OFFICE CAPITALIZATION RATES: WHY DO THEY VARY ACROSS METROPOLITAN MARKETS?

by Petros S. Sivitanides and Rena C. Sivitanidou

Acknowledgments
The authors gratefully acknowledge the National Real Estate Index (a Koll publication) and CB Commercial Torto-Wheaton Research for the data provided for this article.

Exemplifying the relationship between a property's net (operating) income and asset value, the capitalization rate is instrumental in the application of various methodologies for investment analysis. In the context of the direct capitalization approach, a market-extracted (ex-post) capitalization rate is typically applied to a real asset's achievable net income to yield an estimate of its value. In the context of the modern income approach, or discounted cash flow (DCF) methodology, the prevailing capitalization rate is often employed as a benchmark to yield a terminal capitalization rate, which, in turn, is used to derive a property's likely resale price and investment value.[1]

Given their widespread use in investment analysis methodologies, capitalization rates have been the focus of a growing body of empirical work. A first segment of this literature encompasses studies that have shed considerable light on the role capital markets and public policy variables (e.g., the stock earnings-price ratio, mortgage rates, expected inflation and changes in the tax code) have played in driving intertemporal movements in capitalization rates.[2] A second segment of the relevant literature involves studies that have explored the extent of those rates' cross-section variations. For example, several studies have examined variations in capitalization rates across broad property types and concluded that averaging these rates eliminates important information.[3] A few other studies have also attempted to explore *spatial* differentials in capitalization rates but, being limited in scope, they have only examined the extent of such differences across either broadly-defined regions or submarkets within given metropolitan areas. Moreover, such studies present limited attempts, if any, to unveil specific factors that may be responsible for shaping observed spatial variations in capitalization rates.[4]

A clear omission, then, in this cross-section research involves a question that is especially pertinent to institutional investors with geographically diversified holdings. This question entails the extent to which capitalization rates vary across metropolitan markets and, most importantly, the specific factors underlying such variations. The widely recognized segmentation of real estate markets along metropolitan boundaries renders such questions meaningful and important to address.

Petros S. Sivitanides, Ph.D., *is a research director at Westmark Realty Advisors in Los Angeles, California. His primary responsibilities include real estate market, property and fund forecasting, as well as advanced MPT applications for institutional real estate portfolios. Sivitanides holds a Ph.D. from M.I.T.'s Department of Urban Studies and Planning with a specialization in urban and real estate economics.*

Rena C. Sivitanidou, Ph.D., *is an assistant professor at the School of Urban Planning and Development, University of Southern California.*

Given the paucity of relevant research, this article is intended to shed light on the underlying determinants of intermetropolitan differentials in capitalization rates. Recognizing the existence of nontrivial variations across property types in such rates, this analysis focuses only on the case of cross-section differences in *office* capitalization rates. The second section of the paper develops a modeling framework for identifying metropolitan-specific factors which determine intermetropolitan differentials in office capitalization rates. Section three discusses the data and variable proxies employed in the empirical analysis, and the fourth section presents the empirical model used to test the effects of such variables and provides the empirical results. The concluding section summarizes the findings of the study, places them into a broader context and discusses potential avenues for future research.

A Simple Model Of Income And Asset Value

In defining a framework to explore the underlying determinants of interarea differences in office capitalization rates, a simple adjustment model is considered. This model builds on two fundamental premises. First, at any given point in time t, each metropolitan asset market is characterized by an implicit equilibrium capitalization rate, C^e_{jt}, that reflects the marginal investor's minimum required rate of return. Second, in light of inefficiencies in the real estate asset and space markets, capitalization rates tend to slowly adjust to those equilibrium values dictated by new market realities. As such, capitalization rates prevailing at any point in time may deviate from their equilibrium level. Given such a partial adjustment process, the relationship between C_{jt} and C^e_{jt} is described by (1), where δ denotes the speed by which C_{jt} adjusts toward C^e_{jt}.[5]

$$\ln C_{jt} = \delta \ln C^e_{jt} + (1-\delta)\ln C_{jt-1} \quad (1)$$

The identification, then, of the determinants of the prevailing capitalization rate requires modeling the determinants of the equilibrium capitalization rate, C^e_{jt}. Outlined in (2)-(5), such a model synthesizes the direct income capitalization and the DCF approaches as they pertain to an average property within a given metropolitan area j. Note that this model does not explicitly account for potential debt financing and taxes, as relevant data are not available for the individual transactions in each metropolitan area's sample.[6]

$$C^e_{jt} = Y_{jt}/P^e_{jt};\ P^e_{jt} = V^e_{jt} \quad (2)$$

$$V^e_{jt} = \sum_{n=1}^{T}\left[\frac{CF_{jt}}{(1+d_{jt})^n}\right] + \frac{SP_{jT}}{(1+d_{jt})^T} \quad (3)$$

$$CF_{jt} = \beta Y_{jt};\ SP_{jT} = Y_{jt}[(1+g_{jt})^{T+1}] / C_{jT} \quad (4)$$

$$C_{jT} = C^e_{jt} + r_{jt} \quad (5)$$

Following the typical income capitalization model, *Equation* (2) defines the equilibrium capitalization rate, C^e_{jt}, as the ratio of the net operating income (NOI), Y_{jt}, over the equilibrium transactions price, P^e_{jt}. As shown, the latter must equal *that* investment value, V^e_{jt}, reflecting the marginal investor's minimum required rate of return, or discount rate, d_{jt}. *Equations* (3)-(5) exemplify the conventional DCF model typically used by institutional investors in estimating investment value, V^e_{jt}. As shown by (3), the latter is the sum of two components. The first component is the present value of annual cash flows, CF_{jt}, expected to be realized during the holding period of T years; as shown in (4), CF_{jt} is assumed to be a constant percentage, β, of net operating income, Y_{jt}, which is, in turn, is assumed to grow annually at a constant rate, g_{jt}.

The second component is the present value of the property's resale price, SP_{jT}, at T; as shown in (4), SP_{jT} is estimated as the ratio of net operating income at time T+1 over a terminal capitalization rate, C_{jT}. Lastly, as indicated by (5), the latter is typically derived from the prevailing capitalization rate (which in *this* equilibrium formulation equals C^e_{jt}) by adding a premium, r_{jt}, that reflects the riskiness of future cash flows.

Incorporating (3)-(5) in (2) yields (6). Solving (6) for C^e_{jt} yields (7), expressing the equilibrium capitalization rate in terms of three sets of exogenous determinants: the discount rate d_j; the expected rate of growth of net income, g_{jt}, and the risk adjustment associated with the terminal capitalization rate. Lastly, incorporating (7) into (1) yields (8), the empirical formulation of the prevailing capitalization rate.

$$C^e_{jt} = \frac{Y_{jt}}{\beta Y_{jt}\left[\sum_{n=1}^{T}\left[\frac{(1+g_{jt})^n}{(1+d_{jt})^n}\right] + \frac{(1+g_{jt})^{T+1}}{(C^e_{jt}+r_{jt})(1+d_{jt})^T}\right]} \quad (6)$$

$$C^e_{jt} = c[d_{jt},\ r_{jt},\ g_{jt}] \quad (7)$$

$$\ln C_{jt} = \delta \ln C^e_{jt}(d_{jt},\ r_{jt},\ g_{jt}) + (1-\delta)\ln C_{jt-1} \quad (8)$$

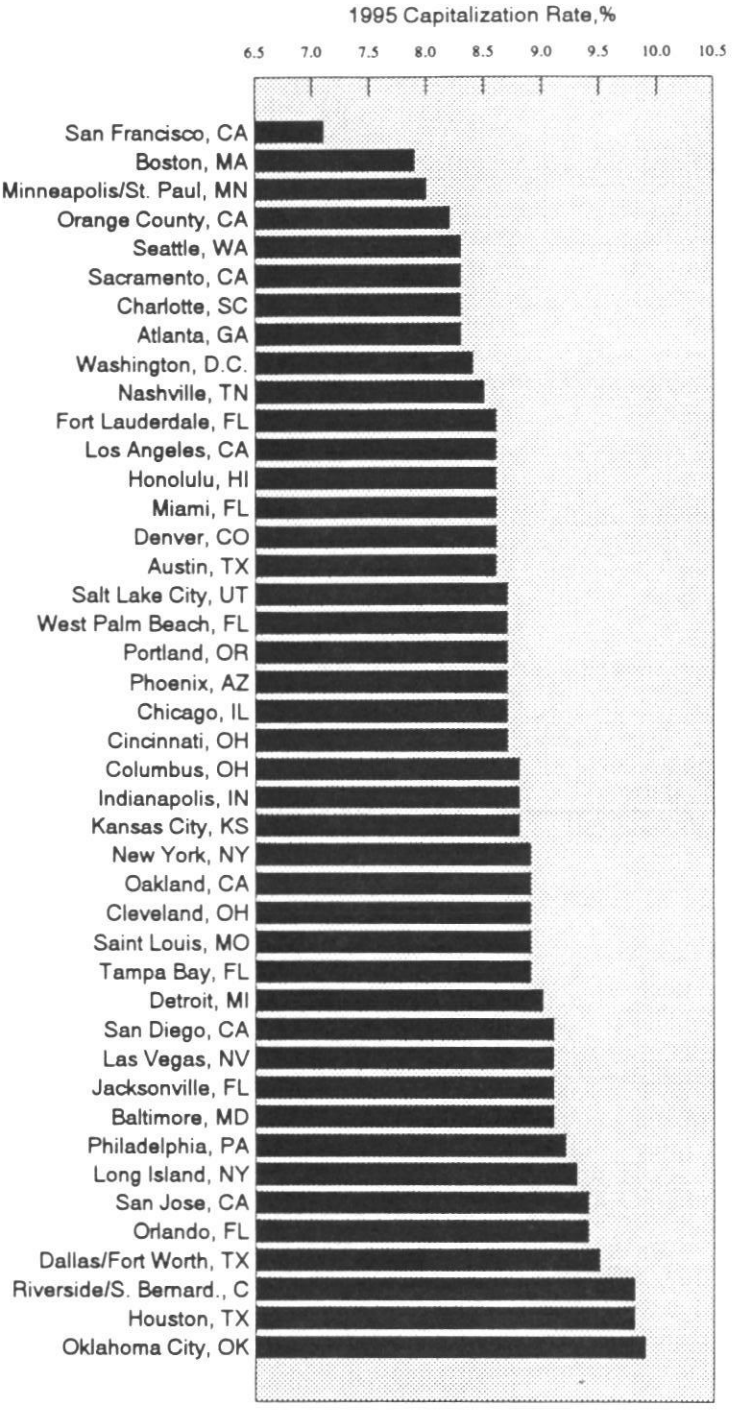
The Data And Variable Proxies

The empirical formulation in (8) sets the platform for the empirical analysis of cross-section variations in capitalization rates. What follows is a discussion of the market-extracted capitalization rates used in this analysis and the alternative empirical proxies developed for the three sets of explanatory variables embedded in (8).

FIGURE 1

Average Metropolitan Capitalization Rates

Metropolitan Area	Capitalization Rate, % 1995	1991
San Francisco, CA	7.1	7.1
Boston, MA	7.9	8.2
Minneapolis/St. Paul, MN	8.0	9.1
Orange County, CA	8.2	7.2
Seattle, WA	8.3	8.4
Sacramento, CA	8.3	8.7
Charlotte, SC	8.3	8.8
Atlanta, GA	8.3	8.7
Washington, D.C.	8.4	7.4
Nashville, TN	8.5	9.4
Fort Lauderdale, FL	8.6	9.3
Los Angeles, CA	8.6	7.4
Honolulu, HI	8.6	6.9
Miami, FL	8.6	11.0
Denver, CO	8.6	9.9
Austin, TX	8.6	10.0
Salt Lake City, UT	8.7	9.4
West Palm Beach, FL	8.7	9.7
Portland, OR	8.7	7.8
Phoenix, AZ	8.7	9.6
Chicago, IL	8.7	7.9
Cincinnati, OH	8.7	8.8
Columbus, OH	8.8	9.1
Indianapolis, IN	8.8	9.4
Kansas City, KS	8.8	8.7
New York, NY	8.9	8.1
Oakland, CA	8.9	8.3
Cleveland, OH	8.9	9.0
Saint Louis, MO	8.9	9.0
Tampa Bay, FL	8.9	8.9
Detroit, MI	9.0	8.5
San Diego, CA	9.1	8.2
Las Vegas, NV	9.1	9.4
Jacksonville, FL	9.1	8.8
Baltimore, MD	9.1	8.7
Philadelphia, PA	9.2	8.9
Long Island, NY	9.3	9.1
San Jose, CA	9.4	8.7
Orlando, FL	9.4	8.8
Dallas/Fort Worth, TX	9.5	9.4
Riverside/S. Bernard., CA	9.8	9.2
Houston, TX	9.8	9.1
Oklahoma City, OK	9.9	11.5
Average	8.8	8.8
Standard Deviation	0.5	0.9



Source: The National Real Estate Index (a Koll publication)

Capitalization Rates, C_j
Market-extracted capitalization rates for each of 43 metropolitan markets were obtained from the National Real Estate Index (a Koll publication). These metropolitan-wide capitalization rates reflect averages of transaction-specific ratios of actual NOI over the transaction price.

Although this analysis places emphasis on cross-section variations in the 1995 capitalization rates, for comparison purposes spatial variations in the 1991 capitalization rates are also examined. Referring to the fourth quarter of 1995 and 1991, these capitalization rates are portrayed in Figure 1. As seen from this figure, the 1995 estimates range from 7.1% in San Francisco to 9.9% in Oklahoma City; their mean and standard deviation are estimated at 8.8% and 0.5, respectively. Exhibiting a somewhat greater variability, the 1991 estimates range from 6.9% in Honolulu to 11.5% in Oklahoma City; their mean and standard deviation are estimated at 8.8% and 0.9, respectively. Although variations in neither 1995 nor 1991 are enormous, they are sufficiently large to induce substantial differences in investment value estimates.[7] A closer look, then, into their interarea determinants is warranted.

Variable Proxies
Appropriate proxies are discussed now for the three sets of determinants for capitalization rate variations across markets, including the discount rate, risk premium associated with the terminal capitalization rate and income growth expectations.

Discount rate (d). The conventional components of the discount rate include the real opportunity cost of investment capital, usually proxied by the riskless T-bill rate; expected inflation, often reflected in the difference between the short-and long-term T-bill rates; and several investment risk premiums. Given a nationally integrated capital market, only investment risk premiums are expected to vary across metropolitan areas. Thus, for the purpose of this cross-section analysis, only proxies for these premiums are developed.

Four such proxies, presumably shaping investor risk perceptions across metropolitan office markets, can be identified. The *first* involves the softness of the space market as reflected, for example, in the prevailing vacancy rate; the higher this rate, the higher the risk that rent growth forecasts will not be realized. The *second* encompasses the perceived construction risk or the tendency of the market to become oversupplied. This can be proxied by the completions rate, computed as the ratio of completions over the existing stock. The *third* includes the size of the office market as measured by the total inventory of office space or total office employment; smaller markets have not traditionally been favored by institutional investors and, as such, may be considered as having a higher liquidity risk. Lastly, the *fourth* involves the perceived volatility of a metropolitan economy that can be proxied by variables measuring the variability of historic metropolitan growth rates, the diversity of industrial structure or the sensitivity of the metropolitan economy to national influences.[8]

Risk premium associated with derivation of terminal capitalization rate (r). As already mentioned, the terminal capitalization rate used for the derivation of the sales price at the end of the holding period is calculated by adjusting current, market-extracted capitalization rates for the perceived riskiness of the income stream. Such riskiness is accounted for by the factors already discussed.

Expected income growth (g). The cash flow of a property is driven by its NOI which is, in turn, determined by rental rates. Therefore, expectations for cash flow growth are determined by expectations for rental growth. As such, the latter can be proxied by one or more of the following influential office market variables: changes in office rents, vacancy rates and total or office employment, as well as completion or absorption rates. Vacancy rate levels may also affect income growth expectations as markets with lower vacancy rates may be considered more likely to experience rent increases. Which of these variables best capture investor expectations for rental growth is an empirical question that can only be resolved through the estimation of (8).

The Empirical Model
The database used for the empirical analysis includes the capitalization rate data already discussed along with data on several office market variables obtained from CB Commercial, Torto Wheaton Research. The detailed empirical model specification was formulated after an extensive experimentation with a number of alternative definitions and lag structures of the variable proxies just discussed. The chosen specification of these proxies, the respective explanatory variable group they may represent, and their expected effects on capitalization rates are summarized in Table 1. Shown in (9), the empirical model incorporating these proxies assumes a log-log functional form proxying the nonlinearities embedded in (1) and (6). Note that under such a functional form both the dependent and all independent variables that do not assume negative values are in logarithmic form.

$$lnCAP = b_0 + b_1\ lnLCAP + b_2\ lnSTOCK + b_3\ lnCOMP + b_4\ ABS + b_5\ lnVAC + b_6\ lnGVOL \quad (9)$$

where:

LCAP : Lagged Capitalization Rate (lag = 6 quarters)
STOCK : Lagged Office Stock (lag = 2 quarters)
COMP : Lagged Completions Rate = Completions/Stock (lag = 4 quarters)
ABS : Lagged Absorption Rate or Absorption/Stock (lag = 4 quarters)
VAC : Lagged Vacancy Rate (lag = 2 quarters)
GVOL : Growth Volatility, estimated as the standard deviation of metropolitan employment growth rate during the preceding 5 years

Estimation Results

Table 2 presents the estimation results of (9), applied to both the 1995 and 1991 capitalization rates. The discussion first focuses on the 1995 estimates. Two useful insights are gained from the inspection of the estimation results:

(i) Differences in market conditions play an important role in shaping intermetropolitan variations in office capitalization rates.

TABLE 1

Variable Proxies and Expected Effects on Capitalization Rates

Variable	Proxy for	Expected Effect on Capitalization Rate
Vacancy Rate, *VAC*	Risk Premium, Income Growth Expectations	Positive Positive
Lagged Completions Rate, *COMP*	Risk Premium, Income Growth Expectations	Positive Positive
Lagged Absorption Rate, *ABS*	Income Growth Expectations	Negative
Office Market Size, *STOCK*	Risk Premium	Negative
Job Growth Volatility, *GVOL*	Risk Premium	Positive

This conclusion is reflected in the solid performance of critical office market variables such as the vacancy rate, *VAC*, the completions rate, *COMP*, the absorption rate, *ABS*, and the size of the office market, *STOCK*. In particular, the significant positive signs of the marketwide vacancy rate, *VAC*, and the lagged completions rate, *COMP*, most likely indicate that investors require a risk premium or adjust downwards their income growth expectations when investing in markets with higher vacancy or completion rates. Similarly, the significant negative effect of lagged absorption, *ABS*, may mirror the upward adjustments in investor income growth expectations in office markets with higher absorption rates. The negative effect of office space inventory, *STOCK*, is consistent with the argument that real estate investors place a risk premium when investing in properties located in smaller cities. Lastly, the interest of real estate investors in markets that are more stable than others is signified by the statistical significance of *GVOL*, whose positive sign may reflect the risk premium investors require when buying assets in volatile markets.

(ii) On average, office capitalization rates appear not to adjust rapidly in response to changes in metropolitan office market conditions.

Such a conclusion is bolstered by the significance and magnitude of the coefficient of the lagged capitalization rate, *LCAP*. Estimated as one minus this coefficient, the average adjustment speed embedded in these empirical results is well below unity, the value that signifies an instantaneous adjustment process.[9]

The Empirical Results Using The 1991 Capitalization Rate

By and large, conclusions similar to those just advanced can be reached through the inspection of the estimation results pertaining to the 1991 capitalization rates. Yet some variables appear to exert weaker effects than those uncovered by the results pertaining to the 1995 capitalization rates. As shown in Table 2, the effect of *GVOL*, capturing growth volatility, and *COMP*, measuring the lagged completions rate, appear to be statistically insignificant predictors of the 1991 capitalization rate. As such insignificance cannot be attributed to collinearity effects, a plausible explanation may lie in recessionary forces that might have put additional strains on already oversupplied office markets in 1991. In light of such dismal market conditions, it is quite likely that the past completions rate and the historic volatility of the economy alike became less relevant as risk measures.

Conclusion

This article lends credence to the argument that interarea differentials in office capitalization rates *do exist*, thereby suggesting that institutional investors

TABLE 2*

Estimation Results
Dependent Variable: Natural Logarithm of the Capitalization Rates

	Parameter Estimates[b]	
Independent Variables[c]	**1995**	**1991**
VAC	0.0767	0.0876
	(3.32)	(3.20)
COMP	0.0051	0.0036
	(1.75)	(0.69)
ABS	−0.8362	−0.6544
	(−2.46)	(−2.13)
STOCK	−0.0129	−0.0260
	(−1.98)	(−2.80)
GVOL	0.0111	0.0031
	(1.60)	(0.28)
LCAP	0.6507	0.6022
	(6.86)	(7.87)
CONSTANT	−3.536	−3.2586
	(−14.04)	(−12.84)
Number of Observations	43	43
R-Squared	0.75	0.85
Adjusted R-Squared	0.71	0.83

[a] The results presented here are based on OLS (Ordinary Least Squares)
[b] T-statistics in parenthesis below the coefficients
[c] All independent variables but ABS are expressed in natural logarithms

account for such variations when valuing diversified real estate holdings across metropolitan office markets.

The empirical findings suggest that such variations are largely determined by differences in critical office market variables that presumably shape investor income growth expectations and risk perceptions. Such variables include the vacancy rate, completions rate, absorption rate, the size of the market and the historic volatility of the metropolitan economy. Lastly, the estimation results are consistent with the assertion that, on average, capitalization rates do not respond very rapidly to changing market conditions.

The comparison between the 1995 and 1991 estimation results suggests that real estate cycles may also influence the effect of the factors just discussed. Thus, future analysis of such rates should explore the significance of cyclical real estate movements and the relative importance of the time-varying and cross-section effects of these factors. Such analysis will hopefully provide additional insights into the underlying determinants of capitalization rates and, perhaps, shed more light on the partial adjustment processes that seem to underlie movements in such rates.

NOTES

1. The DCF model undeniably represents the valuation approach most commonly used by the institutional real estate investment community. The thinness of the commercial real estate market, signified by the small number of transactions (due to few bids to buy or offers to sell), the illiquidity of commercial real estate assets, as well as the lack of readily available information on market prices clearly render such approach preferable over traditional market or sales comparison methodologies. See Gibbons, James: "What to Do About Capitalization," *The Appraisal Journal*, October 1986, pp. 618-623.
2. See Ambrose, Brent and Hugh Nourse: "Factors Influencing Capitalization Rates," *Journal of Real Estate Research*, Volume 8, Number 2, Spring 1993, pp. 221-237; Evans, Richard: "A Transfer Function Analysis of Capitalization Rates," *Journal of Real Estate Research*, Volume 5, Number 3, Fall 1990, pp. 371-379; Froland, Charles: "What Determines Cap Rates in Real Estate," *Journal of Portfolio Management*, Number 13, 1987, pp. 77-83; Nourse, Hugh: "The 'Cap Rate', 1966-1984: A Test of the Impact of Income Tax Changes on Income Property," *Land Economics*, Volume 63, Number 2, 1987, pp. 147-152; Fisher, Jeffrey, George Lentz and Jerrold Lentz: "Tax Incentives for Investment in Non-Residential Real Estate," *National Tax Journal*, Volume XXXVII, Number 1, March 1984, pp. 69-87.
3. See Ambrose, Brent and Hugh Nourse: "Factors Influencing Capitalization Rates," *Journal of Real Estate Research*, Volume 8, Number 2, Spring 1993, pp. 221-237; Dokko, Y., R.H. Edelstein, M. Pomer, and E.S. Urdang: "Determinants of the Rate of Return for Nonresidential Real Estate: Inflation Expectations and Market Adjustment Lags," *AREUEA Journal*, Volume 19, Number 1, 1991, pp. 52-69.
4. Sirmans, C.F., Stacy Sirmans and Ben Beasly: "Income Property Valuation and the Use of Market Extracted Overall Capitalization Rates," *The Real Estate Appraiser and Analyst*, Summer 1986, pp. 64-68; Saderion, Zahra, Barton Smith and Charles Smith: "An Integrated Approach to the Evaluation of Commercial Real Estate," *Journal of Real Estate Research*, Volume 9, Number 2, Spring 1994, pp. 151-167; Grissom, T., D. Hartzell, and C. Liu: "An Approach to Industrial Real Estate Market Segmentation and Valuation Using the Arbitrage Pricing Paradigm," *AREUEA Journal*, Volume 15, Number 3, 1987, pp. 199-219; Hartzell, D., J. Hekman, and M. Miles: "Diversification Categories in Investment Real Estate," *AREUEA Journal*, Volume 15, Number 2, 1987, pp. 98-109.
5. A similar notion has been advanced in the analysis of rates of returns. See Dokko, Y., R. H. Edelstein, M. Pomer, and E.S. Urdang: "Determinants of the Rate of Return for Nonresidential Real Estate: Inflation Expectations and Market Adjustment Lags," *AREUEA Journal*, Volume 19, Number 1, 1991, pp. 52-69. Also see Pindyck Robert and Daniel Rubinfeld, *Econometric Models and Economic Forecasts* (New York: McGraw-Hill, Inc., 1991), pp. 208-209.
6. The band of investment approach should be used for the calculation of ex-post capitalization rates derived from transactions that involve debt financing. For more information on this approach see Ambrose, Brent and Hugh Nourse: "Factors Influencing Capitalization Rates," *Journal of Real Estate Research*, Volume 8, Number 2, Spring 1993, pp. 221-237; Nourse, Hugh: "The 'Cap Rate', 1966-1984: A Test of the Impact of Income Tax Changes on Income Property," *Land Economics*, Volume 63, Number 2, 1987, pp. 147-152; and Webb, James and C. F. Sirmans,"Yields and Risk Measures for Real Estate, 1966-1977," *Journal of Portfolio Management*, Volume 7, Number 1, 1988, pp. 14-19.
7. See Brueggeman, William and Jeffrey Fisher, *Real Estate Finance and Investments* (Boston, MA: Irwin, 1993), p. 441.
8. Such measures were obtained from Regional Financial Associates, *Precis: Metro Edition* (West Chester, PA: Regional Financial Associates, 1996) Volumes 2 and 3.
9. Given (1), an adjustment speed that takes the value of 1 signifies an instantaneous adjustment to new market conditions. In contrast, an adjustment speed close to zero signifies an extremely slow adjustment process. Given the cross-sectional nature of this analysis, the estimated adjustment coefficients are "average". Differences in speeds of adjustments across metropolitan markets can only be discerned through time series analysis.