A Cross Sectional Analysis of Cap Rates by MSA

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Abstract

Much attention has been paid to capitalization rates or "cap rates" defined as the net operating income over transaction price, also known as a "going-in" current yield on commercial real estate when calculated at the time of purchase. We know that there are a number of global factors that drive capital markets and required rates of return that help to explain observed cap rates over time, but we know little about factors driving the geographical cross-sectional variation of these cap rates. Why are cap rates for similar sized and type property so much lower or higher in one metropolitan statistical area than another? Using data from Real Capital Analytics for multifamily properties we explore several models that combine the expected influences from housing demand growth, supply constraints, liquidity risk and the interaction of these. We document a very strong and robust relation between supply constraints and cap rates as well as evidence of capital flowing from larger markets to smaller markets in recent years. We also find weak but generally supportive evidence of influences from expected growth rates, liquidity and other risk factors.

Keywords: Cap Rates, Real Estate Yields, Real Estate Pricing

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"While research we are doing at Torto Wheaton Research (TWR) leads us to believe real estate is priced correctly today, we find that pricing is very inefficient across markets. When we line up cap rates with our estimates of market gross income growth, we do not see the relationship that ought to be there – a negative correlation that shows low cap rates in markets expected to do better in the future and high cap rates in markets expected to do less well in the future. In other words, according to TWR's outlook for markets and property types, pricing is not efficient."

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I. Introduction

Defined as the net operating income over transaction price, cap rates are widely used in various investment analysis methodologies to derive a property's likely resale price and current investment value. Basically interpreted as return on asset or current yield for commercial real estate, this measure can provide important information about the equilibrium behavior of real estate market pricing and expected trends in supply. When values exceed the cost of construction, we should expect construction rates to continue or even accelerate; when the reverse is true construction should stop. If markets are informationally efficient, then cap rates can theoretically be a priori indicators of changes in construction or rental growth rates. These cap rates can also be used to reverse engineer the growth rates or the risks implied assuming equilibrium conditions.

While capitalization rates have received a lot of attention in recent empirical real estate literature, most research has focused on explaining the patterns in cap rates over time or the variation in cap rates across different property types. Our study extends the existing literature by addressing a question that has received far less attention than needed, namely what are the factors driving the geographical cross-sectional variation in these cap rates.

Capital is usually considered fungible and will flow towards the highest returns relative to perceived risks. Yet, all real estate is essentially local. Segmentation (geographic market allocation) of real estate markets along MSAs makes it important to know the extent to which cap rates vary geographically across MSAs for similar property types as well as the specific factors generating such variation. Why are some cap rates for similar sized and type property so much lower or higher in one metropolitan statistical area than another? Does the data provide support for the theoretical relations that would lead us to conclude that pricing across markets for similar type properties is efficient? How can we identify those markets that seem to be (at least temporarily) out of equilibrium? These questions are particularly important from the point of view of institutional investors with geographically diversified holdings. Such investors are certainly seeking multi-period returns from both period yields and appreciation. We hope to reveal the implicit assumptions or factors that help explain differences in current pricing between segmented markets. Moreover, understanding the reasons behind these differences can help us better predict how relative cap rates would change with underlying changes in local demand/supply factors.

Using data from Real Capital Analytics for multifamily properties we explore several models that combine the expected influences from demand growth, supply constraints, liquidity, risk and the interaction of these. Starting from real transaction data, this study provides a compelling analysis that considers most of the factors previously taken into account in the literature, as well as additional factors that were not given the appropriate attention in earlier work.

The main contribution of this study is two fold. First, we document substantial geographical variation across MSAs for the gap between apartment cap rates and the risk free rate. For our sample, the range that the average cap rate exceeds the risk free rate varies from a minimum of 0.66% (obtained for San Diego, CA) to a maximum of 3.99% (obtained for Columbus, OH) during our study period. Given that macroeconomic factors should affect all cap rates similarly, it follows that only geographically specific characteristics can be responsible for this wide variation.

Second, guided by theory (the classic Gordon model), we consider several factors that could potentially cause this variation, such as demand growth, supply constraints, liquidity, risk, capital flows or the interaction of these. We document a very strong and robust relation between supply constraints and cap rates, i.e. more stringent supply constraints for a given MSA are reflected by lower cap rates. This relation is both statistically and economically significant. Moreover, we provide evidence supporting previous literature showing that the liquidity of the market is an important determinant of cap rates (specifically, more liquid markets have lower cap rates). We also provide supportive evidence of capital flowing from larger markets to smaller markets (large markets lead smaller markets in terms of cap rate behavior[1]).

Our study contributes to key unanswered questions in the literature with interesting results. Theory implies that rental growth rates should be one of the determining factors for the variation in cap rates. While previous work tried to capture this effect, most studies have focused on direct growth measurements that only capture the demand driver of rental growth rates; the results obtained were mixed and the conclusion was that data provides very weak support for the theory. However we make the point that expected rental growth depends on both supply and demand factors. For a given rate of growth in the demand driver, the expected rental growth rate will be higher the tighter the supply is. Our results suggest that supply side constraints have a more discernable impact on cap rate variations relative to direct growth

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[1] Although this flow could reverse in the same process, the cycle data is insufficient for us to follow this question further.

measurements. Hence, not including the supply side aspect in the context of the Gordon model may be responsible for the weak results obtained in previous literature.[2]

Beyond answering the question of cross-sectional variation in cap rates, studying this issue helps us understand or identify conditions of disequilibria among different markets. If we assume that real estate markets are on average fairly priced, then we can uncover how factors which drive going-in yields affect current pricing. Consequently, we could estimate the impact of faster growth rates, or tighter supply constraints on real estate values using our models. In addition, we could gain insight into which markets seem out of alignment with the others, hopefully leading to a greater understanding of the general issue of the pricing process of real estate markets. In agreement with the quote that prefaces this study, we find that pricing across geographical markets for apartments does not reflect relations that ought to be there according to theoretical models. We illustrate this point in more detail by showing how our methodology can be applied to identify markets that seem to be (temporarily) out of equilibrium, a question that can be of great potential interest to practitioners targeting areas for acquisition or for sale.

The remainder of the paper is organized as follows. Section II addresses the contribution of this study in the context of current literature. Section III provides the theoretical background and our hypotheses. Section IV describes the data and methodology used. Section V documents a wide cross-sectional variation in average apartment cap rates across MSAs. Factors causing this variation are investigated in Section VI. Section VII concludes the paper.

II. Literature Review

Considering their widespread application in the pricing of real estate and the increasing availability of more reliable localized data, we are witnessing more empirical work using

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[2] One could find a higher than average growth rate in a particular market but an even faster stream of supply as well, negating the expected impact on the cap rate and value with a demand only model.

national and regional cap rates. Studies exploring the behavior of cap rates can be classified in two broad categories. The first identifies the role different factors play in driving intertemporal movements in capitalization rates (Evans (1990); Ambrose and Nourse (1993); Jud and Winkler (1995), Fisher (2000)). These studies document relations between national market cap rates and interest rates, stock earnings-price ratio, changes in tax codes etc.

A major theme of this time series category of research focuses on the intertemporal relation between cap rates and proxies for expected real rental growth rates (Hendershott and MacGregor (2005a, 2005b); Chen, Hudson-Wilson and Nordby (2004)). While theory predicts a strong relation between these two variables, previous literature provides contexts telling a different story[3]. The results obtained to this point are mixed and the general conclusion is that data provides weak support of the theory. This naturally leads into the deeper question of temporary fluctuations around equilibrium values and of whether investors act rationally and correct these deviations. This issue is still under debate in the literature. On one hand, Hendershott and MacGregor (2005a) confirm previous results showing that US investors behave irrationally[4]; on the other hand the same authors (2005b) obtain the opposite results for UK office and retail cap rates, while Chen et al (2004) conduct a thorough analysis of the connection between cap rates, pricing, risk and fundamentals over time and show that real estate in most property types in the US is rationally priced.

The second stream of literature features determinants of cross sectional variation in cap rates. Most studies examined variations in cap rates across broad property types (Ambrose and Nourse (1993); Dokko, Edelstein, Pomer and Urdang (1991)). These articles show that

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[3] For example Lusht and Fisher (1984) addressed a closely related topic and found that debt levels for commercial properties were largely independent of anticipated growth. Since the availability of debt is a major driver of market prices, their result is consistent with the weak relationship between growth and cap rates observed subsequently.

[4] The authors show that investors do not factor expectations of mean or trend reversion of real cash flows into their asset pricing, as reflected in capitalization rates.

differences across property types are important in evaluating cap rates and failure to account for these differences can lead to biased results. Other studies in this category (including the current study) focus on the geographical variations in cap rates for the same type of properties.

Early studies in this area simply identified variation in cap rates across broadly defined regions or submarkets within a given MSA (Hartzell, Hekman and Miles (1987); Saderion, Smith and Smith (1994)). Consequently, the reasons why some cap rates for similar sized and type property are so much lower or higher in one metropolitan statistical area versus another remain largely unexplored in previous literature. However, in two notable papers, Sivitanidou and Sivitanides (1996) and (1999) focused on the cross-sectional variation of office capitalization rates and identified specific factors underlying such variation. In their more recent paper, they show that, despite evidence for some degree of market integration, the office asset market is segmented to a significant extent across metropolitan boundaries and that metropolitan office asset markets are inefficient in varying degrees.

Our study is different from theirs in several important aspects, including the methodology involved, type of data used, the focus on apartment (multifamily) cap rates, and more importantly the fact that we examine the supply side effect on expected growth rates in the context of the Gordon model. Although we incorporate time dummies to control for temporal effects, we do not focus on these longer term drivers of cap rate movement and our study is cross-sectional in nature. Nevertheless, put in the context of the investor rationality debate previously described, our results gain an intertemporal flavor – assuming that investors do behave rationally, our methodology can be applied to identify markets that seem to be temporarily out of equilibrium, thus spotting potential profit opportunities[5].

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[5] Of course, this interpretation hinges not only on the assumption of investor rationality, but also on the acceptance of the equilibrium cap rate models proposed.

III. Cap Rates Models and Hypotheses

In this section we present the theoretical underpinning of our hypotheses by connecting them to the theoretical models previously used in the finance and real estate literature. The model most often employed in previous work is the classic Gordon growth model applied to commercial real estate as a particular class of financial assets.

For example[6], if we denote the price of an apartment building at the end of period t by P_t and its net rent from period t to $t+1$ by H_{t+1}, then we can define the gross return from holding the apartment building from t to $t+1$ as $1+R_{t+1}=\frac{P_{t+1}+H_{t+1}}{P_t}$. This definition of the return to commercial real estate is similar to that of common stock (except that a commercial property provides real estate services at a market value H_{t+1} instead of paying dividends).

If we accept the simplifying conditions of the Gordon constant growth model[7], we can express the price as $P=\frac{H}{r-g}$ and consequently define cap rates as $CapRate=\frac{H}{P}$, where r is the nominal rate of return and g is the expected long term (constant) income growth. In other words, assuming constant expected discount rates and a constant expected rate of growth in net rent, we can express the cap rate simply as their difference:

$$CapRate=\frac{H}{P} = r-g \tag{1}$$

Based on the Gordon model discussed above, variables affecting r or g will in turn affect cap rates – the intuition being that a higher discount rate results in higher cap rates, while

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[6] See Plazzi et al (2006) for a more detailed discussion on returns in the context of real estate and cap rate models.

[7] The model assumes a constant income growth per period, as well as implying constant risk premia and risk free rates over time (see Geltner, Miller, Eicholtz and Clayton (2007), pg 594 for a more detailed discussion of the Gordon model in the context of real estate literature).

a higher expected real growth results in lower cap rates[8]. Hence the model guides us as to where to look for potential factors that can determine cross-sectional variation across MSAs. For example, suppose that the cap rate for apartments in Columbus is higher than the cap rate of similar apartments in San Diego. The Gordon model suggests that either expected real discount rates in Columbus are higher than those expected in San Diego or that future real rents in Columbus are expected grow at a slower real rate than in San Diego or both. Furthermore, it follows that in order to explain cross-sectional variations in cap rates for similar type properties, we need to identify factors that can potentially generate differences in expected growth rates and risk premia across MSAs.

Although the derivation above applies to any financial asset, we have to take into account that one of the main aspects in which commercial real estate differs from common stock is that prices of commercial properties are likely to be more sensitive than stocks to geographic, demographic and local economic factors due to geographical market segmentation.

Following the intuition of the Gordon model and proxies used in previous literature we investigate the effect of several factors that could potentially influence cap rates (through their respective effect on expected growth rates and discount rates). The factors explored include expected growth of demand and supply constraints (as drivers of expected growth rate), along with liquidity, risk and capital flows (as drivers of expected discount rates).

The determinants of expected growth rates

Most of previous empirical work has focused on demand driver proxies for the expected rental growth. We also investigate the demand side effect by considering variables such as Employment Growth, GMP Growth, Income Growth and Population Growth. All of these variables are designed to capture the demand side effect on the expected rental growth in the

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[8] Generally, one should define these in real terms – since inflation for the period of our study did not exhibit significant variation and the nature of our analysis is cross-sectional, we do not specifically control for inflation.

Gordon model, and thus we expect a negative effect in relation to cap rates. To construct these proxies we use data series from Economy.com and we build annualized geometric averages over the next 10 years (2006-2015) predictions.

However, it is important to note that the expected rental growth depends on both supply and demand factors. For a given rate of growth in the demand driver, the expected rental growth rate will be higher the tighter the supply is. One of the main contributions of this study is to investigate and document a strong effect of supply factors in the context of the Gordon model (an issue that has received far too little attention in previous literature).

To proxy for supply constraints we use the index reflecting stringency of regulation in a given MSA first built in Malpezzi (1996) and further developed in Malpezzi, Chun and Green (1998)[9]. The index developed by Malpezzi is our main proxy for supply constraints and is available for 33 out of the 34 MSAs that we have available transaction data for. In a more recent paper, Xing, Hartzell and Godschalk (2006) make the point that it is important to differentiate between measurements regarding the supply side of regulations and land management tools. While the former reflects the regulation development process and hence can respond to market conditions more quickly, the latter reflects growth management and its adoption takes longer and can affect both supply and demand of housing. Accordingly, the authors build two separate indices: the Development Process Restrictiveness Index (DPRI) and Growth Management Tools Index (GMTI) and provide evidence of a significant positive relation between DPRI, GMTI and housing prices. To check for the robustness of the relation between cap rates and supply constraints we also use both of these indices as an alternative for Malpezzi et al (1998) regulatory index. Although more refined, the main drawback of these

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[9] We are grateful to Stephen Malpezzi for supplying us with an updated version of the supply constraints index.

indices for our study is that we can only match 22 out of the 34 MSAs for which transaction data is available in our data set.

The determinants of expected discount rates

Discount rates are mainly driven by investors' perceptions of risk across different MSA apartments markets. The perceived volatility of a metropolitan economy (proxied by variables such as the historical or expected variability of metropolitan growth rates) can be one potential driver of investors' risk perceptions. We use standard deviation of the expected Employment Growth, GMP Growth, Income Growth, and Population Growth as a proxy for uncertainty/volatility of a certain MSA[10]. The time series standard deviation of quarterly returns per MSA (provided by NCREIF) is another measure aimed at capturing differences in perceived risks across MSAs.

Theoretical models of risk premia, such as the classic CAPM for example, suggest that higher risk levels (measured by beta) result in high risk premia, which reflect in turn in higher discount rates. Following previous literature, we try to build beta proxies for apartment markets across MSAs – we use NCREIF data to calculate beta measures based on quarterly returns per MSA and the aggregate NPI Apartment index or the aggregate NPI National Index[11]. However, it is important to note that the relation between beta and cap rates is not clear cut. Very often high beta assets have high discount rates (from CAPM), but they also tend to have low dividend yields (their expected return is large because of the expected growth rate). Hence, although we expect a positive relation between beta and risk (and thus between beta and cap rates), we have to take into account that growth rates and discount rates may not be independent and the relation between cap rates and beta will eventually reflect the net

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[10] We follow Sitivanidou and Sivitanides (1996) in using standard deviation of growth rates as a potential proxy that captures the perceived volatility of the metropolitan economy and hence shapes investors risk perceptions across MSAs.

[11] We follow the methodology described in Breidenbach et al (2006) to calculate beta measures.

dominating effect between the change in growth rates and the change in discount rates (see discussion of results in Section VI).

Another risk related factor that may affect discount rates is liquidity. Numerous studies have explored and documented the effect of liquidity in the context of real estate[12]. The intuition is that investments in less liquid markets are going to be deemed by investors as more risky and will reflect in higher required rates of return and hence higher discount rates applied to those respective markets. Consequently, investments in markets that are perceived to be more liquid may be associated with a lower capitalization rate. In order to capture liquidity we used the average sales volume per MSA calculated based on the transaction data available to us. Moreover, it is generally true that markets are more competitive and liquid when there's a lot of institutional interest. Institutional investors will want to be in markets where there are more transactions and where they will be able to sell a property quickly (most likely to another institutional investor) – hence the probability of selling quickly would be greater in markets with greater institutional interest. Based on this argument, we used NCREIF data to obtain the aggregate dollar volume of institutional sales for the period of our study as an additional proxy designed to capture liquidity.

Also, Fisher et al (2003) find evidence that transaction volume and liquidity is greater in rising markets when prices are increasing (cap rates are falling). They develop a model that shows how buyers' reservations prices increase relative to sellers' in an up market (and vice versa in a down market) thus leading to greater transactions. Furthermore, Fisher et al (2007) also find evidence that there is a link between capital flows and returns for apartments at the national level and for MSAs that tend to have the most institutional capital. Thus, we might expect that during an up market, increasing prices and lower cap rates would be observed first

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[12] Sivitanidou and Sivitanides (1999) explore liquidity in the context of office cap rates; Benveniste, Capozza, Senguin (2001) investigate the value of liquidity in the context of REITS

in the more liquid markets which would be the larger MSAs with more institutional capital and greater transaction activity. It is easier for institutional investors to add capital where they already have investments, property managers in place and an acquisition team already active in the market. Given the hypothesis that larger MSAs tend to attract capital sooner in a rising market (due to more investor activity, more liquidity, more information etc), and considering existing evidence of a connection between capital flows and returns it makes sense to investigate whether there is a connection between capital flows and cross-sectional differences in cap rates across MSAs.

In order to build a proxy that captures such capital flows, we employed the following methodology: based on average sales volume in the previous year (2004), we picked the largest three MSAs out of our sample of 34 (Los Angeles, Phoenix and New York) and we calculate a comparison base as the average of all transaction cap rates available for 2004 for the three MSAs. Considering that larger markets are always easier for those executing new investments, it is reasonable to believe that capital will flow into these markets first. Thus, by calculating the ratio (difference) between the comparison base and the average cap rate for each MSA in 2004, we can basically obtain a measure of cap rates in excess of the largest markets. The larger this ratio is the closer is the MSA to the largest markets in terms of their cap rates, and by investigating its connection with future cap rates, we can examine whether capital rate compression occurs first in larger MSAs that are more liquid. A negative and significant relation between CapRateRatio (Spread) and average cap rates in the 2005 cross-section can be interpreted as evidence that when the market is rising, capital tends to flow to the larger markets first (driving down those cap rates) and then to the smaller markets.

In summary, the previous paragraphs outline the intuition for several potential driving factors of cross-sectional variation in cap rates, through their respective effect on expected rent growths and expected discount rents. Our hypotheses are summarized in the following table:

Factor	Proxy for Factor	Expected Effect	Rationale*
Expected Growth Rates	*Employment Growth, GMP Growth, Income Growth, Population Growth*	-	Demand driver for growth rate in the Gordon Model
Supply Constraints	*Malpezzi (1998) Index, Indices developed in XHG(2006)*	-	More restrictive supply constraints would result in a higher rent growth for a given increase in demand
Liquidity	*Sales Volume, NCREIF dummy*	-	More liquidity implies less risk, which results in a lower discount rate in the Gordon model
Risk Measures	*Std Dev of Growth Rates, Beta*	+	Higher risk results in a higher discount rate in the Gordon model
Capital Flow Measures	*Cap Rate Ratio*	-	Capital flows from large markets towards smaller markets when capital allocated to real estate is expanding.

IV. Data and Methodology

This paper uses multifamily properties transaction data obtained from Real Capital Analytics. The data set contains detailed information on 2456 transactions that occurred during the period 2000-2005. After eliminating observations that are missing information for any of the variables of interest and MSAs without enough observations, we obtain 2116 usable transaction observations that cover 34 MSAs.

The methodology used involves three steps. First we use all transaction data available (2116 observations) to build an apartment cap rate model that can best explain transaction level cap rates. Although our analysis is focused on the cross-section of cap rates across MSAs, our data is essentially panel data and hence we have to make sure time effects do not affect our conclusions. Taking into account that our sample period is characterized by big changes in the yield curve (see figure in Appendix A), we conduct our analysis on cap rates in excess of the risk free rate, instead of simply using the level of cap rates as a dependent variable. We use the 10 years Treasury rate as a proxy for the risk free rate to match the characteristics of real estate as a long term investment[13]. Also, at this stage we control for property characteristics such as square feet, purpose, age, distance to the center of the city etc, while including dummies to control for location and time (other factors changing through time in addition to the risk free rate).

Second, we build 2005 constant quality cap rates by using 2005 averages per MSA in the model previously identified to construct a cross-section of average apartment cap rates in excess of the risk free rate per MSA. Since the property characteristics were already controlled for, the variation in these average gaps between cap rates and the risk free rate per MSA should be caused solely by different characteristics of the geographical markets on which the transactions occurred.

In the third step we are identifying several factors determining the cross-sectional variation in these average gaps between apartment cap rates and the risk free rates. We use the intuition provided by the Gordon model to identify potential candidates that can influence the variable of interest through their respective effects on expected rental growth and discount rates. We investigate two main categories of factors: (1) potential drivers of expected growth rates – including both expected growth of demand proxies, as well as supply constraints factors – and (2) potential drivers of discount rates – such as risk, liquidity and capital flows. Section III above discusses our hypotheses and Exhibit 1 presents a summary of definitions and data sources for the proxies employed.

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[13] Alternatively, it could be argued that since real estate becomes more and more securitized, cap rates tend to move with the market, in which case a short term interest rate would be the appropriate proxy for the risk free rate. Results remain qualitatively unchanged when the 1 month LIBOR is used as a proxy instead (see App. B)

V. Average Cap Rate Estimation

In the absence of detailed empirical transaction data, factors determining equilibrium values can be modeled to estimate expected equilibrium cap rates, once an acceptable model has been developed. Our work builds upon the previous literature with respect to this effort. However, in light of possible inefficiencies in the real estate asset and space markets, capitalization rates prevailing at any certain point in time may deviate from their equilibrium level and slowly adjust to longer term equilibrium values (see Sivitanidou and Sivitanides (1996)). So we recognize that markets will exhibit some harmonic fluctuation around equilibrium cap rates leading to the usual cautions in the utilization of any cap rate models for valuation purposes.

To value individual properties, the cap rate should be based on recent sales of properties at the same location with similar cash flow and value characteristics. Hence we consider attributes that affect the variation of transaction cap rates, such as the size, age and type of property sold, the purpose of the property, the distance from the property to the center of the city and its location. We include these variables as proxies for things (otherwise uncontrolled for) that may affect risk or return growth and through that may have an effect on cap rates[14]. In order to control for the time variation we include 5 year dummies in our model.

The empirical model takes the following form[15]:

$$R_i - R_f = a_0 + a_1 SqFt_i + a_2 AgeatSale_i + a_3 GardenDummy_i + a_4 Mid / Highrise_i + \tag{2}$$

$$+ a_5 CondConv_i + a_6 DistanceToCenter + \sum_{j=1}^{5} b_j YearDummy + \sum_{j=1}^{33} c_j MSADummy_i$$

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[14] For example, age is a variable associated with location. Newer properties tend to be in growth areas and thus we bring in a possible growth effect that is locational in nature but we capture it via "age" since we don't have an index for the quality of the location (same type of argument can be made for size, type of property etc.)

[15] Although other forms were also considered, the linear form seems to do the best job of capturing variation in the data. Several other deal-specific variables (such as vacancy rate) were considered but were not included in the final model since they did not provide significant improvement (see the part C of the Robustness Checks Appendix for results with the vacancy rate proxies included).

Exhibit 4 presents estimation results of (2) applied to the whole sample of apartment transaction data available to us. As we can see from the p-values presented in the table, year dummies and property characteristics are highly significant in explaining transaction excess cap rates, which is consistent with our initial intuition and previous literature. Location is significant in explaining differences in transaction cap rates – the coefficients of approximately two thirds of the 33 MSA Dummies included are significant at 5% level. Additionally, the joint test on the MSA dummies presented at the bottom of Exhibit 4 is highly significant, indicating that including location is necessary in explaining the cross-sectional variation of cap rates. Location within the MSA is also significant, as reflected by the low p-value of the coefficient on the Distance to Center variable.

In the next step we use transaction data to obtain 2005 MSA averages for each of the independent variables considered in equation (2). These averages are presented in Exhibit 5. Using these averages together with the estimated coefficients from Exhibit 4 we construct a cross-section of 2005 empirical average constant quality excess cap rates for each of the 34 MSAs considered in the analysis.

As we can see from Exhibit 6, there is considerable cross-sectional variation in the average excess apartment cap rates obtained as previously described. The mean of the sample is 2.24% with a standard deviation of 0.72%, and individual average cap rates in excess of the 10 years Treasury rate vary from a minimum of 0.66% (obtained for San Diego, CA) to a maximum of 3.99% (Columbus, OH).

The methodology described so far basically follows the one described in Hendershott and Turner (1999), in the sense that we use transaction (property) specific characteristics to account for location, property type etc in order to obtain quality adjusted cap rates that are comparable across MSAs. We then calculate average quality adjusted cap rates per MSA. Given that individual characteristics were already taken into account and controlled for in the process of obtaining these average values, it follows that only market specific characteristics can be responsible for this geographical variation.

VI. Exploring the determinants of cross-sectional cap rate variation

Considering previous literature, we investigate several potential factors that can be responsible for differences between geographical markets and hence for the cross-sectional variation in the average gap between apartment cap rates and the risk free rate. Guided by the Gordon model, we consider two categories: (1) factors that can influence the expected rental growth (demand expected growth rates, supply constraints) and (2) factors that may influence the expected discount rate (liquidity, risk, capital flows). A description of the proxies used for each category of potential factors is presented in Exhibit 1, while summary statistics of the main variables are included in Exhibit 2 and univariate results in Exhibit 3.

In what follows we present the estimated results in the context of the multivariate analysis presented in Exhibit 7. In the last part of this section we discuss the overall results and provide an example of how our models can be used to derive pricing implications for different markets.

Estimation Results

Expected demand growth

Given the relation illustrated by the Gordon model, we expect areas that have high expected growth rates to be characterized by low average cap rates. The results we obtain in this case are surprising, in the sense that we do not find a strong demand side effect on cap rates.

All variables considered as proxies for the expected growth of demand (Employment Growth, GMP Growth, Income Growth, Population Growth) are generally not significant as explanatory variables of Excess Cap Rates (see Exhibit 7). When used in conjunction with the Xing et al (2006) supply constraints indices, Employment Growth rate seems to be marginally improving the explanatory power of the model (Exhibit 7, Panel A).

As the quote at the beginning of this article suggests, this is one of the relations implied by theory that is apparently not supported by the data. Several explanations could be offered for these results: (1) our proxies are noisy and although the relation exists we are not able to capture it; (2) the theoretical models provide the wrong intuition; (3) the pricing across markets is inefficient for apartments at this particular point in time. We further detail the third potential explanation at the end of this section, where we show how we can use our models to identify markets temporarily out of equilibrium.

It is important to note that our results are maybe not so surprising if considered in the context of previous work that has also documented this weak connection between growth rates and cap rates (Hendershott and MacGregor (2005a)). This is precisely what led us into investigating the next category of factors (supply constraints) as another driver of rental growth rates that may capture rental growth effects better than the demand growth proxies discussed above.

Supply Constraints

The main point of this study is that rental growth rates are not only driven by demand side effect, but also by supply side characteristics. Previous literature has focused only on proxies designed to capture the demand growth, and hence concluded that the theoretical relation between growth rates and cap rates is not (or weakly) supported by the data. We show that supply constraints have a more discernable impact on cap rate variations relative to direct growth measurements. Hence, not including the supply side aspect in the context of the Gordon model may be responsible for the weak results obtained in previous literature.

Several early studies show that regulation/supply restrictiveness positively impacts housing prices and values (Malpezzi (1996), Malpezzi, Chun and Green (1998), Mayer and Sommerville (2000a, 2000b)). More recently, supply stories have been investigated in relation to prices with very promising results (see Gyuorko et al (2006), Niewerburgh and Weill (2006)). Hence it makes sense to investigate whether supply side phenomena affect variation in cap rates across MSAs. We investigate two sets of proxies for supply constraints: (1) the index built by Malpezzi (1996) and further refined in Malpezzi, Chun and Green (1998) and (2) the two indices built by Xing et al (2006) which are meant to capture supply restrictiveness (DPRI) and land management tools (GMTI). Given the empirical evidence that supply constraints positively affect prices, we expect to find a negative relation between supply constraints indices and cap rates (MSAs with the more restrictive supply constraints should have lower cap rates on average).

The univariate results (Exhibit 3) provide the first sign supportive of this hypothesis. The correlation between logExCapRates and Malpezzi98 Index is strongly negative (-0.679) and very significant. The same story is observed when investigating correlations with DPRI and GMTI. Moreover, it seems that the two indices built by Xing et al (2006) are able to capture additional information by comparison with Malpezzi98 – although DPRI and Malpezzi98 are highly positively correlated (0.671), the second index from Xing et al (2006), GMTI, is not significantly correlated with Malpezzi98, yet presents a strong negative correlation with logExCapRates[16]. However, univariate results are limited and cannot tell the whole story, so we continue our investigation with a multivariate regression analysis.

By looking at the results from Exhibit 7 (Panel A) we can see that our hypothesis is confirmed by the very strong negative influence of supply constraints over LogExCapRates. Consistent with correlations presented in Exhibit 3, considering DPRI and GMTI as proxies for supply constraints significantly improves the explanatory power of the cross-sectional tests versus using Malpezzi98 (Models 5, 6, 7 vs Models 1, 2, 3, 4). However, we could only match 22 out of the 34 MSAs when using the indices from Xing et al (2006), while using Malpezzi98 allows us to use 33 out of the 34 MSAs in our sample. Additionally, Exhibit 3 shows a strong positive correlation between DPRI and our liquidity measures indicating that we may encounter some multi-collinearity problems when using the Xing et al indices in our analysis.

The data very clearly shows that there is a significant relation between the supply constraints in a given MSA and the estimated average Excess Apartment Cap Rate for that MSA. This relation is both statistically and economically significant and is robust to the proxy used for supply constraints. Also, the results show that this connection is not likely to be subsumed by other effects – the coefficients remain significant after including any other variables in our regression (See Panel A, B, C of Exhibit 7).

Liquidity

Considering that the liquidity of a market affects investors required risk premia, this should translate in an inverse relation between liquidity and cap rates (more liquidity for a given MSA should result in a lower cap rate). The first proxy we consider to control for liquidity is the average sales volume per MSA which we obtain from the transaction data available to us. Secondly, considering that markets with more institutional participation are

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[16] Similar results are presented in Xing et al (2006).

deemed to be more liquid, we try to capture liquidity by the aggregate institutional sales volume for each respective MSA during the period of our study. However, it is important to note that this proxy based on institutional interest has high correlation with the Xing et al DPRI index, which can create a potential multi-collinearity problem (this justifies our choice of using the Sales Volume vs NCREIF variables in models containing DPRI and GMTI).

Given the characteristics of the Average Sales Volume and Aggregate NCREIF Volume (see descriptive stats), we use log of these variables in the multivariate regressions. We can see from Exhibit 7 that the coefficients are always statistically and economically significant. More liquid MSAs have significantly lower cap rates than the less liquid ones. This relation holds no matter what proxy is used for supply constraints and what other variables are included in the regression (see Panel A, B, C of Exhibit 7).

Risk

Uncertainty about future cash flows produced by a given property should affect the current value of that property. Accordingly, the higher the perceived risk for a given MSA, the higher the cap rate observed for that MSA should be (because of the higher discount rate). We tried several proxies in an effort to capture uncertainty: standard deviation of growth rates, time series and intra MSA standard deviation of apartment prices as well as beta measures designed to capture covariance between MSA returns and two aggregate indices from NCREIF website: NPI Apartments and NPI National.

While the standard deviation of GMP provides significant explanatory power in conjunction with the Xing et al indices (models 5, 6, 7 of Exhibit 7, Panel A), the results are not robust when the Malpezzi index is used (see Panel B, Exhibit 7). Overall, we cannot conclude that either standard deviation of growth rates, time series or intra MSA standard deviation of apartment prices have significant and robust explanatory power in explaining cross-sectional variation in cap rates across MSAs.

More interestingly, although the Beta measures appear to be highly significant and do increase the adjusted R-squares when included in multivariate regressions, the direction of the relation is the opposite of what we expect. This is not necessarily contradictory of theoretical predictions though. As mentioned in Section III, high beta assets often have not only high discount rates (from CAPM), but also low dividend yields (the expected growth rate drives the large expected return). So it could be that the negative sign of our beta coefficients captures the dominating effect of growth rates over the one of the discount rates[17]. It is also possible that the collinearity introduced by the significant correlation between the liquidity proxies and the beta variable is partially responsible for this result, although excluding the proxies for liquidity does not fix the problem with the risk coefficient (see Model 9 of Exhibit 7, Panel B). We have to leave it to future research to identify a more refined proxy for risk that can better capture the clear discount rate effect that generates cross-sectional variation in Cap Rates across MSAs.

Capital Flow

As discussed earlier, when there's a general economic uptrend, capital should first flow into bigger markets and once they are saturated it should gradually flow to the second and third tier markets. If this hypothesis is correct, large markets should lead smaller markets in terms of cap rate behavior. Of course, the reverse is true in a downturn cycle, but since our data only refers to one cross-section, it limits the scope of our study to identifying a flow from larger to smaller markets.

Our capital flow proxy is described in detail in Section III. Since we want to eliminate any potential endogeneity problems, we avoid using 2004 data to explain average excess cap

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[17] While theoretically this issue could be addressed by including an interaction variable between growth and beta, untabulated results show unsatisfactory results regardless of the proxies involved.

rates that were obtained based on the same information (we used observations from 2004 to estimate the coefficients for the model in Exhibit 4). Hence every time we include the CapRateRatio variable on the right hand side we re-estimate the dependent variable based on the same model but only using 2005 transaction data. The results estimated in Exhibit 7 are consistent with the capital flow hypothesis, since the coefficients on the CapRateRatio are negative and significant and including this variable increases the explanatory power of the cross-sectional regression[18].

Interaction Terms

Previous literature suggests that the relation between cap rates, supply constraints and expected growth rates may not be linear (see discussion in Xing et al, 2006). To control for the potential non-linearity of this relation we included interaction terms calculated as the product of the supply constraint proxy and the expected growth rate for demand. However, contrary to Xing et al (2006) our results do not show a significant improvement on terms of explanatory power when the interaction terms are included in the cross-sectional tests (see Exhibit 7).

Discussion of Cap Rate Models Results

To summarize, our results show that supply constraints and liquidity of the market are strong explanatory variables for the cross-sectional variation in cap rates. Supply constraints have a more discernable impact on cap rate variations relative to direct demand growth measurements that were previously considered in the literature.

Robustness Checks

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[18] Since capital flows are not the main point of our paper, we did not spend much time on investigating this relation in depth – the cross-sectional analysis receives priority instead.

To make sure that our results are not solely driven by the methodology employed, we also explored using a single step approach instead of the three step procedure described in Section IV. Instead of obtaining average excess cap rates per MSA for year 2005, we used the transaction data directly, by replacing our location dummies with the factors that can be responsible for geographical cross-sectional variation in cap rates (supply restrictiveness indices, liquidity, expected demand growth etc). When we collapse the three steps into one as described, results remain qualitatively unchanged (see part D of the Appendix). Although the results are qualitatively unchanged, the main drawback of this methodology is that the results are harder to interpret, since the coefficients do not give a direct sense of the extent of cross-sectional geographical variation across MSA.

Given the strong theoretical support in favor of a connection between demand growth and cross-sectional variation in cap rates, there are several potential explanations for the surprisingly weak relation that we find in the data. On one hand, it is conceivable that our proxies do not satisfactorily capture the expected growth of demand. On the other hand, given that we are not the first to document this type of result (see quote at the beginning of this study) it is also possible to infer that this weak relation is evidence of markets departing (at least temporarily) from equilibrium values. Interpreted this way, our results can lead to inferences about pricing efficiency across markets for the same type properties (in our case, apartments).

Pricing Implications

As mentioned in the previous paragraphs, our methodology can provide insights beyond just identifying factors that generate cross-sectional variation in average apartment cap rates. Our analysis can be applied to identify markets that seem to be temporarily out of equilibrium, thus spotting potential profit opportunities. The main cross-sectional models presented can be used to gain insight into which markets are out of alignment with the others at the point of our analysis, simply by identifying the MSAs with the greatest deviation from the model.

If the real estate markets are in equilibrium at least in the long run, high deviations from the model could identify potential mispricings across MSAs which can translate into profit opportunities given that the markets will eventually correct such mispricings (of course, this is true in the context of investors rationality – see discussion in Section II).

For example, using model 1 presented in Exhibit 7 (Panel A), we can obtain the estimated residuals and rank the MSAs in order of these estimated residuals (Exhibit 8). Theoretically, the MSAs with the lowest (negative) residuals are the ones with CapRates lower than our model would predict, and the ones with the highest (positive) residuals have higher cap rates than predicted.

If our model predicts cap rates fairly accurate, we can further draw conclusions about multifamily properties values (prices) in certain MSAs as of 2005. Consequently, we can say that (as of 2005) relative to our model, the apartment market for San Diego seems to be overpriced (has the lowest residuals). Conversely, apartment real estate values in, Las Vegas, Columbus (OH) and Tampa are underpriced (have high positive residuals). Hence, if markets correct miss-pricings and return to equilibrium in the long run[19], we would expect prices in the first set of MSAs to decline in the future, while prices in the latter set of MSAs should increase[20]. The analysis is fairly robust over the choice of model – we obtain roughly the same conclusions using the other models including the Malpezzi Index that are included in Panel A of Exhibit 7 (Exhibit 8 only includes results using Model 1, for illustration purposes).

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[19] Of course, we cannot define what "long-run" means based on the current analysis. An interesting future research question would be to investigate how long does it take for the markets to correct.

[20] We do not employ a complete analysis to see if cap rates return to equilibrium values in time – the main focus of this paper is the determinants of the cross-sectional variation in cap rates across MSAs. However, as a preliminary investigation, we did check and the average apartment cap rates for 2006 in San Diego did increase, while those for Tampa, Columbus and Las Vegas decreased. It is a worthwhile study to examine the time to move towards long term equilibrium estimates.

VII. Conclusions

This study documents and explores large geographical differences in apartment capitalization rates across MSAs. Empirical findings suggest that such variations are largely determined by the supply constraints and the liquidity of different geographical markets. Specifically, MSAs with more stringent supply constraints and more liquid MSAs have significantly lower cap rates than their counterparts. Our results suggest that supply side constraints have a more discernable impact on cap rate variations relative to direct growth measurements. Hence, not including the supply side aspect in the context of the Gordon model may be responsible for the weak results obtained in previous literature.

Uncovering the driving factors behind geographic variation of cap rates is important as it can help us better understand and identify conditions of disequilibria among different markets. If we assume that real estate markets are on average fairly priced, then we can uncover how factors which drive going-in yields affect current pricing. Consequently, we could estimate the impact of faster growth rates, or tighter supply constraints based on economic trends or new regulations on real estate values, mortgage risk or even property taxes as side effects. In addition, we could gain insight into which markets seem out of alignment with the others, hopefully leading to greater understanding of the general issue of the shorter term dynamic pricing process of real estate markets.

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Exhibit 1
Definitions and Data Sources for Variables Used in Cross-Sectional Analyses

Category	Variable	Definition	Data Source
	AverageExCapRate	Average Apartment Cap Rate (in excess of the 10 yrs Treasury rate) per MSA for 2005 calculated based on linear model described in Exhibit 4	Linear model estimated based on apartment transaction data form Real Capital Analytics
Growth Rates	**Employment GrRate** **GMPGrRate** **PopulationGrRate** **IncomeGrRate**	2005 Expected Growth Rates per MSA calculated as annualized geometric averages over the next 10 years predictions	Quarterly Employment, Gross Metro Product, Population, and Income series per MSA from Economy.com (2006 – 2015)
Supply Constraints	**Malpezzi98**	Index reflecting stringency of regulation in a given MSA	Malpezzi, Chun and Green (1998)
	DPRI	Development Process Restrictiveness Index	Xing, Hartzell, and Godschalk (2006)
	GMTI	Growth Management Tools Index	
Liquidity	**AverageSalesVol**	Calculated from original data as the sum of transaction prices per MSA	Apartment transaction data from Real Capital Analytics
	NCREIF Sales	Aggregate sales per MSA calculated based on NCREIF data for the period of our study	NCREIF
Risk Proxies	**StdDevEmployment** **StdDevGMP** **StdDev Population** **StdDevIncome**	Standard Deviation of respective expected Growth Rates over the period 2006-2015 designed to capture uncertainty (risk)	Economy.com
	StdDev IntraMSA	Standard deviation of individual properties within a given MSA	NCREIF
	TimeSeriesStdDev	Time Series Standard Deviation per MSA using quarterly MSA returns (time periods per MSA differ, depending on data availability)	NCREIF
	BetaApts	Beta measure calculated using quarterly returns per MSA against the aggregate NPI Apartment Index (1990 – 2004)	NCREIF
	BetaNat	Beta measure calculated using quarterly returns per MSA against the aggregate NPI National Index (1990 – 2004)	NCREIF
Capital Flow Measures	**CapRateRatio** **CapRate Spread**	The largest three MSAs (based on average sales in 2004) are used to calculate a 2004 CapRateIndex (average of all transaction cap rates for the three MSAs) For each MSA, the ratio (difference) between average CapRate of MSA in 2004 and index (the average CapRate per MSA for 2004 is obtained by averaging transaction data). To avoid endogeneity problems, every time this variable is used we reestimate the dependent variable using only 2005 transaction data.	Apartment Transaction Data from Real Capital Analytics
Interaction Terms	**Empl_Interaction** **GMPInteraction** **IncomeInteraction** **PopInteraction**	Interaction of respective growth rate for 2005 and supply constraints (Growth Rate *Malpezzi98)	Economy.com and Malpezzi, Chun and Green (1998)

Exhibit 2
Descriptive Statistics for the Variables used in Cross-Sectional Tests

The table presents descriptive statistics for the variables used in cross-sectional regressions to explain the variation of cap rates across MSAs. Statistics are obtained for year 2005. The data sources and methodologies used to obtain each variable are as described in Exhibit 1.

Category	Variable	N	Mean	Std Dev	Median	Minimum	Maximum
	AverageExCapRate	34	0.022	0.007	0.022	0.007	0.040
	logExCapRate	34	-3.859	0.377	-3.800	-5.028	-3.221
Growth Rates	**EmploymentGrRate**	34	0.020	0.010	0.020	0.005	0.049
	GMPGrRate	34	0.054	0.010	0.053	0.039	0.086
	PopulationGrRate	34	0.016	0.008	0.016	-0.003	0.033
	IncomeGrRate	34	0.032	0.004	0.033	0.025	0.041
Supply Constraints	**Malpezzi98**	33	21.045	2.343	20.626	17.139	26.639
	DPRI	22	11.277	5.715	10.000	3.600	25.000
	GMTI	27	3.415	1.908	3.000	0.500	7.000
Liquidity	**AverageSalesVol (mil $)**	34	267.156	346.439	159.233	7.806	1742.000
	AggregNCREIFSales (mil $)	32	2332.050	2481.460	1473.100	19.309	10976.690
Risk Proxies	**StdDevEmployment (%)**	34	0.099	0.042	0.095	0.035	0.207
	StdDevGMP (%)	34	0.162	0.031	0.162	0.078	0.255
	StdDevPopulation (%)	34	0.046	0.024	0.042	0.015	0.143
	StdDevIncome (%)	34	0.116	0.057	0.102	0.073	0.410
	StdDevIntraMSA	34	0.113	0.071	0.083	0.051	0.327
	TimeSeriesStdDev	34	0.028	0.010	0.026	0.004	0.058
	BetaApts	30	1.095	0.461	1.174	0.143	2.372
	BetaNat	30	0.802	0.373	0.748	-0.006	1.773
Capital Flow Measures	**CapRateRatio**	34	1.138	0.130	1.132	0.825	1.412
	CapRateSpread	34	0.008	0.008	0.008	-0.011	0.025
Interaction Terms	**Empl_Interaction**	33	0.427	0.227	0.395	0.131	1.177
	GMP_Interaction	33	1.141	0.251	1.114	0.783	1.814
	Income_Interaction	33	0.681	0.117	0.659	0.501	0.929
	Pop_Interaction	33	0.349	0.186	0.332	-0.067	0.739

Exhibit 3
Correlation Table

Table presents Pearson correlation coefficients for selected variables used in the main cross-sectional regressions to explain variation of cap rates across MSAs (p-values are presented in parentheses). Variables refer to year 2005 and are obtained as described in Exhibit 1.

	logExCap Rates	**Empl GrRate**	**Malp 98**	**DPRI**	**GMTI**	**Avg SalesVol**	**NCREIF Sales**	**StdDev GMP**	**TimeS StdDev**	**Beta Nat**	**CapRate Ratio**	**Empl Interact**
logExCap Rates	1	0.192 (0.277)	-0.679 <.0001	-0.761 <.0001	-0.434 (0.024)	-0.360 (0.037)	-0.310 (0.085)	0.104 (0.560)	-0.088 (0.620)	-0.575 (0.001)	-0.629[a] <.0001	0.083 (0.644)
Employment GrRate		1	-0.008 (0.964)	-0.228 (0.308)	0.088 (0.664)	-0.253 (0.149)	-0.335 (0.061)	0.055 (0.758)	0.453 (0.007)	-0.364 (0.048)	0.192 (0.277)	0.982 <.0001
Malpezzi 98			1	0.671 (0.001)	0.109 (0.597)	0.338 (0.054)	0.249 (0.177)	-0.214 (0.232)	0.282 (0.112)	0.333 (0.078)	-0.568 (0.001)	0.161 (0.371)
DPRI				1	0.213 (0.342)	0.379 (0.082)	0.386 (0.076)	0.181 (0.422)	0.222 (0.320)	0.630 (0.002)	-0.618 (0.002)	-0.106 (0.649)
GMTI					1	-0.097 (0.630)	-0.284 (0.151)	-0.058 (0.776)	0.049 (0.809)	0.020 (0.919)	-0.402 (0.038)	0.124 (0.545)
Average SalesVol						1	0.438 (0.012)	0.142 (0.422)	-0.071 (0.690)	0.458 (0.011)	-0.331 (0.056)	-0.238 (0.182)
NCREIF Sales							1	0.149 (0.417)	-0.035 (0.851)	0.553 (0.002)	0.225 0.2161	-0.310 (0.089)
StdDev GMP								1	0.118 (0.505)	0.199 (0.292)	-0.036 (0.838)	0.022 (0.903)
TimeSeries StdDev									1	0.339 (0.067)	0.197 (0.262)	0.503 (0.003)
BetaNat										1	-0.520 (0.003)	-0.344 (0.068)
CapRate Ratio											1	0.119 (0.510)
Empl Interaction												1

a. reported correlation is calculated using the 2005 average cap rate from the linear model described in table IV, with the parameters estimated based on 2005 transaction data only (in order to avoid endogeneity problems)

Exhibit 4
Apartment Cap Rate Model Estimates

In order to obtain average cap rates in excess of the risk free rate per MSA we use the apartment transaction data for the period 2000-2005 in a model of the following form:

$$R_i - R_f = a_0 + a_1 SqFt_i + a_2 AgeatSale_i + a_3 GardenDummy_i + a_4 Mid/Highrise_i + \\ + a_5 CondConv_i + a_6 DistanceToCenter + \sum_{j=1}^{5} b_j YearDummy + \sum_{j=1}^{33} c_j MSADummy_i$$

The dependent variable is the cap rate in excess of the risk free rate corresponding to each transaction (the risk free rate is measured by the 10 yrs Treasury Rate in the month of the respective transaction). The table presents the estimated coefficients, along with the t statistics and respective p values. SqFt represents the size of the property sold measured in square feet. YearDummy captures the time when the transaction was completed. GardenDummy and Mid/Highrise are dummy variables meant to capture property type. CondConv is a dummy variable meant to capture the purpose of the property (takes value 1 if property is used for condo conversion and 0 otherwise). Distance to Center is the distance to the center of the city measured in miles. 33 MSA dummies are included to capture geographic variations (the 34th MSA, Phoenix, is the reference group). The last part of the table presents a joint test for the 33 location dummies (the null hypothesis is that $c_1=c_2=\ldots=c_{33}=0$ in the model above).

Variable	Coefficient	Test Statistic	p-Value Two Tailed
Constant	0.021	15.29	0.000
Sq Ft (mil)	-0.008	-3.58	0.000
Age at Sale	0.000	3.94	0.000
2000	0.008	3.51	0.001
2001	0.015	11.95	0.000
2002	0.016	18.05	0.000
2003	0.014	17.22	0.000
2004	0.005	7.03	0.000
Garden	0.002	3.23	0.001
Mid/Highrise	0.000	-0.34	0.736
Condo Conv	-0.008	-7.52	0.000
Distance To Center	0.000	5.70	0.000
Albuquerque	0.010	3.35	0.001
Atlanta	0.004	2.63	0.009
Austin	0.001	0.50	0.620
Chicago	-0.006	-2.65	0.008
Columbus, OH	0.017	4.57	0.000
Dallas	0.009	6.18	0.000
Denver	-0.004	-1.72	0.085
Fort Myers	0.000	0.11	0.913
Fresno	0.007	2.02	0.044
Houston	0.006	4.43	0.000
Indianapolis, IN	0.005	1.48	0.140
Jacksonville	-0.001	-0.36	0.720
Kansas City	0.008	2.73	0.006
Las Vegas	0.008	4.59	0.000

Los Angeles	-0.014	-13.29	0.000
Miami	-0.006	-3.44	0.001
New York	-0.012	-5.90	0.000
Orlando	-0.002	-0.67	0.504
Portland	-0.003	-1.22	0.224
Raleigh	-0.002	-0.65	0.514
Reno, NV	0.003	0.93	0.351
Sacramento	-0.008	-4.94	0.000
Salt Lake City	0.003	0.77	0.440
San Antonio	0.008	3.00	0.003
San Diego	-0.017	-10.90	0.000
San Francisco	-0.019	-12.86	0.000
Sarasota	0.001	0.42	0.672
Seattle	-0.004	-2.48	0.013
Stockton-Lodi, CA	-0.003	-0.81	0.417
Tampa	0.006	4.30	0.000
Tucson	0.004	1.46	0.146
Washington	0.001	0.56	0.576
West Palm Beach	-0.005	-2.16	0.031
r^2	**Adj. r^2**	**SE**	**Observ.**
0.471	**0.459**	**0.012**	**2116**
Joint Test of MSA Dummies		**F Value**	**Pr > F**
		23.9	<.0001

Exhibit 5
MSA Averages

Averages for the variables included in the cap rate model (presented in Exhibit 4) are calculated for each MSA for year 2005. These averages are used with the estimated coefficients from Exhibit 4 in order to obtain the 2005 cross-section of average cap rates per MSA (see Exhibit 6).

MSA Description	Sq Ft	Age	Garden	Mid/ Highrise	Condo Conv	Distance To Center
Albuquerque, NM	217286	22.40	0.70	0.15	0.00	5.57
Atlanta, GA	325167	17.35	0.36	0.05	0.05	13.46
Austin, TX	244777	12.21	0.62	0.03	0.03	8.23
Chicago, IL-IN-WI	173463	43.52	0.45	0.29	0.10	16.71
Columbus, OH	255104	31.73	0.45	0.09	0.00	7.36
Dallas, TX	285634	17.63	0.61	0.04	0.00	15.07
Denver, CO	229952	18.84	0.53	0.13	0.09	19.85
Fort Myers, FL	246183	12.76	0.67	0.00	0.24	7.03
Fresno, CA	196779	23.67	0.87	0.00	0.20	5.30
Houston, TX	281765	18.08	0.78	0.05	0.03	13.79
Indianapolis, IN	272061	26.00	0.92	0.00	0.08	19.18
Jacksonville, FL	275435	22.55	0.50	0.00	0.20	7.54
Kansas City, MO-KS	281343	9.78	0.50	0.00	0.17	12.74
Las Vegas, NV-AZ	226886	17.35	0.73	0.00	0.11	5.54
Los Angeles, CA	95439	31.68	0.67	0.10	0.03	24.06
Miami, FL	246439	22.23	0.47	0.23	0.35	21.61
New York, NY-NJ-CT-PA	101593	59.62	0.15	0.80	0.07	12.33
Orlando, FL	312275	11.56	0.30	0.04	0.07	7.63
Phoenix, AZ	177223	18.61	0.75	0.05	0.06	24.51
Portland, OR-WA	170880	16.70	0.76	0.03	0.00	9.24
Raleigh, NC	271252	13.05	0.19	0.00	0.00	15.98
Reno, NV	244526	14.25	0.50	0.00	0.00	3.27
Sacramento, CA	155535	23.92	0.68	0.01	0.07	9.70
Salt Lake City, UT	270158	20.23	0.23	0.00	0.00	8.77
San Antonio, TX	231770	16.65	0.65	0.04	0.00	9.26
San Diego, CA	73003	26.66	0.62	0.05	0.26	17.99
San Francisco, CA	58787	40.00	0.66	0.21	0.06	37.77
Sarasota, FL	254863	17.43	0.50	0.00	0.50	8.24
Seattle, WA	177387	18.42	0.57	0.15	0.05	14.08
Stockton-Lodi, CA	92544	27.67	0.83	0.00	0.00	8.23
Tampa, FL	237850	17.95	0.50	0.03	0.15	16.93
Tucson, AZ	161100	19.50	0.88	0.00	0.00	6.80
Washington, DC-MD-VA-WV	324090	23.69	0.42	0.51	0.00	20.43
West Palm Beach, FL	296385	12.15	0.52	0.07	0.37	10.14

Exhibit 6
Estimated Average Apartment Cap Rates (in excess of risk free rate) per MSA for 2005

Estimated coefficients of the linear model presented in Exhibit 4 are used along with MSA averages presented in Exhibit 5. The estimated cap rate represents the average cap rate in excess of the risk free rate per MSA for year 2005. The proxy used for the risk free rate is the 10 yrs Treasury rate. Estimates are expressed in percentages and presented in descending order.

MSA	Average Cap Rate In Excess of Risk Free Rate (%)
Columbus, OH	3.990
Albuquerque, NM	3.228
Dallas, TX	3.218
San Antonio, TX	3.026
Las Vegas, NV-AZ	2.937
Houston, TX	2.921
Indianapolis, IN	2.913
Kansas City, MO-KS	2.857
Fresno, CA	2.837
Tampa, FL	2.830
Tucson, AZ	2.727
Atlanta, GA	2.562
Reno, NV	2.470
Phoenix, AZ	2.448
Salt Lake City, UT	2.424
Washington, DC-MD-VA-WV	2.395
Austin, TX	2.289
Stockton-Lodi, CA	2.188
Portland, OR-WA	2.052
Fort Myers, FL	2.043
Raleigh, NC	1.987
Jacksonville, FL	1.955
Sarasota, FL	1.954
Seattle, WA	1.917
Denver, CO	1.885
Orlando, FL	1.834
Chicago, IL-IN-WI	1.811
Sacramento, CA	1.546
Miami, FL	1.519
New York, NY-NJ-CT-PA	1.320
West Palm Beach, FL	1.319
Los Angeles, CA	1.224
San Francisco, CA	0.954
San Diego, CA	0.655

Exhibit 7
Cross-Sectional Regressions

The table presents estimated coefficients for the main empirical models estimated for the 2005 cross-section of average cap rates in excess of the risk free rate per MSA (corresponding t-values are presented in parentheses). The dependent variable is the natural logarithm of the average excess cap rates presented in Exhibit 6. Adjusted R-square values and the number of observations used for each model are included. In addition, we present the F test for the significance of each model, along with the AIC and BIC values for each model (however, these values need to be treated with caution, since not all of the models are comparable). Variables are calculated as described in Exhibit 1. Panel A includes the models with the highest explanatory power. Additional models that were tested using Malpezzi98 Index as a supply constraints proxy are presented in Panel B. Panel C contains additional models using the two indices from Xing et al (2006) as proxies for supply constraints.

Panel A: Main Cross-Sectional Tests

Model	**1**	**2**	**3**	**4**[a]	**5**	**6**	**7**[a]
Intercept	-0.252	0.213	-0.715	1.158	-2.298	-2.219	-0.415
	(-0.33)	*(0.24)*	*(-0.56)*	*(1.00)*	*(-3.43)*	*(-3.05)*	*(-0.34)*
EmplGrRate	5.301	5.804			11.284		
	(1.10)	*(1.12)*			*(1.83)*		
Malpezzi Index	-0.105	-0.106	-0.098	-0.067			
	(-5.29)	*(-5.20)*	*(-4.53)*	*(-1.74)*			
DPRI					-0.047	-0.052	-0.044
					(-5.19)	*(-5.58)*	*(-2.36)*
GMTI					-0.088	-0.075	-0.159
					(-2.96)	*(-2.38)*	*(-3.20)*
logSales	-0.080			-0.098	-0.081	-0.083	-0.132
	(-2.26)			*(-1.69)*	*(-2.23)*	*(-2.04)*	*(-2.07)*
logNCREIFSales		-0.094	-0.040				
		(-2.46)	*(-0.64)*				
BetaNat			-0.350				
			(-2.06)				
StdDevGMP					3.607	3.863	4.983
					(2.42)	*(2.39)*	*(1.91)*
TimeSeriesStdDev						4.878	
						(0.54)	
CapRateRatio				-1.948			-0.770
				(-2.29)			*(-1.91)*
Adj R square	***53.07%***	***55.87%***	***60.23%***	***54.06%***	***78.84%***	***74.88%***	***71.56%***
F test	***13.06***	***13.66***	***15.13***	***9.27***	***16.65***	***13.52***	***11.53***
AIC	***-84.68***	***-79.26***	***-75.55***	***-49.70***	***-65.26***	***-61.49***	***-41.62***
BIC	***-81.61***	***-76.12***	***-72.32***	***-46.56***	***-59.04***	***-55.27***	***-35.40***
NoObs	***33***	***31***	***29***	***33***	***22***	***22***	***22***

a. Dependent variable is the average cap rate obtained from the linear model described in table IV, except the parameters of the model are now estimated based on 2005 transaction data only (in order to avoid endogeneity problems)

Panel B: Additional Cross-Sectional Tests using Malpezzi Index as proxy for Supply Constraints

Model	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Intercept	-0.143	-1.591	-1.588	-1.796	0.073	-0.030	-0.540	-1.198	-2.165	-1.697	-1.236	-1.571	6.063
	(-0.18)	*(-2.53)*	*(-3.29)*	*(-2.92)*	*(0.10)*	*(-0.04)*	*(-0.62)*	*(-1.38)*	*(-3.62)*	*(-1.62)*	*(-0.40)*	*(-1.77)*	*(1.34)*
EmplGrRate							8.648			8.051			
							(1.18)			*(0.14)*			
GMPGrRate		4.781									-5.335		
		(0.89)									*(-0.09)*		
PopulationGrRate			2.233									-0.515	
			(0.31)									*(-0.01)*	
IncomeGrRate				9.760					17.337				-2.307
				(0.84)					*(1.56)*				*(-1.69)*
Malpezzi98	-0.104	-0.114	-0.114	-0.110	-0.104	-0.106	-0.099	-0.098	-0.091	-0.110	-0.135	-0.113	-0.490
	(-5.11)	*(-5.07)*	*(-5.07)*	*(-5.02)*	*(-5.08)*	*(-4.95)*	*(-4.13)*	*(-4.49)*	*(-4.31)*	*(-2.39)*	*(-0.96)*	*(-2.85)*	*(-2.26)*
LogAverage SalesVol	-0.086				-0.096	-0.087	-0.073	-0.018					
	(-2.44)				*(-2.54)*	*(-2.36)*	*(-1.56)*	*(-0.38)*					
StdDev Employment	0.726												
	(0.64)												
StdDevGMP		-0.781											
		(-0.46)											
StdDevPopulation			1.955										
			(0.77)										
StdDevIncome				-0.512									
				(-0.56)									
StdDevIntraMSA					0.382								
					(0.54)								
TimeSeriesStdDev						0.862							
						(0.18)							
BetaApts							-0.060						
							(-0.45)						
BetaNat								-0.383	-0.459				
								(-2.37)	*(-3.45)*				
Empl_Interaction										-0.020			
										(-0.01)			
GMP_Interaction											0.446		
											(0.17)		
Pop_Interactionn												0.268	
												(0.10)	
Income_Interaction													11.533
													(1.76)
Adj R square (%)	**51.79%**	**42.34%**	**43.26%**	**42.27%**	**51.60%**	**51.16%**	**52.76%**	**59.80%**	**63.16%**	**44.79%**	**41.97%**	**42.10%**	**47.28%**
F test	***12.46***	***8.83***	***9.13***	***8.81***	***12.37***	***12.17***	***8.82***	***14.89***	***17.00***	***9.65***	***8.72***	***10.56***	***8.76***
AIC	***-83.79***	***-77.88***	***-78.41***	***-77.84***	***-83.66***	***-83.36***	***-69.75***	***-75.24***	***-77.77***	***-79.31***	***-77.67***	***-80.83***	***-77.75***
BIC	***-80.72***	***-74.82***	***-75.35***	***-74.78***	***-80.59***	***-80.29***	***-65.75***	***-72.02***	***-74.54***	***-76.25***	***-74.61***	***-77.77***	***-74.68***
NoObs	**33**	**33**	**33**	**33**	**33**	**33**	**29**	**29**	**29**	**33**	**33**	**33**	**33**

Panel C: Additional Cross-Sectional Tests using Indices from Xing et al (2006) as Proxies for Supply Constraints

Model	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Intercept	-1.983	-3.802	-3.052	-3.683	-1.692	-1.932	-2.050	-3.383	-3.293	-3.233	-3.158	-3.919
	(-2.70)	*(-8.31)*	*(-15.30)*	*(-7.05)*	*(-2.08)*	*(-2.38)*	*(-2.63)*	*(-3.27)*	*(-10.30)*	*(-3.20)*	*(-11.05)*	*(-3.59)*
EmplGrRate							12.880		16.846			
							(1.73)		*(1.09)*			
GMPGrRate		6.529								5.115		
		(0.82)								*(0.27)*		
PopulationGrRate			8.265								11.244	
			(1.14)								*(0.73)*	
IncomeGrRate				18.863				30.825				29.304
				(1.17)				*(1.92)*				*(0.84)*
DPRI	-0.041	-0.056	-0.050	-0.059	-0.048	-0.049	-0.042	-0.043	-0.048	-0.052	-0.050	-0.057
	(-4.08)	*(-5.86)*	*(-4.77)*	*(-6.01)*	*(-4.72)*	*(-4.64)*	*(-3.75)*	*(-3.73)*	*(-4.78)*	*(-5.18)*	*(-4.73)*	*(-5.57)*
GMTI	-0.120	-0.081	-0.105	-0.077	-0.097	-0.100	-0.113	-0.071	-0.080	-0.190	-0.084	-0.020
	(-3.73)	*(-2.37)*	*(-2.84)*	*(-2.20)*	*(-3.00)*	*(-2.97)*	*(-3.43)*	*(-2.09)*	*(-0.84)*	*(-0.57)*	*(-0.96)*	*(-0.07)*
LogAverageSalesVol	-0.070				-0.076	-0.067	-0.064	-0.026				
	(-1.74)				*(-1.68)*	*(-1.47)*	*(-1.46)*	*(-0.57)*				
StdDevEmployment	2.878											
	(2.05)											
StdDevGMP		3.015										
		(1.74)										
StdDevPopulation			-1.460									
			(-0.47)									
StdDevIncome				1.066								
				(1.34)								
StdDevIntraMSA					0.819							
					(1.14)							
TimeSeriesStdDev						6.639						
						(0.65)						
BetaApts							-0.013					
							(-0.10)					
BetaNat								-0.283				
								(-1.42)				
Empl_Interaction									-1.474			
									(-0.34)			
GMP_Interaction										1.640		
										(0.27)		
Pop_Interaction											-1.319	
											(-0.30)	
Income_Interaction												-1.768
												(-0.18)
Adj R square (%)	**73.66%**	**71.31%**	**66.23%**	**70.73%**	**69.45%**	**67.92%**	**71.10%**	**72.52%**	**68.86%**	**66.36%**	**67.72%**	**67.69%**
F test	***15.68***	***14.05***	***11.29***	***13.69***	***12.94***	***12.12***	***11.33***	***12.08***	***12.61***	***11.36***	***12.00***	***11.18***
AIC	***-61.12***	***-59.24***	***-55.65***	***-58.80***	***-57.86***	***-56.78***	***-58.41***	***-59.52***	***-57.43***	***-55.73***	***-56.62***	***-55.48***
BIC	***-56.35***	***-54.47***	***-50.88***	***-54.03***	***-53.09***	***-52.01***	***-52.19***	***-53.30***	***-52.66***	***-50.97***	***-51.85***	***-50.72***
NoObs	***22***	***22***	***22***	***22***	***22***	***22***	***22***	***22***	***22***	***22***	***22***	***22***

Exhibit 8
Spreads Between Actual and Estimated Average Excess Cap Rates

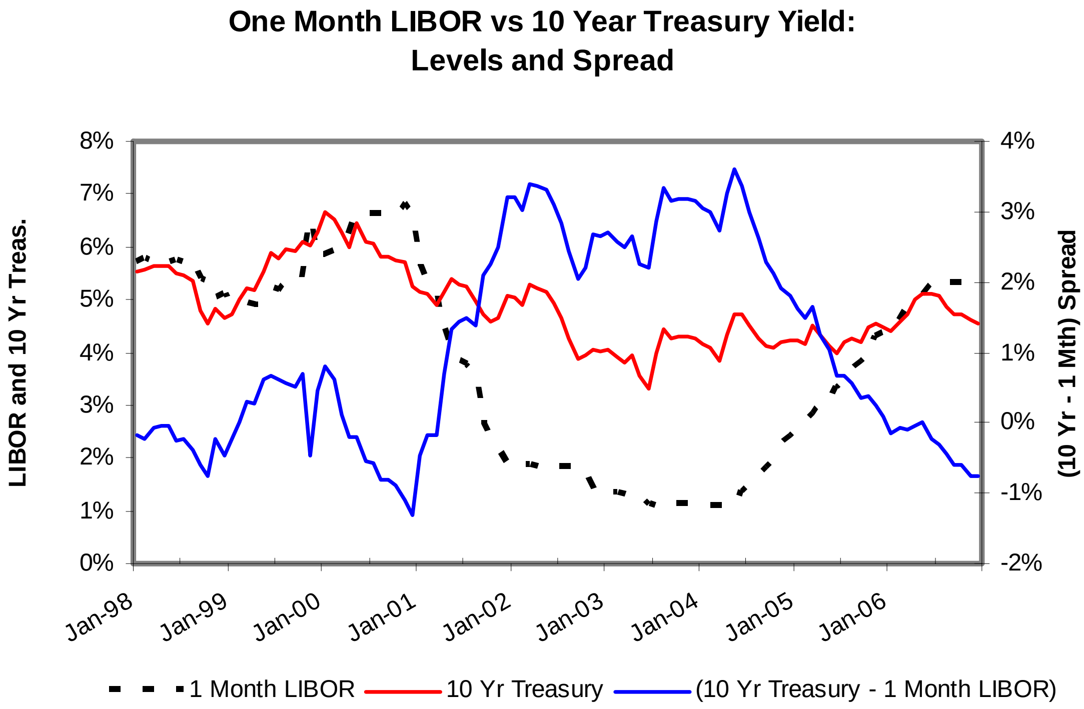
The table presents MSA ranked based on the spread between the actual ExCapRate and the predicted ExCapRate obtained from Model 1 in Exhibit 7/Panel A (values presented in the table are unlogged and expressed in percentages).

Rank	MSA	Actual ExCapRate (%)	Predicted ExCapRate (%)	Spread (Residuals) (%)
1	San Diego	0.655	1.556	-0.901
2	Portland	2.052	2.763	-0.711
3	Denver	1.885	2.512	-0.627
4	Chicago	1.811	2.401	-0.590
5	West Palm Beach	1.319	1.722	-0.403
6	Sacramento	1.546	2.010	-0.464
7	Salt Lake City	2.424	3.029	-0.606
8	Orlando	1.834	2.146	-0.312
9	Jacksonville	1.955	2.286	-0.332
10	Sarasota	1.954	2.107	-0.153
11	Fort Myers	2.043	2.178	-0.135
12	Seattle	1.917	2.022	-0.105
13	Kansas City	2.857	3.003	-0.145
14	Raleigh	1.987	2.061	-0.073
15	Houston	2.921	2.993	-0.072
16	San Francisco	0.954	0.977	-0.023
17	Indianapolis, IN	2.913	2.789	0.124
18	Austin	2.289	2.160	0.130
19	Miami	1.519	1.431	0.087
20	Phoenix	2.448	2.218	0.230
21	Stockton-Lodi, CA	2.188	1.937	0.251
22	San Antonio	3.026	2.629	0.397
23	Los Angeles	1.224	1.053	0.171
24	Atlanta	2.562	2.193	0.370
25	Tucson	2.727	2.319	0.408
26	Albuquerque	3.228	2.703	0.525
27	Dallas	3.218	2.636	0.582
28	New York	1.320	1.055	0.265
29	Reno, NV	2.470	1.962	0.507
30	Fresno	2.837	2.199	0.638
31	Tampa	2.830	2.089	0.740
32	Columbus, OH	3.990	2.758	1.232
33	Las Vegas	2.937	2.019	0.918

Appendix
Robustness Checks

A. Changes in Yield Curve

The figure presents the 1 month LIBOR, the 10-year Treasury and the Spread over the period 1998-2006. Our sample period (2000-2006) is characterized by big fluctuations in the yield curve, which motivates us to look at the gap between cap rates and the risk free rate versus just the level of the cap rates.



B. Using Monthly 1 month LIBOR as Proxy for Risk Free Rate

Given that real estate markets become more and more securitized, an argument can be made that they move with the market, and hence a short term interest rate is a more suitable proxy for the risk free rate. In step 1, we replace the cap rate in excess of the 10 years Treasury rate with the 1 month LIBOR rate. All other variables are defined as in Exhibit 4. The table presents the estimated coefficients, along with the t statistics and respective p values.

Variable	Coefficient	Test Statistic	p-Value
Constant	0.021	15.29	0.000
Sq Ft (mil)	-0.008	-3.58	0.000
Age at Sale	0.000	3.94	0.000
2000	0.008	3.51	0.001
2001	0.015	11.95	0.000
2002	0.016	18.05	0.000
2003	0.014	17.22	0.000
2004	0.005	7.03	0.000
Garden	0.002	3.23	0.001
Mid/Highrise	0.000	-0.34	0.736
Condo Conv	-0.008	-7.52	0.000
Distance To Center	0.000	5.70	0.000
Albuquerque	0.010	3.35	0.001
Atlanta	0.004	2.63	0.009
Austin	0.001	0.50	0.620
Chicago	-0.006	-2.65	0.008
Columbus, OH	0.017	4.57	0.000
Dallas	0.009	6.18	0.000
Denver	-0.004	-1.72	0.085
Fort Myers	0.000	0.11	0.913
Fresno	0.007	2.02	0.044
Houston	0.006	4.43	0.000
Indianapolis, IN	0.005	1.48	0.140
Jacksonville	-0.001	-0.36	0.720
Kansas City	0.008	2.73	0.006
Las Vegas	0.008	4.59	0.000
Los Angeles	-0.014	-13.29	0.000
Miami	-0.006	-3.44	0.001
New York	-0.012	-5.90	0.000
Orlando	-0.002	-0.67	0.504
Portland	-0.003	-1.22	0.224
Raleigh	-0.002	-0.65	0.514
Reno, NV	0.003	0.93	0.351
Sacramento	-0.008	-4.94	0.000
Salt Lake City	0.003	0.77	0.440
San Antonio	0.008	3.00	0.003
San Diego	-0.017	-10.90	0.000
San Francisco	-0.019	-12.86	0.000
Sarasota	0.001	0.42	0.672
Seattle	-0.004	-2.48	0.013
Stockton-Lodi, CA	-0.003	-0.81	0.417
Tampa	0.006	4.30	0.000
Tucson	0.004	1.46	0.146
Washington	0.001	0.56	0.576
West Palm Beach	-0.005	-2.16	0.031

r^2	**Adj. r^2**	**SE**	**Observ.**
0.471	**0.459**	**0.012**	**2116**

C. Controlling for Vacancy Rate

Our data set contains Occupancy Rate (expressed as a percentage) for 1408 out of the 2116 usable transaction observations. To take advantage of this information, we tried to model expected future growth rent as a function of Vacancy Rate. Several proxies were considered: (1) VR – simple vacancy rate expressed as a positive percentage (VR=1-Occupancy Rate); (2) VR1 – difference between the vacancy rate of a given transaction and the average vacancy rate of that market in the prior year ($VR1 = VR_{it} - \overline{VR_{t-1}}$) and (3) VR2 – proxy meant to capture the market's current vacancy rate relative to its long run or natural rate ($VR2 = VR_{it} - \overline{VR_i}$). Coefficients and p-values for each of the three models are included below, along with the respective adjusted R square. The dependent variable is the Cap Rate in excess of the risk free rate (10 year Treasure Rate is used as proxy for the risk free rate).

Proxy for Vacancy Rate:	**VR**		**VR1**		**VR2**	
Variable	**Coefficient**	**p values**	**Coefficient**	**p values**	**Coefficient**	**p values**
Constant	0.018	*<.0001*	0.019	*<.0001*	0.019	*<.0001*
Sq Ft (mil)	-0.010	*0.00*	-0.009	*0.00*	-0.010	*0.00*
Age at Sale	0.000	*0.00*	0.000	*0.00*	0.000	*0.00*
2000	0.006	*0.07*			0.006	*0.07*
2001	0.014	*<.0001*	0.011	*<.0001*	0.014	*<.0001*
2002	0.016	*<.0001*	0.015	*<.0001*	0.016	*<.0001*
2003	0.014	*<.0001*	0.014	*<.0001*	0.014	*<.0001*
2004	0.005	*<.0001*	0.005	*<.0001*	0.005	*<.0001*
Proxy for Vacancy Rate	0.011	*0.00*	0.009	*0.01*	0.011	*0.00*
Garden	0.003	*0.00*	0.003	*0.00*	0.003	*0.00*
Mid/Highrise	0.000	*0.84*	0.001	*0.41*	0.000	*0.84*
Condo Conv	-0.006	*<.0001*	-0.007	*<.0001*	-0.006	*<.0001*
Distance to Center	0.000	*<.0001*	0.000	*<.0001*	0.000	*<.0001*
Albuquerque	0.010	*0.01*	0.004	*0.43*	0.009	*0.01*
Atlanta	0.004	*0.04*	0.005	*0.02*	0.004	*0.03*
Austin	0.002	*0.46*	0.002	*0.62*	0.002	*0.48*
Chicago	-0.005	*0.11*	-0.010	*0.02*	-0.006	*0.09*
Columbus, OH	0.020	*<.0001*	0.023	*0.00*	0.020	*<.0001*
Dallas	0.011	*<.0001*	0.011	*<.0001*	0.011	*<.0001*
Denver	-0.004	*0.18*	-0.005	*0.19*	-0.004	*0.16*
Fort Myers	0.003	*0.40*	0.002	*0.57*	0.002	*0.46*
Fresno	0.006	*0.11*	0.007	*0.07*	0.007	*0.05*
Houston	0.007	*<.0001*	0.007	*<.0001*	0.007	*<.0001*
Indianapolis, IN	0.005	*0.13*	0.008	*0.05*	0.006	*0.10*
Jacksonville	0.002	*0.62*	-0.003	*0.58*	0.002	*0.64*
Kansas City	0.010	*0.00*	0.010	*0.00*	0.010	*0.00*
Las Vegas	0.010	*<.0001*	0.010	*<.0001*	0.010	*<.0001*
Los Angeles	-0.012	*<.0001*	-0.012	*<.0001*	-0.013	*<.0001*
Miami	-0.005	*0.01*	-0.006	*0.00*	-0.006	*0.00*
New York	-0.010	*0.00*	-0.008	*0.04*	-0.009	*0.00*
Orlando	-0.001	*0.67*	-0.002	*0.61*	-0.001	*0.62*
Portland	0.000	*0.88*	0.000	*0.95*	-0.001	*0.83*
Raleigh	0.000	*0.96*	-0.003	*0.40*	0.000	*0.99*
Reno, NV	0.007	*0.19*	0.011	*0.21*	0.007	*0.22*

Sacramento	-0.008	*<.0001*	-0.008	*<.0001*	-0.008	*<.0001*
Salt Lake City	0.005	*0.56*	0.007	*0.54*	0.004	*0.60*
San Antonio	0.007	*0.02*	0.008	*0.02*	0.007	*0.02*
San Diego	-0.014	*<.0001*	-0.015	*<.0001*	-0.015	*<.0001*
San Francisco	-0.017	*<.0001*	-0.018	*<.0001*	-0.018	*<.0001*
Sarasota	0.003	*0.49*	0.008	*0.26*	0.003	*0.52*
Seattle	-0.004	*0.09*	-0.004	*0.05*	-0.004	*0.06*
Stockton-Lodi, CA	-0.002	*0.68*	-0.003	*0.45*	-0.002	*0.60*
Tampa	0.007	*<.0001*	0.008	*<.0001*	0.007	*<.0001*
Tucson	0.004	*0.20*	0.004	*0.19*	0.004	*0.20*
Washington	0.002	*0.51*	0.000	*0.92*	0.001	*0.64*
West Palm Beach	-0.006	*0.03*	-0.007	*0.02*	-0.006	*0.02*
Adjusted R^2	***44.41%***		***44.06%***		***44.43%***	
No. Obs	***1408***		***1268***		***1408***	

D. Alternative methodology

To make sure that our results are not driven by the methodology employed, we consider an alternative method. Instead of the three-step analysis employed in the main body of the paper we use a single step analysis, where the regression uses transaction level data (location dummies are replaced with variables meant to capture geographical cross-sectional differences). The model now takes the following form:

$$R_i - R_f = a_0 + a_1 SqFt_i + a_2 AgeatSale_i + \sum_{j=1}^{5} b_j YearDummy_i + a_3 GardenDummy_i + a_4 Mid/Highrise_i +$$

$$+ a_5 CondConv_i + a_6 DistanceToCenter_i + Malpezzi98_i + VacancyRate_i + LogSales_i + EmploymentGrRate_i$$

The expected employment growth rate is reestimated based on data from economy.com for each quarter of the period 2000-2005 and then matched with each transaction that occurred during that given quarter. The table below contains coefficients and t values for two models – one including occupancy rate and one without occupancy rate. The dependent variable is the cap rate in excess of the 10 yrs Treasury rate.

	Model 1	**Model 2**
Constant	0.096	0.078
	(12.63)	*(13.90)*
Sq Ft (mil)	-0.003	0.002
	(-1.32)	*(0.09)*
Age at Sale	0.000	0.000
	(3.23)	*(3.76)*
2000	0.007	0.011
	(1.73)	*(4.14)*
2001	0.016	0.016
	(9.84)	*(12.30)*
2002	0.017	0.017
	(14.72)	*(17.53)*
2003	0.014	0.014
	(13.99)	*(16.35)*
2004	0.004	0.004
	(4.54)	*(5.52)*
Garden	0.003	0.002
	(3.24)	*(3.01)*
Mid/Highrise	-0.000	-0.001
	(-0.28)	*(-0.55)*
Condo Conv	-0.007	-0.009
	(-5.67)	*(-8.32)*
DistanceToCenter	0.000	0.000
	(3.60)	(4.10)
Malpezzi98	-0.002	-0.002
	(-12.84)	*(-16.24)*
OccupancyRate	-0.014	
	(-3.55)	
logSales	-0.001	-0.001
	(-4.02)	*(-3.60)*
QEmplGrRate	0.005	0.005
	(4.36)	*(5.57)*
Adj R square	***39.51%***	***40.28%***
NoObs	***1375***	***2065***