The Variation of Capitalization Rates across Submarkets within the Same Metropolitan Area

by

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Submitted to the Department of Urban Studies and Planning on August 5, 2004
in partial fulfillment of the Requirement for the Degree of
Master of Science in Real Estate Development

at the
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ABSTRACT

This paper investigates the variation of capitalization rates across submarkets within the same metropolitan area by using a database with 73 transactions of office properties located in nine submarkets of Atlanta during the period from the third quarter of 2000 to the second quarter of 2003. The results show that capitalization rates are quite predictable at the submarket level. Movements of capitalization rates are shaped by local market information, national capital market information and characteristics of individual property. The study also examines the behavior of real estate investors in forming their expectations of future income streams. A cross-sectional model with time dummy variables is used in this paper.

Thesis Supervisor: William C. Wheaton
Title: Professor of Economics
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CHAPTER 1 - INTRODUCTION

1.1 Background

In real estate, the capitalization rate is traditionally used to capture the relationship between the current net operating income and property value. It measures the ability of a property to generate future incomes after deducting from operating expenses and normal vacancy but before deducting financing charges and income taxes. The capitalization rate is very closely related to the overall return of a property before financing and taxes, and it is used worldwide.

1.2 Roles of Capitalization Rates

To further recognize the important role of the capitalization rate in real estate, three major fields that heavily rely on the capitalization rate need to be specified. First of all, the capitalization rate plays a particularly important role in property valuation for real estate investors. Compared to the discount cash flow (DCF) valuation model, discounting the forecasted cash flows by explicating the appropriate risk and return factors of the investment, the capitalization rate looks more like a short-cut and does not completely represent the overall return of a property. As a comparable measure, however, it actually reflects the investors’ perceptions of risk and expectations of returns by converting the market expected income stream from a commercial property into an estimate of asset market value by dividing the net operating income stream by the expected capitalization rate (Brueggeman and Fisher, 1993).
Secondly, market analysts use the capitalization rate as a very good measure to interpret the real estate market development. Fundamentally, the capitalization rate should reflect the information driven from real estate space market. On the other hand, the real estate market, as an asset market, should be integrated into the whole capital market due to the competitive national capital market. The capitalization rate representing investors’ perceptions of risk and expectations of returns is comparable to some financial parameters, such as corporate P/E ratio, interest rate, and S&P 500 index. Thus, movements of capitalization rates provide a good index to track the development of the real estate market by shedding the light on the link between real estate space market and national capital asset market.

Finally, the academics often apply the capitalization rate to test for market efficiency, especially for the private real estate market. The capitalization rate reflects heterogeneous investors’ expected returns across different local real estate markets, which usually have different amounts of inherent investment risk. Due to the degree of market information efficiency, investors might have different perceptions of risk for the local markets with the same profile of risk, and meanwhile the impacts on capitalization rates from space markets may be lagged. Many academics have researched and are working on such studies about the segments of the real estate market by analyzing capitalization rates across different markets.

1.3 Objectives and Findings
Motivated by the importance of the capitalization rate, this paper attempts to explore the variation of capitalization rates across submarkets within the same metropolitan area. The study examines seventy-three transacted properties across nine submarkets in Atlanta during the period from the third quarter of 2000 to the second quarter of 2003, when market rents and the interest rate dropped dramatically. The data includes characteristics of properties such as ages and floors, and submarket information such as market size, annual absorption and completion, vacancy rate, and rental growth.

The results of this paper show that capitalization rates are strongly predictable at the submarket level. Characteristics of property, such as age and floor, are very important determinants of the capitalization rate by affecting investors’ perceptions of risk and expectations of rental income. Movements of market-specific capitalization rates exhibit a high incorporation with the national capital market, as well as with local office-market features, including space stock level, absorption rate, and past rate of rental income growth. The study also discusses whether real estate investors use a ‘backward-looking’ approach or a ‘forward-looking’ in forming their expectations of future incomes.

The rest of this paper is structured as follows. First, it reviews some empirical work on capitalization rates, and then states methodology in the third section. The fourth section describes data and some estimations, while laying out the modeling framework in the fifth section. The estimation results appear in the sixth section. A final conclusion and future desirable research are discussed in the seventh section. The references are attached on the last pages.
CHAPTER 2 – EMPIRICAL WORK

As the capitalization rate is such a valuable measure in estimating property valuation, interpreting real estate market development and testing for market efficiency, it is not surprising that there are such extensive empirical studies on the capitalization rate (or return). The research can generally be separated into three main camps in terms of the different market contexts they focus on.

2.1 Capitalization Rates in a Global Context

First of all, some research study capitalization rates in a global context. The recent papers include: Case et al. (1999) examine the impact of changes in GDP on property returns. They find that the international GDP and country-specific GDP have the explaining power for movements of indirect real estate returns. Ling and Naranjo (2000) perform a cross-country analysis on indirect real estate returns. They report that country-specific effects drive indirect real estate returns. Eichholtz and Huisman (1999) investigate the cross section differences between expected excess returns on the international shares. The results show that market size and interest rates have important influences on excess property share returns. Wit and Dijk (2003) examine the determinants of direct office real estate returns by analyzing a global database across Asia, Europe, and the United States. They find that gross domestic product, inflation, unemployment, vacancy rate, and the available stock all have an impact on real estate returns.

2.2 Capitalization Rates Linked to National Market
The second camp of the empirical literatures investigates the variation of capitalization rates by linking it to national economic variables. For examples, Fisher, Lentz and Stern (1984) and Nourse (1987) explore the relation between capitalization rates and tax regimes by using data from the American Council on Life Insurance (ACLI). They report changes of capitalization rates when real estate related tax law changed. Froland (1987) looks at impacts on capitalization rates from the competitive asset trading market, using quarterly capitalization rates for apartments, retail, office, and industrial property from the first quarter of 1970 through the second quarter of 1986. He finds particularly strong correlations of capitalization rates with mortgage rates, ten-year bond rates, and corporate P/E ratio. Chandrashekaran and Young (2000) create a sector model and then used it to its predictive power when they find interactions between capitalization rates and S&P 500, inflation measures and inflation and default spreads. It is worth to note that these studies above usually only involve the time-series movements of capitalization rates without cross-section variants.

### 2.3 Capitalization Rates on Local Market Scale

Some research study that local real estate market information should have strong effects in shaping capitalization rates. In these studies, the authors usually apply the cross-sectional analysis method to explore the variation of capitalization rates across broad property types or different metropolitan areas. Ambrose and Nourse (1993) use data from the American Council of Life Insurance (ACLI), and find the regional variation of capitalization rates by defining some national real estate market areas as North, South, East and West. Jud and Winkler (1995) draw other financial theoretical under-pricings of
the WACC and CAPM models to develop a theoretic model of the capitalization rate for real estate properties. By using the National Real Estate Index panel database of twenty one metropolitan areas for fifteen half-year periods starting in the second half of 1985, they find that movements of capitalization rates are strongly related to changes in capital market returns, but the adjustments have significant lags and market relationships vary across local areas. Sivitanidou and Sivitanidies (1999) look at metropolitan-specific office capitalization rates and report serial correlation in area-specific time trends, by using a panel approach to analyze office market capitalization rates in seventeen metropolitan areas over the period of 1985-95. Sivitanides, Jon Southard, Torto and Wheaton (2001) apply a panel approach to study how capitalization rates vary across metropolitan markets and time by systematically examining NCREIF data. The database includes data across fourteen metropolitan areas for sixteen years starting in 1983. They report that local market factors play an extremely important role in the variation of capitalization rates, and that appraisal-based valuation is more “backward” than “forward” looking.

With studies of the third camp, people realized that the real estate market is segmented in some aspects, particularly in the boundary of metropolitan areas. However, there are very little studies to explore the spatial differences in capitalization rates on individual properties, especially across submarkets within the same metropolitan area. The reason might be the lack of data of individual property cross-sections or time series. Some recent exceptions are: Hendershott and Turner (1999) and Janssen, Soderberg and Zhou (2001) do research in individual property context, by both using 403 property transaction-based
capitalization rates in Stockholm from the second quarter of 1990 to the second quarter of 1992. Hendershott and Turner calculate ‘constant-quality’ capitalization rates across three property types and five semiannual periods, by using variables including density of land use, building age, property type, a measure of below-market financing and time dummy variables. They uncover that building quality adjustment and property types are very important in determining capitalization rates. This paper also reports a location factor by using location dummy variables. Janssen, Soderberg and Zhou use hedonic models to explain capitalization rates across building types, ages and four specific locations. They find that capitalization rates significantly depend on property features. Clayton, Geltner and Hamilton (2001) study 202 appraisals on 33 properties in Canada over the period of 1986-96. Rather than the issue of cross-sectional determinants of valuations, they are more concerned with the smoothing issues of time-series appraisal.

2.4. Market Context This Paper Focuses On

Against the background that there are rare studies investigating the capitalization rate in the submarket context, this paper will explore the variation of capitalization rates across nine submarkets within the Atlanta metropolitan area by using seventy-three office property transaction-based data and a cross-sectional analysis approach. The results show that characteristics of properties, submarket real estate information, and national capital market have strong influences on capitalization rates.
CHAPTER 3 - METHODOLOGY

3.1 Capitalization Rates in Efficient and Equilibrium Market

As mentioned before, the capitalization rate is the ratio of future net operating income (NOI) to property value. The property value here should be determined by the interplay between the demands from asset market and the supply from space market. If the market is perfectly efficient and competitive enough, the property value should be the transaction price, as well as the present value of the future net income the property is expected to generate. In other words, the capitalization rate can be depicted as

\[
\text{Cap rate} = \frac{\text{NOI}_1}{\text{PV \ (of \ property)}}
\]

\[
\text{PV \ (of \ property)} = \frac{\text{NOI}_1}{1+i} + \frac{\text{NOI}_2}{(1+i)^2} + \ldots + \frac{\text{NOI}_t}{(1+i)^t}
\]

To simplify, Formula (2) assumes that the discount rate \((i)\) keeps constant during the property expected holding period. For the theory of market efficiency, \((i)\) represents the minimum required rate of return for marginal investors. It should and must reflect the appropriate risk of expected cash flow. The future income stream would not change if the space market is in equilibrium. The equilibrium is explained by the combination that the vacancy rate is equal to a natural vacancy rate and that the expected rental growth is the same as the depreciation rate forever (Hendershott and Turner (1999)). In addition, if the investors do not change their perception of risk, the property value would not change either. Thus, in such an ideal environment, the capitalization rate would not change.
Of course, markets are not always in equilibrium. Empirical evidence has shown that the property space market seems to exhibit periodic movements of overbuilding and underbuilding where vacancy rates and rent deviate significantly from equilibrium values. Furthermore, the space market and even the capital market are not completely efficient. The interplay between the asset market and the space market is not non-friction. The heterogeneous investors would have different perceptions of risk and these perceptions vary by time. These factors cause movements of property values, especially in heterogeneous markets. Empirically, values and rents do not move one for one, and theoretically we would expect values to move less cyclically than rents (Wheaton, 1998). All of those result in the variation of capitalization rates across markets and time series.

3.2 Decomposition of Capitalization Rate

To better understand movements of capitalization rates, we will continue to decompose the capitalization rate. If the future net income is expected to grow at a constant rate \( g \) forever, \( \text{NOI}_t = \text{NOI}_{t-1} \times (1+g) \), mathematically it is able to get a more simplified equation, Cap rate = \( i - g \). Moreover, the discount rate \( i \), which reflects both capital opportunity costs and market risk, can be split into two other components, risk free rate \( r_f \) and appropriate risk premium \( r_p \), respectively. Therefore we are able to express the capitalization rate as

\[
\text{Cap rate} = r_f + r_p - g
\]  

(3)
3.2.1 Risk-free Rate

It seems to be obvious that the using of the risk free rate is a valuable measure of risk, as all investors have to compete hard for capital in an ‘integrated’ national capital market. The risk-free rate presents the time value of assets, and theoretically it reflects a guaranteed return without any risk. Thus, it is reasonable that investors in real estate expect a higher return, which results in a higher capitalization rate, in response to rises of interest rate. Although the 10-year Treasury bill rate does not perfectly match the risk free rate as the Treasury bill has default risk and there are different profiles of liquidity risk between real estate assets and finance assets, Sivitanides, Jon Southard, Torto and Wheaton (2001) have shown that the 10-year Treasury rate “worked better than other masteries and is consistent with the conventional view of real estate as a long-term investment vehicle”.

3.2.2 Risk Premium

The risk premium component is much more difficult to quantify than the risk free rate. In finance, arbitrary portfolio theory (APT) proves that risk premium should include any risk associated with individual property, and its return should be the rate of overall return net the risk free rate.

Empirically, there are three main factors affecting the property risk premium. First, national capital market information should have an impact on the risk premium (Sivitanides, Jon Southard, Torto and Wheaton (2001)). When interest rate rises, it not only adjusts the risk free rate mentioned above, but also changes risk perspectives of
investors. They might ask more or less price for a ‘unit’ of risk. Second, local market factors should matter as well (Sivitanidou and Sivitanidies (1999), and Grissom, Hartzell and Liu (1987)). Risk perceptions should be shaped by some specific structural features of the metropolitan area or of its submarkets. Those features include market size, vacancy level, annual absorption and completion, employment, GMP, and so on. Third, characteristics of the property, such as age, floor, location, and density of land use, are most likely to influence the investors’ perceptions of risk (Hendershott and Turner (1999)) and expectations of rental growth. A building with a superior location might be less risky for investors than a building in an inferior area in generating a future income stream if all other variables are held constant.

3.2.3 Expected Rental Growth Rate

If we split the expected rate of rental growth into the expected rate of real rental growth and expected general inflation growth rate, it would be relatively easier to clarify the factors driving expectation of income growth. As a national economic factor, the expected general inflation rate should have an impact on the capitalization rate. When the inflation rate is predicted to be higher, real estate investors will expect a higher growth rate in rental income. They would like to pay a higher price to acquire the property now and accept a lower capitalization rate.

In real estate, the estimation of the growth rate of future income is usually based on market rents, as the existing lease structure often causes significant lags between changes in market rent and changes in property income. Thus, the expected rate of real rental
growth is replaceable by the expected growth rate of real market rent, which is largely determined by the level of expected local space market demand and supply. At the submarkets level, the demand and supply of space market is mainly reflected by vacancy rate and annual absorption and completion rates. Furthermore, the characteristics of property might affect the future growth rate of rental income as well. The buildings with different ages could have different expected rental growth rates because of their different abilities to generate future cash flows and their different expected obsolescence rates.

To further understand the expected growth rate of real market rent, however, it is very important to know another theory about the movements of the real estate market. Wheaton (1998) points out that real estate markets always exhibit periodic episodes of under-building and over-building, suggesting that prices or rents are typically mean-reverting, stationary series. The property markets are not random walks, and movements of markets are quite predictable. This theory provides a good judgment of whether the market expectation is ‘forward-looking’ or ‘backward-looking’, which reflect the degree of efficiency for real estate markets. When the market rent is at or near historic highs, rational investors should anticipate a lower subsequent income growth when they use the ‘forward-looking’. If the market rent is near a historic low, the rational investors should have a higher growth expectation. On the other hand, if the investors like to use the ‘backward-looking’ method, they would have opposite expectations when the rent is at historic highs or lows. That is, when the market is up, they will assume that this growth will continue even further and have a higher expected growth rate than the rational investors have.
CHAPTER 4 - DATA AND ESTIMATIONS

4.1 Overview

The data is supplied by Real Capital Analytics (RCA) and Torto Wheaton Research (TWR), two well-known companies in producing a national real estate market database. RCA provided the raw data that records seventy-three office property transactions during the period from the third quarter of 2000 to the second quarter of 2003 in Atlanta. TWR combined the RCA’s raw data with its own database, especially in rental income. Meanwhile, TWR provided the historic information of nine submarkets, where the seventy-three properties are located, from the fourth quarter of 1987 to the first quarter of 2004 in Atlanta.

4.2 Transaction-based Properties

Among the raw data of seventy-three transactions, every property records its transaction price and some physical characteristics, such as total floor area, floors, built year, and location (zip code). All properties have rarely good capitalization rates except seventeen properties. To measure the capitalization rate for an individual property, we have to estimate its rental income stream, which RCA does not provide. TWR uses a two-part process to estimate an appropriate market gross rental income stream for every individual property. First, if the asset in question could be matched directly between the two databases, TWR uses market asking rent and occupancy history for the tracked building to estimate a gross "income" series. The rents were grossed up when they are quoted on a net basis and represented "income" as it showed the asking rents without any
concessions. Combining assumptions on a typical 5 year-lease term with the rent and occupancy histories for the assets, TWR estimated these gross income streams for the matched assets. Second, for those assets that could not be matched directly, TWR applies the rents and occupancies of assets with similar physical characteristics in the location to estimate those properties.

Moreover, TWR made some estimations for built years as RCA reports the built years of some properties in decades, such as 1960’s or 1970’s. The process of this estimation is very similar to the way TWR estimated the income streams. TWR tried to match the buildings to its own database to get the exact years first. There are seventeen properties in this case that could not be matched. TWR estimated their built years by looking at what sort of rents and occupancy a 1960’s era building in that location, size and floor range.

4.2.1 Estimation of Operating Costs

To calculate the net capitalization rate, we still need to obtain an operating cost of every property, which the database does not provide. Fortunately, there are seventeen properties with their own closed capitalization rates, respectively. Thus, it is reasonable to utilize these seventeen properties and build a model to estimate the operating costs of other properties. As we all know,

\[
\text{Cap rate} = \frac{\text{Occupancy rate} \times (\text{Gross rent} - \text{Operating cost})}{\text{Price}} \tag{4}
\]

---

Equation (4) assumes that the total floor area is equal to the net rentable area as there is no such information in this case. Every item on the right side of the formula should be in dollars per square foot, expect occupancy rate as a percentage. Thus Equation (4) can be derived as

\[
\text{Operating cost} = \text{Occupancy rate} \times \text{Gross rent} - \text{Cap rate} \times \text{Price} \quad (5)
\]

Since most investors would like to use the expected average market vacancy rate instead of the current vacancy rates of individual properties while valuing future income streams of properties 2, plus in Atlanta this number tends to be 90%, this paper uses 90% as the occupancy rates in Formula (5). Under this assumption, we can have a series of operating costs of properties by utilizing the seventeen properties with closed capitalization rates.

On the other hand, the operating cost is very closely related to some characteristics of individual property such as size, floor, and age. A high-rise that is an older building is more likely to have a higher operating cost than a low-rise that is a brand new building. In this case, the correlation between floor and size is relatively high (0.58). The building size and age are used as two variables to build a hedonic model with the dependent variable of the operating cost. The model is written as

\[
\text{Operating cost} = f(\text{size, age}) \quad (6)
\]

2. Actual building occupancy rates and current vacancy rates of submarkets were also used to estimate the operating costs. Neither of them had a better regression result than the one with 90% vacancy rate.
Equation (6) expresses the operating cost as a function of an individual building size and age, which are two determinants of the operating cost. The result of regression is shown in Table 1. Using the result of regression model, we can estimate the operating costs of all properties. The final estimations have a range of $3 to $11 per square foot, and an average of $5.03.

**Table 1**

<table>
<thead>
<tr>
<th>Operating Cost Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>Coefficients</td>
</tr>
<tr>
<td>T Stat</td>
</tr>
<tr>
<td>Standard Error</td>
</tr>
</tbody>
</table>

4.2.2 Transaction-based Capitalization Rates

With the estimation of operating costs, we are able to have the capitalization rates of individual properties by using Formula (4). Again, it applies 90% as the expected average future occupancy rate for each property and assumes the net rental area is same as the total floor area. Among seventy-three calculated capitalization rates, there are several extremely high capitalization rates, as high as 34%. It suggests that these properties might already have had the leases far below the normal market leases, resulting higher estimated capitalization rates on actual transaction prices. As there is no information regarding the lease structure, this paper would assume that properties are under market leases and some extreme capitalization rates are treated as random standard errors. The overall average capitalization rate is 11.83%.
4.2.3 Data Descriptions of Transaction Properties

Tables 2, 3, 4, 5 (shown below) describe the data of seventy-three transacted properties in terms of geography, deal time, property age and floors, respectively. The latter two represent the characteristics of property.

Table 2 delineates the individual properties diversified by nine submarkets and the number of transactions, average capitalization rates, average rents and transaction prices. As can be seen, the average capitalization rates are quite different across the nine submarkets. The lowest one is 6.77% in Buckhead, and the highest one is 15.26% in Northeast Atlanta. Meanwhile, the lowest rents are around $16.5-$17.00 in Downtown Atlanta, Midtown Atlanta and South Atlanta, while the highest average transaction price is in Buckhead, $175.97. This information tells us that the average capitalization rate could vary by the submarkets, but the variation is not only determined by the differences of markets.

Table 3 depicts the number of property transactions according to four time periods, and their average capitalization rates, rents and transaction prices. We can see that the average capitalization rate increased in 2001, decreased in 2002 and rebounded in 2003. The rents increased in 2001 and after that decreased continuously. The average prices moved in the opposite way of the movements of the average capitalization rates, decreasing in 2001, increasing in 2002 and deceasing in 2003 again. This table gives us some sense of the movements of the average capitalization rates during four annual periods from 2000 to 2003.
Table 4 and Table 5 show data descriptions by the property characteristics. Table 4 diversifies the properties by their ages. The average rent decreases as the building age increases. However, the average capitalization rate increases as the building age increases, except the properties with higher ages than 25. The mathematic reason is that the average prices decrease more quickly than the average rents do when the properties are younger than 25. The average prices decrease by 14% and the average rents decrease by only 4%, when the ages of properties increase from below 5 to the range of 5-15. To some extent, we might be able to conclude that the ages might have a positive impact on the average capitalization rates, except for the buildings older than 25.

Table 5 describes the data by the floors of buildings. 59 out of 73 properties in the database are 1-10 stories. The average capitalization rates decrease when the buildings are higher. Neither the average rents nor the average prices move in the same way as the capitalization rates. Compared to the changes in rents and prices by age (see Table 4), the changes in rents and prices by floors are quite smooth. More importantly, when the properties have less than 3 floors, the average capitalization rate is extremely high, 15.63%, almost 50% more than the average capitalization rate of properties with 5-10 floors. This might tell us that the investors view office properties with 1-2 floors in Atlanta as extremely risky assets. They would like to ask for higher capitalization rates than they do for others.
Table 2

Regional Distribution of Properties

<table>
<thead>
<tr>
<th>Submarkets</th>
<th>Number</th>
<th>Average Cap*</th>
<th>Average Rent*</th>
<th>Average Price*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buckhead</td>
<td>5</td>
<td>6.77%</td>
<td>20.63</td>
<td>175.97</td>
</tr>
<tr>
<td>Central Perimeter</td>
<td>9</td>
<td>13.31%</td>
<td>22.03</td>
<td>135.47</td>
</tr>
<tr>
<td>Downtown Atlanta</td>
<td>6</td>
<td>10.48%</td>
<td>16.47</td>
<td>76.87</td>
</tr>
<tr>
<td>Midtown Atlanta</td>
<td>5</td>
<td>7.38%</td>
<td>16.89</td>
<td>145.97</td>
</tr>
<tr>
<td>North Fulton</td>
<td>14</td>
<td>8.94%</td>
<td>18.24</td>
<td>138.53</td>
</tr>
<tr>
<td>Northeast Atlanta</td>
<td>9</td>
<td>15.26%</td>
<td>17.85</td>
<td>93.06</td>
</tr>
<tr>
<td>Northlake</td>
<td>1</td>
<td>13.53%</td>
<td>18.63</td>
<td>84.98</td>
</tr>
<tr>
<td>Northwest Atlanta</td>
<td>18</td>
<td>14.68%</td>
<td>20.21</td>
<td>105.90</td>
</tr>
<tr>
<td>South Atlanta</td>
<td>6</td>
<td>11.66%</td>
<td>16.96</td>
<td>98.54</td>
</tr>
<tr>
<td>Total</td>
<td>73</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3

Annual Distribution of Properties

<table>
<thead>
<tr>
<th>Time period</th>
<th>Number</th>
<th>Average Cap*</th>
<th>Average Rent*</th>
<th>Average Price*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>21</td>
<td>8.99%</td>
<td>18.63</td>
<td>135.37</td>
</tr>
<tr>
<td>2001</td>
<td>26</td>
<td>13.91%</td>
<td>19.18</td>
<td>107.49</td>
</tr>
<tr>
<td>2002</td>
<td>20</td>
<td>11.68%</td>
<td>19.06</td>
<td>120.36</td>
</tr>
<tr>
<td>2003</td>
<td>6</td>
<td>13.26%</td>
<td>18.93</td>
<td>100.83</td>
</tr>
<tr>
<td>Total</td>
<td>73</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4

Properties Distribution by Age

<table>
<thead>
<tr>
<th>Building Age</th>
<th>Number</th>
<th>Average Cap*</th>
<th>Average Rent*</th>
<th>Average Price*</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5.0</td>
<td>15</td>
<td>10.09%</td>
<td>20.44</td>
<td>146.53</td>
</tr>
<tr>
<td>5.0-15.0</td>
<td>19</td>
<td>12.50%</td>
<td>20.32</td>
<td>126.98</td>
</tr>
<tr>
<td>15.0-25.0</td>
<td>21</td>
<td>14.36%</td>
<td>18.89</td>
<td>99.78</td>
</tr>
<tr>
<td>&gt;25.0</td>
<td>18</td>
<td>9.63%</td>
<td>16.40</td>
<td>107.97</td>
</tr>
<tr>
<td>Total</td>
<td>73</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5

Property Distribution by Floors

<table>
<thead>
<tr>
<th>Floors</th>
<th>Number</th>
<th>Average Cap*</th>
<th>Average Rent*</th>
<th>Average Price*</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;3</td>
<td>23</td>
<td>15.63%</td>
<td>17.72</td>
<td>92.53</td>
</tr>
<tr>
<td>3-10</td>
<td>36</td>
<td>10.31%</td>
<td>19.10</td>
<td>129.66</td>
</tr>
<tr>
<td>10-20</td>
<td>9</td>
<td>9.96%</td>
<td>21.09</td>
<td>142.18</td>
</tr>
<tr>
<td>&gt;20</td>
<td>5</td>
<td>8.66%</td>
<td>19.91</td>
<td>114.81</td>
</tr>
<tr>
<td>Total</td>
<td>73</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Average Cap represents the average capitalization rate of properties. Average Rent and Average Price here is in dollars per square foot. The rent is the property market rent estimated by TWR and the price represents the transaction price.

4.3 Submarkets Information Data

The second part of the database consists of nine submarkets information in Atlanta. It includes the information of space market supply and demand, such as space stock (net rentable area), physical vacancy rate, and the levels of absorption and completion, and the information of asking gross market nominal rent. TWR tracked them quarterly from 1987 to 2004. Charts 1, 2, 3 and 4 (attached in last pages) show quarterly net rentable areas, the levels of absorptions and completions, vacancy rates and asking gross rents for the nine submarkets in Atlanta from the first quarter of 1994 to the first quarter of 2004.

Chart 1 depicts the movements of net rentable areas of submarkets. Among those markets, South Atlanta had the smallest space market while Center Perimeter had the largest one. South Atlanta, Northlake and Downtown Atlanta had the lowest growth in office spaces over the past 10 years, and North Fulton had the highest growth, which means that North Fulton was a highly developing market.
In Chart 2, North Fulton had the biggest completion over the past 10 years, and it seems to be a leading market in construction among the nine submarkets. South Atlanta had the lowest completion. The level of completion for each market went up quickly after 1997. That is, the new construction in Atlanta was very active after 1997. In Chart 3, the trends of absorptions in North Fulton, Center Perimeter and Downtown Atlanta had the biggest standard deviations over the past 10 years. The trends in Northlake and South Atlanta had the lowest deviation. There was a big drop in absorption for each market in 2001. That is, the rental space demand decreased dramatically after 2001.

Chart 4 reports the tendencies of asking gross rent over the past 10 years. It seems that there was a rent peak between 2000 and 2001. Midtown Atlanta and South Atlanta had the highest average rental growth rate over the past 10 years. Center Perimeter had a negative growth rate from 1994 to 2004. North Fulton had the biggest increase before 2001, and after that it had the biggest downturn. Chart 5 shows the physical vacancy level from 1994 to 2004. The vacancy rate for each market, except for Downtown Atlanta, was relatively low during the period from 1996 to 1999 and then increased continuously. Downtown Atlanta moved in the opposite direction compared to others. Its vacancy rate was high from 1994 to 1999 while low from 2000 to 2004. Northlake had the lowest average vacancy rate over the past 10 years. Center Perimeter had the biggest increase in vacancy rate, while South Atlanta had the biggest downturn from 2001 to 2004.
CHAPTER 5 – MODELING FRAMEWORK

5.1 Overview

Based on the discussion in Section III and using the data described in Section IV, we can start to set an appropriate model to examine the variation of capitalization rates across the submarkets, and to discover specific factors that may determine the capitalization rates. We have learned that characteristics of properties, local real estate information and national capital markets, may have an impact on the capitalization rates of individual properties by adjusting the risk perception or income-growth expectations in time paths, or both. These factors will be built into the model, which is usually referred as the cross-sectional model with time dummy variables.

5.2. Characteristics of Individual Property

Firstly, the capitalization rate can be expressed as a function of characteristics of property for a given property with market rent lease structure at a point in time. That is,

\[ \text{Cap rate} = f(\text{age}, \text{floors}, \text{bltest}) \]  

(7)

In Equation (7), ‘bltest’ is a dummy variable if the age of property is estimated by TWR since the raw transaction data reports its age in decades like the 1970’s or 1960’s. There are 17 properties with such estimated ages. Using Equation (7), it is possible to check the effects on the capitalization rate from the characteristics of property. The capitalization
rates calculated here are usually called “constant-quality” capitalization rates. This concept provides a good way to compare the capitalization rates of properties with similar physical qualities in different markets, and makes us better understand other influences on capitalization rates.

5.3 Local Submarket Factors

Equation (7) must be modified since the local real estate market information should have an impact on the capitalization rates as well. These factors can be separated into two categories. One category is local-fixed office-market influences. These influences are time-invariant and include some features that are not completely fixed but change slowly through time (Sivitanidou and Sivitanides (1999)). The second category is time-variant local office-market influences.

5.3.1 Local-fixed Factors

For the local-fixed office-market influences, this paper uses as variables the size of submarket (NRA), the average vacancy rates (VAC), the average absorption rate (ABS) and completion rate (CPT), and the average growth rate of asking gross rent (GRT) over past several years.

---

3. Hendershott and Turner (1999) defines the constant quality capitalization rate as “similar properties trading in a given location where the tenants and landlords have a given set of leasing and financing options and where the extent of above or below market existing leases and above or below market financing does not vary”.

---
$NRA$ is depicted as the current rentable area of a submarket. As a measure of space stock, it may reflect the perception of liquidity risk and expectation of rental growth rate. With a larger market, real estate investors might view it as a more liquid market than the smaller market. They may accept a lower capitalization rate for a larger market based on the liquidity risk. On the other hand, the rental income in the larger market is expected to grow slower than the one in the small market if other factors are the same for both markets. This factor will result in a higher capitalization rate for the larger market. Overall, the coefficient sign of $NRA$ depends on the offset from both influences.

Most professionals would like to treat $ABS$ and $GRT$, $CPT$ and $VAC$ as time-variant factors on the capitalization rate. However, in this paper the data pool is so small and limited over only four annual periods. It is better to treat these four factors as time-invariant influences and then take time-variant effects of them as dummy variables along with other time-variant variables. $ABS$ tends to measure the demand side information of submarkets by representing the average of absorption levels over past years. It is depicted as the average of percentages of the annual absorptions over the current space stock. It is expected to have a positive impact on the capitalization rate by reducing investors’ perceptions of risk and expectation of rental growth rates. The higher the average annual absorption rate, the lower the risk of a future potential decrease in rents and asset values.

Reflecting the income-growth expectation for a submarket, $GRT$ is depicted as the annual compounded rental growth rate over past years. If the investors are ‘backward-looking’, the average growth rate of asking gross rent should have a negative impact on the
capitalization rate, since a historic high of rental growth rate makes those investors have a higher expected future rental growth and accept a lower current capitalization rate. If the investors were ‘forward-looking’, they would have opposite expectations. The reason is that they would expect a lower future growth rate and thus a higher capitalization rate, when the current rental growth rate is historically high.

\(CPT\) measures newly built and market-available spaces over the past years. This is typically lagging information owing to the characteristic of the real estate construction process. It is calculated by averaging the percentages of annual completions over the current space stock. As a supply measure, \(CPT\) is expected to have a negative impact on the capitalization rate. The higher the average completion rate, the lower the expected rental growth rate and the higher the risk of investment.

\(VAC\) is calculated by the average of percentages of annual occupied spaces to the current space stocks over past years. It would reflect the softness of the office-space markets and the net supply for next year if there is no more new completion. Compared to a market with a lower average vacancy rate, the market with a higher one should be expected to have a lower expected rental growth rate and a higher risk and thus a higher capitalization rate, if all else is held constant. Therefore, \(VAC\) is expected to have a positive impact on the capitalization rate.

Overall, these time-invariant factors show investors historic information of space supply and demand for a specific real estate submarket during past several years. This
background information should influence the investors’ perceptions of market risk and expectations of future rental income growth. Moreover, these factors might have ‘physical’ impacts on current rental income due to ‘lagged’ effects in real estate. So this paper mainly uses these four factors over the past 8 years as time-invariant variables of the dependent of the capitalization rate. Meanwhile this paper examines these factors over the last 10 years and 6 years and attempts to see which one has the most effective impact on the capitalization rate. Table 6 describes these factors in different submarkets over different past years.

### Table 6

**Local Market Description**

1. **Data over last 10 years (1994.1-2004.1)**

<table>
<thead>
<tr>
<th>Submarkets</th>
<th>ABS</th>
<th>GRT</th>
<th>CPT</th>
<th>VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buckhead</td>
<td>1.676%</td>
<td>1.257%</td>
<td>2.228%</td>
<td>11.793%</td>
</tr>
<tr>
<td>Central Perimeter</td>
<td>0.081%</td>
<td>-0.089%</td>
<td>1.016%</td>
<td>12.543%</td>
</tr>
<tr>
<td>Downtown Atlanta</td>
<td>1.109%</td>
<td>1.227%</td>
<td>0.401%</td>
<td>14.61%</td>
</tr>
<tr>
<td>Midtown Atlanta</td>
<td>1.806%</td>
<td>3.093%</td>
<td>2.317%</td>
<td>13.69%</td>
</tr>
<tr>
<td>North Fulton</td>
<td>11.374%</td>
<td>1.859%</td>
<td>20.952%</td>
<td>17.04%</td>
</tr>
<tr>
<td>Northeast Atlanta</td>
<td>5.840%</td>
<td>0.562%</td>
<td>7.950%</td>
<td>14.61%</td>
</tr>
<tr>
<td>Northlake</td>
<td>0.728%</td>
<td>2.031%</td>
<td>0.497%</td>
<td>9.522%</td>
</tr>
<tr>
<td>Northwest Atlanta</td>
<td>1.843%</td>
<td>0.973%</td>
<td>2.794%</td>
<td>12.044%</td>
</tr>
<tr>
<td>South Atlanta</td>
<td>3.673%</td>
<td>1.208%</td>
<td>3.495%</td>
<td>21.441%</td>
</tr>
</tbody>
</table>
2. Data over last 8 years (1996.1-2004.1)

<table>
<thead>
<tr>
<th>Submarkets</th>
<th>( ABS^* )</th>
<th>( GRT^{**} )</th>
<th>( CPT^{***} )</th>
<th>( VAC^{****} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buckhead</td>
<td>1.329%</td>
<td>1.438%</td>
<td>2.785%</td>
<td>11.633%</td>
</tr>
<tr>
<td>Central Perimeter</td>
<td>-0.043%</td>
<td>-0.074%</td>
<td>2.490%</td>
<td>12.942%</td>
</tr>
<tr>
<td>Downtown Atlanta</td>
<td>0.255%</td>
<td>1.513%</td>
<td>0.502%</td>
<td>13.582%</td>
</tr>
<tr>
<td>Midtown Atlanta</td>
<td>1.257%</td>
<td>4.024%</td>
<td>2.896%</td>
<td>13.436%</td>
</tr>
<tr>
<td>North Fulton</td>
<td>12.256%</td>
<td>1.205%</td>
<td>22.965%</td>
<td>17.806%</td>
</tr>
<tr>
<td>Northeast Atlanta</td>
<td>6.320%</td>
<td>-0.286%</td>
<td>9.594%</td>
<td>16.076%</td>
</tr>
<tr>
<td>Northlake</td>
<td>-0.130%</td>
<td>2.489%</td>
<td>0.565%</td>
<td>8.988%</td>
</tr>
<tr>
<td>Northwest Atlanta</td>
<td>1.753%</td>
<td>0.976%</td>
<td>3.492%</td>
<td>12.264%</td>
</tr>
<tr>
<td>South Atlanta</td>
<td>3.839%</td>
<td>1.278%</td>
<td>4.369%</td>
<td>20.979%</td>
</tr>
</tbody>
</table>

3. Data over last 6 years (1998.1-2004.1)

<table>
<thead>
<tr>
<th>Submarkets</th>
<th>( ABS^* )</th>
<th>( GRT^{**} )</th>
<th>( CPT^{***} )</th>
<th>( VAC^{****} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buckhead</td>
<td>0.705%</td>
<td>-1.030%</td>
<td>2.817%</td>
<td>12.740%</td>
</tr>
<tr>
<td>Central Perimeter</td>
<td>-1.147%</td>
<td>-1.646%</td>
<td>2.773%</td>
<td>15.484%</td>
</tr>
<tr>
<td>Downtown Atlanta</td>
<td>1.009%</td>
<td>2.104%</td>
<td>0.669%</td>
<td>12.440%</td>
</tr>
<tr>
<td>Midtown Atlanta</td>
<td>1.636%</td>
<td>5.354%</td>
<td>3.861%</td>
<td>13.976%</td>
</tr>
<tr>
<td>North Fulton</td>
<td>8.321%</td>
<td>-2.625%</td>
<td>16.183%</td>
<td>20.220%</td>
</tr>
<tr>
<td>Northeast Atlanta</td>
<td>5.943%</td>
<td>-2.226%</td>
<td>9.624%</td>
<td>18.988%</td>
</tr>
<tr>
<td>Northlake</td>
<td>-0.615%</td>
<td>1.492%</td>
<td>0.656%</td>
<td>9.412%</td>
</tr>
<tr>
<td>Northwest Atlanta</td>
<td>1.178%</td>
<td>-1.039%</td>
<td>3.759%</td>
<td>13.672%</td>
</tr>
<tr>
<td>South Atlanta</td>
<td>4.367%</td>
<td>2.497%</td>
<td>5.568%</td>
<td>22.11%</td>
</tr>
</tbody>
</table>

* \( ABS \) means the average of annual absorption rates depicted as the percentages of absorptions to current stock.

** \( GRT \) measures the annual compounded growth rate of rental income.

*** \( CPT \) means the average of annual completion rates calculated by completions to current stock.

**** \( VAC \) describes the average vacancy rate over past years.
5.3.2 Correlation Analysis for Local-fixed Factors

Although every submarket has virtually different historical market information of four factors in Table 6, those variables plus the NRA factor might be highly correlated with each other. The reasons might be (1) one variable is calculated by others. ABS is calculated by absorption level divided by NRA. CPT is described as a percentage of completion level over NRA. These might result in high correlations among them. (2) For a local submarket, these factors might be highly correlated econometrically as the size of the market is relatively small and any change in each factor might result in the movements of other factors in the same degree. Thus, it is better to use correlation analysis to examine their relations. Table 7 reports the correlations among five factors over 10 years, 8 years and 6 years, respectively.

### Table 7

**Correlation Analysis**

**1. Factors over past 10 years (1994.1-2004.1)**

<table>
<thead>
<tr>
<th></th>
<th>VAC</th>
<th>CPT</th>
<th>NRA</th>
<th>ABS</th>
<th>GRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAC</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPT</td>
<td>0.487181</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRA</td>
<td>-0.69528</td>
<td>-0.17484</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABS</td>
<td>0.545016</td>
<td>0.993779</td>
<td>-0.24616</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>GRT</td>
<td>0.526518</td>
<td>0.572725</td>
<td>-0.54864</td>
<td>0.640059</td>
<td>1</td>
</tr>
</tbody>
</table>
2. Factors over past 8 years (1996.1-2004.1)

<table>
<thead>
<tr>
<th></th>
<th>VAC</th>
<th>CPT</th>
<th>NRA</th>
<th>ABS</th>
<th>GRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAC</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPT</td>
<td>0.612095</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRA</td>
<td>-0.66639</td>
<td>-0.18607</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABS</td>
<td>0.65232</td>
<td>0.994177</td>
<td>-0.24777</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>GRT</td>
<td>0.306583</td>
<td>0.173087</td>
<td>-0.5444</td>
<td>0.24548</td>
<td>1</td>
</tr>
</tbody>
</table>

3. Factors over past 6 years (1998.1-2004.1)

<table>
<thead>
<tr>
<th></th>
<th>VAC</th>
<th>CPT</th>
<th>NRA</th>
<th>ABS</th>
<th>GRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAC</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPT</td>
<td>0.772414</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRA</td>
<td>-0.55049</td>
<td>-0.27269</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABS</td>
<td>0.768777</td>
<td>0.976005</td>
<td>-0.37631</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>GRT</td>
<td>-0.11319</td>
<td>-0.45715</td>
<td>-0.50916</td>
<td>-0.33337</td>
<td>1</td>
</tr>
</tbody>
</table>

In Table 7, we can find that the correlation between *ABS* and *CPT* is extremely high, and the coefficient is around 0.99. It means that they would have the same impact on the capitalization rate. We have to choose one of them as a variable in the model. *ABS* is a suitable factor since it is a good indication for the demand of space-market. Furthermore, *VAC* has relatively high correlations with each variable, which means that the effects on the capitalization rate from other variables can overlap the effect from *VAC*. Finally, this paper uses *NRA*, *ABS*, and *GRT* as variables rather than using all five variables. So Equation (7) should be modified as
Cap rate = \( f(NRA, ABS, GRT, \text{age}, \text{floors}, \text{bltest}) \) \hspace{1cm} (7')

5.3.3 Local Time-variant Factors

As mentioned before, this paper considers local time-variant factors as time dummy variables due to the limitation of the data. It does not mean that there is no time effect between the local submarket factors and the capitalization rates. More details will be discussed in Section 5.4 with national capital-market factors.

5.4 National Capital-market Factors and Other Time-variant Factors

5.4.1 National Capital-market Factors

The national capital market consists of two major factors on the capitalization rate: expected interest rate and expected inflation rate. In the economy, these two factors actually are very closely related. When the interest rate is high, the inflation rate is more likely to be low. If the inflation rate is too low, the interest rate is more likely to decrease. As important measures for economy, they are tracked by almost all professionals and should influence investors’ expectations of economy and perceptions of risk, at least at the nation capital market level.

In real estate, assuming an ‘integrated’ national capital-market across the submarkets efficiently, both components would reflect the opportunity costs of investment, the perception of market risk and expectation of rental growth rate. The interest rate is expected to have a positive impact on the capitalization rate, while the inflation rate might have a negative one (see Section 3). With the limitation of data, this paper attempts
to treat the national capital-market factors as time dummy variables which allow the capitalization rate to change over time.

5.4.2 Other Time-variant Factors

The advantage of time dummy variables is that they will reflect time affects from all influences over four annual periods, by allowing the capitalization rate changes over time. These influences are not only from national capital-market factors, but also include time variant effects from the local submarkets mentioned in Section 5.2, and any other time variant factors if they would affect the capitalization rate. The common point of those factors is that they are constant across nine submarkets on time paths, no cross-sectional effects on the capitalization rate.

5.5 Model

With the discussions above, the model can finally be expressed as

\[
\text{Cap rate} = f(TMD, NRA, ABS, GRT, \text{age, floors, bltest}) \tag{7''}
\]

Here, \(TMD\) presents dummy variables to account for time effects across the nine submarkets. The year 2000 is used as a default in this paper. Equation (7’’) builds into a linear function of the capitalization rate all factors that would have impacts on the capitalization rates. Those influences include the characteristics of property, local real estate market factors, and national capital-market factors.
CHAPTER 6 – ESTIMATION RESULTS

Table 8 reports the coefficients on five time dummy variables, local market factor variables - \textit{NRA}, \textit{ABS} and \textit{GRT}, and variables of property characteristics - age, floors and bltest, as well as their standard errors (in parentheses) and the equation adjusted R$^2$ and standard error. The regression analyses are done under three different scenarios. In the first column \textit{ABS} and \textit{GRT} are calculated as the averages over the past 10 years (1994.1-2004.1). In the second and third column, they are calculated over the past 8 years (1996.1-2004.1) and the past 6 years (1998.1-2004.1), respectively.

6.1 Characteristics of Property

The variables of property characteristics, age, floors and ‘bltest’ are constant across three scenarios, since their coefficients and standard errors are almost same. The age’s coefficient (-0.0006) is quite small and about the size of their standard errors (0.0005). The capitalization rate of a twenty-year older building is 1.2% smaller than the capitalization rate of the younger one. It suggests that the depreciation of properties in this database is relatively modest compared to the increases in their values. The explanation might be that those older buildings have better locations than younger ones. The coefficient on the floors variable is around -0.0027 with the standard error of 0.00093. This coefficient actually is not very small. A twenty-floor high-rise building would have almost 4.4% less in the capitalization rate than a single floor building has. The suggestion might be that those buildings have good views and locations in Atlanta, and investors view them less risky than they do for the low-rise buildings. The coefficient
of the dummy variable of ‘bltest’ is quite big (0.031), and the standard error is very small (0.016). If a building’s age is estimated by TWR since RCA reports it as 1970’s, this building would have a 3.1% higher capitalization rate than has a building with its reported real age. At first glance, it appears unreasonable. However, the fact is that among those 17 properties with estimated ages, 12 properties are single-floor buildings (only other 2 single-floors with real ages). Meanwhile, the average ages of those 17 properties are 22. We can see that the properties with estimated ages are usually old single-floor buildings. Those proprieties might have much higher capitalization rates than the others, since they are most unlikely to have location and view advantages (if have, they would have already been replaced by multi-floor buildings). This result actually is consistent with the data description in Table 5, where the properties with 1-2 floors have extremely higher capitalization rates than the others.

6.2 Local Market Factors

The estimation results are quite significant for the local market variables, especially in the 8-year scenario. This means that the local real estate factors do have substantial influences on the capitalization rate, and that those factors over the past 8 years have the most effects on the capitalization rate. The variable of market size (NRA) has the coefficient of 0.0000019 with the standard error of 0.0000011. That is, if the size of space market increases by 10 million square feet, the capitalization rate of this market will go up by 1.9% (the average NRA of nine submarkets in 2004.1 is 13.5 million square foot). The sign of NRA coefficient suggests that the investors may prefer the smaller submarkets in Atlanta. The reason might be that the higher growth rate of rental income
### Table 8

Regression results of variables (dependent variable: capitalization rate)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Time Periods</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>10-Years</td>
<td>8-Years</td>
<td>6-Years</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>0.115**</td>
<td>0.118**</td>
<td>0.119**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.029)</td>
<td>(0.028)</td>
<td>(0.033)</td>
</tr>
<tr>
<td>Time effect variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y1(2001)</td>
<td></td>
<td>0.043**</td>
<td>0.044*</td>
<td>0.044**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.015)</td>
<td>(0.015)</td>
<td>(0.016)</td>
</tr>
<tr>
<td>Y2(2002)</td>
<td></td>
<td>0.007</td>
<td>0.009</td>
<td>0.011</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.016)</td>
<td>(0.017)</td>
<td>(0.017)</td>
</tr>
<tr>
<td>Y3(2003)</td>
<td></td>
<td>0.027</td>
<td>0.027</td>
<td>0.028</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.024)</td>
<td>(0.024)</td>
<td>(0.025)</td>
</tr>
<tr>
<td>Local market variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRA</td>
<td></td>
<td>0.0000021*</td>
<td>0.0000019*</td>
<td>0.0000014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0000012)</td>
<td>(0.0000011)</td>
<td>(0.0000017)</td>
</tr>
<tr>
<td>ABS</td>
<td></td>
<td>-0.215*</td>
<td>-0.268**</td>
<td>-0.528**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.126)</td>
<td>(0.109)</td>
<td>(0.191)</td>
</tr>
<tr>
<td>GRT</td>
<td></td>
<td>-1.056*</td>
<td>-0.948*</td>
<td>-0.341</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.604)</td>
<td>(0.547)</td>
<td>(0.342)</td>
</tr>
<tr>
<td>Variables of property characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td>-0.0006</td>
<td>-0.0006</td>
<td>-0.0007</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0005)</td>
<td>(0.0005)</td>
<td>(0.0006)</td>
</tr>
<tr>
<td>Floors</td>
<td></td>
<td>-0.0027**</td>
<td>-0.0027**</td>
<td>-0.0027**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.00092)</td>
<td>(0.00093)</td>
<td>(0.00096)</td>
</tr>
<tr>
<td>Bltest</td>
<td></td>
<td>0.031*</td>
<td>0.030*</td>
<td>0.033**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.016)</td>
<td>(0.016)</td>
<td>(0.016)</td>
</tr>
<tr>
<td>Adjusted R Square</td>
<td></td>
<td>0.34</td>
<td>0.35</td>
<td>0.31</td>
</tr>
<tr>
<td>Standard Error</td>
<td></td>
<td>0.049</td>
<td>0.048</td>
<td>0.050</td>
</tr>
</tbody>
</table>

Notes: Standard errors are in parenthesis below the coefficients. One asterisk indicates statistical significance at the 10% and two asterisks mean significance at 5% levels.
for the smaller submarket is attractive enough for investors after offsetting the increasing liquidity risks.

*ABS* exhibits a statistically significant negative effect on the capitalization rate. The result is consistent with the hypothesis that more demand for the space market, the smaller capitalization rates. The magnitude of coefficient is small. One percent increase in the annual average absorption rate results in 27 base-point increases in the capitalization rate. It is worth to note that the coefficients of *ABS* increases by three scenarios over the past 10 years, 8 years and 6 years. One simple explanation could be that investors are looking more at the short-term absorption rate in Atlanta submarkets. They may believe that the lagging impact from demands of space market should not be over so backward.

The coefficient of *GRT* does have a negative sign and is almost in unity. If the average annual rental growth rate goes up by 1% over the past 8 years, the capitalization rate will drop by 1%. This is a big change and exactly the same as what Equation (3) tell us. It suggests that the investors are probably very sensitive to the measures of rental growth rates for submarkets. Regarding the issue of ‘forward-looking’ or ‘backward-looking’ in the market, the results seem to support the former one that investors use the ‘forward-looking’ approach to form their expectations of rental growth. From Table 6.1 and Table 6.2, we can see that *GRT* of each submarket over the past 10 years is smaller than *GRT* over the past 8 years. If the investors are ‘backward-looking’, the coefficient of *GRT* over the past 10 years should be smaller than the coefficient of *GRT* over the past 8 years since investors would expect a lower growth rate when the rental growth is in a lower position.
The analysis shows an opposite result in coefficients of GRTs, a bigger coefficient on GRT over the past 10 years\textsuperscript{4}. However, the difference of coefficients between two GRTs is not so significant. This makes the argument of ‘forward-looking’ for investors at the submarket level a little bit weak.

6.3 Time Dummy Variables

The statistical significance of time dummy variables indicates that there are some fixed influences that support sustained differentials in capitalization rate in the time series. All coefficients have positive signs as long as using the year 2000 as a default. That is, post-2000 capitalization rates are higher than the one of 2000. The capitalization rate moved up by 4.4% from 2000 to 2001, and then went down by 3.5% in 2002 and was most likely to increase 1.8% in 2003, though the coefficients of 2002 and 2003 are insignificant. It suggests that investors were very pessimistic in 2001 and then became much more optimistic in 2002 and 2003.

The peak of rents of most submarkets in Atlanta occurred between the end of 2000 and the beginning of 2001, and then dropped over the following 3 years. This tendency is very similar to the movements of estimated capitalization rates. Investors seem to be ‘forward-looking’, since rational investors should have lower expectations for rental income growth when the rents are at historic highs and ask for higher capitalization rates. However, again, as the data is only over four annual periods and no lag issue is well

\textsuperscript{4} Although the coefficient of GRT over the past 6 years is insignificant since GRTs of some submarkets are up and others are down compared to GRTs over the past 8 years (see Table 6.3), the coefficient of GRT much lower than the one over the past 8 years. This trend also supports the augment of ‘forward-looking’.
considered, it is relatively weak to confirm that investors are ‘forward-looking’ at the
submarket level.

6.4 Summary

Figure 1 and Figure 2 plot the estimated capitalization rates by time series and across
submarkets. The sample property was a 10-story 10-year old building when the
transaction was made.

Figure 1 shows that the capitalization rates for each submarket almost moved together by
time. The tendency tells us again that investors were very pessimistic for the future
market in 2001, and then turned back to be optimistic in 2002 and 2003. Midtown
Atlanta, South Atlanta, and North Fulton have relatively low capitalization rates. Center
Perimeter and Northwest Atlanta have relatively high ones. The highest one of Center
Perimeter is around 13%-17.2%. The lowest one in Midtown Atlanta is about 6%-8.8%. The
gap of them keeps constant, in 2000 about 7% and in 2003 around 7% as well. The
investors might view those two markets with same differences of risks in time series.

Figure 2 reports the variation of capitalization rates across nine submarkets. We can see
some deviations of capitalization rates among different submarkets during the same
period. In 2000, the lowest capitalization rate is about 6% in Midtown Atlanta, and the
highest one is about 13% in Center Perimeter.

5. Compared to the results found in Table 2, the highest average capitalization rate of Northeast Atlanta and
the lowest average capitalization rate of Buckhead, we can see the big difference between the ‘constant-
quality’ capitalization rate and the average capitalization rate.
CHAPTER 7 - CONCLUSION

Since capitalization rates are so extensively applied in property valuations and so regularly used in market development analyses and empirical studies of market behaviors, it is worth to do this research by exploring the capitalization rate at the submarket level. With the limited number of transaction records of properties actually sold over the past four years in Atlanta, this study investigates the issues of the variation of capitalization rates across submarkets within the same metropolitan area by using the cross-sectional analysis method.

7.1 Findings

The results of this research highly indicate that the capitalization rates are quite predictable at the submarket level. There are three major findings in this study. First of all, characteristics of property will affect investors’ risk perceptions and expectation of rental income growth, and thus are very important determinants of the capitalization rate. The age and floor of property show substantial effects on the capitalization rate in this case. Generally, the age has a negative impact and the floor has a positive one. Some low-rise, old buildings are more likely to have extremely high capitalization rates. Thus, to compare the abilities of different properties to generate the future income streams, it is important to calculate the ‘constant-quality’ capitalization rates, holding the quality of properties at the same level.
Secondly, movements of market-specific capitalization rates are shaped by local office-market features, including space stock level, absorption rate, and past rate of rental income growth. These features result persistent different capitalization rates across submarkets in this case. As a measure of size of market, the space stock has a negative impact on the capitalization rate, even though a smaller market would have the bigger risk in liquidity. Representing the space demand information, the absorption rate has a positive influence on the capitalization rate. Past rental growth rate has a negative effect in unity. This paper shows that investors might possibly use ‘forward-looking’ rather than ‘backward-looking’ in forming their expectations of rental growth at the submarket level, but the result is not so strong due to the limitation of the data.

Lastly, capitalization rates exhibit a high incorporation with time variant factors. Statistically, these factors should include all time factors that would have influences on the capitalization rates, such as interest rate, inflation rate and other time effects from local markets. The study suggests rising capitalization rates in Atlanta over the periods of 2000-2003 with a temporal big jump in the beginning of 2001.

7.2 Further Research

Further research could address some related issues. First, it needs to look at more local markets to see whether the results are consistent with the one found in Atlanta. Second, some studies could examine capitalization rates at the submarket level in time series based on the available data over long time periods. In this paper, time factors are treated as dummy variables in determining the capitalization rates. Further research should try to
explore the time-effect determinants of the capitalization rates at the submarket level. Meanwhile, further research should look at whether the gaps of capitalization rates between different submarkets are persistent for a long time period. Certainly, based on a data over a long time period, it will also be more precise to discover the issue of ‘backward-looking’ or ‘forward-looking’. Furthermore, it is desirable to do some small research about how to estimate the operating costs accurately based on the rents estimated by TWR. Finally, it is always interesting to explore the issues of lagged capitalization-rate adjustment within the same metropolitan area.
REFERENCES


Chart 3 - Absorption

Chart 4 – Asking Gross Rent
Chart 5 – Vacancy Rate