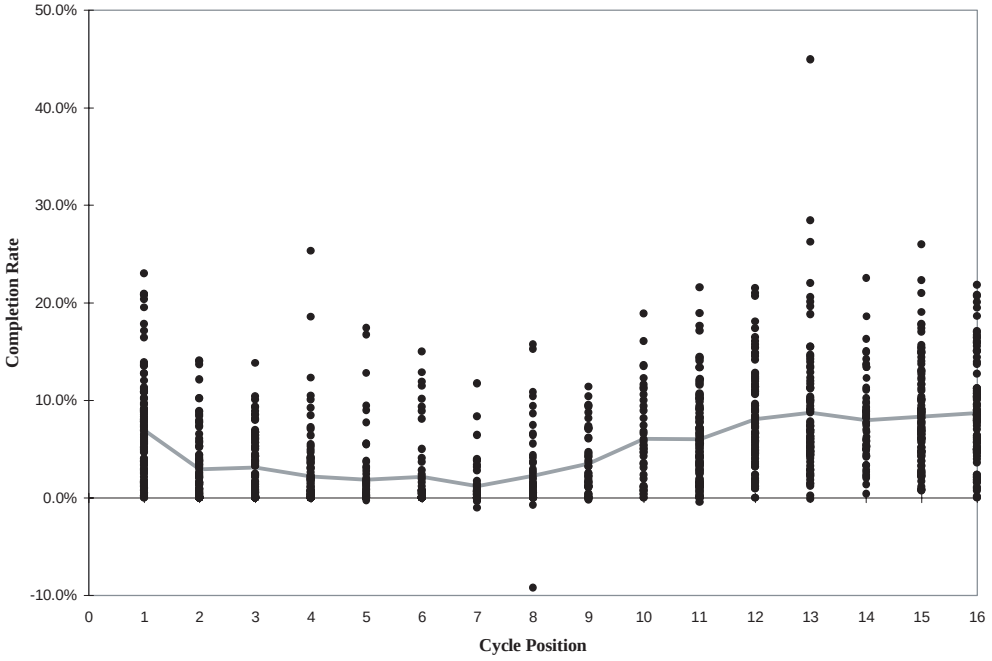


Exhibit 11
Office Absorption Distributions

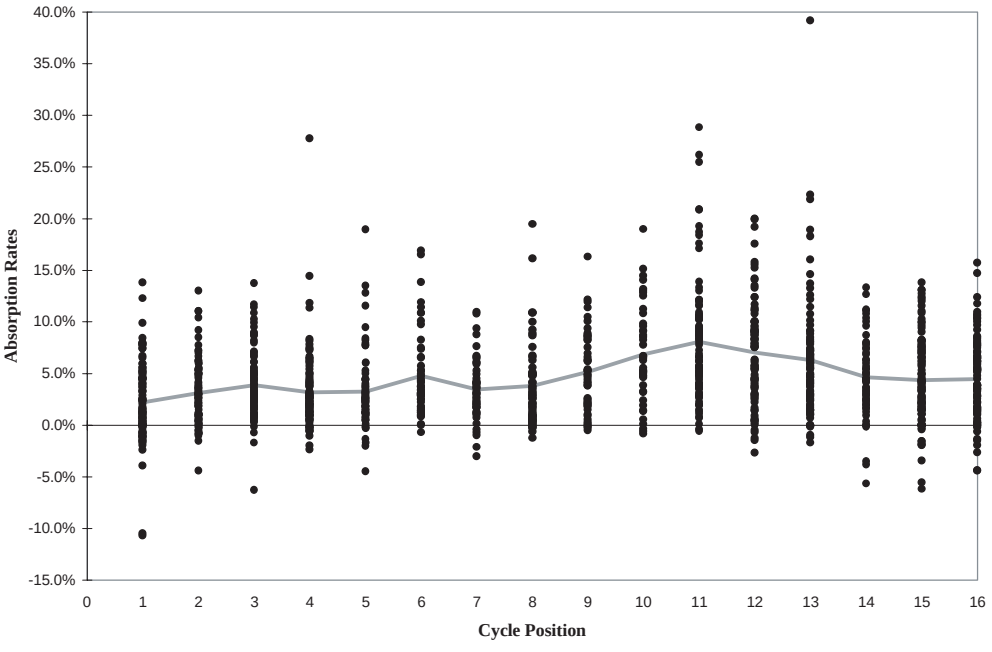


Exhibit 12
Industrial Rental Growth Distributions

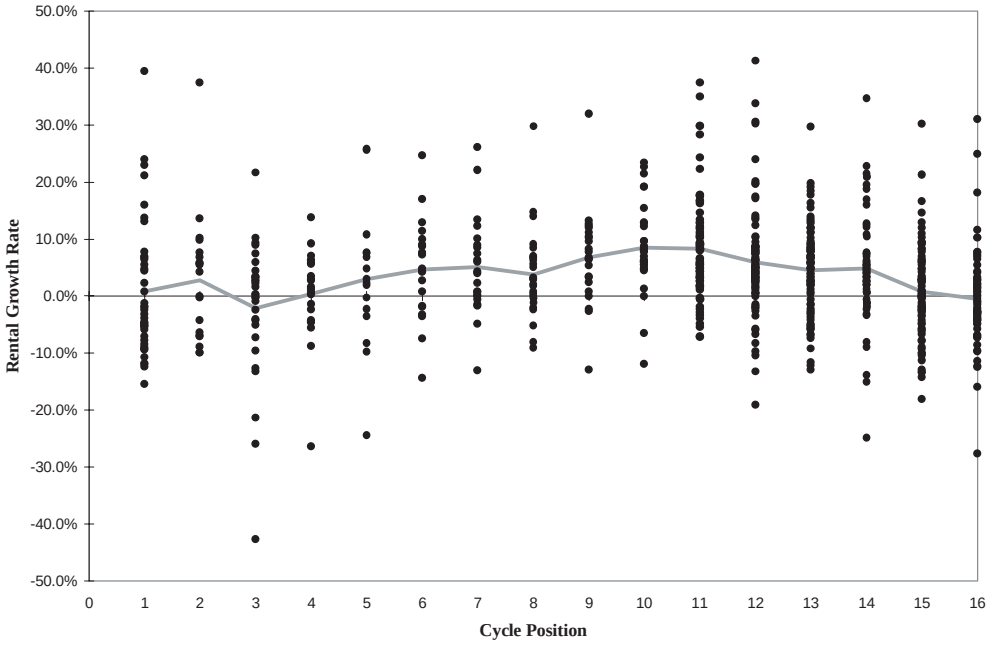


Exhibit 13
Industrial Completion Distributions

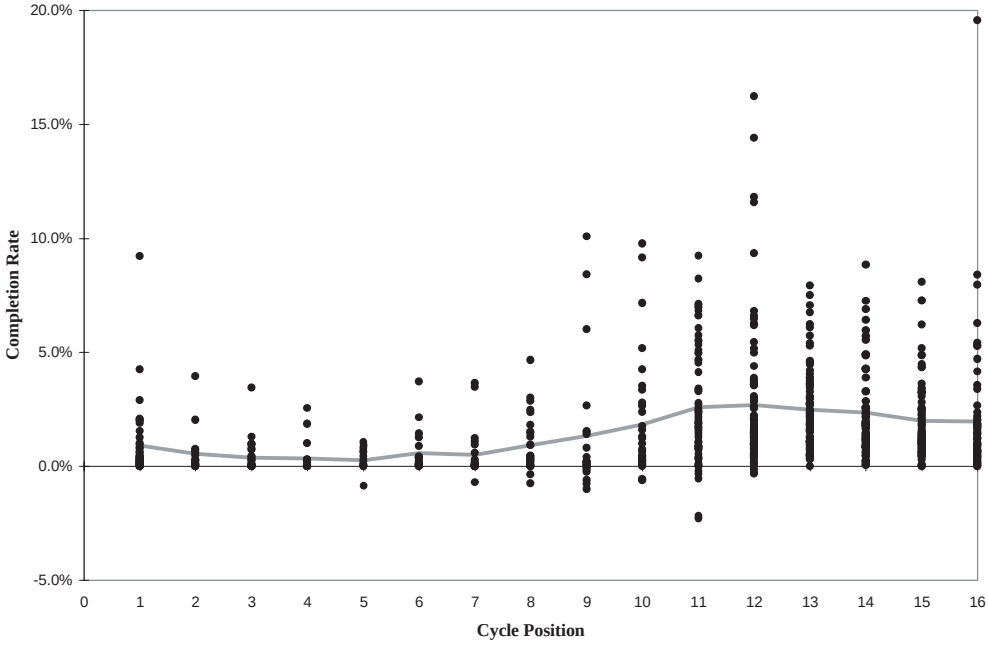
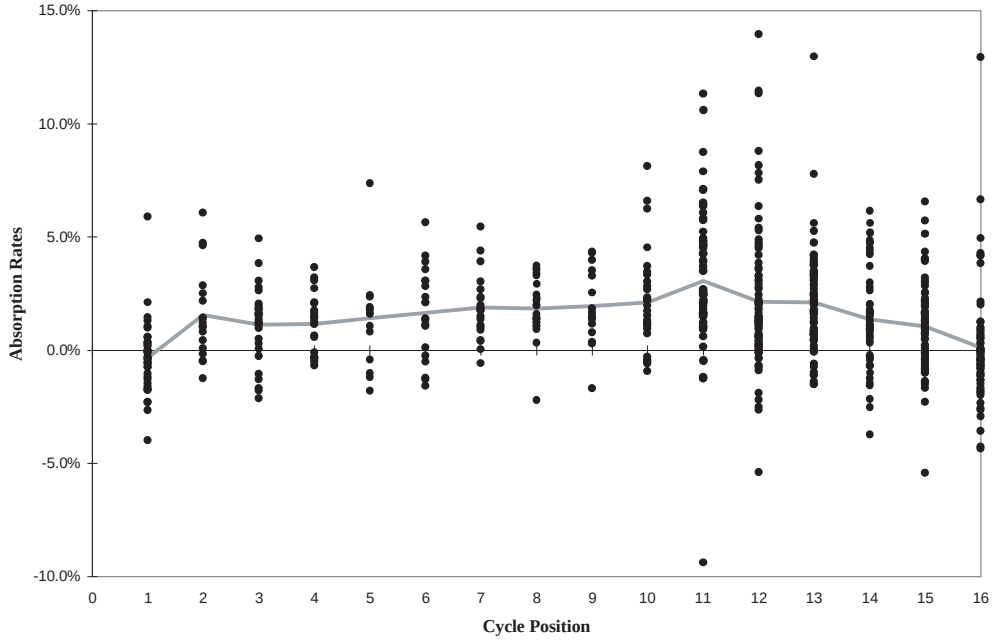


Exhibit 14
Industrial Absorption Distributions



This gives weak support to the distribution hypothesis in the up cycle, but not in the down cycle. Overall rental growth rate distribution both widened and narrowed through the cycle, so the distribution change hypothesis could not be confirmed.

The industrial supply (completion) average was low at the bottom of the cycle at 0.9%, then dropped more to 0.3%, on average, at point 5. It grew at point 6, declined at point 7, then from the cost feasible rents point 8 completion rates rose steadily to a high of 2.9% at point 11, the top of the cycle. Completions remained rather high, but slowly declined through the down cycle points as is characteristic of oversupply periods (Exhibit 13).

Demand as characterized by average industrial absorption also grew during the up cycle from a low of −0.3% to a high of 3.6% at the peak point #11 and then fell during the down cycle back to 0.1% at point 16. The standard deviation of absorption did increase in the up cycle and decline in the down-cycle (Exhibit 14). Thus, demand growth became more variable by market (some hot, some cold) in the up cycle, but consolidated in the down cycle which would not support the rental growth distribution hypothesis.

Conclusion

Physical market cycles driven by demand and supply interaction can be defined as an occupancy level cycle. This study analyzed occupancy level and rental growth interaction in office and industrial markets. The fifty-four markets studied proved to be relatively similar in their occupancy trends, which helped identify average market rental growth rates. Rental growth rates behaved as hypothesized, being low and negative at the bottom of the physical cycle, improving toward inflation levels at the long-term average occupancy (LTAO), then growing at higher rates toward the peak of the physical cycle. Rental growth rates were positive but steadily declined (marginal rate of growth negative) from the peak cycle point during the hypersupply phase of the down cycle. Rental growth rates dropped below inflation and went negative in the recession phase of the cycle.

These results lead to the conclusion that occupancy levels play a major role in determining rental growth rates in office and industrial markets throughout the U.S. These results could be used for making better investment decisions, as cyclical instead of linear rental growth rate estimates can be used by real estate investors in modeling future returns. Additionally, future rental growth rates may be more accurately estimated using demand and supply forecasts that are combined into a physical market cycle occupancy-estimating model. Investors, property managers and appraisers should carefully consider a market's cycle position in their analysis and decisions. One use of this work would be underwriting or appraising properties with increasing rental growth rates in the up cycle or at the cycle peak assuming declining rental growth rates in a discounted cash flow model. Rental growth is also a key to underwriting future real estate investment trust cash flows and earnings as their portfolio of properties has some percent of leases rolling over each year. Another use would be for asset managers who can plan to write shorter term leases during market up cycles to capture future rent increases and write longer leases at the cycle peak to maintain higher rents and thus higher property cash flow during the next down-cycle.

This research also analyzed rental growth rate distributions among fifty-four U.S. markets studied and did not find strong evidence that all market growth rates were tightly clustered around the national average. Thus, each individual market may need to be studied and modeled differently. Supply and demand distributions at different points in the cycle gave some but weak support to the national average rental growth being characteristic of most markets. Part of the difference between office and industrial cycles may be that industrial cycles have a lower amplitude or magnitude than the office cycles as supply is easier to produce in reaction to increasing demand. Thus, the market does not have as much time to react to changes in occupancy. The conclusion is that office and industrial national average rental growth rates appear to be relatively predictable by cycle point, except during the recovery phase of the industrial cycle.

Endnotes

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