Using NIC MAP Data to Model Consumer Behavior Across Geographic Areas

What Statistics and Multivariate Econometric Modeling can Tell us about Demand for Independent Living Space

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History

- **NIC and RED CAPITAL Research have collaborated in the past to identify useful ways NIC MAP data can be employed to model senior housing demand and pricing behavior**
- **Our previous efforts included the following projects:**
  - *Developed multivariate models that forecast independent and assisted living demand relative to demographic characteristics of the population living in a 5-mile radius of a given site*
  - *Developed equations that predict the equilibrium price ($/per occupied unit) of independent living and assisted living space given 5-mile radius primary market area demographics*
  - *Statistically evaluated the impact of home price and home sales velocity trends at the metropolitan area and zip code levels on the relative demand for independent living space*

Current Objective

- **Recently, the NIC MAP coverage universe expanded to include the 100 largest metropolitan markets in the U.S.**
  - ***Original 31 Top Metro Markets with full data coverage***
  - ***32 – 100 Markets with narrower metrics and minimal data history***

- **Our latest analysis seeks to determine whether the expanded market data available from NIC MAP can help identify the causes of observed variances in senior housing demand across metro areas**

Our Hypothesis: The Demographic and Economic Characteristics of Metropolitan Areas Determine their Relative Demand for I/L Space

- **The Expanded NIC MAP Coverage Data Reveal That**
  - ***The relative demand for senior housing space varies significantly across metro areas***
  - ***These variances are affected by levels of independent living supply, but factors other than unit availability also are at work. These may be identifiable with the use of statistical/econometric techniques.***

- **Implications and practical benefit**
  - ***Identifying and quantifying these factors may assist investors in site selection and property acquisition efforts by helping to identify underserved populations and to a lesser degree over-supplied markets***

Our Plan to Test the Hypothesis

- **Steps taken to Test the Hypothesis**
  - ***Perform cross-section analysis of market performance data from NIC MAP 100 metropolitan markets and demographic and housing market data applicable to those markets***
  - ***Identify statistically significant variables that correlate demographic, income and housing market characteristics of each metro population and the degree of independent living consumption in their respective markets***
  - ***Develop a multivariate equation that "forecasts" the propensity to consume I/L space at the metropolitan level***
- **Practical application**
  - ***Identify markets wherein demand is materially higher or lower than the level predicted by the market (outliers)***
  - ***Use mathematical and logical approaches to determine whether outliers represent areas of opportunity for independent living practitioners or potential risks to be avoided by investors, lenders and other capital providers***

Key Metric: Independent Living Usage

- First, we selected an outcome to predict
- Unit absorption would be ideal but the available data do not lend themselves to cross-sectional statistical analysis
- Instead, we created a custom metric, which we call the Usage Rate

The Usage Rate is the *Ratio* of *Occupied I/L Units* (inventory * mean occupancy) in a given metropolitan area and *the number of households headed by individuals aged 75+ years* living in the applicable metropolitan area. Economists would call this the "average propensity to consume."

Independent Living Usage Rate Extremes

Highest Five Ratios	Lowest Five Ratios
Portland (12.0%)	Melbourne, FL (1.8%)
Seattle (11.9%)	New York (2.0%)
Richmond (11.4%)	Las Vegas (2.3%)
Madison (11.2%)	Providence (2.5%)
Milwaukee (11.1%)	New Orleans (2.8%)

Independent Living Usage Rates Across Metropolitan Areas

Metro	Usage	Metro	Usage	Metro	Usage	Metro	Usage
Portland, OR	12.0%	Austin, TX	7.9%	Virginia Beach, VA	6.0%	Augusta, GA	4.4%
Seattle, WA	11.9%	Tulsa, OK	7.7%	Atlanta, GA	6.0%	Los Angeles, CA	4.3%
Richmond, VA	11.4%	San Jose, CA	7.4%	Oklahoma City, OK	5.9%	Cleveland, OH	4.2%
Madison, WI	11.2%	Cincinnati, OH	7.3%	Stockton, CA	5.8%	Modesto, CA	4.1%
Milwaukee, WI	11.1%	Colorado Springs, CO	7.3%	Charleston, SC	5.7%	San Francisco, CA	4.1%
Philadelphia, PA	10.7%	New Haven, CT	7.2%	Nashville, TN	5.7%	Sacramento, CA	4.0%
Harrisburg, PA	10.5%	San Diego, CA	7.1%	Akron, OH	5.5%	Riverside, CA	3.8%
Raleigh, NC	10.4%	Fort Myers, FL	7.1%	Fresno, CA	5.4%	Bakersfield, CA	3.7%
Minneapolis, MN	10.2%	Chicago, IL	7.0%	Hartford, CT	5.4%	Syracuse, NY	3.6%
Grand Rapids, MI	9.9%	Columbus, OH	7.0%	Greenville, SC	5.2%	Birmingham, AL	3.6%
Washington, DC	9.8%	Ventura, CA	6.9%	Memphis, TN	5.1%	Pittsburgh, PA	3.6%
Jacksonville, FL	9.3%	St. Louis, MO	6.6%	Albany, NY	5.0%	Youngstown, OH	3.5%
Baltimore, MD	9.1%	Omaha, NE	6.5%	Worcester, MA	5.0%	Daytona Beach, FL	3.1%
Greensboro, NC	8.9%	Dayton, OH	6.5%	Columbia, SC	4.9%	Buffalo, NY	3.0%
Tucson, AZ	8.9%	Sarasota, FL	6.4%	Boston, MA	4.7%	Poughkeepsie, NY	3.0%
Charlotte, NC	8.9%	Rochester, NY	6.3%	Toledo, OH	4.7%	New Orleans, LA	2.8%
Phoenix, AZ	8.8%	Orlando, FL	6.3%	Miami, FL	4.6%	Providence, RI	2.5%
Denver, CO	8.8%	Little Rock, AR	6.2%	Lakeland, FL	4.5%	Las Vegas, NV	2.3%
Dallas, TX	8.6%	Detroit, MI	6.2%	Springfield, MA	4.5%	New York, NY	2.0%
Des Moines, IA	8.4%	Tampa, FL	6.2%	Allentown, PA	4.4%	Melbourne, FL	1.8%

Modeling the I/L Usage Rate: Possible Explanatory Variables

- **Demographic / Economic Trends**
  - Population Density
  - Population and Household Growth
  - Homeownership Rate
  - Household Income (including measures of I/L affordability and percent of 75+ HHs with MHI above $40,000)
  - Gross Metro Product (metro equivalent of GDP)
  - Population Migration (probability the 75+ HH will move to another metro area after retirement)
- **Housing Market Trends**
  - Home Price Changes (short- and long-term)
  - Percent of Homes Sold at a Loss
- **Other Possibilities**
  - Availability of State Medicaid / Medicare reimbursement

Best Fit I/L Usage Rate Equation

$$\text{Usage Rate} = -0.004 + 0.252Y_1 + 0.056Y_2 + 0.382Y_3 - 0.0842Y_4 + 0.01Y_5 + 0.090Y_6 + 1.028Y_7$$

Where:

Y_1 is the percent of HHs headed by 75+ with MHI above $40,000 *(1%)*

Y_2 is home price growth from Q1 2005 to Q1 2009 (Zillow.com) *(1%)*

Y_3 is the compound average household growth rate from 2000 to 2008 *(5%)*

Y_4 is annual mean IL RevPOR divided by median household income *(1%)*

Y_5 is a dummy variable (equals one if median home price is above 120% of US median)

Y_6 is a dummy interaction term between Y_4 and Y_5 *(5%)*

Y_7 is the difference between the growth rates of all households and the subset of 75+ households *(5%)*

(Percentages Denote the Applicable Variable t-Statistic)

Variable Data Means and Ranges

Variable	Description	Min	Average	Max
Y_1	% of 75+HH ($40m+ income)	29.6%	45.1%	63.1%
Y_2	Home price chg (1Q05-1Q09)	-53.3%	-8.8%	21.8%
Y_3	HH Growth (CAGR '00-'08)	-3.2%	1.2%	4.4%
Y_4	RevPOR / MHI	24.6%	50.6%	77.0%
Y_5	Home Price Dummy	0	15.7%	1
Y_6	Dummy Interaction	-37.8%	-2.7%	9.0%
Y_7	HH Growth (All – 75+)	-2.7%	-0.2%	1.4%

Highlight: Household Growth Differentials (All HHs – 75+HHs)

Market	HH Growth	75+HH Growth	Difference
Melbourne	1.7%	3.3%	-1.6%
Las Vegas	4.2%	5.7%	-1.5%
Dayton	-0.1%	1.2%	-1.3%
San Jose	0.6%	1.8%	-1.3%
Stockton	2.4%	1.0%	1.4%
Portland, OR	1.5%	0.4%	1.1%
New Orleans	-3.2%	-4.3%	1.1%
New Haven	0.1%	-0.9%	1.0%

Equation Example: Saint Louis

Usage Rate = -0.004 + 0.252Y_1 + 0.056Y_2 + 0.382Y_3 - 0.0842Y_4 + 0.01Y_5 + 0.090Y_6 + 1.028Y_7

Usage Rate^ = -0.004

+ 0.252 * (44%) = 11.1%

+ 0.056 * (-2.8%) = -0.1%

+ 0.382 * (0.7%) = 0.3%

- 0.0842 * (55%) = -4.6%

+ 0.01 * (0) = 0

+ 0.090 * (0) = 0

+ 1.028 * (-0.1%) = -0.1%

= 6.1%

Equation Example: Washington DC

$$\text{Usage Rate} = -0.004 + 0.252Y_1 + 0.056Y_2 + 0.382Y_3 - 0.0842Y_4 + 0.01Y_5 + 0.090Y_6 + 1.028Y_7$$

Usage Rate^ = -0.004

+ 0.252 * (63.1%) = 15.9%

+ 0.056 * (-18.6%) = -0.8%

+ 0.382 * (1.1%) = 0.4%

- 0.0842 * (45.9%) = -3.9%

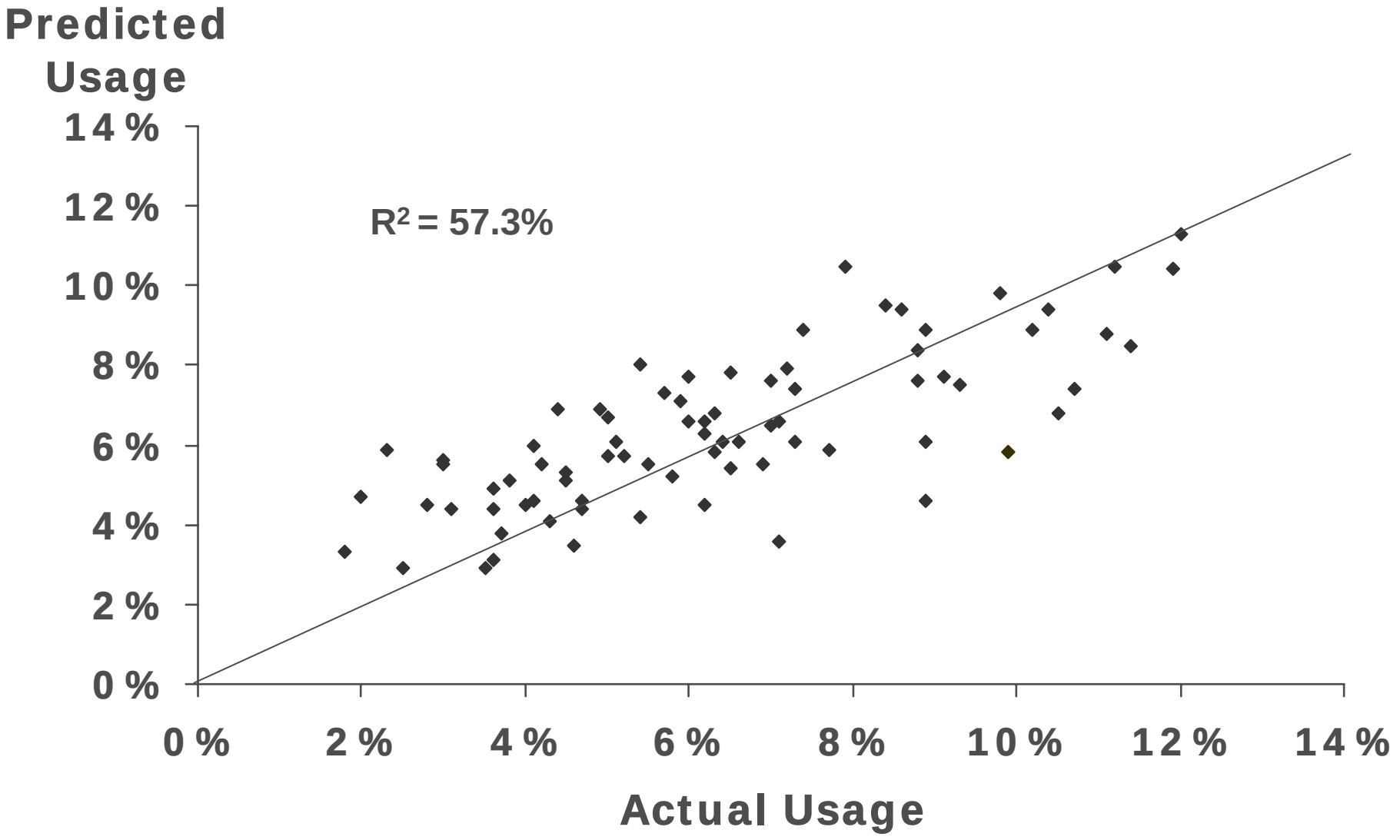
+ 0.01 * (1) = 0.7%

+ 0.090 * (-18.6%) = -1.7%

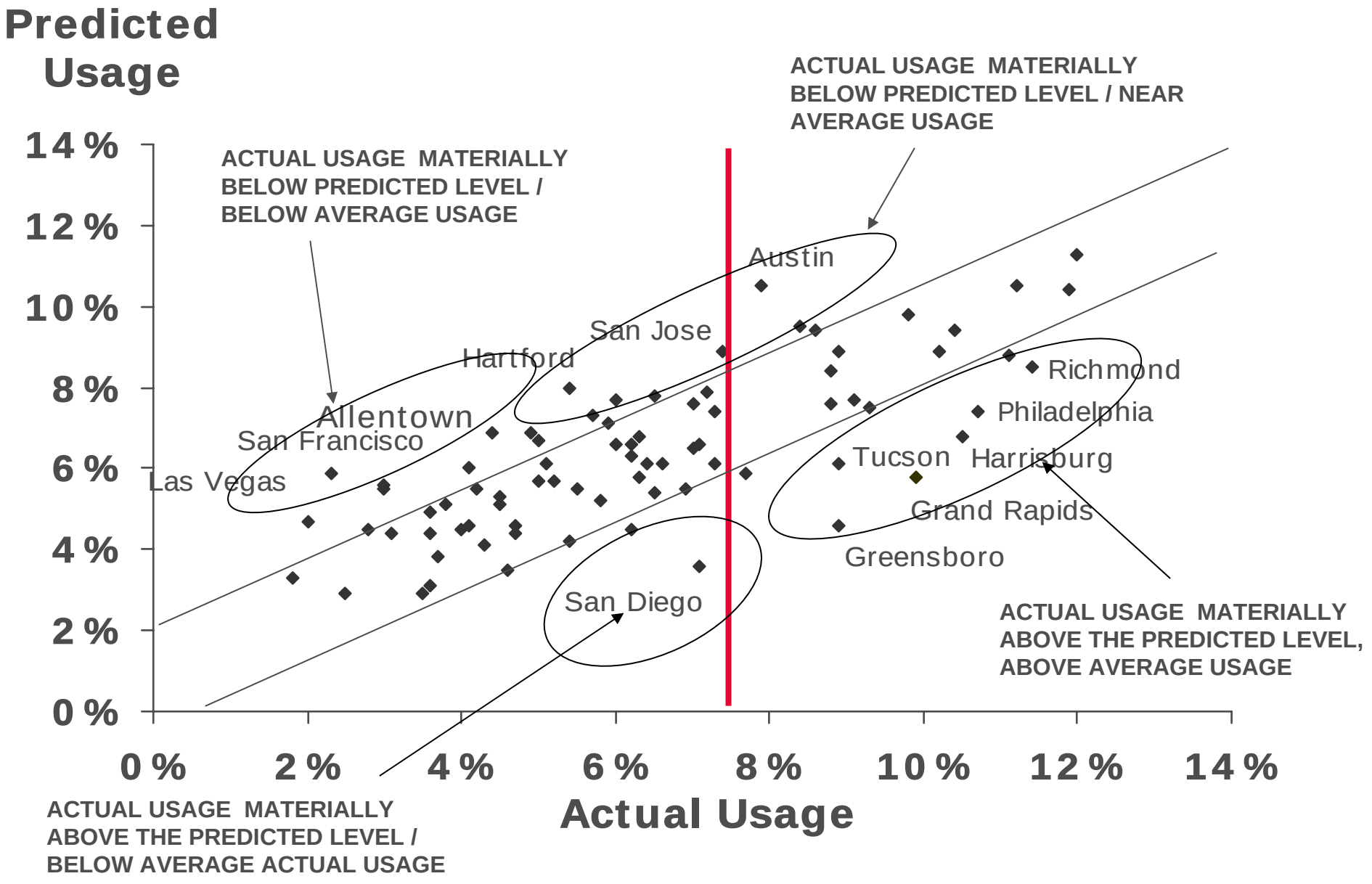
+ 1.028 * (-0.5%) = -0.5%

= 9.8%

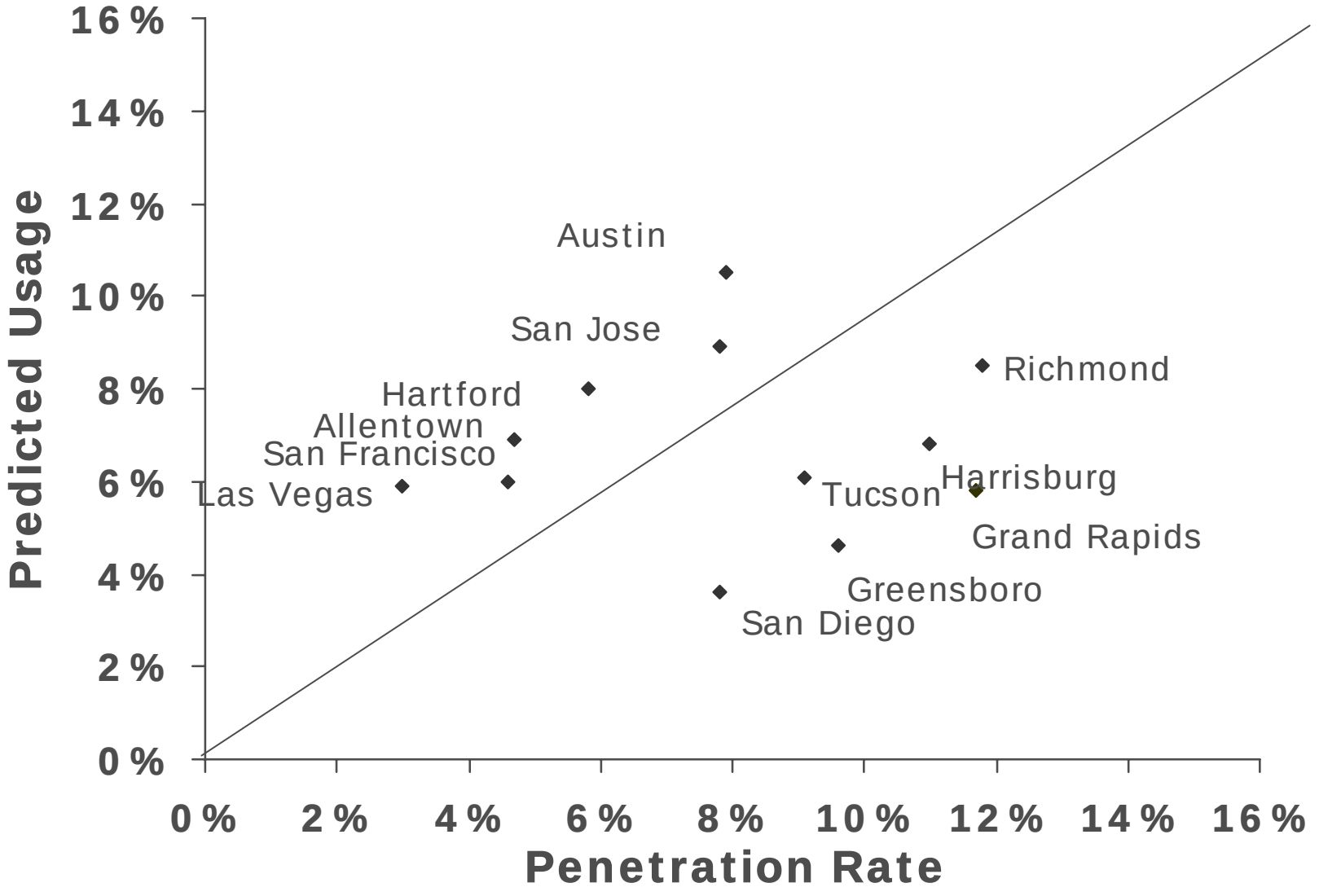
Mapping The Results: Actual vs Predicted Usage for the NIC 100



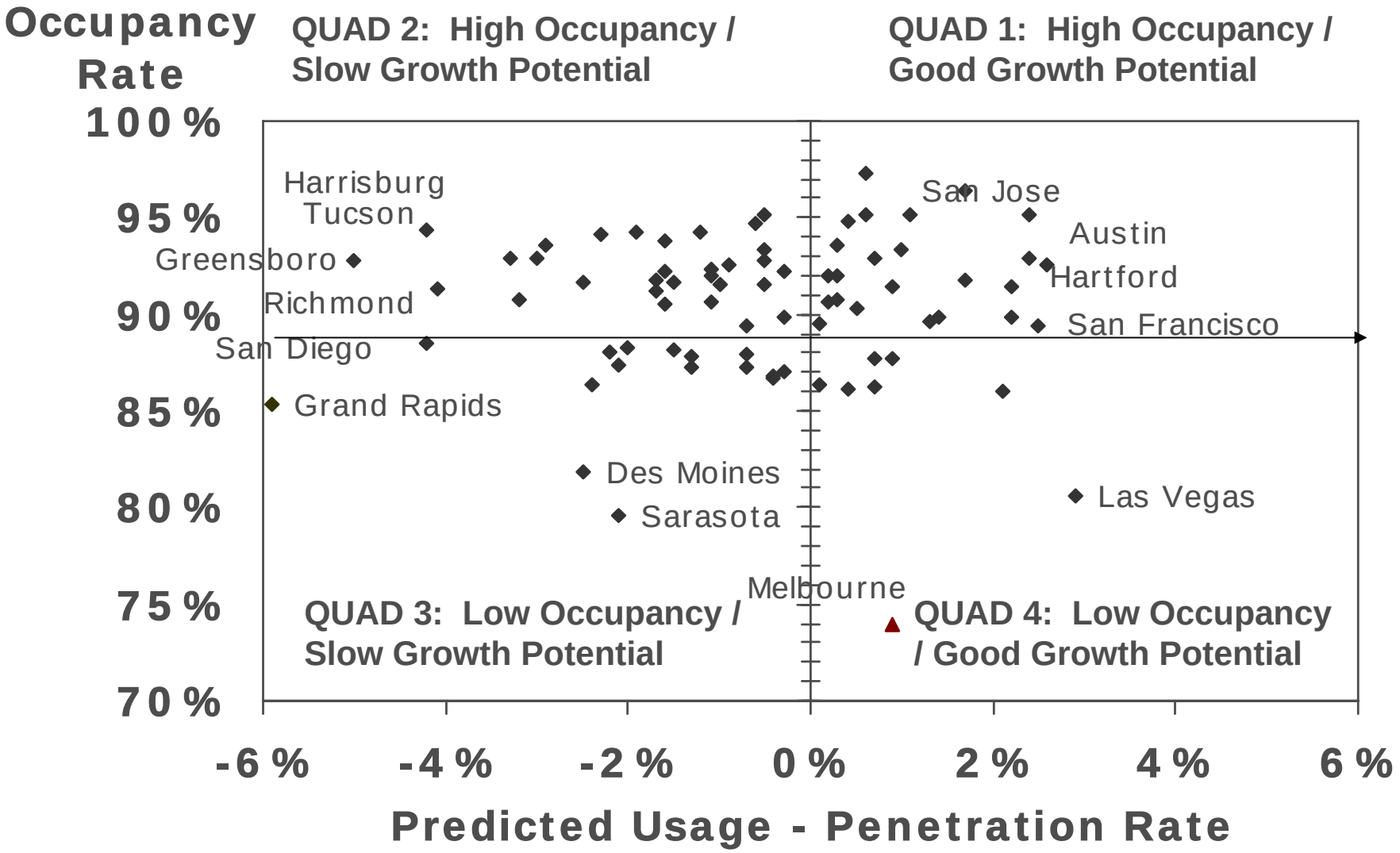
Identifying Outliers Among Metro Areas



Isolating Outliers



Segregate MSAs into Quadrants



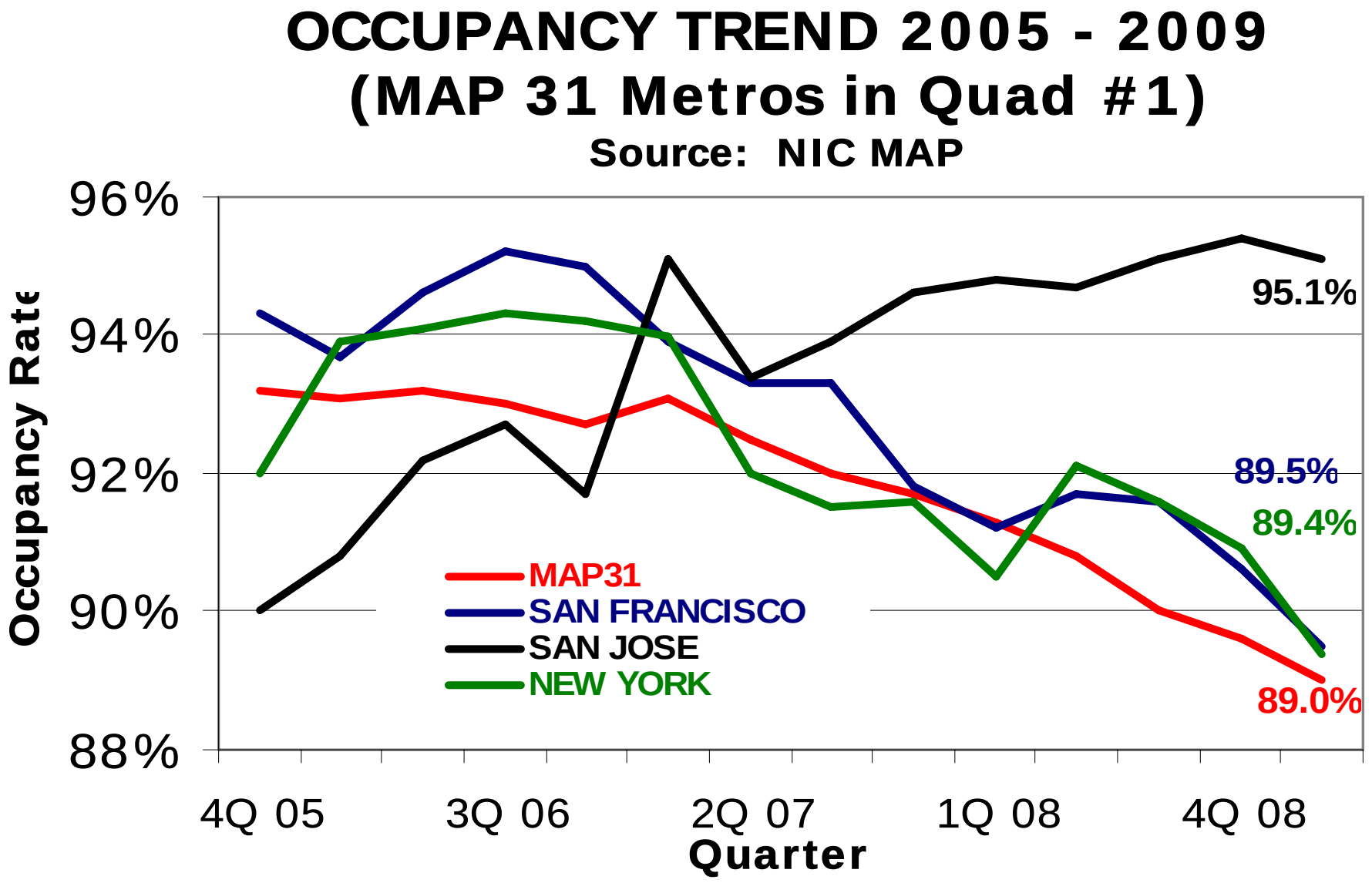
Comparing Recent Market Performance Among Quadrants

Graph Area	Occupancy vs. NIC MAP Mean (89.4%)	Predicted Usage - Penetration Rate	Metro Count	12-Month Rent Growth (1Q 08 – 1Q 09)	12-Month Occupancy Rate Change (1Q08 – 1Q09)
QUAD 2	Above Average	Negative	19	3.3% (#2)	-1.58% (#2)
QUAD 3	Below Average	Negative	17	3.2% (#3)	-4.40% (#4)
QUAD 1	Above Average	Positive	19	3.9% (#1)	-0.78% (#1)
QUAD 4	Below Average	Positive	11	2.4% (#4)	-3.30% (#3)
	Metros with Complete Data		75	3.2%	-2.25%

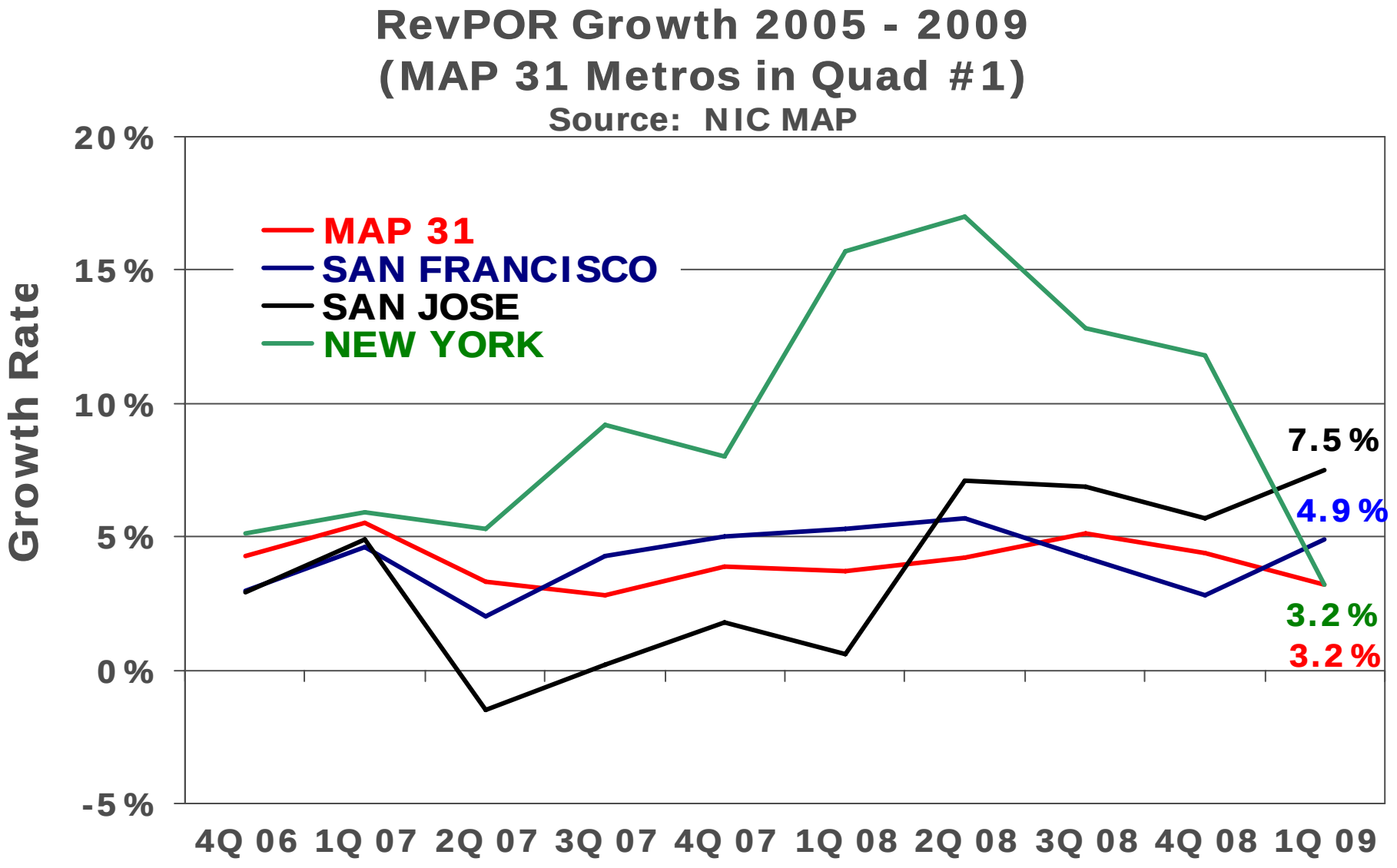
Hi Occ / Neg PU-PR QUAD 2		Lo Occ / Neg PU-PR QUAD 4		Hi Occ / Pos PU-PR QUAD 1		Lo Occ / Pos PU - PR QUAD 3	
Metro	RevPOR Growth	Metro	RevPOR Growth	Metro	RevPOR Growth	Metro	RevPOR Growth
Toledo	6.6%	Ventura	15.7%	Allentown	13.5%	Omaha	9.2%
Columbus	6.1%	Orlando	5.2%	Greenville	9.3%	Cleveland	4.0%
Portland	6.0%	Stockton	4.1%	Austin	6.4%	Las Vegas	4.0%
Milwaukee	5.3%	Seattle	3.5%	Worcester	5.2%	Poughkeepsie	3.7%
Washington	5.3%	Detroit	3.5%	Modesto	5.0%	Dallas	3.5%
Saint Louis	4.6%	Colo. Springs	2.9%	New Orleans	4.8%	Nashville	3.5%
Dayton	4.2%	Tampa	2.8%	Springfield	4.6%	Dallas	3.5%
Los Angeles	3.9%	Denver	2.6%	San Jose	4.6%	Riverside	3.2%
Baltimore	3.7%	Akron	2.5%	San Francisco	4.2%	Atlanta	3.2%
Boston	3.6%	Sarasota	1.7%	Albany	4.2%	Riverside	3.2%
Cincinnati	3.4%	Virginia Beach	1.5%	Sacramento	4.1%	Memphis	0.7%
Minneapolis	3.1%	Chicago	1.1%	Syracuse	4.0%	Melbourne	0.5%
Pittsburgh	2.6%	Grand Rapids	-0.6%	Providence	3.7%	Daytona Beach	-4.4%
Tulsa	2.4%	Rochester	-1.2%	Buffalo	2.4%		
Philadelphia	1.9%	Miami	-1.6%	New York	2.4%		
Jacksonville	1.7%	Des Moines	-9.3%	Hartford	2.3%		
Raleigh	1.4%			Birmingham	1.1%		
Ft Myers	0.9%			New Haven	-0.3%		
Fresno	-3.6%			Oklahoma City	-7.7%		
Mean	**3.3%**	**Mean**	**2.4%**	**Mean**	**3.9%**	**Mean**	**3.2%**

Hi Occ / Neg PU-PR QUAD 2		Lo Occ / Neg PU-PR QUAD 4		Hi Occ / Pos PU-PR QUAD 1		Lo Occ / Pos PU - PR QUAD 3	
Metro	**Occ Chg**	**Metro**	**Occ Chg**	**Metro**	**Occ Chg**	**Metro**	**Occ Chg**
Dayton	517	Stockton	1,058	Worcester	585	Atlanta	-93
Columbus	155	Rochester	309	Allentown	485	Riverside	-185
Pittsburgh	152	Colo. Springs	-77	Greenville	292	Daytona Beach	-213
Raleigh	-4	Chicago	-184	Syracuse	92	Dallas	-218
Minneapolis	-60	Detroit	-192	San Jose	39	Las Vegas	-221
Washington	-73	Seattle	-253	Buffalo	31	Omaha	-278
Boston	-96	Miami	-260	Modesto	-6	Cleveland	-307
Los Angeles	-108	Orlando	-275	Hartford	-26	Nashville	-397
Saint Louis	-111	Denver	-310	Albany	-99	Memphis	-605
Baltimore	-144	Virginia Beach	-338	Springfield	-105	Poughkeepsie	-785
Tulsa	-161	Ventura	-582	San Francisco	-147	Melbourne	-1,534
Cincinnati	-188	Akron	-612	Oklahoma City	-239		
Milwaukee	-194	Tampa	-614	Providence	-254		
Philadelphia	-247	Des Moines	-923	Birmingham	-291		
Ft Myers	-333	Sarasota	-1,006	Sacramento	-342		
Portland	-344	Grand Rapids	-1,023	New Haven	-344		
Jacksonville	-435			New Orleans	-364		
Fresno	-502			New York	-369		
Toledo	-829			Austin	-423		
Mean	**-158**	**Mean**	**-330**	**Mean**	**-78**	**Mean**	**-440**

Testing the Model: Plotting Mean Occupancy Rates of Positive Outliers Over Time



Testing the Model: Plotting RevPOR Growth of Positive Outliers Over Time



Highlights and Key Take-aways

- **Expanded NIC MAP data provide researchers with robust new tool to study the behavior of senior housing consumers**
- **RCR employed NIC MAP data to identify the non-supply variables that influence I/L demand across metro areas**
- **We found that a handful of economic, demographic and housing market variables were statistically significant**
  - *Concentration of high-income age-eligible households (AEH)*
  - *Availability of untapped home equity appreciation*
  - *All HH growth rate and relative Adult children/AHE growth rate*
  - *The affordability of independent living costs*
- **We were able to develop a moderately powerful equation predicting usage from the foregoing variables**
- **The equation successfully identified markets that delivered better 12-month occupancy and rent performance**
- **This method may help practitioners to identify over-supplied and under-supplied markets.**

Questions?

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