
A Cross Sectional Analysis of Cap Rates by MSA

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Motivation

- Cap Rates
 - Akin to a “going in yield” → widely used in various investment analysis methodologies to derive a property’s likely resale price and investment value
- If markets are informationally efficient then cap rates may be a priori indicators of markets in equilibrium where growth rates and risks may vary → could reverse engineer the growth rates or the risks implied
- Segmentation (geographic asset 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
 - What are the specific factors generating such variation → If we can understand why they differ we can predict how they would change with underlying changes in driving demand/supply factors
- Literature addressing these specific questions is scarce

Previous Research

Two main directions:

- Studies focused on the time-series movement of cap rates
 - Evans (1990); Ambrose and Nourse (1993); Jud and Winkler (1995)
- Studies focused on cross-sectional variations in cap rates
 - Across broad property types
 - Ambrose and Nourse (1993); Dokko, Edelstein, Pomer and Urdang (1991)
 - Across geographical regions (see next slide)

Previous Research

Studies exploring spatial differences in cap rates:

- Very few focus on MSA cap rates
 - Most look at broadly **defined regions** or submarkets within a given MSA → Hartzell, Hekman and Miles (1987); Saderion, Smith and Smith (1994)
- Underlying factors generating this spatial variation remain largely unexplored
 - Sivitandou and Sivitanides (1996) → focus on the case of cross-sectional differences across MSAs in *office* cap rates

Main Results of this study

- Substantial geographical variation across MSAs for apartment cap rates
- Factors underlying this variation:
 - Very strong and robust relation between supply constraints and cap rates
 - More stringent supply constraints for a given MSA reflect in lower cap rates
 - Evidence of capital flowing from larger markets to smaller markets
 - Large markets lead smaller markets in terms of cap rate behavior
 - This flow could reverse in the same process but the cycle data is insufficient
 - Weak but generally supportive evidence of influences of expected growth rates, liquidity and other risk factors

Data Sources

- Real Capital Analytics
 - Transaction data for multifamily properties (Apartment Cap Rate Data) during 2000-2005
- Economy.com
 - Growth rates metro data
- Malpezzi (1996, 1998); Xing, Hartzell and Godschalk (2006)
 - Supply Restrictiveness Indices
- NCREIF website
 - Aggregate indices, liquidity measures

Methodology

3 steps:

- Build a cap rate model based on all transaction data available
- Use MSA averages in the model previously identified to construct a cross-section of average apartment cap rates per MSA (2005 cross-section)
- Use cross-sectional regression to identify influences of several factors in the cross-section of average cap rates
 - expected growth of demand
 - supply constraints
 - liquidity risk and risk premia
 - capital flow

Step 1 – Average Cap Rate Model

- Cap Rate Model

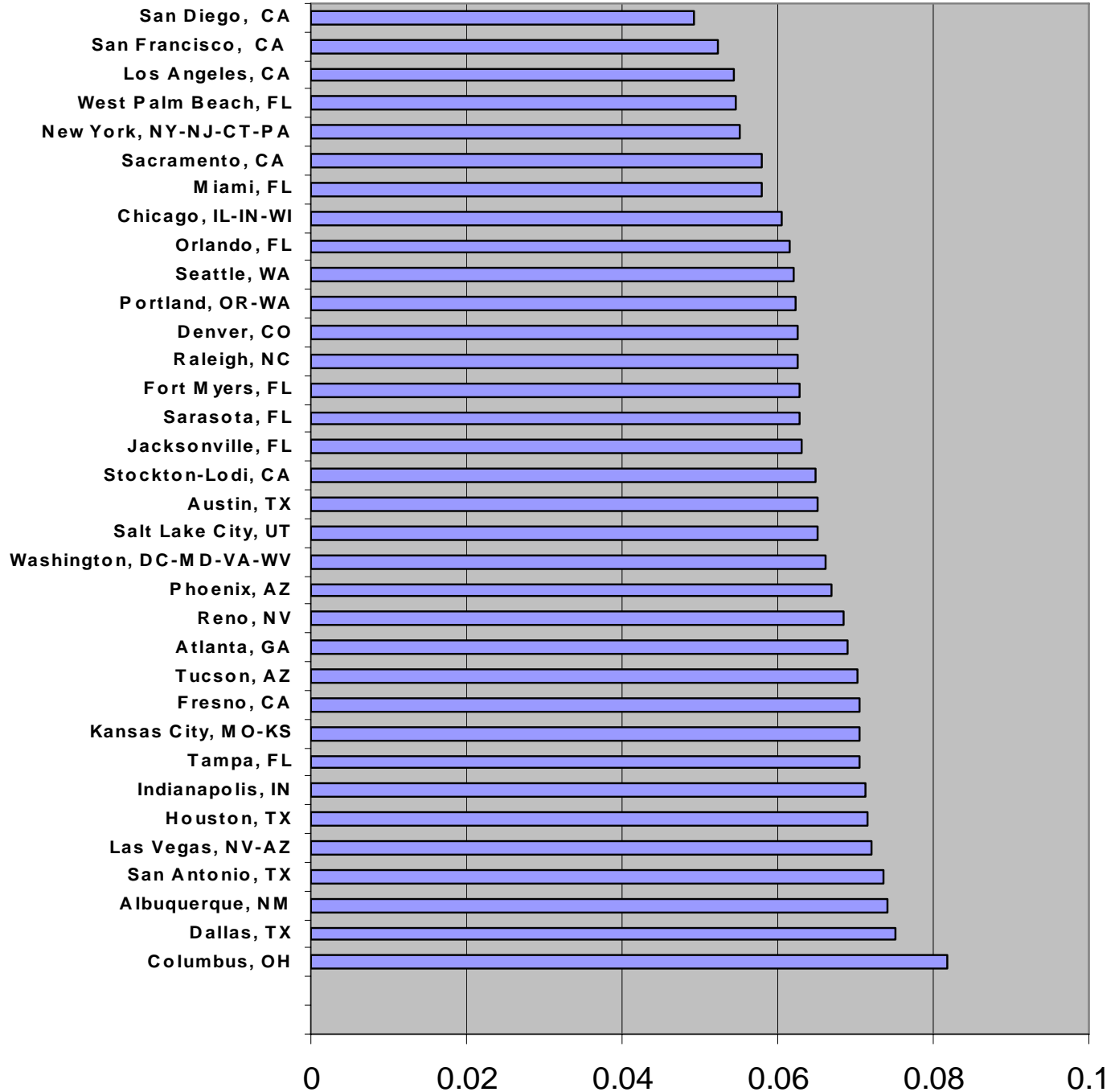
$R_i = f(\text{Size, Age, Year of Sale, Property Subtype, Property Purpose, Location})$

- Empirical model takes the linear form

$$R_i = a_0 + a_1 SqFt_i + a_2 AgeatSale_i + \sum_{j=1}^5 b_j YearDummy + a_3 GardenDummy_i + \\ + a_4 Mid / Highrise_i + a_5 CondConv_i + \sum_{j=1}^{34} c_j MSADummy_i$$

- Use MSA averages to obtain empirical estimates of average cap rates per MSA

Step 2 Average Apartment Cap Rates per MSA (2005)



Descriptive Statistics

Mean	6.49%
Standard Deviation	0.72%
Range	3.26%
Minimum	4.92%
Maximum	8.17%

Step 3 - Theory

Factors Influencing Cap Rates

- General model description

$$\bar{R}_{MSA} = f(\text{Expected Growth, Supply Constraints, Liquidity, Market Risk, Capital Flow})$$

- Dependent variable is the average cap rate per MSA obtained from linear model described in step 1 and 2
- Different proxies for each factor were considered
- Interaction variables (Growth Rates * Supply Constraints) were included to test the linearity of the relation

Expected Effect of Influencing Factors on Cap Rates

<i>Factor</i>	<i>Proxy for Factor</i>	<i>Expected Effect</i>
Expected Growth Rates	<i>Employment Growth, GMP Growth, Income Growth, Population Growth</i>	+
Supply Constraints	<i>Malpezzi (1998) Index, Indices developed in XHG(2006)</i>	-
Liquidity	<i>Sales Volume, NCREIF dummy</i>	-
Risk Measures	<i>Std Dev of Growth Rates, Beta</i>	+
Capital Flow Measures	<i>Cap Rate Ratio</i>	+

Overview of Independent Variables Considered

1. Growth Rates

- Employment Growth, GMP Growth, Population Growth, Income Growth

2. Supply Constraints

- Malpezzi Index (Malpezzi 1998)
- Both Indices developed in Xing, Hartzell, Godschalk (2006)
 - Development Process Restrictiveness Index (DPRI)
 - Growth Management Tools Index (GMTI)

3. Liquidity

- Sales Volume
- NCREIF dummy

4. Risk Proxies

- Standard Deviation of Growth Rates
- Intra MSA Standard Deviation
- Time Series Standard Deviation
- Beta measures – MSA returns against two aggregate indices from NCREIF website: NPI Apartments (BetaApts) and NPI National (BetaNat).

5. Capital Flow Measures

- Cap Rate Ratio, Capital Rate Spread

6. Interaction Terms

- Growth Rates * Supply Constraints

Factors Influencing Cap Rates

1. Expected Growth Rates

- Growth rates affect the expected future cash flows generated by a certain property → High expected growth rates translate into high cap rates
- Proxies considered:
 - Expected Employment Growth
 - Based on the predictions for the next 10 years available from economy.com we can calculate an annual expected employment growth rate
 - Other proxies considered
 - GMP Growth, Population Growth, Income Growth

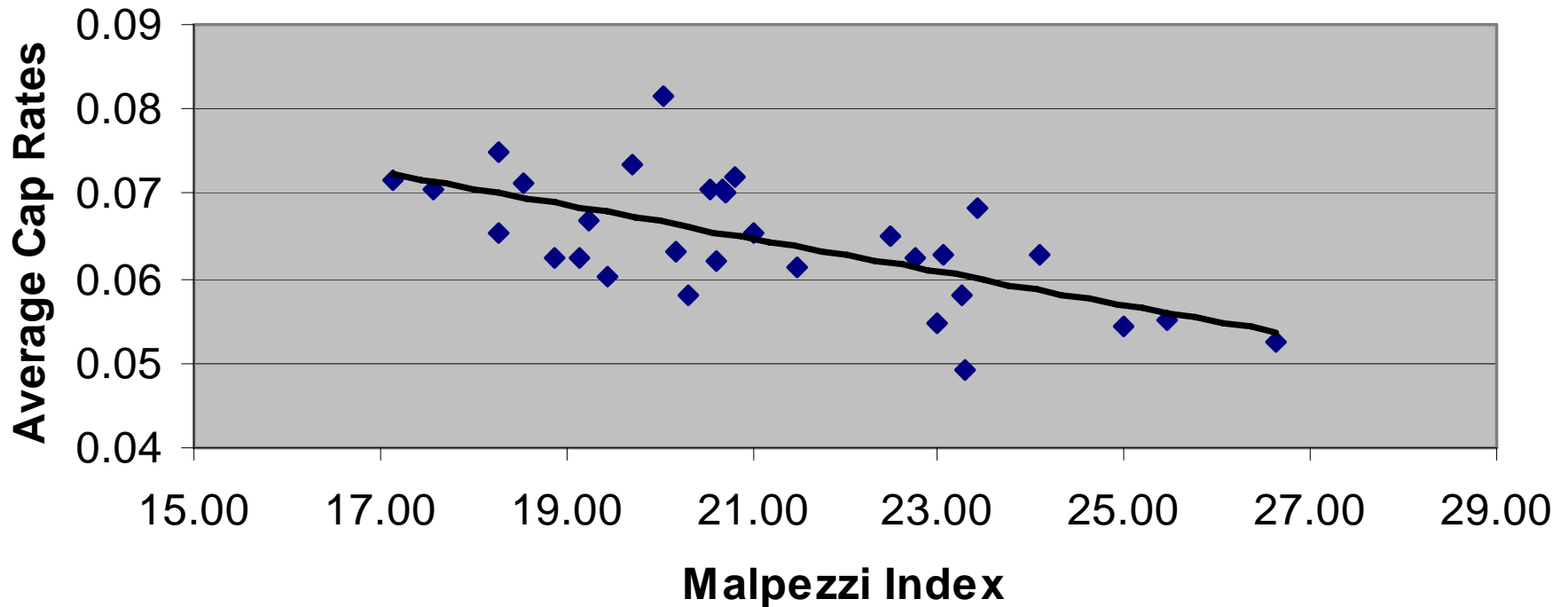
Factors Influencing Cap Rates

2. Supply Constraints

- Several studies show that regulation / supply restrictiveness positively impacts housing prices and values → supply side phenomena should affect variation in cap rates across MSAs
- Malpezzi (1996); Malpezzi, Chun and Green (1998)
 - develop an index reflecting stringency of regulation in a given MSA
 - High index value should reflect strong supply constraints in a particular area, which in turn should result in higher prices and lower cap rates

Supply Constraints

Relation between Cap Rates and Supply Constraints



Supply Constraints

- Xing, Hartzell and Godshalk (2006) → more refined analysis of regulatory stringency
 - Show that it is important to make the difference between measurements regarding:
 - Supply side of regulations (development process regulation) → approval process can respond to market conditions more quickly
 - Land management tools (growth management) – adoption takes longer and they can affect both supply and demand of housing
 - Differentiate between these different aspects of regulatory stringency by building two separate indices:
 - ***Development Process Restrictiveness Index (DPRI)***
 - ***Growth Management Tools Index (GMTI)***
 - Provide evidence of a significant positive relation between DPRI, GMTI and Housing Prices → MSAs with higher DPRI/GMTI should have lower cap rates

Factors Influencing Cap Rates

3. Liquidity

- The liquidity of the market should positively affect prices → more liquidity for a given MSA should result in a lower cap rate
- Proxies considered:
 - Sales Volume per MSA
 - Calculated from transaction data available
 - NCREIF dummy
 - Based on MSA liquidity rank by NCREIF (for top 25 the dummy takes value 1)

Factors Influencing Cap Rates

4. Risk

- Uncertainty about future cash flows affects the value of a certain property → the higher the perceived risk for a given MSA, the higher the cap rate
- Proxies considered
 - Standard Deviation of Growth Rates
 - Time Series and Intra MSA standard deviation of apartment prices
 - Beta measures → designed to capture covariance between MSA returns and two aggregate indices from NCREIF website:
 - NPI Apartments
 - NPI National

Factors Influencing Cap Rates

5. Capital Flow Measures

Hypothesis:

- Capital should first flow into bigger markets and once they are saturated it should gradually flow to the second and third tier markets → *large markets should lead smaller markets in terms of cap rate behavior (or reverse)*

Proxies Considered:

- Capital Flow Measure built as follows:
 - Based on average sales volume in 2004 → pick the biggest three MSAs and calculate a 2004 CapRate Index (as the average of all transaction cap rates available for 2004 for the three MSAs)
 - for each MSA, calculate the ratio (difference) between average CapRate of MSA in 2004 and CapRate Index for 2004
- A positive significant relation between CapRateRatio and average cap rates in the 2005 cross-section can be interpreted as capital flowing from larger to smaller markets

Factors Influencing Cap Rates

5. Interaction Terms

- Growth Rates * Supply Constraints
- Testing the linearity of the relation
- No priors

Results – Correlation Table

- Simple Correlations of Factors with InCapRate:

Category/Proxy	Corr. Coefficient	Prob > r
1. Expected Growth Rates		
Employment Growth Rate	0.174	0.326
2. Supply Constraints		
Malpezzi Index	-0.664	<.0001
DPRI	-0.709	0.000
GMTI	-0.440	0.022
3. Liquidity		
Sales Volume	-0.371	0.031
NCREIF dummy	-0.030	0.876
4. Risk		
StdDevEmployment	0.126	0.479
TimeSeriesStdDev	-0.091	0.609
BetaApts	-0.363	0.049
BetaNat	-0.564	0.001
5. Capital Flow Measures		
CapRateRatio	0.630	<.0001

Empirical Models

Model	1	2	3*	4	5	6*
Intercept	-1.647 (-6.96)	-1.583 (-7.05)	-2.253 (-3.78)	-2.182 (-11.92)	-2.160 (-11.77)	-1.766 (-3.30)
EmplGrRate	1.325 (0.89)			2.442 (1.11)		-4.022 (-0.97)
Malpezzi Index	-0.031 (-5.03)	-0.031 (-5.04)	-0.018 (-1.54)			
DPRI				-0.013 (-5.00)	-0.013 (-5.12)	-0.008 (-1.47)
GMTI				-0.037 (-4.58)	-0.037 (-4.50)	-0.071 (-4.33)
logSales	-0.025 (-2.30)	-0.027 (-2.56)	-0.036 (-2.06)	-0.032 (-3.12)	-0.033 (-3.15)	-0.063 (-3.18)
NCREIF dummy				0.121 (3.76)	0.122 (3.78)	0.080 (1.18)
StdDevEmployment				1.151 (2.36)	1.473 (3.72)	2.110 (2.41)
TimeSeriesStdDev				3.085 (1.31)	3.489 (1.49)	7.094 (1.73)
CapRateRatio			0.510 (2.38)			0.177 (1.68)
Adj R square	50.75%	51.08%	57.13%	81.60%	81.31%	82.70%
NoObs	33	33	33	22	22	22

Additional Models Tested

Model	1	2	3	4	5	6	7	8
Intercept	-2.069 (-13.86)	-1.561 (-6.77)	-1.897 (-6.98)	-0.450 (-0.32)	-2.769 (-18.88)	-2.675 (-15.32)	-2.520 (-7.37)	-2.651 (-8.12)
GMPGrRate					2.371 (0.93)			3.231 (0.53)
PopulationGrRate	0.553 (0.24)							
IncomeGrRate				-48.786 (-1.13)		5.011 (0.93)	8.499 (1.60)	
Malpezzi98	-0.033 (-4.81)	-0.030 (-4.87)	-0.028 (-4.12)	-0.113 (-1.65)				
DPRI					-0.016 (-5.03)	-0.016 (-4.90)	-0.011 (-2.89)	-0.014 (-4.31)
GMTI					-0.026 (-2.34)	-0.025 (-2.16)	-0.024 (-2.10)	-0.036 (-0.34)
LogAverageSalesVol		-0.030 (-2.56)	-0.009 (-0.64)				-0.011 (-0.74)	
StdDevGMP					1.001 (1.80)			
StdDevPopulation	0.476 (0.61)							
StdDevIncome						0.312 (1.18)		
StdDevIntraMSA		0.123 (0.57)						
BetaNat			-0.106 (-2.08)				-0.084 (-1.27)	
GMP_Interaction								0.061 (0.03)
Income_Interaction				2.455 (1.19)				
Adj R square (%)	40.15%	49.96%	56.17%	41.93%	66.44%	62.75%	65.75%	60.05%
NoObs	33	29	33	33	22	22	22	22

Conclusion

- Very strong and robust relation between supply constraints and cap rates
 - More stringent supply constraints for a given MSA reflect in lower cap rates
- Evidence of capital flowing from larger markets to smaller markets
 - Large markets lead smaller markets in terms of cap rate behavior
 - This flow could reverse in the same process but the cycle data is insufficient
- Relation between expected growth rates and average apartment cap rates in the cross-section is not as strong as expected
- Weak but generally supportive evidence of influences of expected growth rates, liquidity and other risk factors