What Makes A Good Hotel Market?

A Panel Based Approach To Examine Lodging Demand Drivers

by

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Submitted to the Program in Real Estate Development in Conjunction with the Center for Real Estate in Partial Fulfillment of the Requirements for the Degree of Master of Science in Real Estate Development

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ABSTRACT

In early 2010, the hotel industry began a historic demand recovery. Across hotel sectors, demand growth pushed rooms occupied above the previous year's figure by more than 10% - almost doubling peak quarterly year-over-year growth. The hotel industry has recovered ahead of the economy for the first time in U.S. history, which is unusual considering the lodging industry has run in sync with all major economic trends in the past. GDP, which traditionally correlates strongly with hotel demand growth, has failed to capture the recovery's magnitude in recent years. International tourism, an economic indicator that saw a significant surge in 2010, was suggested to be one of the probable causes. The objective of this thesis is to identify external economic factors besides GDP that have meaningful impacts on lodging demand. Instead of analyzing the lodging industry as a whole, this thesis zooms into MSA level, compares rooms sold per capita among 54 MSAs throughout the United States, and tries to figure out between market differences and within market variations.

The full-service hotel analysis and limited-service hotel analysis chapters use panel data model and four estimators to derive the most appropriate regression model for each hotel sector. The author examined the correlation and significance of each independent variable to identify meaningful demand drivers at overall, between, and within MSA level. The results show evidence that convention space, domestic enplanement, and international enplanement are all important economic factors for full-service hotels. However, none of them manage to deliver a meaningful explanation on the demand growth in limited-service sector.

The economic development impact chapter access the economic impact to full-service demand from convention space addition, domestic airport expansion, international airport expansion, and conversion between domestic and international terminals. The author also tracked full-service lodging demand growth with enplanement growth for each of the 54 MSAs and combined their regression results together for advanced analysis. The thesis findings reveal that top-tier MSAs and large air transportation hubs have strong correlation between enplanement and full-service lodging demand. Further, the thesis delves deep into potential economic factors that may improve limited-service model.

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This thesis is dedicated to my parents, whose encouragement, sacrifices, and continuous support had made my education experience at MIT a very special part of my life.

-- Jing Yu

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Table of Contents

Table of Exhibits

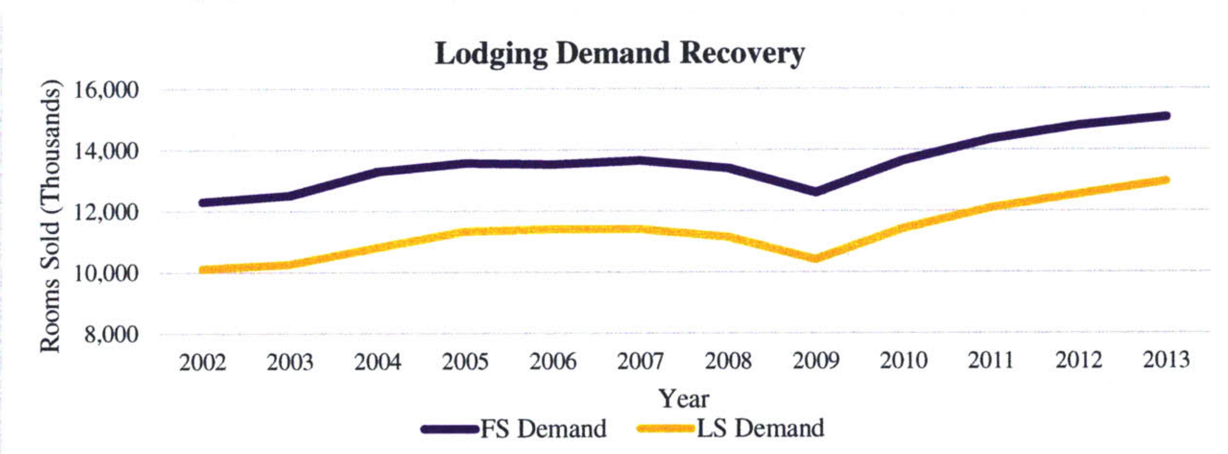
Chapter 1 Introduction

1.1 Hospitality Overview

Hospitality industry is hot! At a projected $25 billion in volume, 2014 has the potential to be the third most active year for U.S. hotel transactions on record.[1] In April 2014, Blackstone acquired Nationwide Select Service Portfolio, a 15-hotel portfolio from OTO Development. In March 2014, Al Mirqab Limited acquired InterContinental New York Barclay. In June 2014, Millennium & Copthorne Hotels acquired Hotel Novotel New York Times Square. In October 2014, Hilton Worldwide announced the $1.95 billion sale of Waldorf Astoria New York to China's Anbang Insurance Group Company... Capital markets activity in the U.S. hotel sector is really intense right now. Upswing performance and dramatic demand recovery since the credit crisis are the fundamental reasons that drive investors' activities.

The hospitality industry has recovered ahead of the economy for the first time in U.S. history, which is unusual considering the lodging industry has run in sync with all major economic trends in the past. Normally, the economy improves and the lodging industry trails about six months later. In 2010, the economy continued to remain in a recession while demand for lodging began to improve. From 2011-2013 this trend was followed with additional growth in both occupancy as well as average daily rates. Demand growth in 2014 is diminished from the historic growth rates recorded in 2010, but positive figure continues to boost occupancy rates. Exhibit 1-1 traces the mean values of rooms sold for 54 MSAs averaged across the 2002-2013 period to illustrate the recent demand recovery (expansion) in lodging industry.

Exhibit 1-1 Lodging Demand Recovery



[1] "Cross Sector Outlook – United States – Hotels", JLL, Lauro Ferroni, Fall 2014, page 7-9

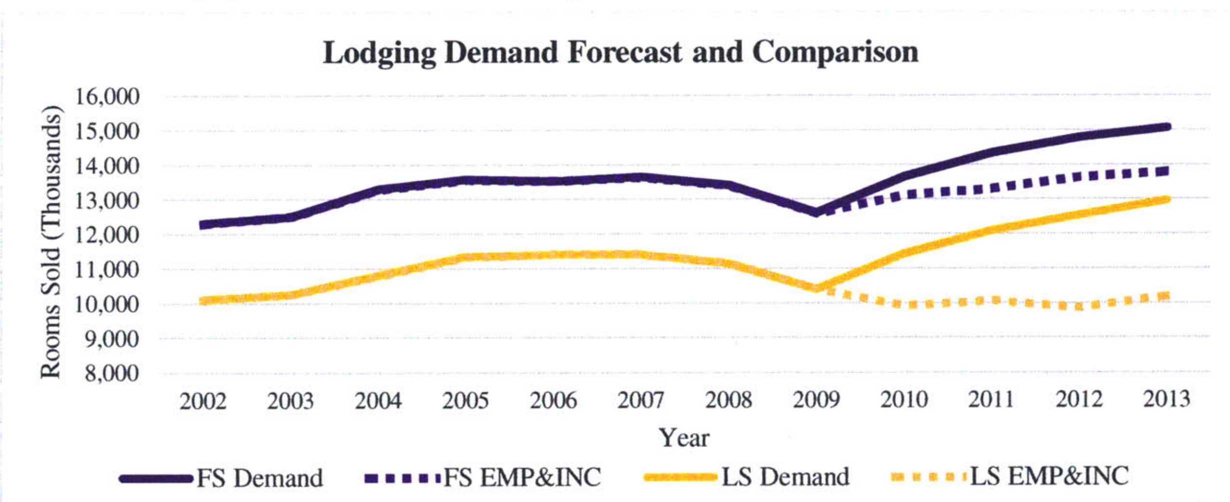
1.2 Demand Drivers

What are the engines that fuel the phenomenal demand growth in recent years? What makes a good hotel market in general?

Demand drivers can be divided into two broad categories, indigenous drivers and exogenous drivers. Indigenous drivers, such as weather, location, culture, and historical heritage, are hard to observe, let alone assess. Therefore, quantifiable exogenous drivers are the main focus of this thesis. Only weather data, such as temperature and relative humidity are included in the analysis.

Historically, movement in a market's demand for rooms has tracked local employment closely. In fact, local employment is generally hotel demand's main driver. However, the recovery of local employment has not correlated with the magnitude of the hotel recovery in recent years. Likewise, GDP has also failed to project the path of the hotel recovery.[2] The author used lodging demand's historical relationship with employment and income to forecast potential demand over the 2010-2013 period, and compared the forecasted result with actual demand data as illustrated in Exhibit 1-2. It is obvious that employment and income alone fail to capture the recovery's magnitude.

Exhibit 1-2 Lodging Demand Forecast and Comparison



Abigail from CBRE suggested that international tourism, an economic indicator that saw a significant surge in 2010, was more closely correlated with hotel demand growth during the recent

[2] "Overview & Outlook – Hotel", CBRE, Abigail Rosenbaum, Fourth Quarter 2013, page 1

recovery than its traditional demand drivers were. But the correlation is not perfect.[3] Is international tourism a true demand driver? If so, which hotel sector or MSA can it represent? Are there any other external economic factors that can trigger lodging demand growth? To answer the question, the author investigated the correlation between rooms sold and potential factors such as convention space, domestic enplanement, and international enplanement and composed this thesis.

1.3 Full-Service VS Limited-Service

The hospitality market can be divided into two broad categories, full-service and limited-service hotels.

Full-service hotels are generally mid-price, upscale or luxury hotels with a restaurant, lounge facilities and meeting space, and offer minimum service levels, often including bell service and room service. These hotels report food and beverage revenue.[4]

Limited-service hotels have rooms-only operations, (i.e. without food and beverage service) or offer a bedroom and bathroom for the night, but very few other services and amenities. These hotels are often in the budget or economy group and do not report food and beverage revenue.[5]

MSAs dominated by full-service hotels are usually destination markets, such as Boston, Miami, New York, New Orleans, San Francisco, and Washington DC. The majority of them is located at the edge of the country. Business and leisure travelers visit them for specific purposes, such as business conference, beach adventure, ski resort, world-renowned universities, and national monuments.

MSAs dominated by limited-service hotels are usually pass-through markets, such as Atlanta, Columbus, Houston, Indianapolis, Nashville, and Raleigh. The majority of them is situated inland, away from the coast, near the middle of the country. Budget conscious travelers visit them for convenient purpose, stopping by on their way to their final destinations.

Exhibit 1-3 tracks the demand growth for full-service and limited-service sectors separately. At aggregated level, demand growth at limited-service hotels is not always in line with that of full-service hotels.

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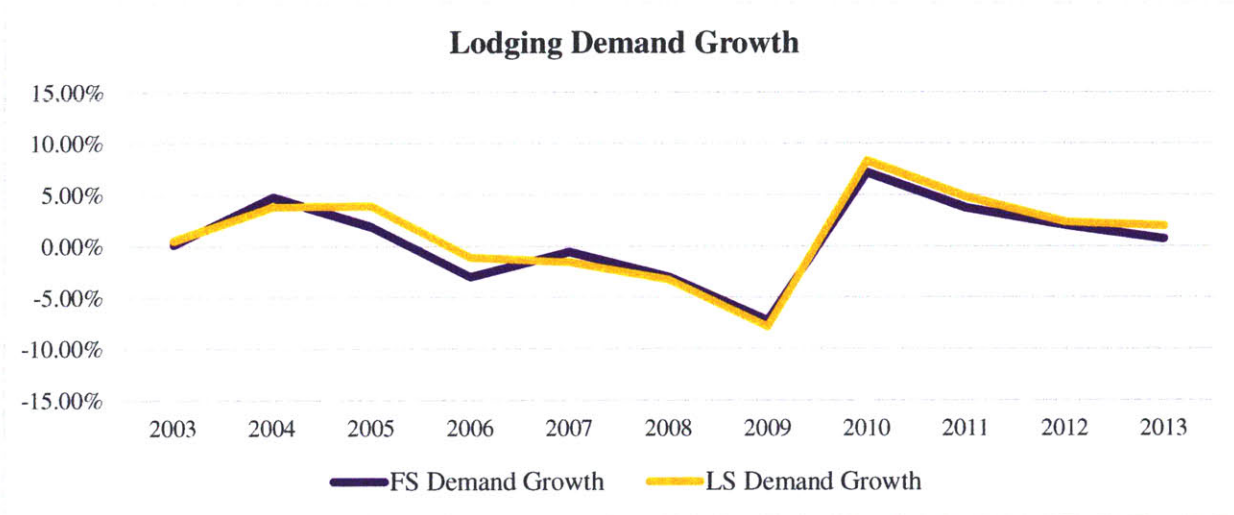
[3] "Can international tourism help predict the U.S. 2014 hotel demand recovery?" CBRE, About Real Estate: A Free CBRE EA Weekly Publication, Volume 15, Number 15, Abigail Rosenbaum, April 21,2014

[4] Glossary, Smith Travel Research, http://www.strglobal.com/resources/glossary/en-gb

[5] Glossary, Smith Travel Research, http://www.strglobal.com/resources/glossary/en-gb

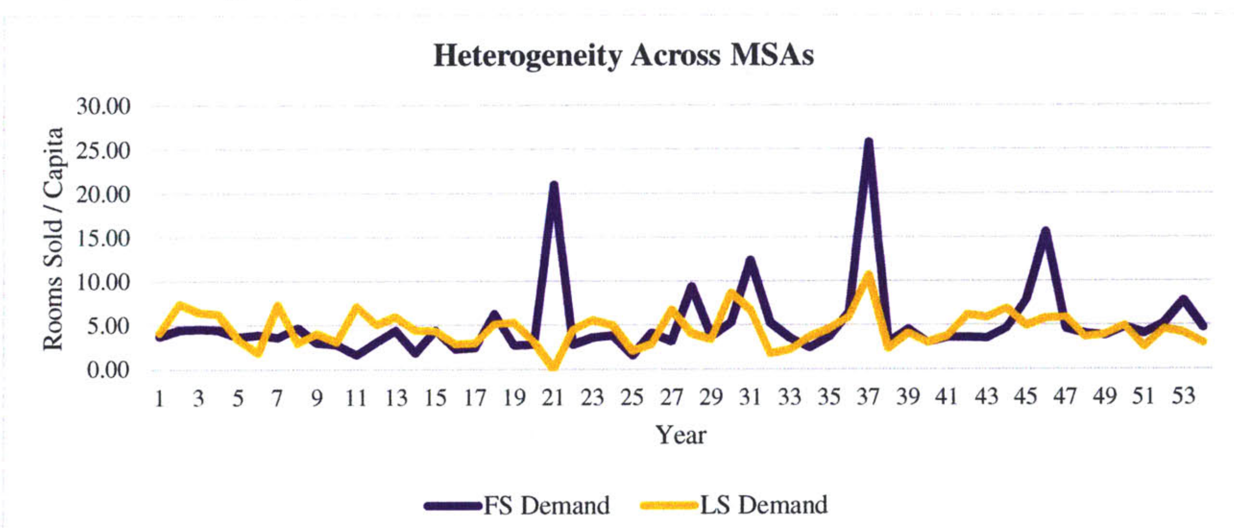
Additionally, demand growth at limited-service hotels has exceeded that of full-service hotels in recent years.

Exhibit 1-3 Lodging Demand Growth



At MSA level, the correlation between full-service and limited-service sectors deteriorates completely. As illustrated in Exhibit 1-4, strong full-service market does not equal to strong limited-service market. For example, in Albany metro area, the limited-service sector had been continually improved and reached historic peak in 2013 while the full-service sector was still tame. Appendix C tracks full-service and limited-service lodging demand for each of the 54 MSAs for detailed comparison. There is hardly any correlation between the two hotel sectors at MSA level.

Exhibit 1-4 Heterogeneity Across MSAs



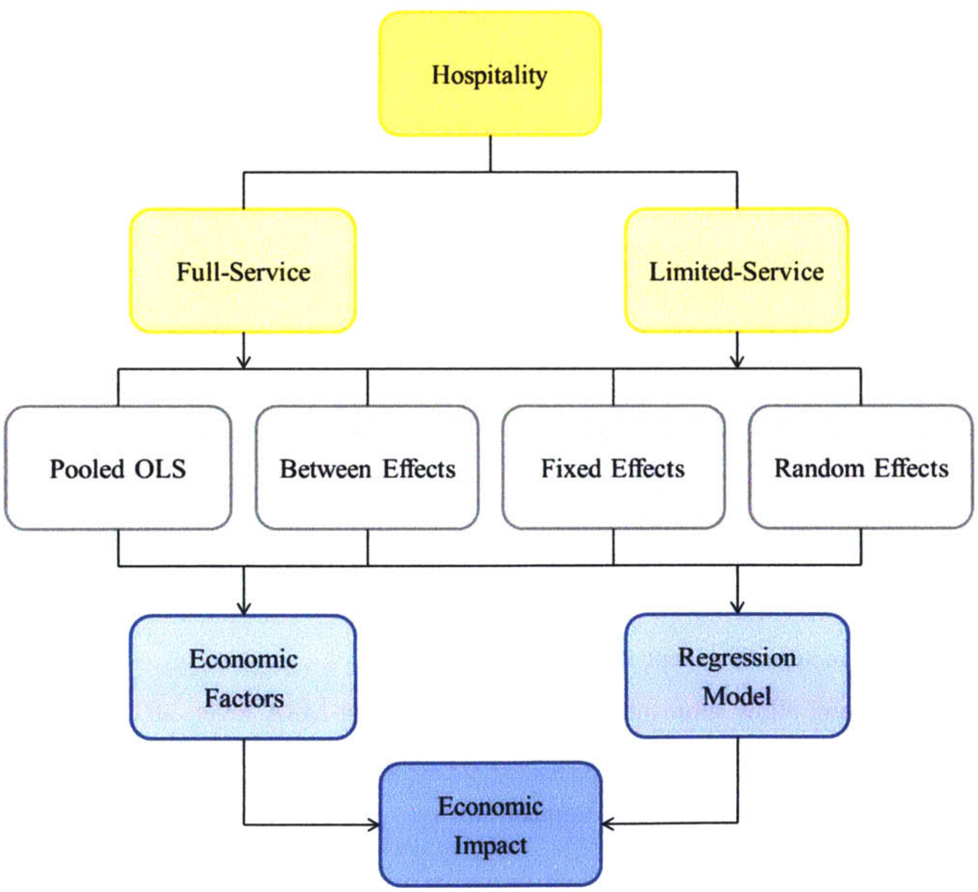
Due to their inherent difference, the author analyzed and assessed the full-service and limited-service hotel sectors separately.

1.4 Thesis Flow

This thesis delves deep into external economic factors that boost a strong hospitality market.

Chapter 2 introduces the methodology, panel regression model and panel estimators, and data used in the analysis. Chapter 3 and 4 analyze panel data at overall, between, and within MSA levels to determine the most appropriate regression model and economic factors for full-service and limited-service hotels, respectively. Chapter 5 assess the economic impact to lodging demand from newly identified economic factors. Chapter 6 summarizes the significance of panel data analysis and economic impact analysis in light of research findings.

Exhibit 1-5 Thesis Framework



Chapter 2 Methodology and Data Collection

2.1 Data Description

Exhibit 2-1 summarizes the sources of the data used for the analysis. Hotel data was provided by Smith Travel Research. Economic and weather data were provided by CBRE. Due to the lack of convention event statistics and inconsistency in exhibition industry, convention space data was used instead of convention attendance or annual events held. Convention space data was based on author's research through various convention center web sites and assistance from tvsdesign. Enplanement Data was obtained from Research and Innovative Technology Administration, Bureau of Transportation Statistics.

Exhibit 2-1 Data Sources Summary

Data Category		Data Source	Unit Comment	Start Year	End Year
Hotel	FS/LS Demand	Smith Travel Research	Avg. Rooms Sold per night	2002	2013
	FS/LS Revenue	Smith Travel Research	Avg. Revenue per night	2002	2013
	FS/LS ADR	Smith Travel Research	ADR per night	2002	2013
Economic	Employment	CBRE	In Thousands	2002	2013
	Income	CBRE	US $ per day	2002	2013
	Population	CBRE	In Thousands	2002	2013
Weather	Temperature	CBRE	Fahrenheit	invariant	invariant
	Wet	CBRE	Relative Humidity	invariant	invariant
Convention	Gross Area	Convention Center Web Sites	SF, In Thousands	2002	2013
	Exhibit Space	Convention Center Web Sites	SF, In Thousands	2002	2013
Enplanement	Domestic	Bureau of Transportation	Avg. enplanement per day	2002	2013
	International	Bureau of Transportation	Avg. enplanement per day	2002	2013
	Total Enplanement	Bureau of Transportation	Avg. enplanement per day	2002	2013

Data Processing

- All flow data, such as rooms sold and enplanement, was either measured for or adjusted to daily average for internal consistency.
- All stock data was measured in thousands except weather.
- To address population impact and allow more meaningful comparison at MSA level, all applicable variables were adjusted to per capita basis.

  For example, FS Rooms Sold/Capita = FS Demand / Population

2.2 Panel Data

Panel data (also known as longitudinal or cross-sectional time-series data) is a dataset in which the behavior of entities are observed across time. These entities (panel ID variables) are 54 MSAs throughout the United States in this study. The sample spans a 12 year period from 2002 to 2013. The author used hotel rooms sold per capita (RS_Cap) as a measure for lodging demand, hence the dependent variable in the following regression analysis. Independent variables include average daily rate (ADR) for either full-service or limited-service hotels, employment per capita (EMP_Cap), income per capita (INC_Cap), temperature (TEMP), humidity (WET), convention center gross square footage per capita (GSF_Cap), domestic enplanement per capita (DOM_Cap), and international enplanement per capita (INT_Cap). Exhibit 2-2 is a snapshot of underlying panel data.

Exhibit 2-2 Panel Data

ID	MSA	Year	RS_Cap	FS ADR	EMP_Cap	INC_Cap	POP	TEMP	WET	GSF_Cap	DOM_Cap	INT_Cap
1	Albany	2002	4.04	100.19	0.52	41.93	841	13.3	38.6	0.000	4.190	0.00354
1	Albany	2003	3.94	103.32	0.52	43.04	848	13.3	38.6	0.000	4.515	0.01711
1	Albany	...	...	...	...	...	...	...	...	...	...	...
1	Albany	2013	3.70	122.41	0.51	47.11	878	13.3	38.6	0.000	3.717	0.01094
2	Albuquerque	2002	4.71	80.98	0.47	37.67	765	57.1	9.47	0.784	10.325	0.00075
2	Albuquerque	2003	4.50	80.89	0.47	37.81	780	57.1	9.47	0.769	10.328	0.00075
2	Albuquerque	...	...	...	...	...	...	...	...	...	...	...
2	Albuquerque	2013	4.41	95.56	0.41	37.34	895	57.1	9.47	0.670	7.568	0.00036
3	Atlanta	2002	4.87	107.83	0.50	44.95	4,514	60.6	49.1	0.960	21.000	1.87058
3	Atlanta	2003	4.61	103.62	0.49	44.86	4,599	60.6	49.1	0.942	21.276	1.74308
3	Atlanta	...	...	...	...	...	...	...	...	...	...	...
3	Atlanta	2013	4.58	123.70	0.44	42.36	5,520	60.6	49.1	0.785	20.015	2.45351
...	...	...	...	...	...	...	...	...	...	...	...	...
54	W Palm Beach	2002	5.29	144.85	0.43	58.66	1,205	75.9	58.53	0.000	6.016	0.06756
54	W Palm Beach	2003	5.26	151.71	0.42	59.50	1,235	75.9	58.53	0.000	6.492	0.13496
54	W Palm Beach	...	...	...	...	...	...	...	...	...	...	...
54	W Palm Beach	2013	4.69	192.21	0.39	58.50	1,376	75.9	58.53	0.254	5.521	0.12164

The author decided to use panel data modeling based on the following reasons:

- Panel data gives the author a large number of data points, increasing the degrees of freedom and reducing the collinearity among explanatory variables, hence improving the efficiency of economic estimates.
- Panel data accounts for individual heterogeneity by allowing individual specific variables, such as the size of convention facilities, domestic and international airports.

- Panel data allows the author to control for variables the author cannot observe or measure like cultural factors or university presence across MSAs, or variables that change over time but not across MSAs, such as federal regulations.

2.3 Variation Types

Exhibit 2-3 illustrates 3 main variation types.

- Overall variation: variation over time and individuals.
- Between variation: variation between individuals.
- Within variation: variation within individuals over time.

The overall variation can be decomposed into between variation and within variation. Time-invariant variables (annual average temperature, annual average humidity) have zero within variation, because they do not vary over time for specific MSA. Individual-invariant variables (time) have zero between variation across MSAs.

Exhibit 2-3 Variation Types

ID	MSA	Time	Variable	Individual mean	Overall mean	Overall deviation	Between deviation	Within deviation	Within deviation (modified)
i		t	X_{it}	$\bar{X}_i$	$\bar{X}$	$X_{it}-\bar{X}$	$\bar{X}_i-\bar{X}$	$X_{it}-\bar{X}_i$	$X_{it}-\bar{X}_i+\bar{X}$
1	Albany	1	4.04	3.93	4.42	-0.38	-0.49	0.12	4.53
1	Albany	2	3.94	3.93	4.42	-0.48	-0.49	0.02	4.43
1	Albany	3	3.80	3.93	4.42	-0.62	-0.49	-0.13	4.29
2	Albuquerque	1	4.71	4.55	4.42	0.30	0.13	0.17	4.59
2	Albuquerque	2	4.50	4.55	4.42	0.09	0.13	-0.04	4.38
2	Albuquerque	3	4.42	4.55	4.42	0.00	0.13	-0.13	4.29
3	Atlanta	1	4.87	4.78	4.42	0.45	0.36	0.09	4.51
3	Atlanta	2	4.61	4.78	4.42	0.20	0.36	-0.17	4.25
3	Atlanta	3	4.86	4.78	4.42	0.44	0.36	0.08	4.49

2.4 Panel Data Models

There are three types of models: the pooled model, the fixed effects model and the random effects model.

Pooled Model: $y_{it} = \alpha + x'_{it}\beta + u_{it}$

Fixed Effects: $y_{it} = \alpha_i + x'_{it}\beta + u_{it}$

Random Effects: $y_{it} = x'_{it}\beta + (\alpha_i + e_i)$

The pooled model has no dummy variables, specifies constant coefficients, and is the most restrictive panel data model. The pooled model can be estimated by pooled OLS estimator.

There are several strategies for estimating fixed effects models, least squares dummy variable estimator (LSDV), within estimator, and between estimator. The LSDV estimator uses dummy variables and produces identical slopes of non-dummy independent variables. Since the number of entities (MSAs) is way larger than the studied time period and each dummy variable removes one degree of freedom, LSDV estimator is not used in this analysis. Within estimator is like including MSA dummy variables (only) for each MSA (i). Between estimator is like including time dummy variables (only) for each year (t). Both between and within estimators are elaborated in the next section.

Random effects model is like including both time and MSA dummy variables but assuming time-invariant variables (annual average temperature and humidity) are actually random over years within each MSA. Random effects model can be estimated by random effects estimator.

Both fixed effects model and random effects model belong to individual-specific effects model, assuming that there is unobserved heterogeneity across individuals captured by α_i, such as an unobserved ability of individual MSA that affect its lodging demand. This ability pertains to specific MSA and is different from one to another, but does not change over time. The question is whether the individual-specific effects α_i are correlated with the regressors. If they are correlated, the author use fixed effect model. If they are not correlated, the author use random effects model.

2.5 Panel Estimators

To isolate between variation from within variation, quantify individual specific effects, and identify true lodging demand drivers, the author utilized 4 different estimators for both full-service and limited-service hotels, and combined those regression results together for economic model comparison and in-depth analysis for each variable.

Pooled OLS Estimator

The pooled OLS estimator is obtained by stacking the data over MSAs and time into one long regression, and completely ignores the fact that the author is dealing with panel data.

Between Estimator

The between estimator only uses the between variation across MSAs. It uses the time average of all variables. In other words, the time variation is not considered, and the data are collapsed with one observation per MSA. For example, Albany metropolitan area has a RS_Cap of 4.04, 3.94, and 3.80, and Albuquerque metropolitan area has a RS_Cap of 4.71, 4.50, and 4.42 measured over 3 years from 2002 to 2004. Then the average RS_Cap for Albany, Albuquerque, and total are 3.93, 4.55, and 4.24 respectively. The between estimator only compares the difference between the time averaged RS_Cap, 3.93, 4.55, and 4.24, and ignores the time variation entirely.

Fixed Effects or Within Estimator

The within estimator uses the within variation over time. It uses time-demeaned variables, the individual specific deviations of variables from their time averaged values. Let us use the same example. Albany metropolitan area has a RS_Cap of 4.04, 3.94, and 3.80 from 2002 to 2004. Then its average RS_Cap is 3.93, and time-demeaned values are 0.11, 0.01, and -0.13. The individual specific effects α_i cancel out in fixed effects estimator. In other words, difference among MSAs, such as Albany versus Albuquerque, is completely ignored. One limitation of the within estimator is that time-invariant variables (annual average temperature and humidity) are dropped from the model and their coefficients are not identified.

Random Effects Estimator

The random effects estimates are a weighted average of the between and within estimates. Random effects assume that variation across MSAs is random and uncorrelated with the regressors, which allows for time-invariant variables to play a role as explanatory variables.

2.6 Tests and Diagnostics

Exhibit 2-4 illustrates the relationship between 3 panel data models and 4 panel estimators to help select the most efficient and consistent model for economic development impact study elaborated in chapter 5.

Exhibit 2-4 Model and Estimator

Estimator/True Model	Pooled Model	Random Effects Model	Fixed Effects Model
Pooled OLS estimator	Consistent	Consistent	Inconsistent
Between estimator	Consistent	Consistent	Inconsistent
Within or fixed effects estimator	Consistent	Consistent	Consistent
Random effects estimator	Consistent	Consistent	Inconsistent

Breusch-Pagan Lagrange Multiplier (LM) Test

The LM test helps the author to decide between a random effects regression and a simple OLS regression. The null hypothesis in the LM test is that variance across MSAs is zero. This is, no significant difference across MSAs, or no panel effect. If the LM test result is insignificant use the pooled OLS regression, otherwise use random effects regression.

Hausman Test

Hausman test tests whether there is a significant difference between the fixed and random effects estimators, videlicet, whether the unique errors (α_i) are correlated with the independent variables. The null hypothesis is that they are not correlated and that the preferred model is random effects versus the alternative fixed effects. If the Hausman test result is insignificant use the random effects regression, otherwise use fixed effects regression.

Chapter 3 Full-Service Hotel Analysis

3.1 Full-Service Overview

In 2013, full-service room demand grew by 1.86% on a year-over-year basis and 0.71% on per capita basis. How much of this growth is derived from within MSA changes and how much of it accounts for between MSA variation? What are the demand drivers at overall, between, and within MSA levels?

Exhibit 3-1 illustrates the full-service demand growth for 5 MSAs (destination markets) as a visual example for between market variation underlying the overall growth picture. Among the 5 MSAs, Miami is the most volatile market. It suffered the biggest occupancy lost from credit crisis, but also experienced the fastest demand recovery. Both New York and Boston have been relatively stable over the past 12 years, with a clear upward demand growth trend after the down turn. On the other hand, Washington DC and Newark have not fully recovered from the credit crisis yet. They even suffered certain demand losses 1 or 2 years ago either due to government cutback and oversupply, or the after-effects of Hurricane Sandy.

Exhibit 3-1 Full-Service Demand Growth

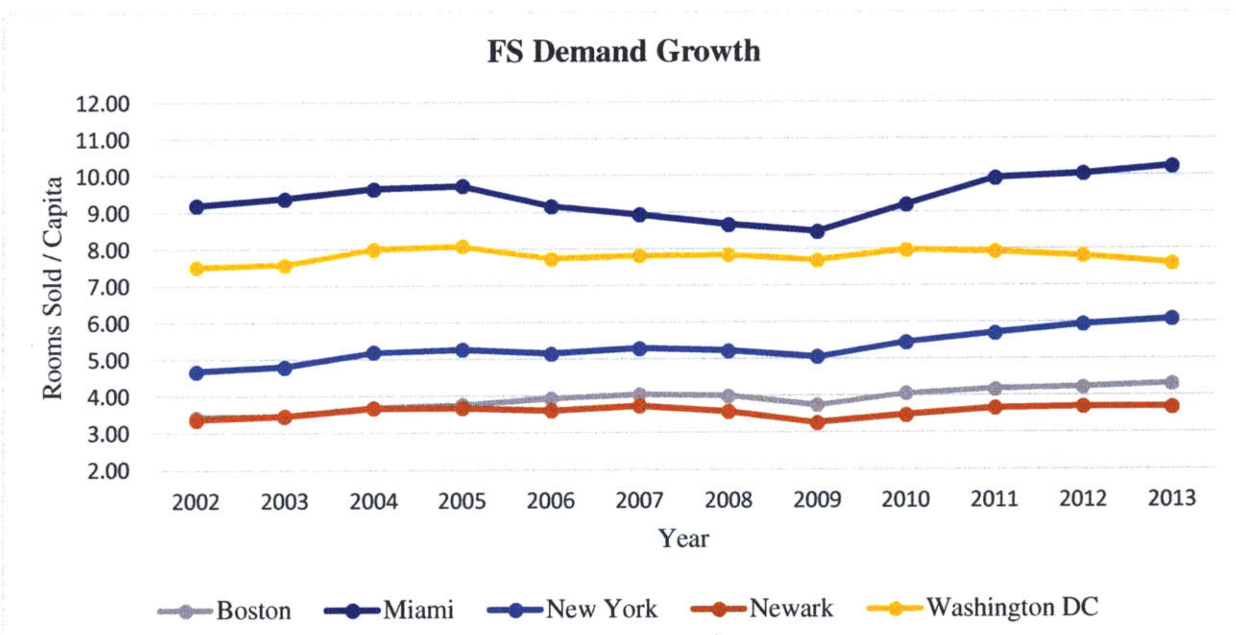


Exhibit 3-2 provides more insights as a thorough panel data summary.

Exhibit 3-2 Full-Service Hotel Panel Data Summary

Variable		Mean	Std. Dev.	Min	Max	Observations
ID	overall	27.5	15.59782	1	54	N = 648
	between		15.73213	1	54	n = 54
	within		0	27.5	27.5	T = 12
Year	overall	2007.5	3.454719	2002	2013	N = 648
	between		0	2007.5	2007.5	n = 54
	within		3.454719	2002	2013	T = 12
RS_Cap	overall	5.143683	4.358658	1.380295	28.81968	N = 648
	between		4.374742	1.52385	25.82453	n = 54
	within		0.4300231	1.957823	8.917175	T = 12
ADR	overall	125.2159	29.95522	74.766	288.1079	N = 648
	between		26.93816	82.84847	239.3856	n = 54
	within		13.56422	65.0796	182.3662	T = 12
EMP_Cap	overall	0.4735203	0.0503486	0.3589202	0.6668104	N = 648
	between		0.0474846	0.3826084	0.6527869	n = 54
	within		0.0178474	0.4333417	0.5179652	T = 12
INC_Cap	overall	48.46425	8.516077	33.67446	85.94436	N = 648
	between		8.359315	37.26571	79.53537	n = 54
	within		1.95792	40.38275	58.78574	T = 12
TEMP	overall	58.17833	11.92573	13.3	76.9	N = 648
	between		12.02842	13.3	76.9	n = 54
	within		0	58.17833	58.17833	T = 12
WET	overall	38.38741	13.93341	8.29	65.15	N = 648
	between		14.05338	8.29	65.15	n = 54
	within		0	38.38741	38.38741	T = 12
GSF_Cap	overall	0.5734615	0.5789007	0	3.798959	N = 625
	between		0.5685863	0	3.280406	n = 53
	within		0.1104146	-0.6134216	1.29288	T = 11.7925
DOM_Cap	overall	9.206369	5.515878	0	28.95097	N = 624
	between		5.448412	0.1484161	24.41004	n = 52
	within		1.12421	3.90305	14.65792	T = 12
INT_Cap	overall	1.067758	1.822421	0	10.37454	N = 624
	between		1.821167	0	8.634229	n = 52
	within		0.251255	-0.6627609	2.808069	T = 12

As indicated in Exhibit 3-2, between variation is way more significant than within variation for all variables. The between variation for full-service lodging demand (RS_Cap) is more than 10 times of within variation. The between variation for Convention Center Gross Area/Capita and Domestic Enplanement/Capita is about 5 times of within variation. The between variation for International Enplanement/Capita is as high as 7 times of within variation.

3.2 Pooled OLS Overview

Exhibit 3-3 summarizes the pooled OLS estimation result.

Stacking all data together and ignoring MSA and time variation, the pooled OLS estimation result can represent 77% of the full-service hotels in United States. Besides employment and income, the two traditional lodging demand drivers, temperature, humidity, convention space, domestic enplanement, and international enplanement all have meaningful impact on full-service demand. Business and leisure travelers seem to prefer higher overall quality and less expensive markets dominated by young employed population. Warm and dry weather is more desirable than cold and humid weather. Expansion in convention facilities, domestic and international airports, and increase in flight scheduled will drive full-service demand growth at this broad bush level. The coefficient of International Enplanement/Capita is about 15 times of that of Domestic Enplanement/Capita, which implies that a conversion from domestic terminal to international terminal may raise lodging demand as well. However, further examination is needed, since domestic enplanement and international enplanement may not be at the same scale.

Exhibit 3-3 FS Pooled OLS Estimation Result

Source	SS	df	MS
Model	9259.40144	8	1157.42518
Residual	2721.29012	592	4.59677384
Total	11980.6916	600	19.9678193

Number of obs	601
F(8, 592)	251.79
Prob > F	0.0000
R-squared	0.7729
Adj R-squared	0.7698
Root MSE	2.144

RS_Cap	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ADR	.0294455	.003837	7.67	0.000	.0219098	.0369813
EMP_Cap	18.53602	2.189557	8.47	0.000	14.23577	22.83626
INC_Cap	-.0361701	.0143912	-2.51	0.012	-.0644342	-.007906
TEMP	.0718363	.008494	8.46	0.000	.0551542	.0885184
WET	-.0556782	.0065887	-8.45	0.000	-.0686183	-.0427381
GSF_Cap	4.954473	.1721164	28.79	0.000	4.61644	5.292506
DOM_Cap	.0499749	.020435	2.45	0.015	.009841	.0901089
INT_Cap	.7594164	.0641728	11.83	0.000	.6333824	.8854504
_cons	-11.7849	1.252524	-9.41	0.000	-14.24483	-9.324968

3.3 Between Effects Overview

Exhibit 3-4 summarizes the between effects estimation result.

Ignoring time variation and focusing on MSA difference only, the between estimator exhibits very similar characteristics as those of pooled OLS estimator. R-square stays high, representing 77% of the US full-service hotel sector. The coefficients for Employment/Capita and Convention Center Gross Area/Capita in between estimation are both higher than those in pooled OLS estimation, indicating the magnitude of between market differences. Income/Capita and Domestic Enplanement/Capita become statistically insignificant. The affluence of destination market, the capacity of domestic airport, and the frequency of domestic flights are not top concerns of business and leisure travelers when selecting one market over another. On the other hand, weather of destination market and the capacity of international airport can be potential deal makers or breakers.

Exhibit 3-4 FS Between Effects Estimation Result

```
Between regression (regression on group means)  Number of obs      =       601
Group variable: ID                              Number of groups   =        51

R-sq:  within  = 0.0760                         Obs per group: min =         1
       between = 0.8051                                        avg =      11.8
       overall = 0.7696                                        max =        12

                                                F(8,42)            =     21.69
sd(u_i + avg(e_i.))=  2.142021                  Prob > F           =    0.0000
```

RS_Cap	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ADR	.0411436	.0151317	2.72	0.009	.0106065	.0716807
EMP_Cap	20.27055	8.258434	2.45	0.018	3.60435	36.93674
INC_Cap	-.0480663	.051918	-0.93	0.360	-.152841	.0567083
TEMP	.0660942	.030303	2.18	0.035	.0049403	.127248
WET	-.0568988	.0227631	-2.50	0.016	-.1028366	-.010961
GSF_Cap	5.149563	.6190051	8.32	0.000	3.900361	6.398766
DOM_Cap	.0527701	.0734841	0.72	0.477	-.0955269	.2010671
INT_Cap	.7161171	.2264563	3.16	0.003	.2591098	1.173124
_cons	-13.21635	4.671073	-2.83	0.007	-22.64296	-3.789742

3.4 Fixed Effects Overview

Exhibit 3-5 summarizes the fixed effects estimation result.

Ignoring MSA difference and focusing on time variation within specific MSA only, the fixed effects estimator exhibits quite different characteristics from those derived from pooled or between estimators. R-square is heavily reduced, can only represent 26.5% of the US full-service sector. If the destination market has been decided, business and leisure travelers enjoy lower room rate and the affluence of local MSA. Labor force participation, and capacity of domestic and international airports are strong drivers for local full-service demand over time. However, the coefficients for Employment/Capita and Convention Center Gross Area/Capita drop dramatically. Convention space becomes so weak that it hardly has any meaningful impact on local lodging demand. Individual-specific effects dominate the idiosyncratic error (Rho approaches 1), which also indicates that between MSA difference is substantial.

Exhibit 3-5 FS Fixed Effects Estimation Result

```
Fixed-effects (within) regression               Number of obs      =       601
Group variable: ID                              Number of groups   =        51

R-sq:  within  = 0.1862                         Obs per group: min =         1
       between = 0.2656                                        avg =      11.8
       overall = 0.2648                                        max =        12

                                                F(6,544)           =     20.75
corr(u_i, Xb)  = 0.2935                         Prob > F           =    0.0000
```

RS_Cap	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ADR	-.0036032	.0017186	-2.10	0.036	-.006979	-.0002273
EMP_Cap	2.44695	1.214137	2.02	0.044	.0619801	4.83192
INC_Cap	.06268	.0124064	5.05	0.000	.0383097	.0870504
TEMP	0	(omitted)				
WET	0	(omitted)				
GSF_Cap	.2595115	.1591577	1.63	0.104	-.0531275	.5721505
DOM_Cap	.0405397	.0172365	2.35	0.019	.0066814	.074398
INT_Cap	.4031851	.0800421	5.04	0.000	.2459557	.5604144
_cons	.6010393	.540982	1.11	0.267	-.4616302	1.663709
sigma_u	3.9880081					
sigma_e	.41770428					
rho	.98914856	(fraction of variance due to u_i)				

F test that all u_i=0: F(50, 544) = 370.50 Prob > F = 0.0000

3.5 Random Effects Overview

Exhibit 3-6 summarizes the random effects estimation result.

Taking both between and within variation into consideration, the random effects estimator exhibits very similar characteristics as those of fixed effects estimator. R-square has been improved to 44.4%. Unobserved variations across MSAs are assumed to be random and uncorrelated with the independent variables here, which allows temperature and humidity to play a role as explanatory variables again. Warm and dry weather is still preferred, even though humidity is statistically insignificant. If random effects is the appropriate model, business and leisure travelers favor low room rate, high labor force participation, high local income, and big convention centers and airports.

Exhibit 3-6 FS Random Effects Estimation Result

```
Random-effects GLS regression                   Number of obs      =       601
Group variable: ID                              Number of groups   =        51

R-sq:  within  = 0.1774                         Obs per group: min =         1
       between = 0.4451                                        avg =      11.8
       overall = 0.4440                                        max =        12

                                                Wald chi2(8)       =    175.20
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

-------------------- theta --------------------
  min      5%       median        95%      max
0.8082   0.9437     0.9437     0.9437   0.9437
```

RS_Cap	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ADR	-.0031538	.0018069	-1.75	0.081	-.0066953	.0003876
EMP_Cap	3.401962	1.280341	2.66	0.008	.8925385	5.911385
INC_Cap	.0494059	.012818	3.85	0.000	.024283	.0745287
TEMP	.1169855	.0266272	4.39	0.000	.0647971	.1691738
WET	-.0280844	.0232557	-1.21	0.227	-.0736647	.0174959
GSF_Cap	.6799123	.1632681	4.16	0.000	.3599126	.999912
DOM_Cap	.050877	.0179016	2.84	0.004	.0157906	.0859635
INT_Cap	.4744491	.079728	5.95	0.000	.318185	.6307131
_cons	-5.43718	1.853155	-2.93	0.003	-9.069298	-1.805063
sigma_u	2.1378908					
sigma_e	.41770428					
rho	.96322974	(fraction of variance due to u_i)				

3.6 Independent Variable Analysis

To better understand the regression results from the above-mentioned four estimators and track the dynamic of between and within MSA changes, each independent variable is examined one by one as follows. Yellow highlight indicates statistic insignificance, blue highlight indicates weak significance, while no highlight indicates significance.

Exhibit 3-7 Average Daily Rate

ADR	OLS	Between	Fixed	Random
Coef.	0.0294455	0.0411436	-0.0036032	-0.0031538
t/z	7.67	2.72	-2.10	-1.75
P>|t/z|	0.000	0.009	0.036	0.081

0.05 < P < 0.1

P > 0.1

Within specific MSA, ADR and Rooms Sold/Capita have a negative correlation. The higher the room rate, the fewer the hotel rooms sold. However, between MSAs, their correlation is actually positive, and the coefficient for between variation is more than 10 times of that of within variation. Business and leisure travelers probably prefer more expensive markets, such as New York and San Francisco, due to their higher overall quality. The higher the room rate, the more desirable the hotel market.

Exhibit 3-8 Employment/Capita

EMP_Cap	OLS	Between	Fixed	Random
Coef.	18.53602	20.27055	2.44695	3.401962
t/z	8.47	2.45	2.02	2.66
P>|t/z|	0.000	0.018	0.044	0.008

0.05 < P < 0.1

P > 0.1

As an indicator for US GDP growth and traditional lodging demand driver, Local Employment/Capita has a strong and positive correlation with Rooms Sold/Capita for both between and within MSAs. The coefficient for between variation is more than 8 times of that of within variation. For business and leisure travelers, MSAs with young employed population are more attractive than those dominated by older retiree population.

Exhibit 3-9 Income/Capita

INC_Cap	OLS	Between	Fixed	Random
Coef.	-0.0361701	-0.0480663	0.06268	0.0494059
t/z	-2.51	-0.93	5.05	3.85
P>|t/z|	0.012	0.360	0.000	0.000

0.05 < P < 0.1

P > 0.1

Between MSAs, Income/Capita has a negative correlation with Rooms Sold/Capita. Even though this correlation is statistically insignificant, it still reveals an interesting finding. That is, high-income markets are not necessarily the place people want to go. Since lodging group is different from income group, it is reasonable to infer that income growth is not really related to lodging demand changes between MSAs. However, within specific MSA, income growth does have a strong positive correlation with lodging demand, and the coefficient for within variation is larger than that of between variation.

Exhibit 3-10 Temperature

TEMP	OLS	Between	Fixed	Random
Coef.	0.0718363	0.0660942	0	0.1169855
t/z	8.46	2.18	omitted	4.39
P>|t/z|	0.000	0.035	omitted	0.000

0.05 < P < 0.1

P > 0.1

Since temperature was taken as annual average and assumed to stay constant for all years, within variation and seasonality cannot be identified by this model. Between MSAs, temperature has a strong positive correlation with Rooms Sold/Capita, which indicates that warm weather is always preferred. Hotel markets along the gulf coast and bay area are probably more attractive to business and leisure travelers.

Exhibit 3-11 Humidity

WET	OLS	Between	Fixed	Random
Coef.	-0.0556782	-0.0568988	0	-0.0280844
t/z	-8.45	-2.50	omitted	-1.21
P>|t/z|	0.000	0.016	omitted	0.227

0.05 < P < 0.1

P > 0.1

Similar to temperature, relative humidity was also taken as annual average and assumed to stay constant for all years. Within variation cannot be identified. Between MSAs, humidity has a strong negative correlation with Rooms Sold/Capita, which indicates that dry weather is always preferred. When both between and within variation are considered under random effects assumption, humidity becomes statistically insignificant.

Exhibit 3-12 Convention Center Gross Area/Capita

GSF_Cap	OLS	Between	Fixed	Random
Coef.	4.954473	5.149563	0.2595115	0.6799123
t/z	28.79	8.32	1.63	4.16
P>|t/z|	0.000	0.000	0.104	0.000

0.05 < P < 0.1

P > 0.1

Between MSAs, Convention Center Gross Area/Capita has an extremely strong and positive correlation with Rooms Sold/Capita. The coefficient for between variation is about 20 times of that of within variation. The bigger the convention facility, the more the hotel night stays. McCormick Place in Chicago, Orange County Convention Center in Orlando, and Georgia World Congress Center in Atlanta play an important role in local full-service demand. However, within specific MSA over time, the size of convention facility has very weak and almost neglectable impact on lodging demand. Convention center expansion does not seem to promote hotel night stays. Adding convention space does not yield the same result as having big convention space.

Exhibit 3-13 Domestic Enplanement/Capita

DOM_Cap	OLS	Between	Fixed	Random
Coef.	0.0499749	0.0527701	0.0405397	0.050877
t/z	2.45	0.72	2.35	2.84
P>|t/z|	0.015	0.477	0.019	0.004

(blue)	0.05 < P < 0.1
(yellow)	P > 0.1

Domestic Enplanement/Capita has a positive correlation with Rooms Sold/Capita for both between and within MSAs. This correlation only makes sense within specific MSA, and is statistically insignificant between various MSAs. Increase in domestic enplanement or expansion in domestic airport in certain MSAs will increase local lodging demand over time. However, this increase hardly has any impact on lodging demand dynamic between MSAs.

Exhibit 3-14 International Enplanement/Capita

INT_Cap	OLS	Between	Fixed	Random
Coef.	0.7594164	0.7161171	0.4031851	0.4744491
t/z	11.83	3.16	5.04	5.95
P>|t/z|	0.000	0.003	0.000	0.000

(blue)	0.05 < P < 0.1
(yellow)	P > 0.1

Unlike changes in domestic enplanement, changes in international enplanement have big and meaningful impact between markets and within markets. As international terminals grow and expand, lodging demand increases substantially. Coastal markets will probably benefit more from the increase in international tourism, as they are normally the first stop or transportation hubs for international arrival.

3.7 Panel Model Selection

To determine the most appropriate panel regression model for full-service hotels, Breusch-Pagan Lagrange Multiplier Test and Huasman Test were performed respectively.

Exhibit 3-15 summarizes the result from Breusch-Pagan Lagrange Multiplier Test.

Since Prob > Chibar2 is less than 0.05 and statistically significant, the author reject the null hypothesis and conclude that random effects is more appropriate than simple OLS regression. There is enough evidence of significant difference across MSAs that should not be ignored.

Exhibit 3-15 Breusch-Pagan LM Test Result for Full-Service Hotels

```
Breusch and Pagan Lagrangian multiplier test for random effects

        RS_Cap[ID,t] = Xb + u[ID] + e[ID,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                  RS_Cap |   19.96782        4.468537
                       e |   .1744769        .4177043
                       u |   4.570577        2.137891

        Test:   Var(u) = 0
                             chibar2(01) =   2410.28
                          Prob > chibar2 =    0.0000
```

Exhibit 3-16 summarizes the result from Huasman Test.

Since Prob > Chi2 is less than 0.05 and statistically significant, the author reject the null hypothesis and conclude that fixed effects model is more appropriate than random effects model for full-service hotels. Under the assumption of fixed effects, individual-specific effects are correlated with the independent variables. Temperature and humidity are dropped from the regression model due to their time-invariant base assumption.

Exhibit 3-16 Hausman Test Result for Full-Service Hotels

```
. hausman fixed random, sigmamore
```

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	Coefficients			
ADR	-.0036032	-.0031538	-.0004493	.0003724
EMP_Cap	2.44695	3.401962	-.9550115	.2439306
INC_Cap	.06268	.0494059	.0132741	.0036158
GSF_Cap	.2595115	.6799123	-.4204008	.0503491
DOM_Cap	.0405397	.050877	-.0103373	.0046805
INT_Cap	.4031851	.4744491	-.071264	.0320395

```
                 b = consistent under Ho and Ha; obtained from xtreg
  B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

             chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                     =       83.47
           Prob>chi2 =      0.0000
```

The chosen panel regression model can be interpreted as follows.

RS_Cap = 0.6010393 - 0.0036032 x ADR + 2.44695 x EMP_Cap + 0.06268 x INC_Cap + 0.2595115 x GSF_Cap + 0.0405397 x DOM_Cap + 0.4031851 x INT_Cap

All independent variables in this model are strong demand drivers except GSF_Cap, which is relatively marginal.

Chapter 4 Limited-Service Hotel Analysis

4.1 Limited-Service Overview

In 2013, limited-service room demand grew by 3.30% on a year-over-year basis and 1.95% on per capita basis. How much of this growth is derived from within MSA changes and how much of it accounts for between MSA variation? What are the demand drivers at overall, between, and within MSA levels? Will convention space, domestic and international enplanement, those newly identified external economic factors in full-service sector, continue to play an important role in limited-service sector?

Exhibit 4-1 illustrates the limited-service demand growth for 5 MSAs (pass-through markets) as a visual example for between variation underlying the overall growth picture. Both Nashville and Houston have experienced tremendous demand growth after the credit crisis and reached their 12-year peak in 2013. In Nashville, music city center, a convention complex located in downtown area, opened to public in 2013. In Houston, Southwest Airlines' new international terminal at William Hobby airport is set for completion in 2015. Can Nashville and Houston's surging demand growth be partially explained by convention and airport addition? The demand recovery speed for Atlanta and Raleigh lagged behind, but finally picked up in 2013. On the other hand, Albuquerque, a heavy reliance on military and government operations, has barely shown any sign of recovery. Its 2013 limited-service demand remained as low as that of 2009.

Exhibit 4-1 Limited-Service Demand Growth

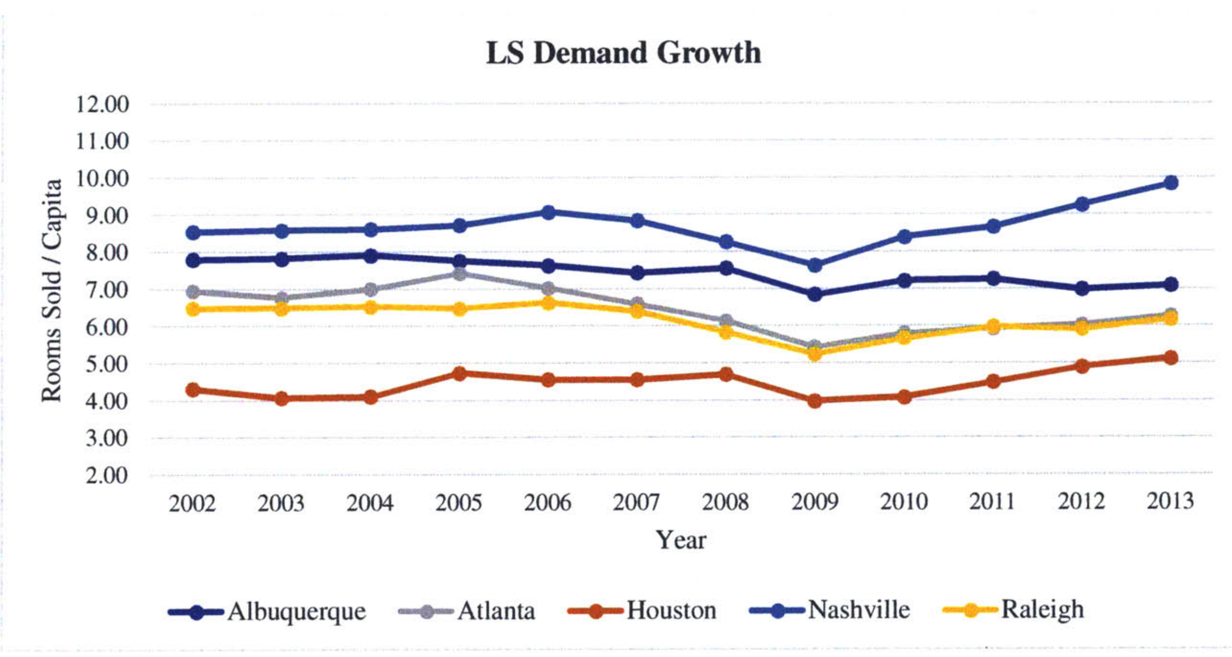


Exhibit 4-2 provides more insights as a thorough panel data summary.

Exhibit 4-2 Limited-Service Hotel Panel Data Summary

Variable		Mean	Std. Dev.	Min	Max	Observations
ID	overall	27.5	15.59782	1	54	N = 648
	between		15.73213	1	54	n = 54
	within		0	27.5	27.5	T = 12
Year	overall	2007.5	3.454719	2002	2013	N = 648
	between		0	2007.5	2007.5	n = 54
	within		3.454719	2002	2013	T = 12
RS_Cap	overall	4.665638	1.854352	1.314683	12.62304	N = 636
	between		1.837723	1.784243	10.72641	n = 53
	within		0.3462641	3.249599	6.562269	T = 12
ADR	overall	80.34513	19.16575	50.7692	185.0169	N = 636
	between		16.89754	58.43993	152.1313	n = 53
	within		9.31371	37.36533	113.4863	T = 12
EMP_Cap	overall	0.4735203	0.0503486	0.3589202	0.6668104	N = 648
	between		0.0474846	0.3826084	0.6527869	n = 54
	within		0.0178474	0.4333417	0.5179652	T = 12
INC_Cap	overall	48.46425	8.516077	33.67446	85.94436	N = 648
	between		8.359315	37.26571	79.53537	n = 54
	within		1.95792	40.38275	58.78574	T = 12
TEMP	overall	58.17833	11.92573	13.3	76.9	N = 648
	between		12.02842	13.3	76.9	n = 54
	within		0	58.17833	58.17833	T = 12
WET	overall	38.38741	13.93341	8.29	65.15	N = 648
	between		14.05338	8.29	65.15	n = 54
	within		0	38.38741	38.38741	T = 12
GSF_Cap	overall	0.5734615	0.5789007	0	3.798959	N = 625
	between		0.5685863	0	3.280406	n = 53
	within		0.1104146	-0.6134216	1.29288	T = 11.7925
DOM_Cap	overall	9.206369	5.515878	0	28.95097	N = 624
	between		5.448412	0.1484161	24.41004	n = 52
	within		1.12421	3.90305	14.65792	T = 12
INT_Cap	overall	1.067758	1.822421	0	10.37454	N = 624
	between		1.821167	0	8.634229	n = 52
	within		0.251255	-0.6627609	2.808069	T = 12

As mentioned in chapter 3 section 3.1 and reiterated in Exhibit 4-2, between variation is way more significant than within variation for all variables. The between variation for limited-service lodging demand (RS_Cap) is more than 5.3 times of within variation. The between variation for ADR is about 1.8 times of within variation. Only panel based analysis can provide further insights.

4.2 Pooled OLS Overview

Exhibit 4-3 summarizes the pooled OLS estimation result.

Stacking all data together and ignoring MSA and time variation, the limited-service pooled OLS estimation result exhibits very similar characteristics as those of full-service OLS estimation. Employment, income, temperature, humidity, convention space, and domestic enplanement all have meaningful impact on limited-service demand. Budget conscious travelers seem to prefer less expensive markets dominated by young employed population. Warm and dry weather is more desirable than cold and humid weather. Expansion in convention facilities and domestic airports, and increase in domestic flights will drive limited-service demand growth at this broad bush level.

Exhibit 4-3 LS Pooled OLS Estimation Result

Source	SS	df	MS
Model	963.610353	8	120.451294
Residual	875.92404	580	1.51021386
Total	1839.53439	588	3.12845985

Number of obs	=	589
F(8, 580)	=	79.76
Prob > F	=	0.0000
R-squared	=	0.5238
Adj R-squared	=	0.5173
Root MSE	=	1.2289

RS_Cap	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ADR	-.0063189	.0039855	-1.59	0.113	-.0141466	.0015088
EMP_Cap	8.487707	1.283451	6.61	0.000	5.966929	11.00848
INC_Cap	-.0629496	.0090576	-6.95	0.000	-.0807392	-.04516
TEMP	.051206	.0049449	10.36	0.000	.0414938	.0609181
WET	-.0211087	.0040234	-5.25	0.000	-.0290109	-.0132066
GSF_Cap	1.068683	.0991512	10.78	0.000	.8739436	1.263422
DOM_Cap	.0894839	.012376	7.23	0.000	.0651766	.1137911
INT_Cap	-.1244745	.0384275	-3.24	0.001	-.1999486	-.0490004
_cons	.6851395	.747241	0.92	0.360	-.7824886	2.152768

The major differences between limited-service and full-service sectors lie in R square, ADR, and international enplanement. R square in limited-service sector is about 25% lower than that of full-service sector, representing 52% of limited-service hotels in United States. ADR has a negative insignificant correlation with Rooms Sold/Capita. Even though lower room rate is preferred by budget conscious travelers, room rate itself is not a determinant factor for limited-service demand. The negative coefficient of International Enplanement/Capita is rather intriguing. One possibility is that the expansion of international airport or the increase of international flights will lead to addition to full-service airport hotels, potential competitors for limited-service hotels, hence reduce limited-service lodging demand. Further examination is needed to test the rationale and consistency of the assumptions.

4.3 Between Effects Overview

Exhibit 4-4 summarizes the between effects estimation result.

Exhibit 4-4 LS Between Effects Estimation Result

```
Between regression (regression on group means)  Number of obs      =       589
Group variable: ID                               Number of groups   =        50

R-sq:  within  = 0.0068                          Obs per group: min =         1
       between = 0.5030                                         avg =      11.8
       overall = 0.5188                                         max =        12

                                                 F(8,41)            =      5.19
sd(u_i + avg(e_i.))=  1.442496                   Prob > F           =    0.0002
```

RS_Cap	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ADR	-.0076231	.0201938	-0.38	0.708	-.0484053	.033159
EMP_Cap	10.03014	5.689323	1.76	0.085	-1.459681	21.51996
INC_Cap	-.0729578	.0396868	-1.84	0.073	-.153107	.0071913
TEMP	.0534311	.02066	2.59	0.013	.0117073	.0951549
WET	-.0160496	.0165223	-0.97	0.337	-.0494172	.0173179
GSF_Cap	1.026939	.4184099	2.45	0.018	.1819428	1.871935
DOM_Cap	.0990875	.0534652	1.85	0.071	-.0088877	.2070626
INT_Cap	-.1651493	.1604085	-1.03	0.309	-.4891008	.1588022
_cons	.2892868	3.3102	0.09	0.931	-6.395798	6.974371

Ignoring time variation and focusing on MSA difference only, the between estimator exhibits similar correlations between dependent and independent variables, but very different P statistics. Employment, income, and domestic enplanement have very weak and marginal impact on limited-service demand. Humidity and international enplanement become statistically insignificant. When selecting one market over another, budget conscious travelers pay little or no attention to the affluence or economic strength of pass-through markets, the capacity of its domestic or international airport, and the frequency of domestic or international flights. They do not even worry about the relative humidity of pass-through MSAs. The only two factors that manage to attract their attention are temperature and convention center gross areas. Budget conscious travelers have clear preference to warm weather and MSAs with large convention facilities and tons of convention activities.

4.4 Fixed Effects Overview

Exhibit 4-5 summarizes the fixed effects estimation result.

Exhibit 4-5 LS Fixed Effects Estimation Result

```
Fixed-effects (within) regression               Number of obs      =       589
Group variable: ID                              Number of groups   =        50

R-sq:  within  = 0.3470                         Obs per group: min =         1
       between = 0.1114                                        avg =      11.8
       overall = 0.0923                                        max =        12

                                                F(6,533)           =     47.21
corr(u_i, Xb)  = -0.6438                        Prob > F           =    0.0000
```

RS_Cap	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ADR	-.000664	.0018416	-0.36	0.719	-.0042817	.0029536
EMP_Cap	1.949862	.8856655	2.20	0.028	.2100383	3.689685
INC_Cap	.096759	.0093176	10.38	0.000	.0784553	.1150627
TEMP	0	(omitted)				
WET	0	(omitted)				
GSF_Cap	.1198309	.1125071	1.07	0.287	-.1011808	.3408427
DOM_Cap	-.0101384	.0124465	-0.81	0.416	-.0345885	.0143118
INT_Cap	.0125478	.0593059	0.21	0.833	-.1039542	.1290497
_cons	-.8994254	.3813811	-2.36	0.019	-1.64862	-.1502309
sigma_u	2.2910476					
sigma_e	.29364877					
rho	.98383739	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(49, 533) =   239.25              Prob > F = 0.0000
```

Ignoring MSA difference and focusing on time variation within specific MSA only, the fixed effects estimator exhibits quite different characteristics from those derived from between estimator. R-square is heavily reduced, can only represent 9.23% of the US limited-service sector. Convention center gross areas, domestic and international enplanement, all become statistically insignificant and fail to capture limited-service demand changes. Local employment and income regain their strength, and become the only two meaningful external economic factors left in this model. The coefficient of Income/Capita reverses its sign in within estimation compared with that of between estimation. When a MSA gets stronger, with higher labor force participation and higher income, it attracts more business and leisure travelers, including budget sensitive travelers. Individual-specific effects dominate the idiosyncratic error (Rho approaches 1), which also indicates that between MSA difference is substantial.

4.5 Random Effects Overview

Exhibit 4-6 summarizes the random effects estimation result.

Exhibit 4-6 LS Random Effects Estimation Result

```
Random-effects GLS regression                   Number of obs      =       589
Group variable: ID                              Number of groups   =        50

R-sq:  within  = 0.3396                         Obs per group: min =         1
       between = 0.0032                                        avg =      11.8
       overall = 0.0086                                        max =        12

                                                Wald chi2(8)       =    239.01
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

------------------- theta --------------------
  min      5%       median        95%      max
0.8001   0.9412     0.9412     0.9412   0.9412
```

RS_Cap	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ADR	.0009678	.0018898	0.51	0.609	-.0027361	.0046717
EMP_Cap	2.479216	.9085244	2.73	0.006	.6985406	4.259891
INC_Cap	.0786795	.009351	8.41	0.000	.0603518	.0970072
TEMP	.0577113	.0179822	3.21	0.001	.0224667	.0929558
WET	-.0102672	.0157194	-0.65	0.514	-.0410766	.0205422
GSF_Cap	.2944124	.1122322	2.62	0.009	.0744414	.5143834
DOM_Cap	.0022304	.0125555	0.18	0.859	-.0223779	.0268387
INT_Cap	-.0362266	.0573781	-0.63	0.528	-.1486855	.0762324
_cons	-3.429526	1.229211	-2.79	0.005	-5.838736	-1.020317
sigma_u	1.4394541					
sigma_e	.29364877					
rho	.96004666	(fraction of variance due to u_i)				

Taking both between and within variation into consideration, the random effects estimator exhibits somewhat similar characteristics as those of fixed effects estimator. R-square falls below 1%, not much representativeness. It is reasonable to infer that random effects is probably not the right model for limited-service hotels. Unobserved variations across MSAs are assumed to be random and uncorrelated with the independent variables here, which allows temperature and humidity to play a role as explanatory variables again. Convention center gross area reclaims its strength and becomes another meaningful economic factor. If random effects is the appropriate model, budget conscious travelers favor high labor force participation, high local income, warm weather, and big convention facilities.

4.6 Independent Variable Analysis

To better understand the regression results from the above-mentioned four estimators and track the dynamic of between and within MSA changes, each independent variable is examined one by one as follows. Yellow highlight indicates statistic insignificance, blue highlight indicates weak significance, while no highlight indicates significance.

Exhibit 4-7 Average Daily Rate

ADR	OLS	Between	Fixed	Random
Coef.	-0.0063189	-0.0076231	-0.000664	0.0009678
t/z	-1.59	-0.38	-0.36	0.51
P>|t/z|	0.113	0.708	0.719	0.609

0.05 < P < 0.1

P > 0.1

In general, ADR and Rooms Sold/Capita have a negative correlation. The higher the room rate, the fewer the hotel rooms sold. However, ADR is statistically insignificant for both between and within MSAs. Even at pooled OLS level, ADR only has very weak and neglectable impact.

Exhibit 4-8 Employment/Capita

EMP_Cap	OLS	Between	Fixed	Random
Coef.	8.487707	10.03014	1.949862	2.479216
t/z	6.61	1.76	2.20	2.73
P>|t/z|	0.000	0.085	0.028	0.006

0.05 < P < 0.1

P > 0.1

Local Employment/Capita has a positive correlation with Rooms Sold/Capita for both between and within MSAs. Even though the coefficient for between variation is more than 5 times of that of within variation, employment changes can better explain within MSA changes than between MSA differences as indicated by their P statistics. The higher the local employment level, the better the local economy, and the more business and leisure travelers.

Exhibit 4-9 Income/Capita

INC_Cap	OLS	Between	Fixed	Random
Coef.	-0.0629496	-0.0729578	0.096759	0.0786795
t/z	-6.95	-1.84	10.38	8.41
P>|t/z|	0.000	0.073	0.000	0.000

0.05 < P < 0.1

P > 0.1

Between MSAs, Income/Capita has a negative correlation with Rooms Sold/Capita. Even though this correlation is weak, it still reveals an interesting finding. That is, cheaper markets are more attractive to budget sensitive travelers. Wealth of local workers and wealth of travelers are two completely different things. Within specific MSA, income growth has a strong and positive correlation with lodging demand, and the coefficient for within variation is larger than that of between variation. As a MSA gets richer, its overall quality gets improved, hence attracts more business and leisure travelers.

Exhibit 4-10 Temperature

TEMP	OLS	Between	Fixed	Random
Coef.	0.051206	0.0534311	0	0.0577113
t/z	10.36	2.59	omitted	3.21
P>|t/z|	0.000	0.013	omitted	0.001

0.05 < P < 0.1

P > 0.1

Since temperature was taken as annual average and assumed to stay constant for all years, within variation and seasonality cannot be identified by this model. Between MSAs, temperature has a strong positive correlation with Rooms Sold/Capita, which indicates that warm weather is always preferred. Budget sensitive or insensitive travelers have similar preference to temperature. The only difference is that the coefficients for limited-service hotels are slightly lower than those of full-service counter party.

Exhibit 4-11 Humidity

WET	OLS	Between	Fixed	Random
Coef.	-0.0211087	-0.0160496	0	-0.0102672
t/z	-5.25	-0.97	omitted	-0.65
P>|t/z|	0.000	0.337	omitted	0.514

0.05 < P < 0.1

P > 0.1

Similar to temperature, relative humidity was also taken as annual average and assumed to stay constant for all years. Within variation cannot be identified. Between MSAs, humidity has a negative insignificant correlation with Rooms Sold/Capita, which indicates that dry weather is preferred, but not a major concern of budget sensitive travelers.

Exhibit 4-12 Convention Center Gross Area/Capita

GSF_Cap	OLS	Between	Fixed	Random
Coef.	1.068683	1.026939	0.1198309	0.2944124
t/z	10.78	2.45	1.07	2.62
P>|t/z|	0.000	0.018	0.287	0.009

0.05 < P < 0.1

P > 0.1

Between MSAs, Convention Center Gross Area/Capita has a very strong and positive correlation with Rooms Sold/Capita. The coefficient for between variation is about 8.5 times of that of within variation. MSAs with larger convention facilities, such as Chicago, Atlanta, and Orlando, are more attractive to business and leisure travelers. Within specific MSA over time, the size of convention facility has no significant impact on lodging demand. Convention center expansion does not seem to promote hotel night stays for limited-service hotels at all. Most convention attendees are sponsored by their companies and have less concern on budget. It is reasonable to infer that convention facility size will have more influence on full-service sector than limited-service sector.

Exhibit 4-13 Domestic Enplanement/Capita

DOM_Cap	OLS	Between	Fixed	Random
Coef.	0.0894839	0.0990875	-0.0101384	0.0022304
t/z	7.23	1.85	-0.81	0.18
P>|t/z|	0.000	0.071	0.416	0.859

0.05 < P < 0.1

P > 0.1

Whether it is between MSAs or within specific MSA, domestic enplanement has no significant impact on hotel rooms sold. Business and Leisure travelers may prefer MSAs with larger domestic airports or more frequent domestic flights, but this relationship is very weak. The negative coefficient under fixed effects assumption makes things even more complicated. In rare cases, expansion in domestic airport or increase in domestic flights may coincide with hotel guest loss. But, there may be additional reasons behind it, such as economic downturn, and this negative correlation is pretty much meaningless.

Exhibit 4-14 International Enplanement/Capita

INT_Cap	OLS	Between	Fixed	Random
Coef.	-0.1244745	-0.1651493	0.0125478	-0.0362266
t/z	-3.24	-1.03	0.21	-0.63
P>|t/z|	0.001	0.309	0.833	0.528

0.05 < P < 0.1

P > 0.1

Opposite to the result from full-service hotel analysis, changes in international enplanement have no meaningful impact on limited-service demand. Budget conscious travelers will probably either stay away from the relative expensive international travel option or opt for a good experience.

4.7 Panel Model Selection

To determine the most appropriate panel regression model for limited-service hotels, Breusch-Pagan Lagrange Multiplier Test and Huasman Test were performed respectively.

Exhibit 4-15 summarizes the result from Breusch-Pagan Lagrange Multiplier Test.

Since Prob > Chibar2 is less than 0.05 and statistically significant, the author reject the null hypothesis and conclude that random effects is more appropriate than simple OLS regression. There is enough evidence of significant difference across MSAs that should not be ignored.

Exhibit 4-15 Breusch Pagan LM Test Result for Limited-Service Hotels

```
Breusch and Pagan Lagrangian multiplier test for random effects

        RS_Cap[ID,t] = Xb + u[ID] + e[ID,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                  RS_Cap |    3.12846        1.768745
                       e |   .0862296        .2936488
                       u |   2.072028        1.439454

        Test:   Var(u) = 0
                             chibar2(01) =   2242.80
                          Prob > chibar2 =    0.0000
```

Exhibit 4-16 summarizes the result from Huasman Test.

Since Prob > Chi2 is less than 0.05 and statistically significant, the author reject the null hypothesis and conclude that fixed effects model is more appropriate than random effects model for limited-service hotels. Under the assumption of fixed effects, individual-specific effects are correlated with the independent variables. Temperature and humidity are dropped from the regression model due to their time-invariant base assumption.

Exhibit 4-16 Hausman Test Result for Limited-Service Hotels

	Coefficients			
	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
ADR	-.000664	.0009678	-.0016319	.0003857
EMP_Cap	1.949862	2.479216	-.5293542	.1870949
INC_Cap	.096759	.0786795	.0180795	.0027909
GSF_Cap	.1198309	.2944124	-.1745815	.0358954
DOM_Cap	-.0101384	.0022304	-.0123688	.0035053
INT_Cap	.0125478	-.0362266	.0487743	.0237866

```
                    b = consistent under Ho and Ha; obtained from xtreg
     B = inconsistent under Ha, efficient under Ho; obtained from xtreg

  Test:  Ho:  difference in coefficients not systematic

                chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                        =        57.06
              Prob>chi2 =       0.0000
```

The chosen panel regression model can be interpreted as follows.

RS_Cap = - 0.8994245 - 0.000664 x ADR + 1.949862 x EMP_Cap + 0.096759 x INC_Cap + 0.1198309 x GSF_Cap - 0.0101384 x DOM_Cap + 0.0125478 x INT_Cap

Only the two traditional lodging demand drivers, Employment/Capita and Income/Capita, remain significant in this model. All other independent variables, such as convention space and enplanement, fail to deliver a meaningful explanation on limited-service demand changes.

4.8 Potential Improvements

4.8.1 GIS Transportation Data

Since the majority of limited-service hotels is located adjacent to the highways and most travelers stop by for convenient purpose, geographic accessibility is crucial to limited-service lodging demand. TransCAD, a transportation planning software that combines GIS and transportation modeling capabilities, may be able to assess the location characteristic of each MSA. Through the analysis of transportation data, hotel location, traffic flow, and network characteristics, highway travel demand can be forecasted as well.

4.8.2 Ceridian – UCLA Pulse of Commerce Index

The Ceridian-UCLA Pulse of Commerce Index (PCI) is based on real-time diesel fuel consumption data for over the road trucking and serves as an indicator of the state and possible future direction of the U.S. economy. By tracking the volume and location of fuel being purchased, the index closely monitors the over the road movement of raw materials, goods-in-process and finished goods to U.S. factories, retailers and consumers.[6] In contrast to other economic indicators, which have a lag time (such as employment and income), the PCI is based on real-time, actual consumption data that provides insight into the economy before the monthly industrial production number is issued. Additionally, PCI index tracks highway movement, a dominant transportation method utilized by limited-service hotel guests but not represented by any of the independent variables examined so far.

[6] http://en.wikipedia.org/wiki/Ceridian-UCLA_Pulse_of_Commerce_Index

Chapter 5 Economic Development Impact

5.1 External Economic Factors

The objective of this chapter is to access the economic impact from controllable external economic factors. Economic development impact is defined as effect on lodging demand at MSA level in this thesis. Based on the analysis in chapter 3 and 4 and the results from fixed effects estimation, the author conclude that convention space, domestic enplanement, and international enplanement are all meaningful economic factors besides the two traditional demand drivers, employment and income, for full-service hotels. Convention space is a weak factor under fixed effects assumption. Domestic enplanement fails to explain between market differences. International enplanement manages to capture both between and within market variation, and is one of the strongest economic factors studied. However, none of them is a strong economic factor for limited-service hotels.

Exhibit 5-1 tracks lodging demand growth with convention space growth on percentage basis for the past 12 years. The correlation between convention space variation and hotel demand variation is relatively weak at aggregated level, with obvious lags, inconsistent magnitude, and some noises.

Exhibit 5-1 Lodging Demand Growth and Convention Space Growth

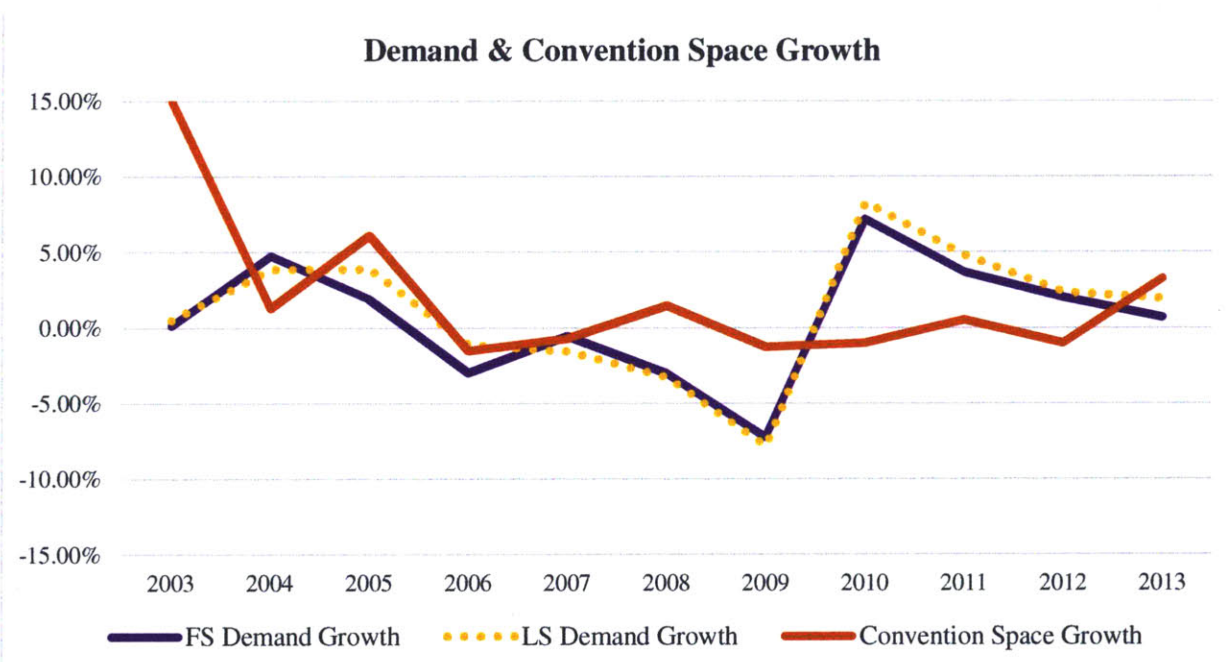
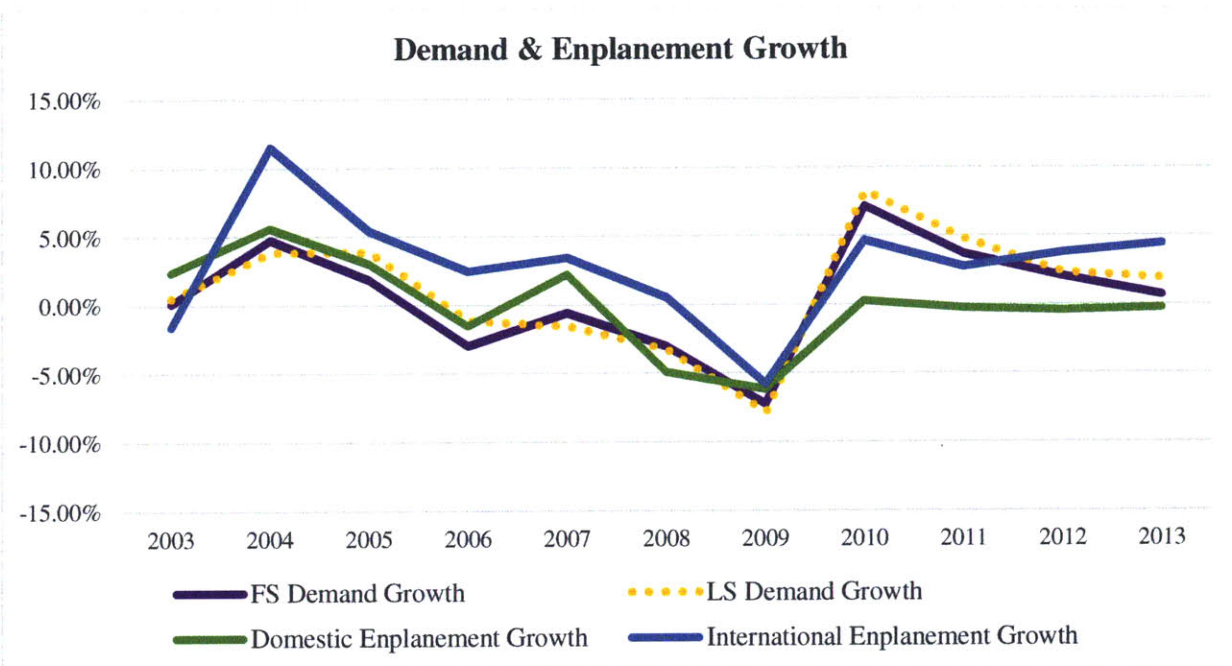


Exhibit 5-2 tracks lodging demand growth with domestic and international enplanement growth on percentage basis for the past 12 years. The correlation between enplanement variation and hotel demand variation is very strong and highly consistent, no lags, no distortion. The bonding relationship between full-service demand and international enplanement is especially powerful at aggregated level.

Exhibit 5-2 Lodging Demand Growth and Enplanement Growth



How much will 1% increase of international enplanement boost full-service occupancy? How much will each MSA be willing to pay for airport or convention center expansion to bring additional full-service demand? This leads us to the next section where the author access the economic impact from convention space, domestic enplanement, and international enplanement respectively.

5.2 Demand Elasticity

Demand elasticity measures how sensitive the full-service lodging demand is to changes in other economic variables. Exhibit 5-3 summarizes the changes in Rooms Sold/Capita corresponding to 10% increase in convention space, domestic enplanement, and international enplanement. Further explanation is elaborated as follows.

Exhibit 5-3 Full-Service Hotel Demand Elasticity

	Rooms Sold/Capita	GSF/Capita	Domestic/Capita	International/Capita
Mean	5.1436830	0.5734615	9.2063690	1.0677580
FS Coefficients		0.2595115	0.0405397	0.4031851
10% Change		0.0148820	0.0373223	0.0430504
Demand Elasticity		**0.29%**	**0.73%**	**0.84%**

5.2.1 Convention Space Addition

Assume population stays constant for all MSAs. Since the average Convention Center Gross Area/Capita is 0.5734615 and coefficient is 0.2595115, a 10% increase in convention space will add 0.0148820 to Rooms Sold/Capita, which equals to a 0.29% increase in full-service lodging demand.

5.2.2 Domestic Airport Expansion

Assume population stays constant for all MSAs. Since the average Domestic Enplanement/Capita is 9.206369 and coefficient is 0.0405397, a 10% increase in domestic terminal (domestic enplanement) will add 0.0373223 to Rooms Sold/Capita, which equals to a 0.73% increase in full-service lodging demand.

5.2.3 International Airport Expansion

Assume population stays constant for all MSAs. Since the average International Enplanement/Capita is 1.067758 and coefficient is 0.4031851, a 10% increase in international terminal (international enplanement) will add 0.0430504 to Rooms Sold/Capita, which equals to a 0.84% increase in full-service lodging demand.

5.2.4 Conversion from Domestic to International Terminal

Ignoring the difference in airplane size and flight frequency, a simple conversion from domestic to international terminal does not just yield a 0.11% increase in full-service demand (difference between demand elasticity), but way more than that. See explanation in Exhibit 5-4 below.

Exhibit 5-4 Economic Impact from Terminal Conversion

	Rooms Sold/Capita	Domestic/Capita	International/Capita	
Mean	5.1436830	9.2063690	1.0677580	1.0677580
Δ Enplanement		-0.9206369	0.9206369	0.46031845
% Change		-10.00%	86.22%	43.11%
FS Coefficients		0.0405397	0.4031851	0.4031851
Δ RS/Capita		-0.0373223	0.3711871	0.1855935
% Change		-0.73%	7.22%	3.61%
Net Change			**6.49%**	**2.88%**

Since the average of Domestic Enplanement/Capita is about 8.6 times of the average of International Enplanement/Capita, a 10% decrease in domestic airport capacity will result in an 86.22% increase in international terminal capacity. The loss of domestic enplanement results in a 0.73% decrease in lodging demand. The increase in international enplanement results in a 7.22% increase in lodging demand, which leads to a net increase of 6.49% from terminal conversion for full-service hotels.

In reality, the capacity of long-distance aircrafts is about 2.5 times of that of short-medium range aircrafts. The frequency of domestic flights is about 5 or 6 times of that of international flights. (Frequency varies based on destination markets.) When convert domestic terminal to international terminal, the swap between domestic enplanement and international enplanement is not 1:1, but with 50% to 60% discount, which leads to a net increase around 2% to 3% for full-service lodging demand.

5.3 Individual MSA Analysis

As noted in Chapter 3 Section 3.4, the fixed effects model can only represent 26.5% of the US full-service sector. The next question is which MSA the fixed effects model can represent. To be specific, which MSA can be best explained by the changes in domestic or international enplanement? Do they share anything in common? The author tracked lodging demand growth with enplanement growth for all 54 MSAs and included the findings in Appendix D.

Exhibit 5-5 Demand and Enplanement Growth – New York

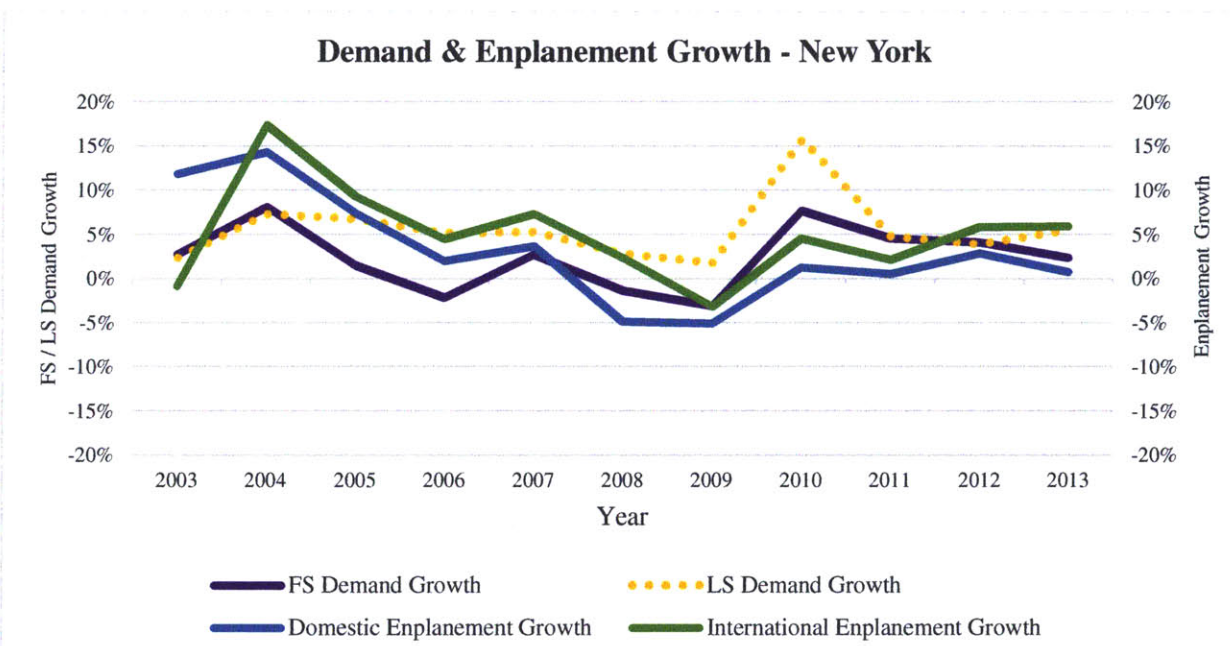


Exhibit 5-6 Demand and Enplanement Growth - Miami

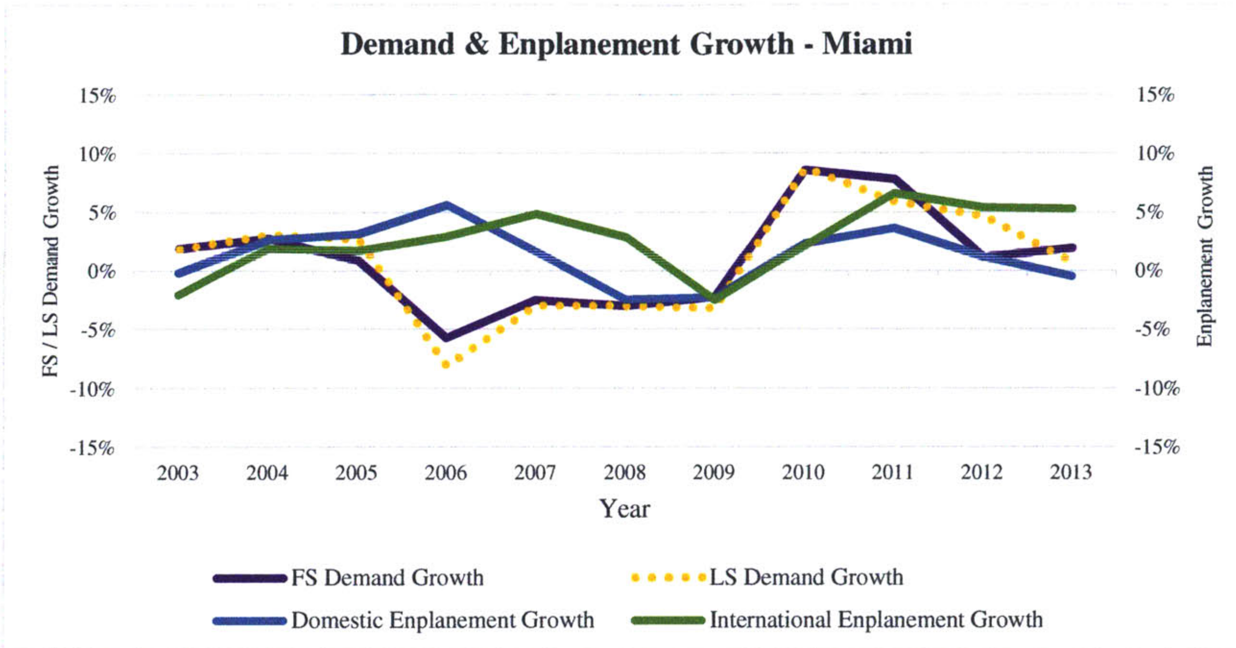


Exhibit 5-5 and 5-6 are two examples of Appendix D. Both New York and Miami are famous destination markets with hundreds of international tourists. The correlation between enplanement growth and full-service demand growth is very strong and consistent for New York. On the contrary, there is hardly any correlation in Miami, sometimes negative, sometimes positive, with random lags.

The author also ran regression between enplanement and rooms sold for each of the 54 MSAs and combined their results together for advanced study. Exhibit 5-7 summarizes the regression results.

Among the 52 MSAs with enplanement data, 14 MSAs show strong correlation, while another 5 show weak correlation between domestic enplanement and full-service demand. 12 MSAs exhibit strong correlation, while another 3 exhibit weak correlation between international enplanement and full-service demand. Only 4 MSAs indicate meaningful impact from both domestic and international enplanement.

Exhibit 5-7 Regression between Enplanement and FS Rooms Sold

$R^2 > 0.75$
$0.50 < R^2 <= 0.75$
$0.25 < R^2 <= 0.50$
$0.00 < R^2 <= 0.25$
$R^2 <= 0.00$

$P <= 0.05$
$0.05 < P <= 0.1$
$P > 0.1$

MSA	R^2	Adjusted R^2	Intercept	Domestic Enplanement/Capita			International Enplanement/Capita		
				Coef.	t	p	Coef.	t	p
Albany	0.316843	0.165030	2.230714	0.401561	2.025732	0.073439	-11.425299	-1.304042	0.224583
Albuquerque	0.472763	0.355599	3.244761	0.130751	2.822591	0.019962	-5.534273	-0.176319	0.863947
Atlanta	0.520800	0.414311	-1.753253	0.301572	2.339947	0.044024	0.046841	0.117840	0.908782
Austin	0.602193	0.513792	-0.027387	0.677231	3.468300	0.007068	-1.241500	-0.421747	0.683104
Baltimore	0.295335	0.138742	2.147169	0.133641	1.602798	0.143443	0.601772	0.962706	0.360846
Boston	0.834282	0.797456	1.105646	0.630543	3.678921	0.005084	-0.674242	-0.439075	0.670959
Charlotte	0.071969	-0.134260	3.283753	0.009313	0.150789	0.883467	0.063538	0.121165	0.906222
Chicago	0.564117	0.467255	2.189991	0.002874	0.034288	0.973396	1.541482	3.087984	0.012972
Cincinnati	0.000366	-0.221775	3.059828	-0.001834	-0.054173	0.957981	0.036899	0.057226	0.955615
Cleveland	0.012537	-0.206900	2.952144	-0.027707	-0.289403	0.778829	0.031252	0.012772	0.990088
Columbia, SC	0.382710	0.245535	1.968835	-0.185972	-1.870776	0.094182	139.628676	0.619165	0.551157
Columbus	0.433845	0.308032	2.671834	0.031634	0.263823	0.797858	9.990230	1.968945	0.080479
Dallas	0.629209	0.546810	0.789400	0.251803	3.025834	0.014343	1.937262	3.150759	0.011723
Dayton	0.207568	0.031472	1.862454	0.002969	0.018996	0.985259	-23.085045	-1.529663	0.160455
Denver	0.205126	0.028487	4.099197	-0.006456	-0.126387	0.902204	0.575583	0.916260	0.383425
Detroit	0.089926	-0.112313	2.110711	-0.051046	-0.239374	0.816178	0.604907	0.681237	0.512867
Edison	N/A	N/A	-	-	-	-	-	-	-
Fort Lauderdale	0.283783	0.124623	4.849592	0.080978	0.621008	0.549997	0.181318	1.028584	0.330524
Fort Worth	0.749613	0.693972	1.638796	-0.046803	-1.374026	0.202681	1.141300	4.513892	0.001460
Hartford	0.629022	0.546583	1.642954	0.160435	3.209321	0.010671	0.838665	0.761846	0.465647
Honolulu	0.606475	0.519025	7.265013	0.099577	0.531337	0.608047	2.089980	3.699466	0.004925
Houston	0.101934	-0.097636	1.969539	0.043495	0.522716	0.613794	0.308134	0.928025	0.377611
Indianapolis	0.366724	0.225996	4.007517	-0.158426	-1.452552	0.180304	13.399572	2.031371	0.072773
Kansas City	0.403850	0.271373	2.723556	0.142457	1.964664	0.081035	2.526366	0.664864	0.522807
Long Island	N/A	N/A	-	-	-	-	-	-	-
Los Angeles	0.865548	0.835670	0.340207	0.603710	3.779618	0.004352	0.103930	0.300031	0.770968
Memphis	0.596842	0.507251	2.893213	0.012997	0.397003	0.700615	0.449522	0.983424	0.351096
Miami	0.289049	0.131060	9.719735	-0.580127	-0.971243	0.356804	0.578613	1.685942	0.126086
Minneapolis	0.060013	-0.148873	3.498089	-0.039607	-0.542107	0.600907	0.741764	0.757462	0.468140
Nashville	0.446120	0.323035	-0.637665	0.744638	2.163313	0.058750	-0.769733	-0.039760	0.969152
New Orleans	0.821632	0.781995	-3.301388	1.633059	5.859067	0.000241	1.287982	0.196046	0.848929
New York	0.800858	0.756605	3.303646	-0.096445	-0.515084	0.618906	0.983707	4.182315	0.002368
Newark	0.264985	0.101648	2.384072	0.066856	1.474160	0.174536	0.030242	0.667574	0.521154
Oakland	0.005185	-0.215885	2.523282	0.000693	0.014933	0.988411	-0.655709	-0.210515	0.837954
Omaha	0.586191	0.494233	2.421664	0.218468	2.388001	0.040690	-77.828496	-3.414855	0.007690
Orange County	0.798661	0.753919	2.917161	0.822007	4.920423	0.000824	5.138337	5.233832	0.000539
Orlando	0.360235	0.218065	29.002982	0.030460	0.085820	0.933488	-2.279003	-1.991613	0.077595
Philadelphia	0.030654	-0.184757	3.258628	0.034529	0.320377	0.755996	-0.472078	-0.508639	0.623239
Phoenix	0.865079	0.835097	0.427649	0.315946	6.872489	0.000073	0.244789	0.446187	0.666004
Pittsburgh	0.541674	0.439823	3.722063	-0.151318	-1.519443	0.162970	1.130557	0.682094	0.512350
Portland	0.645398	0.566598	1.121963	0.319236	3.837475	0.003982	-0.531381	-1.317435	0.220243
Raleigh	0.587079	0.495319	2.760685	-0.018610	-0.327115	0.751061	5.978643	3.061665	0.013535
Richmond	0.242170	0.073763	4.301250	-0.185419	-1.192981	0.263377	-11.380624	-1.672755	0.128705
San Antonio	0.284928	0.126023	5.453791	-0.197854	-0.700766	0.501163	1.255645	1.219674	0.253586
San Diego	0.821404	0.781716	2.206530	0.644606	4.780879	0.001000	5.726364	5.228701	0.000543
San Francisco	0.867203	0.837693	5.099400	0.068010	0.889709	0.396780	1.446226	3.832543	0.004012
San Jose	0.078974	-0.125698	4.705322	-0.055067	-0.443747	0.667702	2.112380	0.868500	0.407683
Seattle	0.836768	0.800495	1.147303	0.079492	0.643340	0.536050	1.928334	5.122830	0.000626
St. Louis	0.655525	0.578975	4.180913	-0.008191	-0.311871	0.762243	-4.174494	-2.666396	0.025774
Tampa	0.030402	-0.185064	5.043921	0.039324	0.195687	0.849202	-2.940708	-0.350351	0.734135
Trenton	0.227508	0.055844	4.052728	-0.032271	-0.201096	0.845094	-	-	-
Tucson	0.518908	0.411999	2.550150	0.484273	1.927565	0.086008	7.194935	1.116728	0.293036
Washington, DC	0.578185	0.484448	6.857115	0.134075	3.351612	0.008502	-0.111762	-0.483121	0.640545
West Palm Beach	0.118450	-0.077450	4.331437	-0.009070	-0.029659	0.976986	4.211120	0.746229	0.474569

It is important to mention that all of the individual MSA regressions have only 12 observations and use up 4 degrees of freedom. In large measure that may be why only half of the markets are significant.

The author also discovers the following findings from the data base.

Top-tier MSAs such as Boston, Chicago, New York, Los Angeles, San Francisco, and Washington DC, in general have very strong correlation between enplanement (either domestic or international) and full-service lodging demand.

MSAs with large air transportation hubs have stronger correlation between enplanement and full-service demand than those without have. Among the top 10 MSAs with highest enplanements in 2013, only Denver and Charlotte fail to draw a meaningful conclusion between enplanement and full-service demand.

As the first stop of international arrival, port of entry has a stronger correlation between full-service demand and international enplanement than that between full-service demand and domestic enplanement. Such MSAs include Chicago, Dallas, Fort Worth, Honolulu, New York, San Francisco, and Seattle, with the exception of Atlanta and Los Angeles, where domestic connecting flights dominate the result.

There must be something special going on in the Florida region. Neither domestic enplanement nor international enplanement manage to explain the demand growth in any of the 5 MSAs (Fort Lauderdale, Miami, Orlando, Tampa, and West Palm Beach) in Florida area.

Chapter 6 Summary

To fully understand the fundamental engines that fuel the dramatic lodging demand growth in recent years and estimate economic impact to future lodging industry, the author delved deep into regression models and external economic factors.

The author rigorously demonstrates that fixed effects regression is the model to use for both full-service and limited-service hotels from the perspective of consistency and efficiency. Even though individual-specific effects dominate the idiosyncratic error and between market difference is substantial, omitted variables that differ between MSAs, such as temperature and humidity, are constant over time and correlated with the independent variables. Fixed effects regression produces constant slopes of independent variables with unique intercept for each MSA, and allows the author to use the changes in the variables over time to estimate the effects of independent variables on lodging demand.

The author recognizes that convention space, domestic enplanement, and international enplanement are all important economic factors for full-service hotels and contribute to the strong full-service market in recent years. Among the 3 newly identified demand drivers, international enplanement has the biggest impact on full-service demand, domestic enplanement takes the second place, and convention space takes the last place. A conversion from domestic terminal to international terminal also boosts full-service demand. Due to the big difference in enplanement market share, terminal conversion yields a higher increase in full-service demand than the increase derived from airport expansion alone.

Exhibit 6-1 Enplanement Market Share

Year	Domestic Enplanement		International Enplanement		Total
2002	433,921,758	88.5%	56,121,618	11.5%	490,043,376
2003	451,746,488	89.0%	55,662,341	11.0%	507,408,829
2004	486,534,422	88.5%	63,104,226	11.5%	549,638,648
2005	504,890,391	88.2%	67,552,573	11.8%	572,442,964
2006	506,121,630	87.8%	70,171,305	12.2%	576,292,935
2007	520,463,992	87.6%	73,449,019	12.4%	593,913,011
2008	500,601,863	87.0%	74,485,694	13.0%	575,087,557
2009	477,175,487	87.1%	70,903,211	12.9%	548,078,697
2010	485,754,290	86.7%	74,683,090	13.3%	560,437,380
2011	492,799,622	86.4%	77,566,603	13.6%	570,366,225
2012	497,462,285	86.1%	80,539,470	13.9%	578,001,755
2013	501,001,737	85.5%	84,628,192	14.5%	585,629,928

Exhibit 6-1 adds up enplanement data across 54 MSAs and illustrates the dynamic shift in market share over the 2002-3013 period. Consistent with the international tourism surge mentioned earlier in chapter 1 and illustrated in appendix F, international enplanement is taking a bigger and bigger market share over the sample period, from 11.5% in 2002 to 14.5% in 2013. The author has reason to believe that the growing forecast coupled with the recent extension of tourist visas between the United States and China will continue to boost the U.S. travel industry and international enplanement. Markets undergone extensive international terminal expansion or conversion can anticipate substantial full-service demand growth.

The author has always been curious why hotel investment activities are highly concentrated in a handful of markets, and not very dispersed. The individual MSA analysis section provides some clues. MSAs that can be better explained by the changes in domestic or international enplanement and the traditional demand drivers are usually top-tier markets, air transportation hubs, or port of entries. And big MSAs tend to serve all purpose.

One thing needs further investigation is the additional demand drivers besides employment and income for limited-service hotels. With the help of GIS transportation software and PCI index mentioned earlier in chapter 4 section 4.8, the author hopes to establish a more sophisticated model and figure out the fundamental economic factors for limited-service hotels. The author will continue to monitor the full-service demand drivers highlighted by this thesis and will be interested in witnessing their impact in real world.

Bibliography

Abigail Rosenbaum. "Can International Tourism Help Predict the U.S. 2014 Hotel Demand Recovery?" CBRE EA Weekly Publication, About Real Estate, April 2014, Volume 15, Number 15

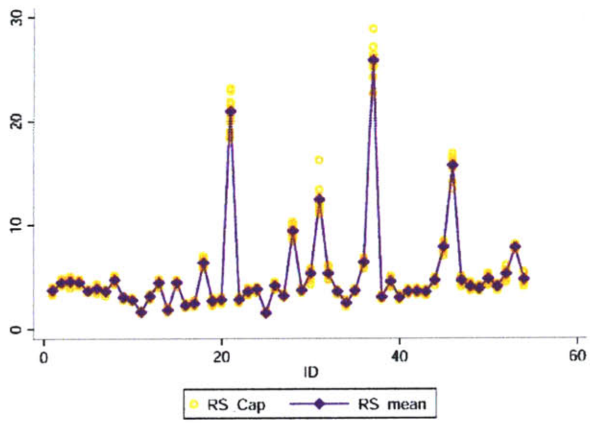
Abigail Rosenbaum. "Overview & Outlook – Hotel." CBRE, Econometric Advisors, Fourth Quarter 2013

Lauro Ferroni. "Cross Sector Outlook – United States – Hotels." JLL, Fall 2014, Page 7-9

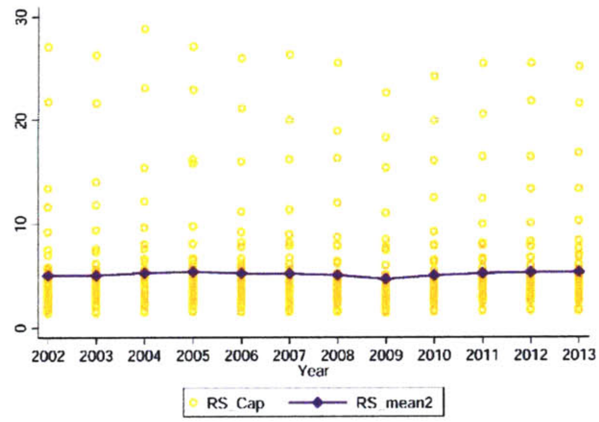
William C. Wheaton and Lawrence Rossoff. "The Cyclic Behavior of the U.S. Lodging Industry." Real Estate Economics, 1998, V26, 1:pp.67-82

Appendix A Heterogeneity Analysis – Full-Service Hotels

Heterogeneity across MSAs

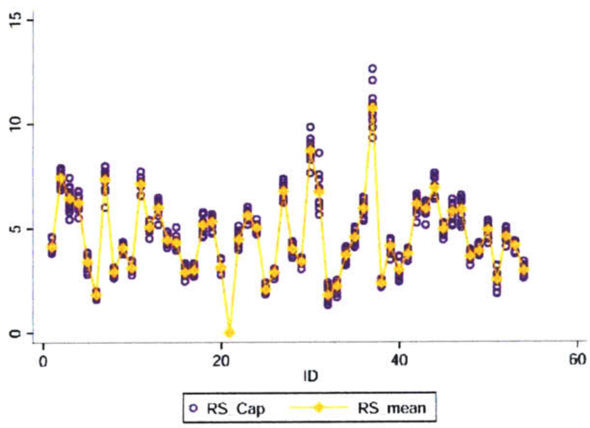


Heterogeneity across Years

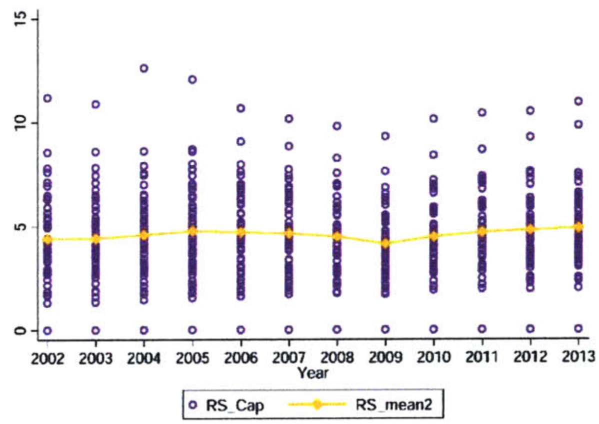


Appendix B Heterogeneity Analysis – Limited-Service Hotels

Heterogeneity across MSAs



Heterogeneity across Years

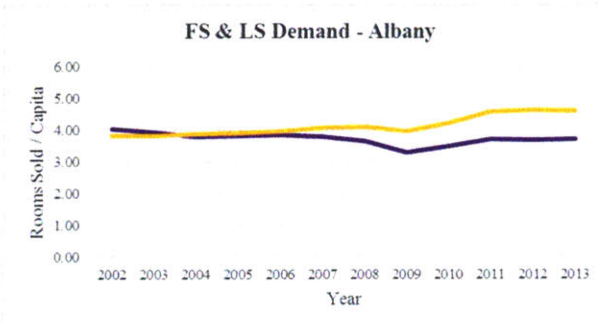


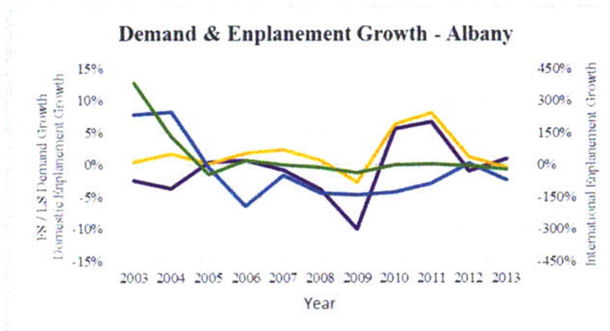
Appendix C Individual Specific Lodging Demand (left)

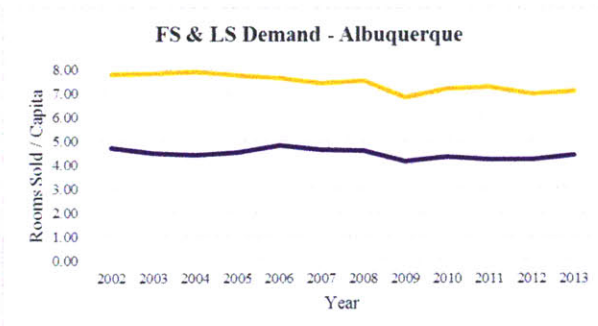
Appendix D Correlation between Demand and Enplanement Growth (right)

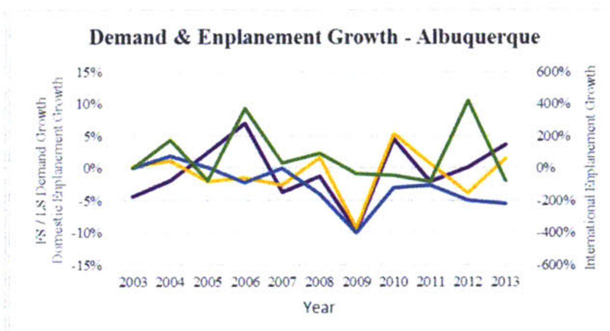
FS Demand Growth
LS Demand Growth
Domestic Enplanement Growth
International Enplanement Growth

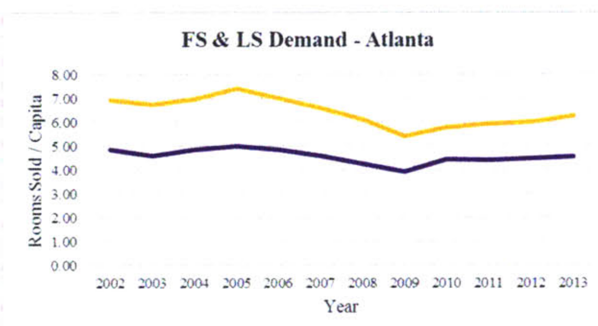
FS Demand
LS Demand

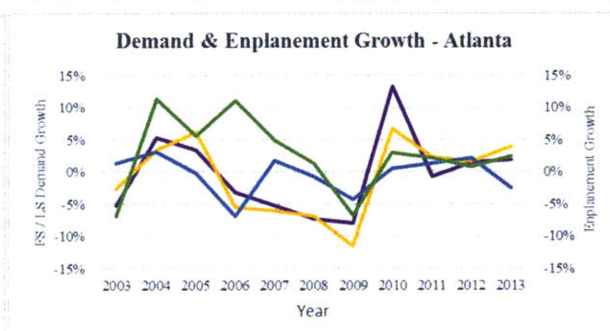


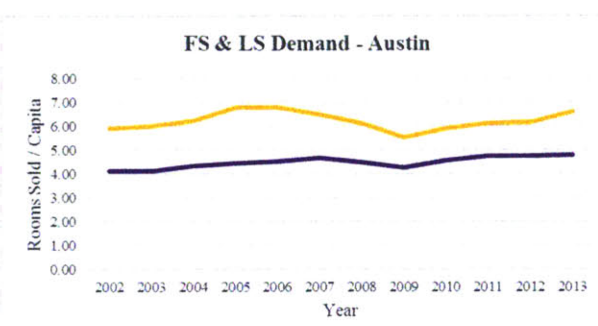


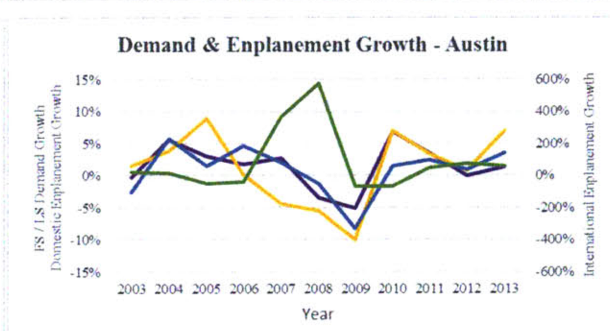


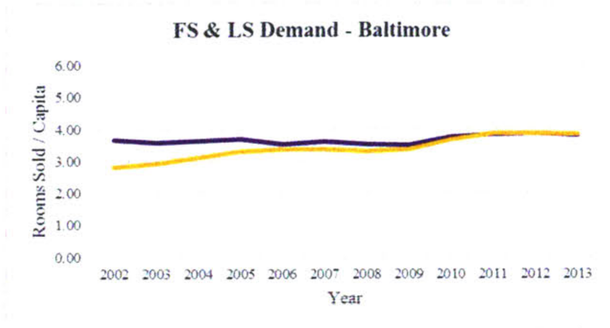








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Rooms Sold / Capita
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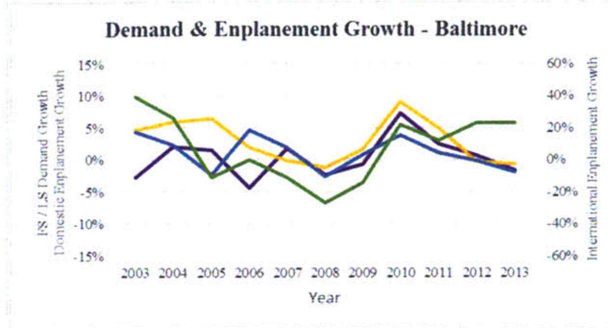
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year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Domestic Enplanement Growth
International Enplanement Growth
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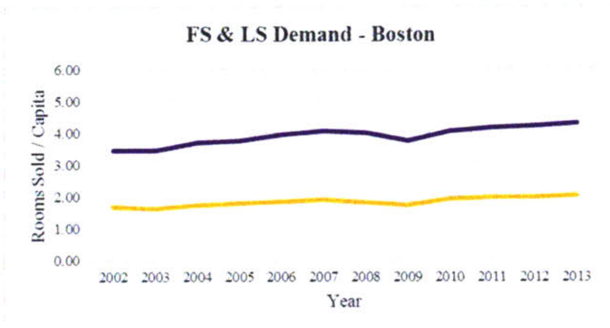
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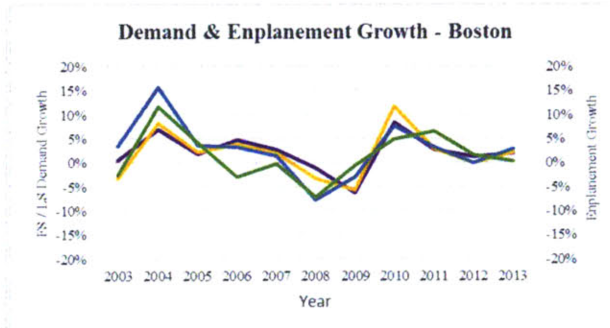
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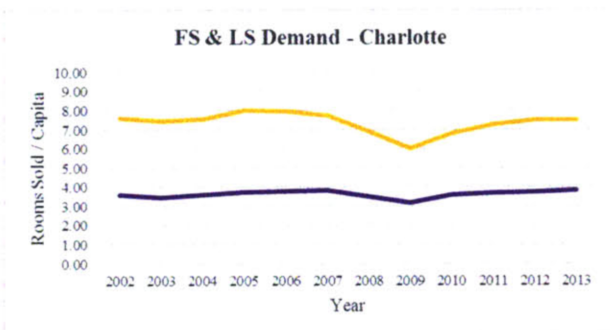
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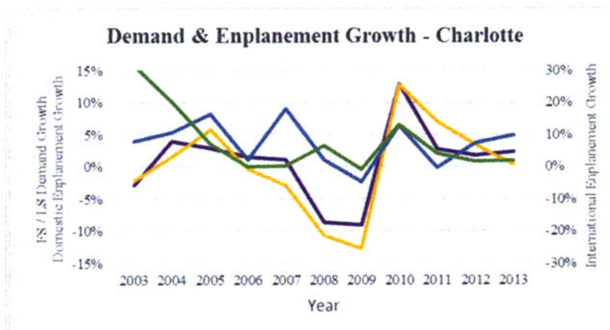
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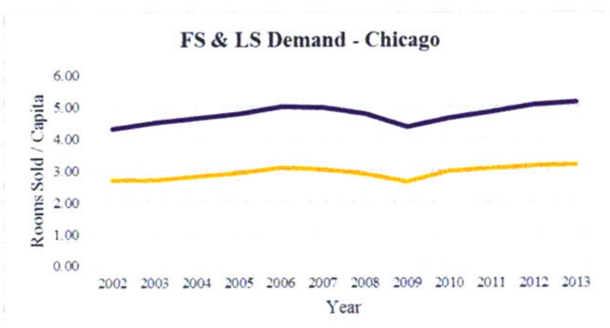
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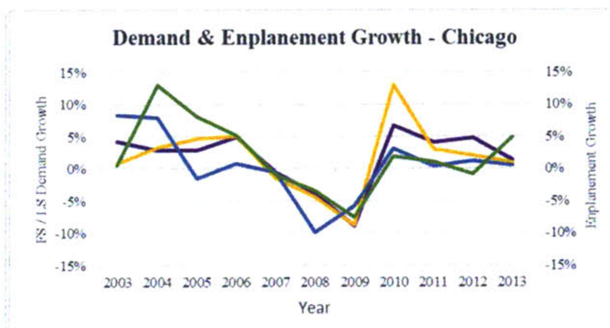
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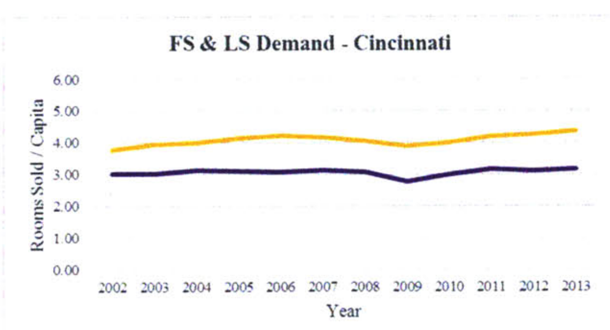
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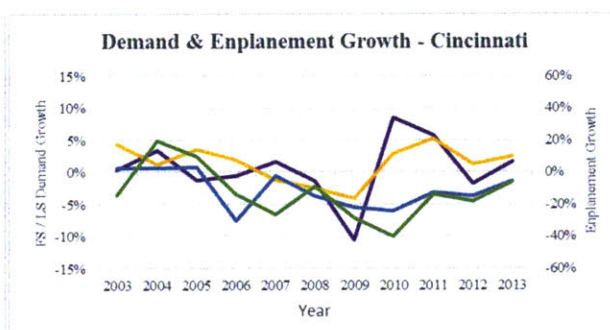
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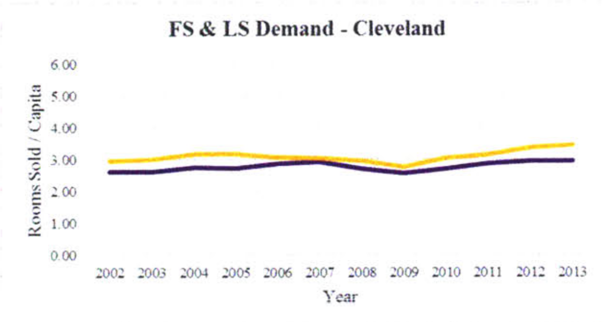
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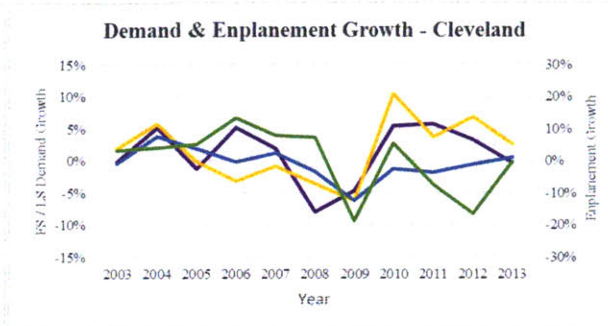
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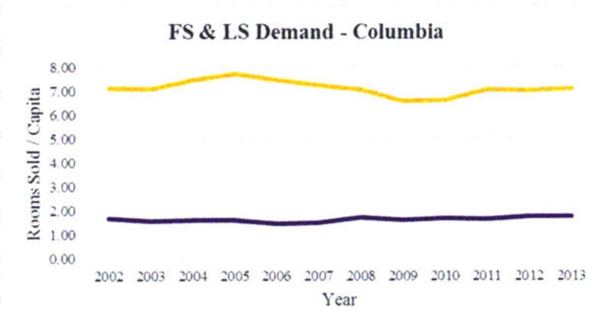
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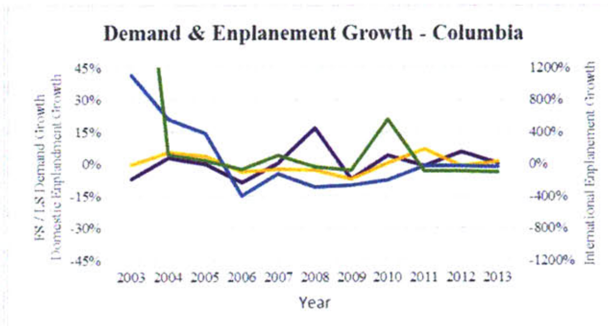
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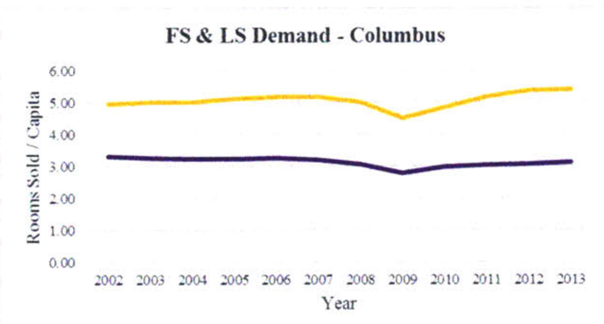
Year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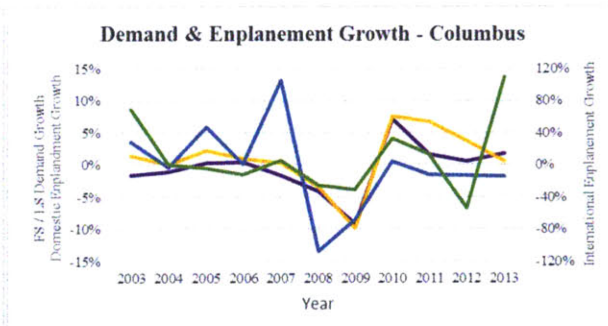
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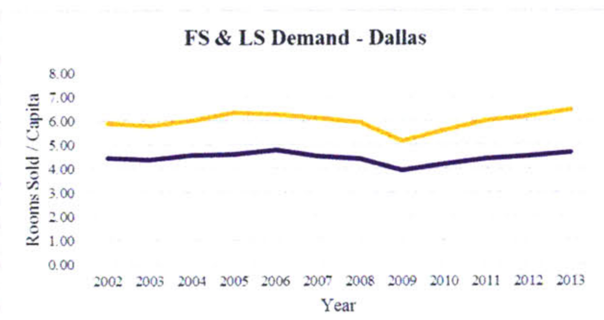
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Rooms Sold / Capita
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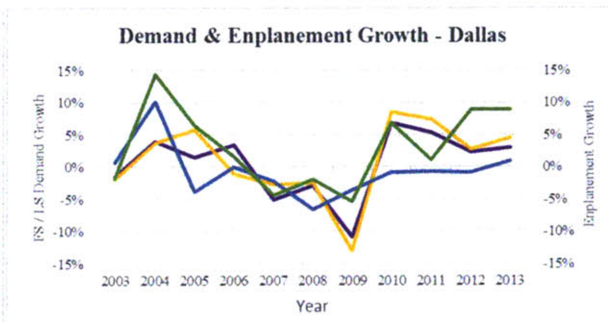
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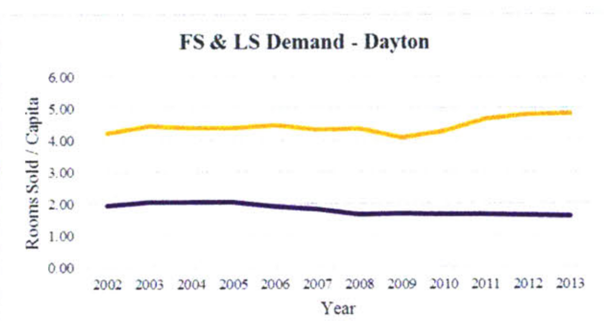
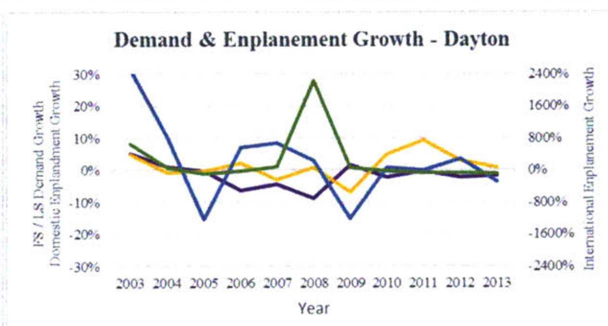
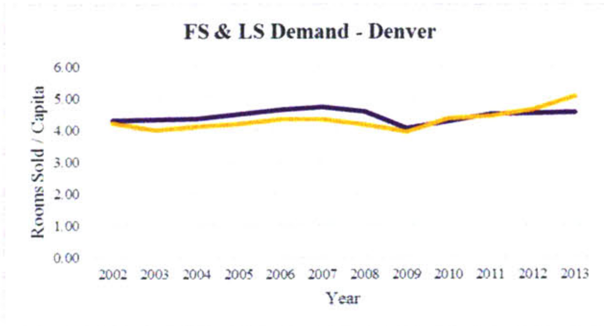
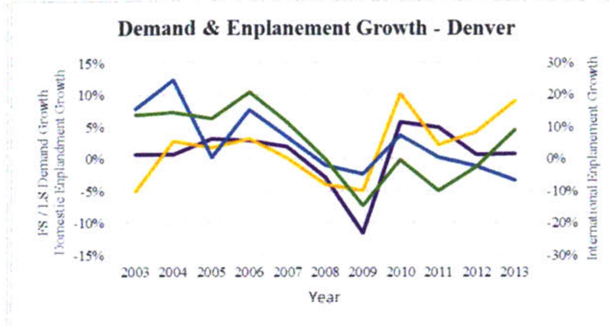
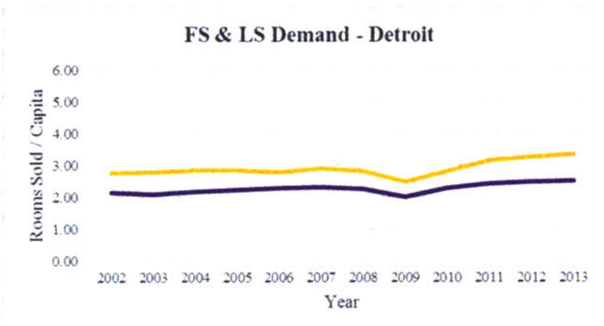
Enplanement Growth
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

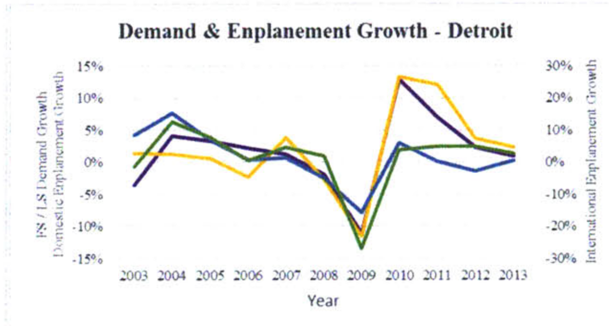

FS & LS Demand - Dayton
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Rooms Sold / Capita
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

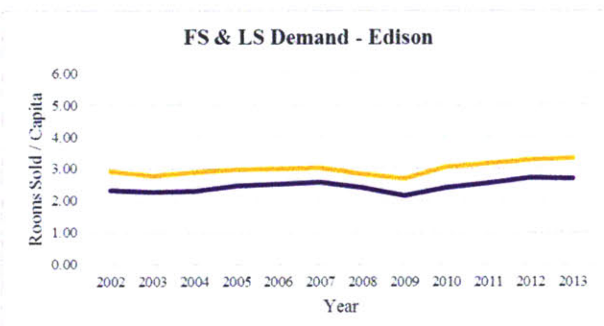

Demand & Enplanement Growth - Dayton
30%
20%
10%
0%
-10%
-20%
-30%
FS / LS Demand Growth
Domestic Enplandment Growth
2400%
1600%
800%
0%
-800%
-1600%
-2400%
International Enplanement Growth
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

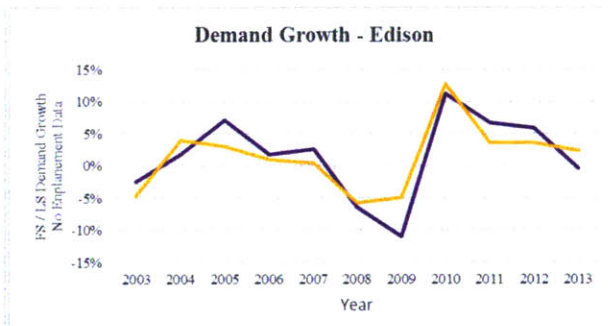

FS & LS Demand - Denver
Rooms Sold / Capita
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

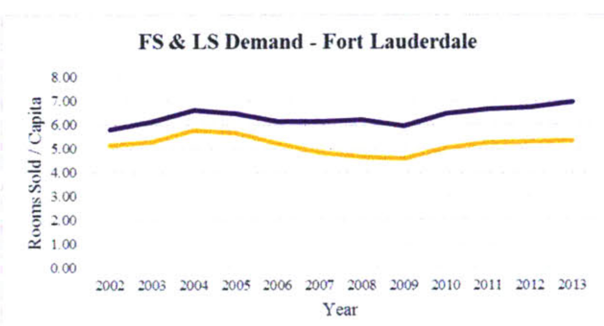

Demand & Enplanement Growth - Denver
FS / LS Demand Growth
Domestic Enplandment Growth
International Enplanement Growth
15%
10%
5%
0%
-5%
-10%
-15%
30%
20%
10%
0%
-10%
-20%
-30%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

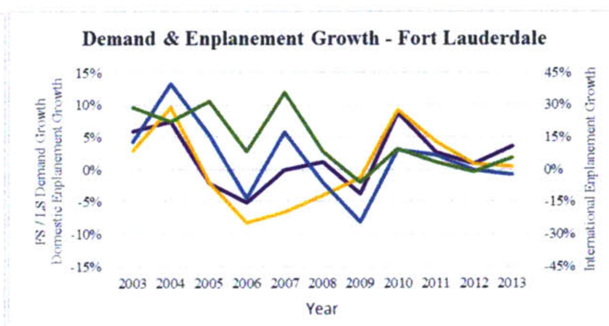

FS & LS Demand - Detroit
Rooms Sold / Capita
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

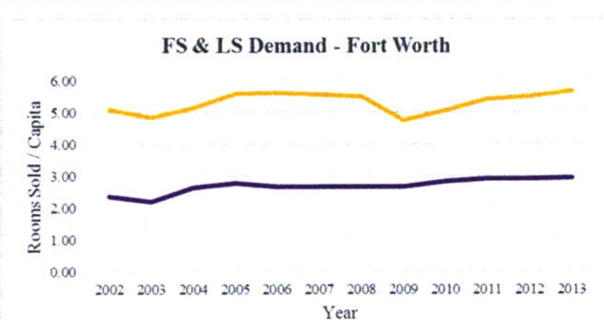

Demand & Enplanement Growth - Detroit
FS / LS Demand Growth
Domestic Enplanement Growth
International Enplanement Growth
15%
10%
5%
0%
-5%
-10%
-15%
30%
20%
10%
0%
-10%
-20%
-30%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

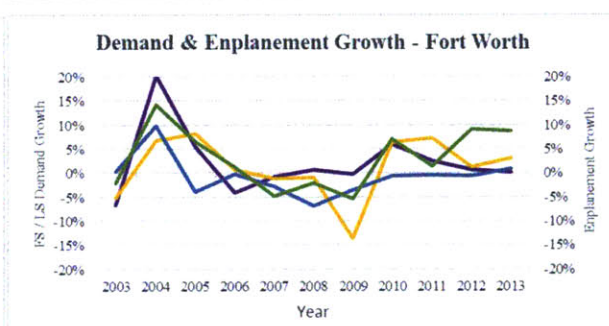

FS & LS Demand - Edison
Rooms Sold / Capita
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

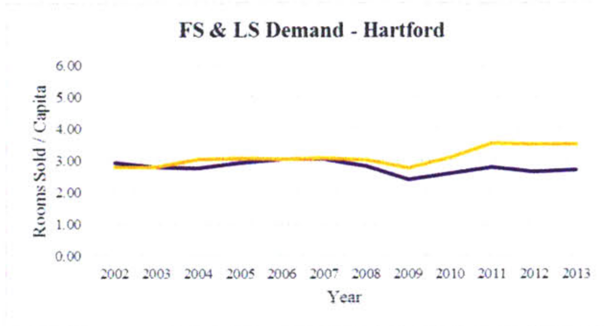

Demand Growth - Edison
FS / LS Demand Growth
No Enplanement Data
15%
10%
5%
0%
-5%
-10%
-15%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

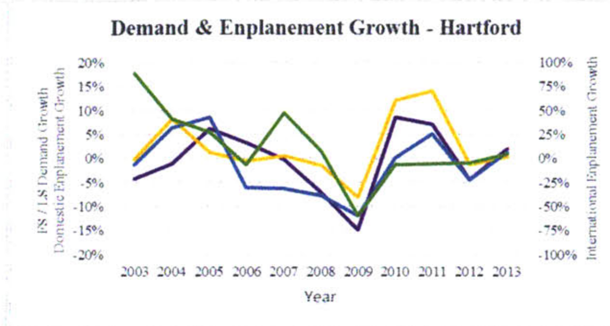

FS & LS Demand - Fort Lauderdale
Rooms Sold / Capita
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

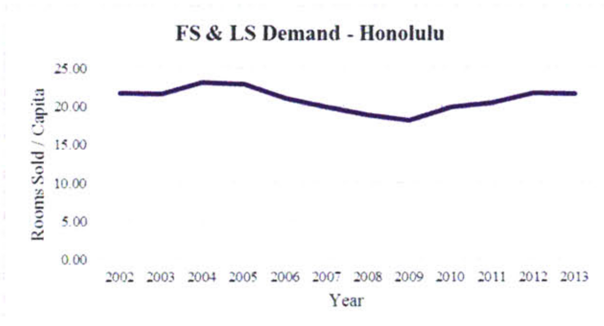

Demand & Enplanement Growth - Fort Lauderdale
FS / LS Demand Growth
Domestic Enplanement Growth
International Enplanement Growth
15%
10%
5%
0%
-5%
-10%
-15%
45%
30%
15%
0%
-15%
-30%
-45%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

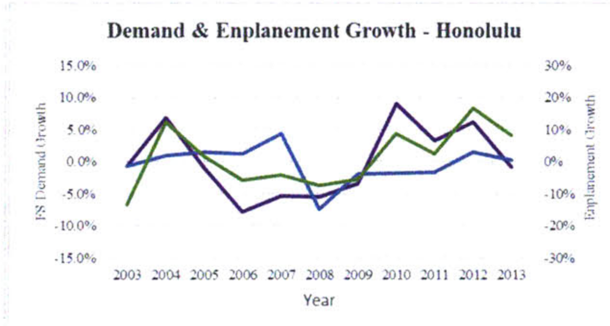

FS & LS Demand - Fort Worth
Rooms Sold / Capita
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

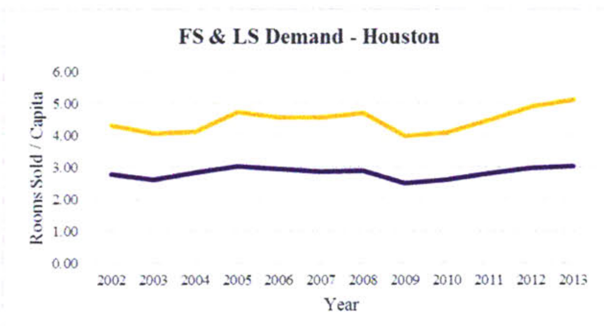

Demand & Enplanement Growth - Fort Worth
FS / LS Demand Growth
Enplanement Growth
20%
15%
10%
5%
0%
-5%
-10%
-15%
-20%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

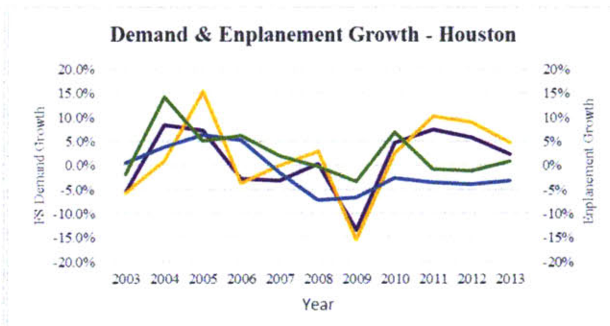

FS & LS Demand - Hartford
Rooms Sold / Capita
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

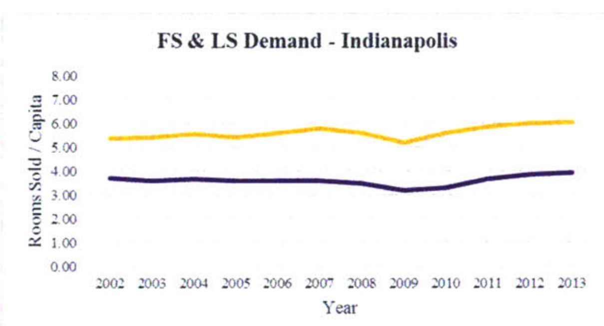

Demand & Enplanement Growth - Hartford
FS / LS Demand Growth
Domestic Enplanement Growth
20%
15%
10%
5%
0%
-5%
-10%
-15%
-20%
International Enplanement Growth
100%
75%
50%
25%
0%
-25%
-50%
-75%
-100%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

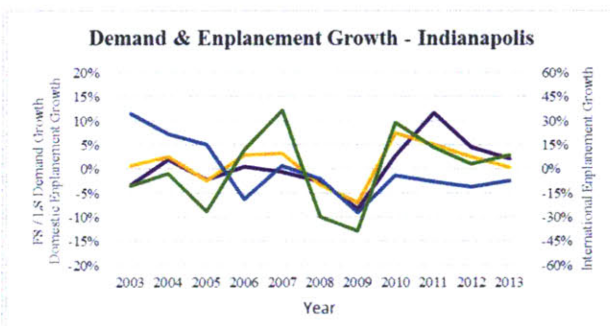

FS & LS Demand - Honolulu
Rooms Sold / Capita
25.00
20.00
15.00
10.00
5.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

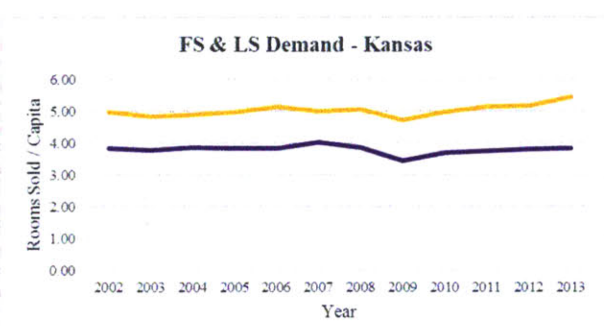

Demand & Enplanement Growth - Honolulu
FS Demand Growth
15.0%
10.0%
5.0%
0.0%
-5.0%
-10.0%
-15.0%
Enplanement Growth
30%
20%
10%
0%
-10%
-20%
-30%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

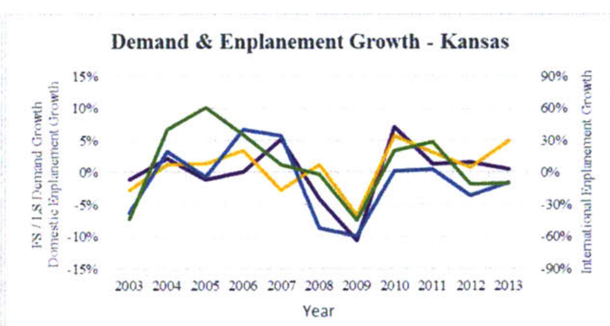

FS & LS Demand - Houston
Rooms Sold / Capita
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

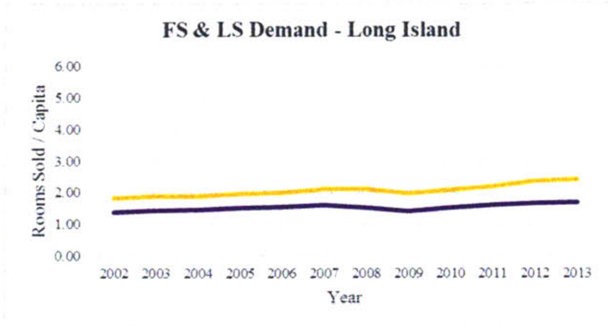

Demand & Enplanement Growth - Houston
FS Demand Growth
20.0%
15.0%
10.0%
5.0%
0.0%
-5.0%
-10.0%
-15.0%
-20.0%
Enplanement Growth
20%
15%
10%
5%
0%
-5%
-10%
-15%
-20%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year


FS & LS Demand - Indianapolis
Rooms Sold / Capita
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

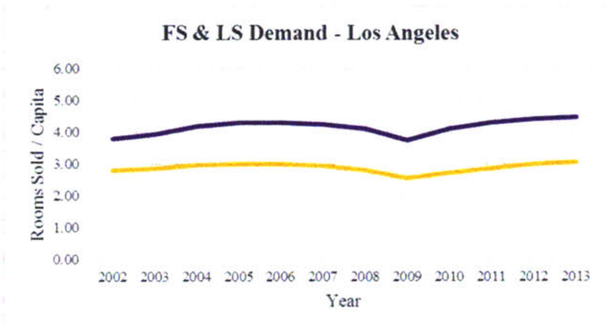

Demand & Enplanement Growth - Indianapolis
FS / LS Demand Growth
Domestic Enplanement Growth
20%
15%
10%
5%
0%
-5%
-10%
-15%
-20%
International Enplanement Growth
60%
45%
30%
15%
0%
-15%
-30%
-45%
-60%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

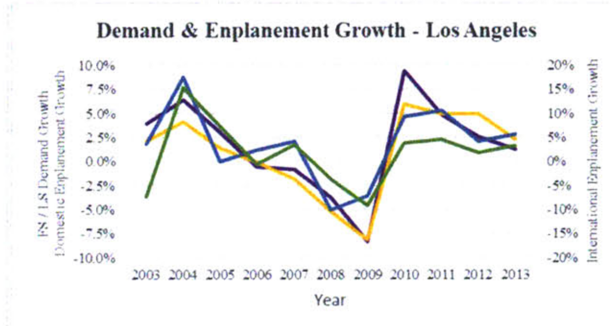

FS & LS Demand - Kansas
Rooms Sold / Capita
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

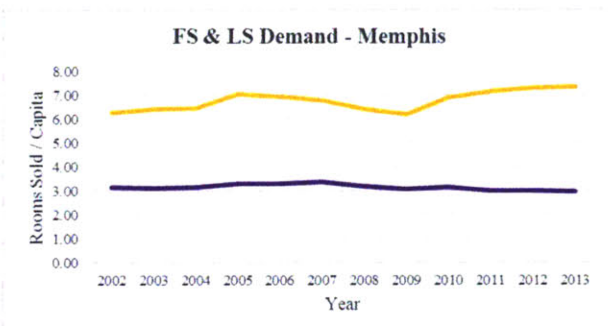

Demand & Enplanement Growth - Kansas
FS / LS Demand Growth
Domestic Enplanement Growth
15%
10%
5%
0%
-5%
-10%
-15%
International Enplanement Growth
90%
60%
30%
0%
-30%
-60%
-90%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

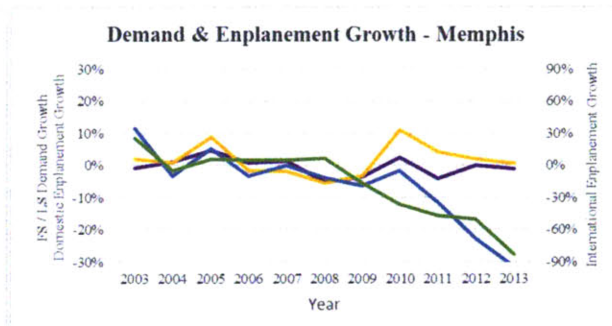

FS & LS Demand - Long Island
Rooms Sold / Capita
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

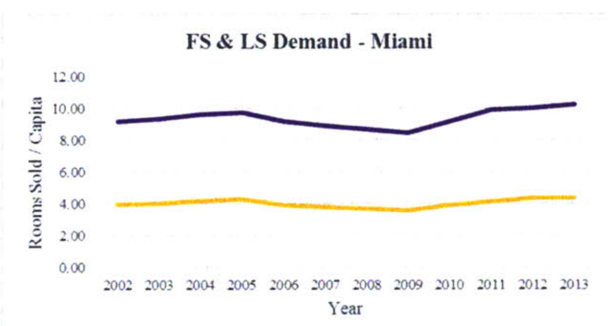

Demand Growth - Long Island
FS / LS Demand Growth
No Enplanement Data
15%
10%
5%
0%
-5%
-10%
-15%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

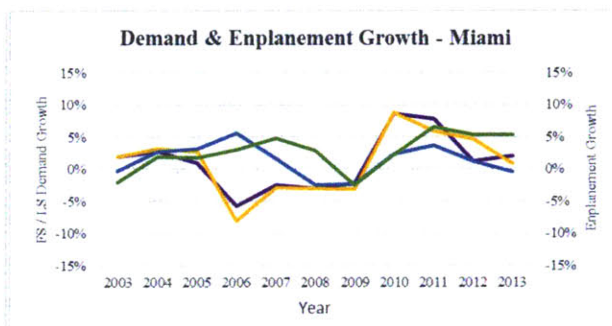

FS & LS Demand - Los Angeles
Rooms Sold / Capita
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

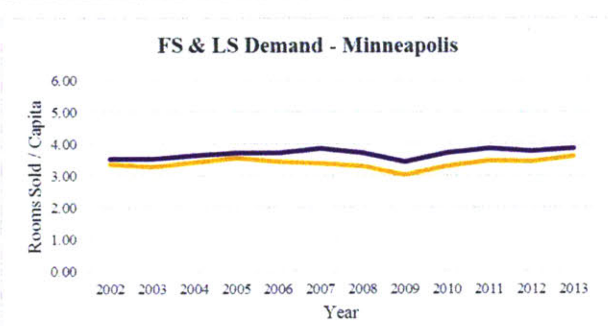

Demand & Enplanement Growth - Los Angeles
FS / LS Demand Growth
Domestic Enplanement Growth
10.0%
7.5%
5.0%
2.5%
0.0%
-2.5%
-5.0%
-7.5%
-10.0%
20%
15%
10%
5%
0%
-5%
-10%
-15%
-20%
International Enplanement Growth
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

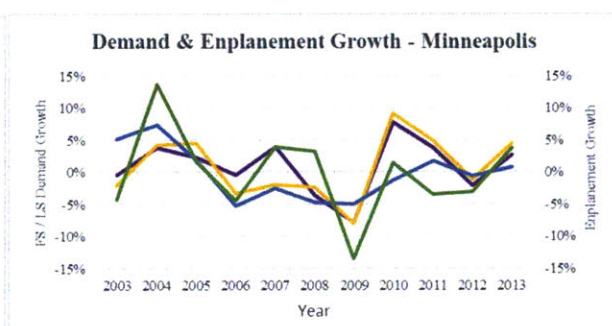

FS & LS Demand - Memphis
Rooms Sold / Capita
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

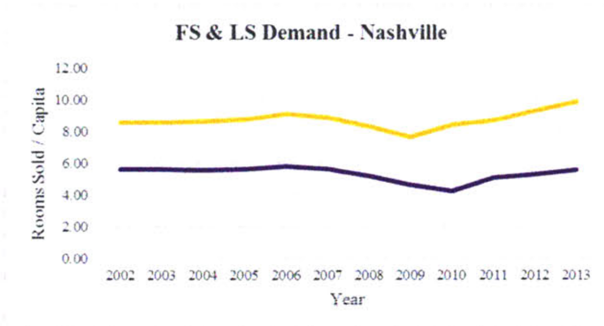

Demand & Enplanement Growth - Memphis
FS / LS Demand Growth
Domestic Enplanement Growth
30%
20%
10%
0%
-10%
-20%
-30%
90%
60%
30%
0%
-30%
-60%
-90%
International Enplanement Growth
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

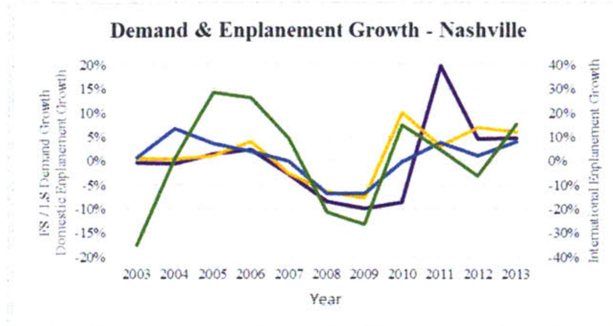

FS & LS Demand - Miami
Rooms Sold / Capita
12.00
10.00
8.00
6.00
4.00
2.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

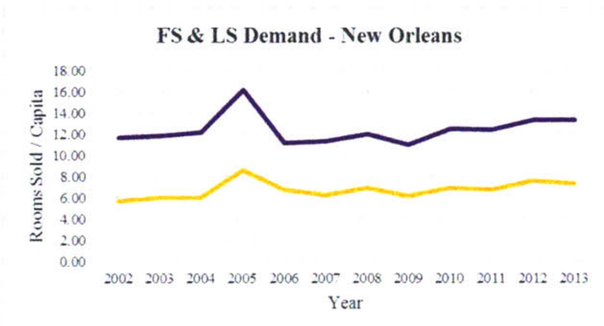

Demand & Enplanement Growth - Miami
FS / LS Demand Growth
15%
10%
5%
0%
-5%
-10%
-15%
15%
10%
5%
0%
-5%
-10%
-15%
Enplanement Growth
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

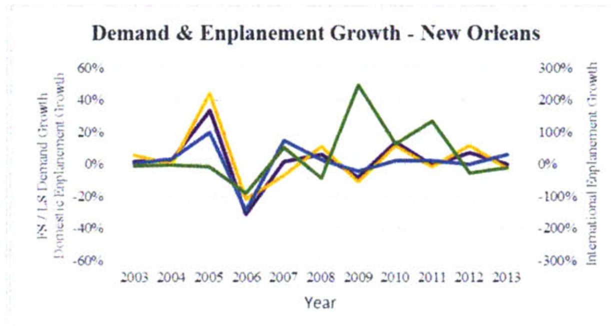

FS & LS Demand - Minneapolis
Rooms Sold / Capita
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

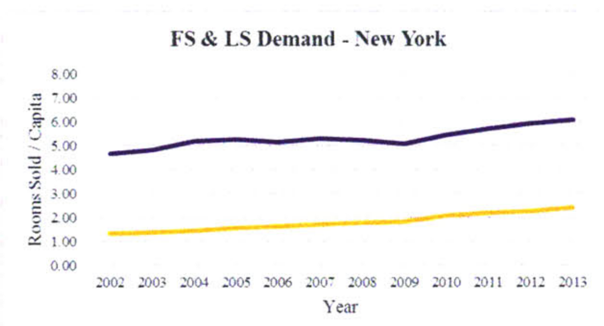

Demand & Enplanement Growth - Minneapolis
FS / LS Demand Growth
15%
10%
5%
0%
-5%
-10%
-15%
15%
10%
5%
0%
-5%
-10%
-15%
Enplanement Growth
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

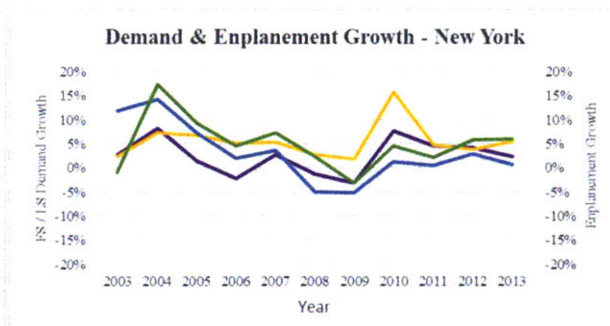

FS & LS Demand - Nashville
Rooms Sold / Capita
12.00
10.00
8.00
6.00
4.00
2.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

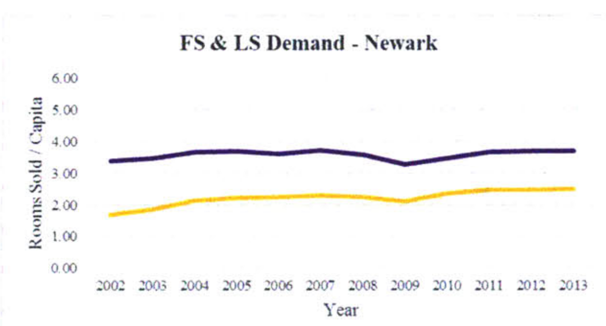

Demand & Enplanement Growth - Nashville
FS / LS Demand Growth
Domestic Enplanement Growth
International Enplanement Growth
20%
15%
10%
5%
0%
-5%
-10%
-15%
-20%
40%
30%
20%
10%
0%
-10%
-20%
-30%
-40%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

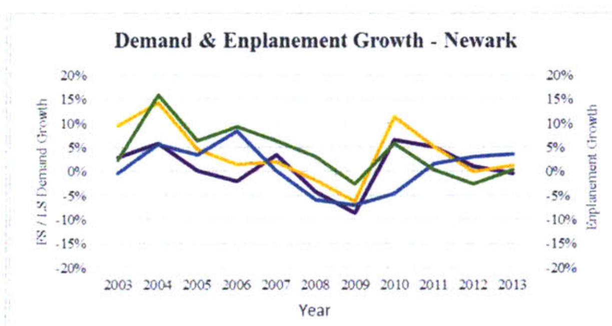

FS & LS Demand - New Orleans
Rooms Sold / Capita
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

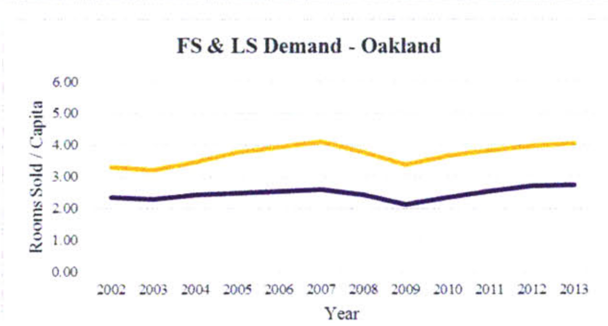

Demand & Enplanement Growth - New Orleans
FS / LS Demand Growth
Domestic Enplanement Growth
International Enplanement Growth
60%
40%
20%
0%
-20%
-40%
-60%
300%
200%
100%
0%
-100%
-200%
-300%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

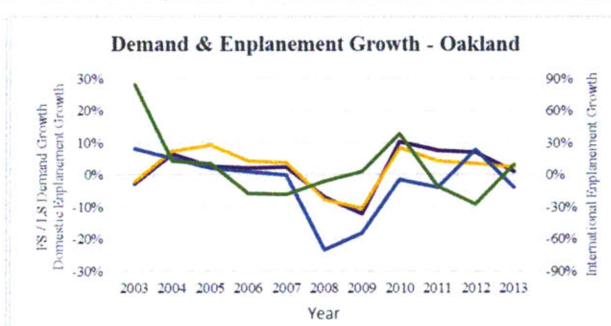

FS & LS Demand - New York
Rooms Sold / Capita
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

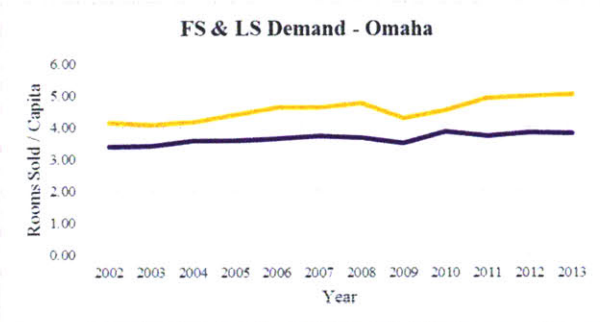

Demand & Enplanement Growth - New York
FS / LS Demand Growth
Enplanement Growth
20%
15%
10%
5%
0%
-5%
-10%
-15%
-20%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

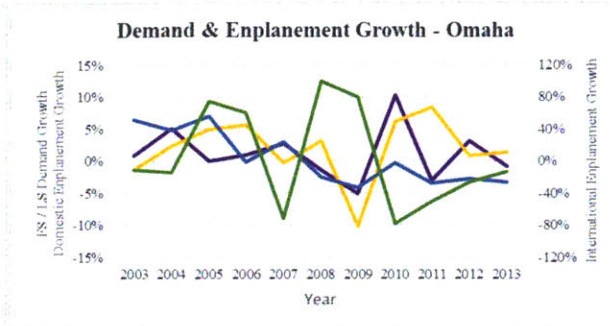

FS & LS Demand - Newark
Rooms Sold / Capita
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

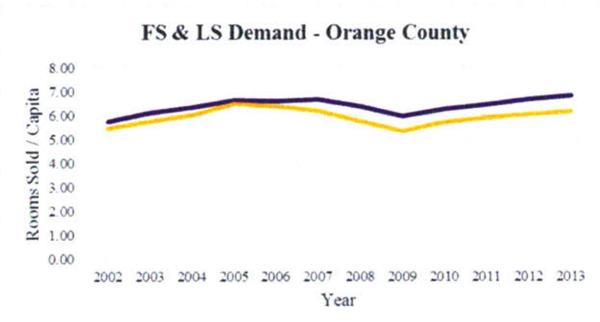

Demand & Enplanement Growth - Newark
FS / LS Demand Growth
Enplanement Growth
20%
15%
10%
5%
0%
-5%
-10%
-15%
-20%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year


FS & LS Demand - Oakland
Rooms Sold / Capita
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

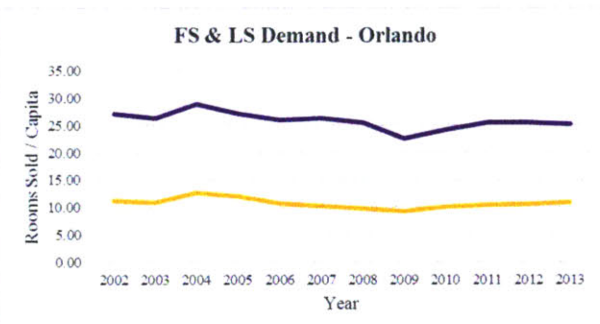

Demand & Enplanement Growth - Oakland
FS / LS Demand Growth
Domestic Enplanement Growth
International Enplanement Growth
30%
20%
10%
0%
-10%
-20%
-30%
90%
60%
30%
0%
-30%
-60%
-90%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

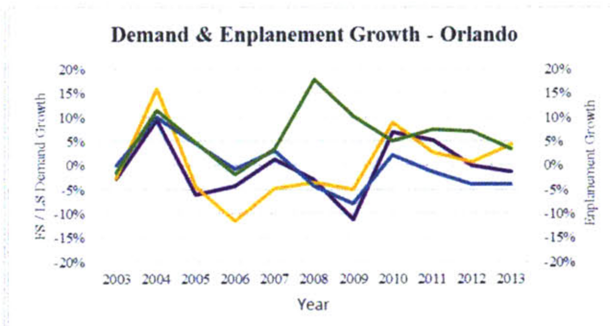

FS & LS Demand - Omaha
Rooms Sold / Capita
6.00 5.00 4.00 3.00 2.00 1.00 0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

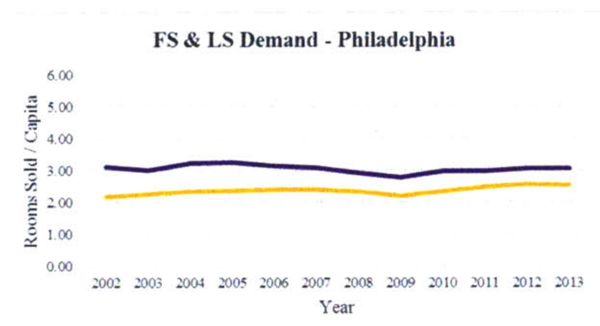

Demand & Enplanement Growth - Omaha
FS / LS Demand Growth
Domestic Enplanement Growth
15% 10% 5% 0% -5% -10% -15%
120% 80% 40% 0% -40% -80% -120%
International Enplanement Growth
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

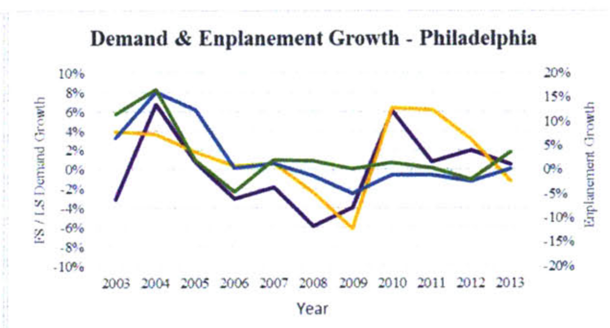

FS & LS Demand - Orange County
Rooms Sold / Capita
8.00 7.00 6.00 5.00 4.00 3.00 2.00 1.00 0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

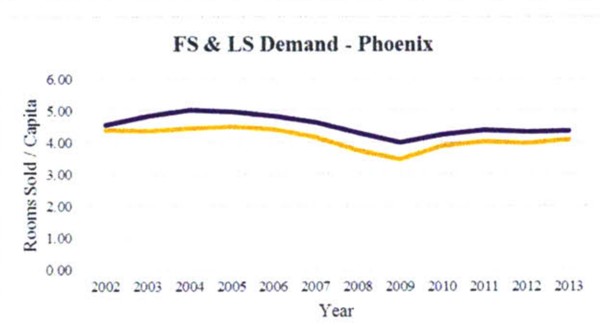

Demand & Enplanement Growth - Orange County
FS / LS Demand Growth
Domestic Enplanement Growth
15% 10% 5% 0% -5% -10% -15%
900% 600% 300% 0% -300% -600% -900%
International Enplanement Growth
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

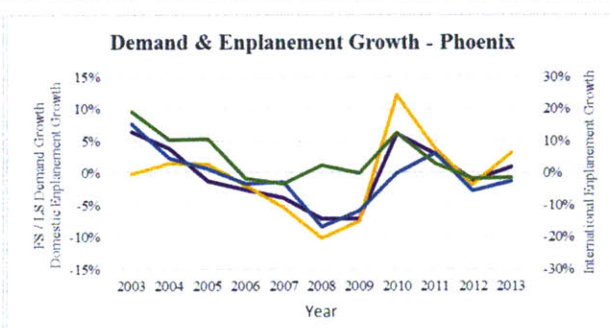

FS & LS Demand - Orlando
Rooms Sold / Capita
35.00 30.00 25.00 20.00 15.00 10.00 5.00 0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

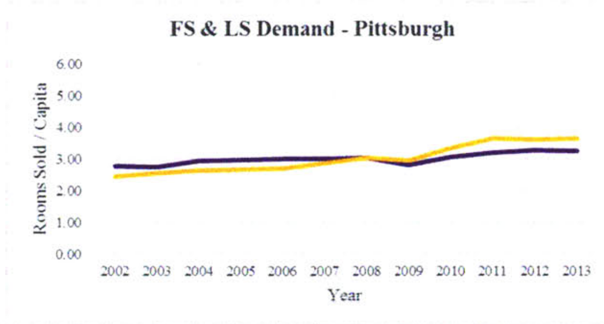

Demand & Enplanement Growth - Orlando
FS / LS Demand Growth
20% 15% 10% 5% 0% -5% -10% -15% -20%
Enplanement Growth
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

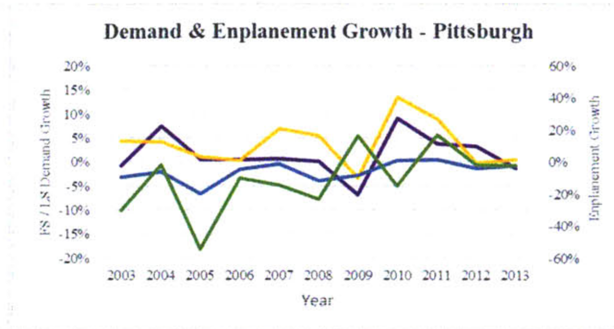

FS & LS Demand - Philadelphia
Rooms Sold / Capita
6.00 5.00 4.00 3.00 2.00 1.00 0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

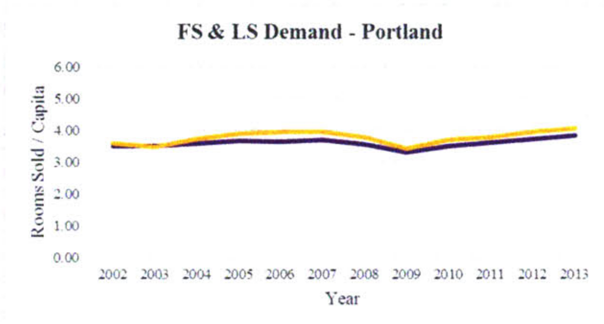

Demand & Enplanement Growth - Philadelphia
FS / LS Demand Growth
10% 8% 6% 4% 2% 0% -2% -4% -6% -8% -10%
20% 15% 10% 5% 0% -5% -10% -15% -20%
Enplanement Growth
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

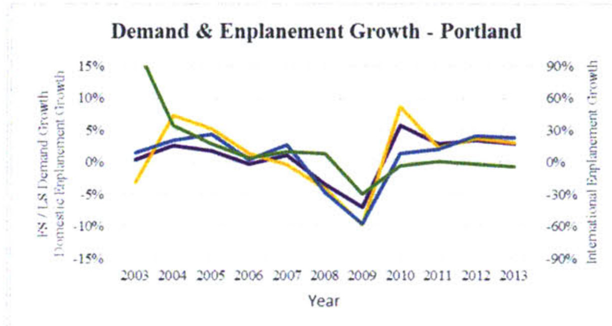

FS & LS Demand - Phoenix
Rooms Sold / Capita
6.00 5.00 4.00 3.00 2.00 1.00 0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

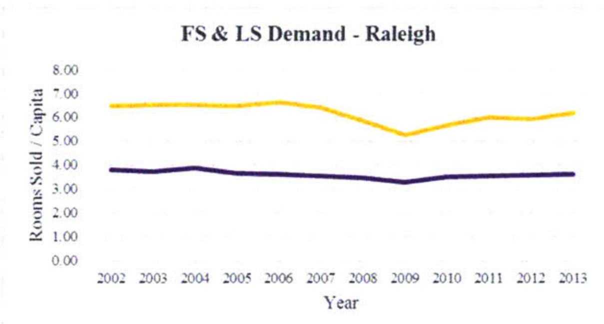

Demand & Enplanement Growth - Phoenix
FS / LS Demand Growth
Domestic Enplanement Growth
15% 10% 5% 0% -5% -10% -15%
30% 20% 10% 0% -10% -20% -30%
International Enplanement Growth
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

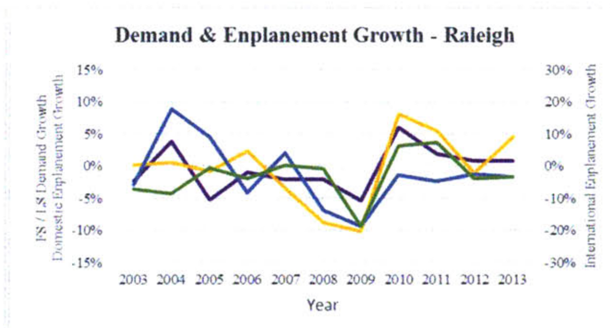

FS & LS Demand - Pittsburgh
Rooms Sold / Capita
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

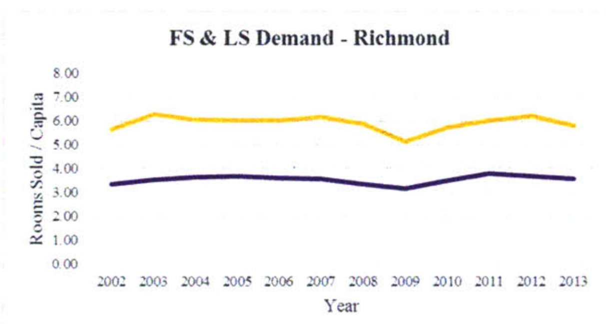

Demand & Enplanement Growth - Pittsburgh
FS / LS Demand Growth
Enplanement Growth
20%
15%
10%
5%
0%
-5%
-10%
-15%
-20%
60%
40%
20%
0%
-20%
-40%
-60%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

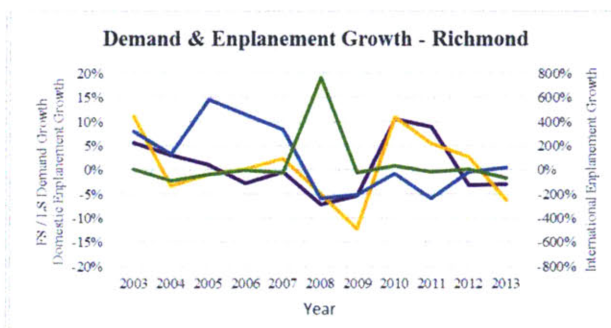

FS & LS Demand - Portland
Rooms Sold / Capita
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

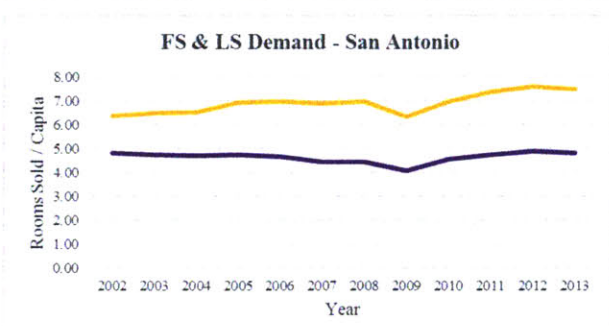

Demand & Enplanement Growth - Portland
FS / LS Demand Growth
Domestic Enplanement Growth
International Enplanement Growth
15%
10%
5%
0%
-5%
-10%
-15%
90%
60%
30%
0%
-30%
-60%
-90%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

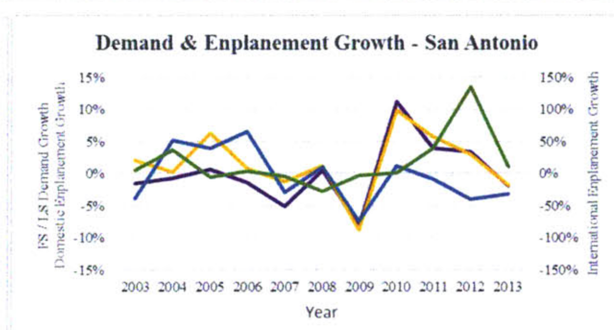

FS & LS Demand - Raleigh
Rooms Sold / Capita
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

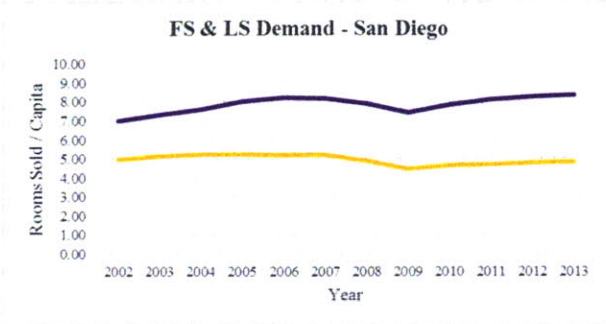

Demand & Enplanement Growth - Raleigh
FS / LS Demand Growth
Domestic Enplanement Growth
International Enplanement Growth
15%
10%
5%
0%
-5%
-10%
-15%
30%
20%
10%
0%
-10%
-20%
-30%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

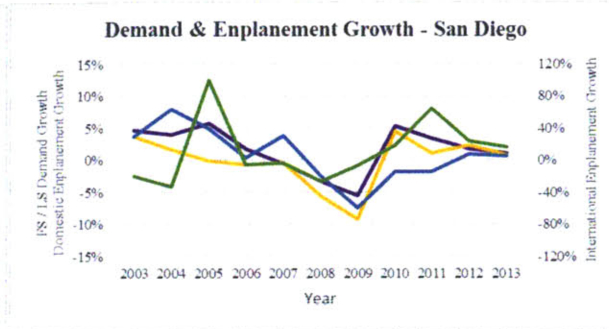

FS & LS Demand - Richmond
Rooms Sold / Capita
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

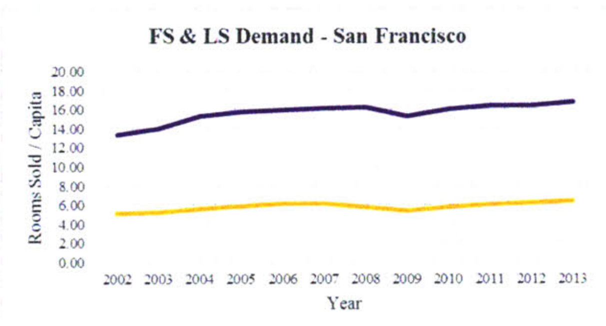

Demand & Enplanement Growth - Richmond
FS / LS Demand Growth
Domestic Enplanement Growth
International Enplanement Growth
20%
15%
10%
5%
0%
-5%
-10%
-15%
-20%
800%
600%
400%
200%
0%
-200%
-400%
-600%
-800%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

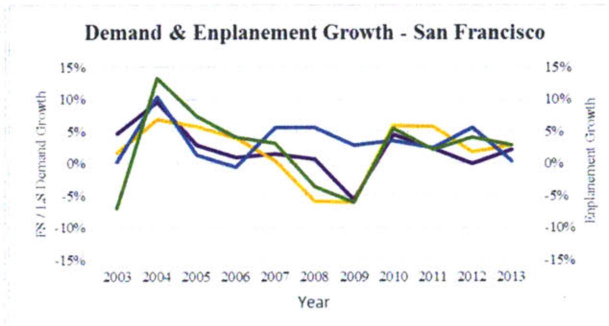

FS & LS Demand - San Antonio
Rooms Sold / Capita
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

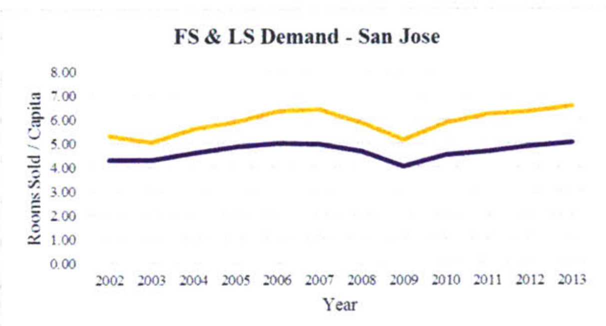

Demand & Enplanement Growth - San Antonio
FS / LS Demand Growth
Domestic Enplanement Growth
International Enplanement Growth
15%
10%
5%
0%
-5%
-10%
-15%
150%
100%
50%
0%
-50%
-100%
-150%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

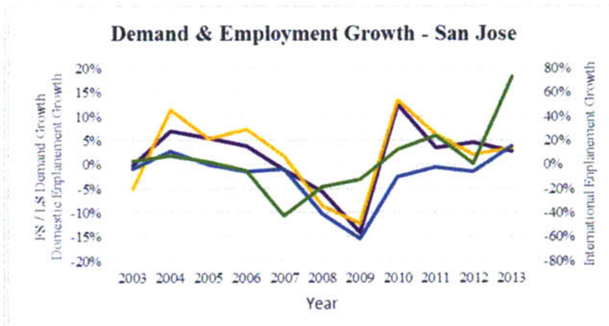

FS & LS Demand - San Diego
Rooms Sold / Capita
10.00 9.00 8.00 7.00 6.00 5.00 4.00 3.00 2.00 1.00 0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

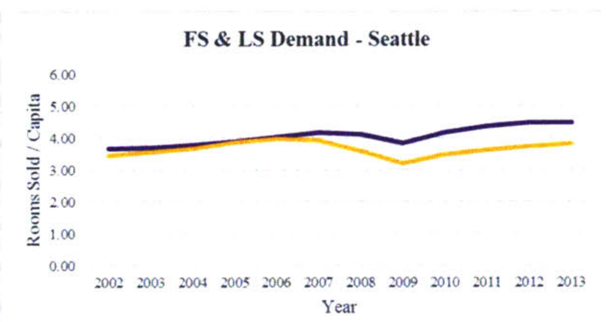

Demand & Enplanement Growth - San Diego
FS / LS Demand Growth
Domestic Enplanement Growth
15% 10% 5% 0% -5% -10% -15%
International Enplanement Growth
120% 80% 40% 0% -40% -80% -120%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

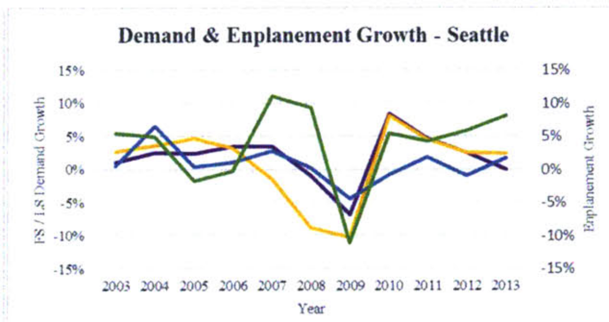

FS & LS Demand - San Francisco
Rooms Sold / Capita
20.00 18.00 16.00 14.00 12.00 10.00 8.00 6.00 4.00 2.00 0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

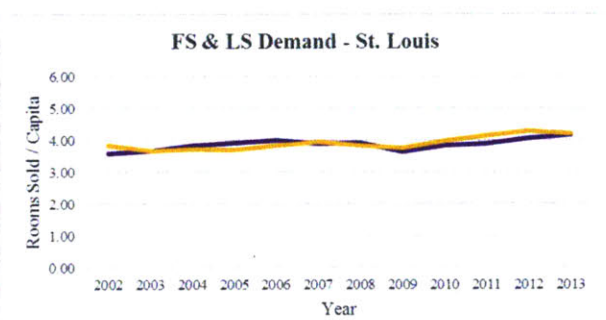

Demand & Enplanement Growth - San Francisco
FS / LS Demand Growth
15% 10% 5% 0% -5% -10% -15%
Enplanement Growth
15% 10% 5% 0% -5% -10% -15%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

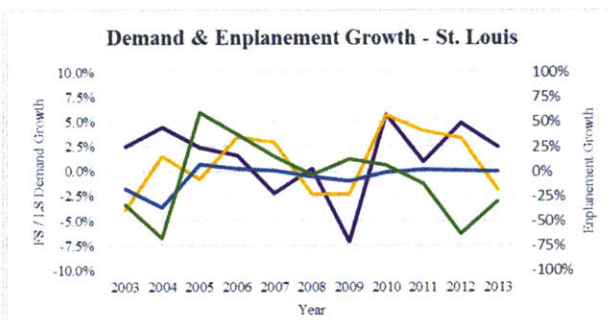

FS & LS Demand - San Jose
Rooms Sold / Capita
8.00 7.00 6.00 5.00 4.00 3.00 2.00 1.00 0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

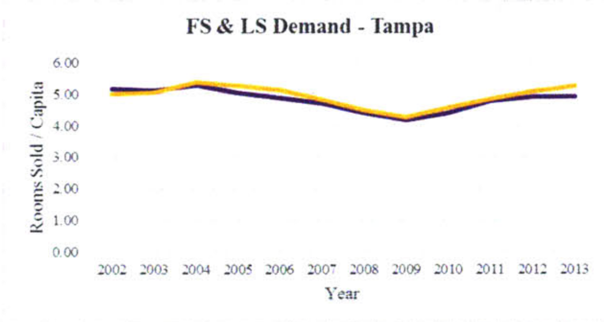

Demand & Employment Growth - San Jose
FS / LS Demand Growth
Domestic Enplanement Growth
20% 15% 10% 5% 0% -5% -10% -15% -20%
International Enplanement Growth
80% 60% 40% 20% 0% -20% -40% -60% -80%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

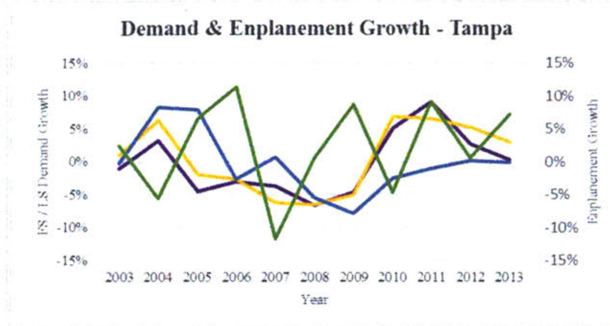

FS & LS Demand - Seattle
Rooms Sold / Capita
6.00 5.00 4.00 3.00 2.00 1.00 0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

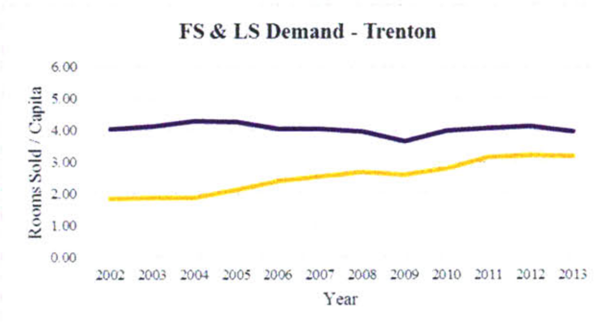

Demand & Enplanement Growth - Seattle
FS / LS Demand Growth
15% 10% 5% 0% -5% -10% -15%
Enplanement Growth
15% 10% 5% 0% -5% -10% -15%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

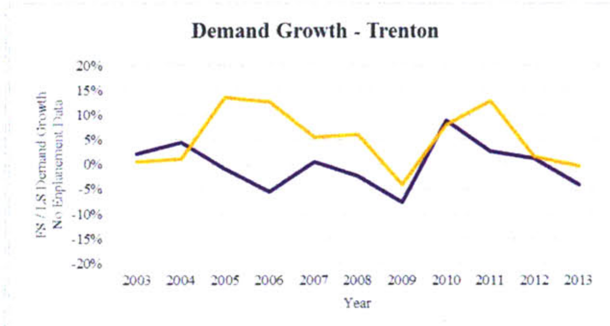

FS & LS Demand - St. Louis
Rooms Sold / Capita
6.00 5.00 4.00 3.00 2.00 1.00 0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

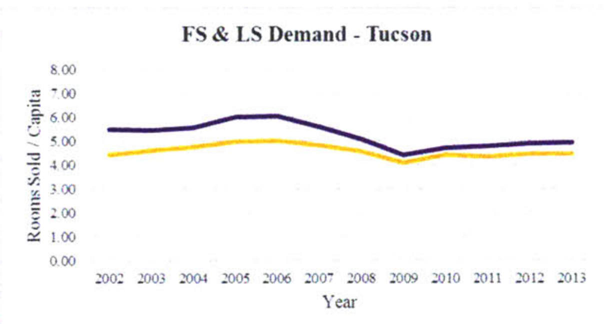

Demand & Enplanement Growth - St. Louis
FS / LS Demand Growth
10.0% 7.5% 5.0% 2.5% 0.0% -2.5% -5.0% -7.5% -10.0%
Enplanement Growth
100% 75% 50% 25% 0% -25% -50% -75% -100%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

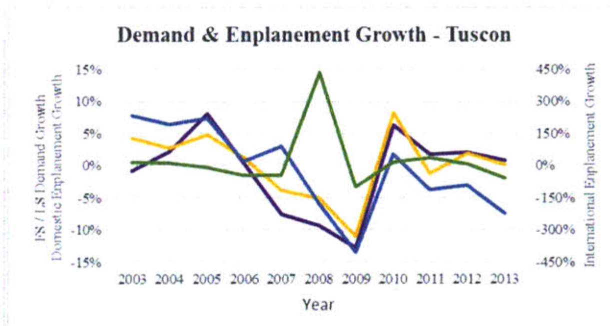

FS & LS Demand - Tampa
Rooms Sold / Capita
6.00 5.00 4.00 3.00 2.00 1.00 0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

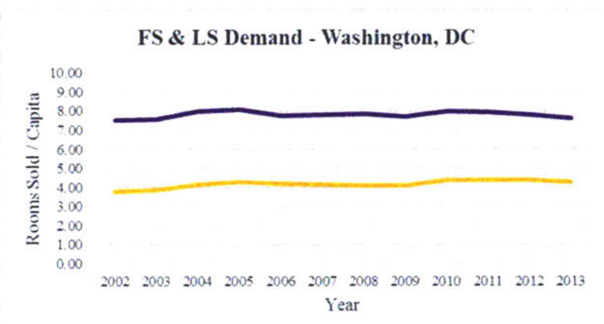

Demand & Enplanement Growth - Tampa
FS / LS Demand Growth
Enplanement Growth
15% 10% 5% 0% -5% -10% -15%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

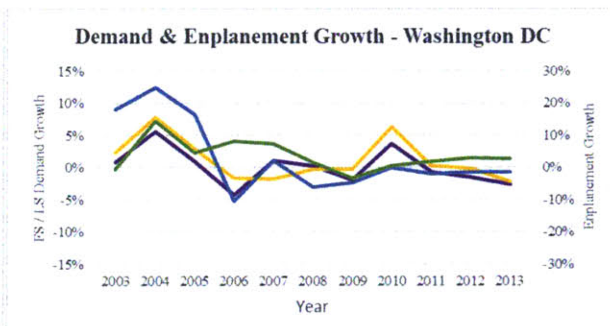

FS & LS Demand - Trenton
Rooms Sold / Capita
6.00 5.00 4.00 3.00 2.00 1.00 0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year


Demand Growth - Trenton
FS / LS Demand Growth
No Enplanement Data
20% 15% 10% 5% 0% -5% -10% -15% -20%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

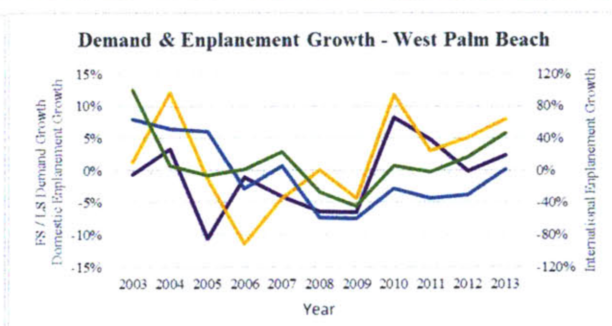

FS & LS Demand - Tucson
Rooms Sold / Capita
8.00 7.00 6.00 5.00 4.00 3.00 2.00 1.00 0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year


Demand & Enplanement Growth - Tuscon
FS / LS Demand Growth
Domestic Enplanement Growth
International Enplanement Growth
15% 10% 5% 0% -5% -10% -15%
450% 300% 150% 0% -150% -300% -450%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year


FS & LS Demand - Washington, DC
Rooms Sold / Capita
10.00 9.00 8.00 7.00 6.00 5.00 4.00 3.00 2.00 1.00 0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year


Demand & Enplanement Growth - Washington DC
FS / LS Demand Growth
Enplanement Growth
15% 10% 5% 0% -5% -10% -15%
30% 20% 10% 0% -10% -20% -30%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year


FS & LS Demand - West Palm Beach
Rooms Sold / Capita
6.00 5.00 4.00 3.00 2.00 1.00 0.00
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

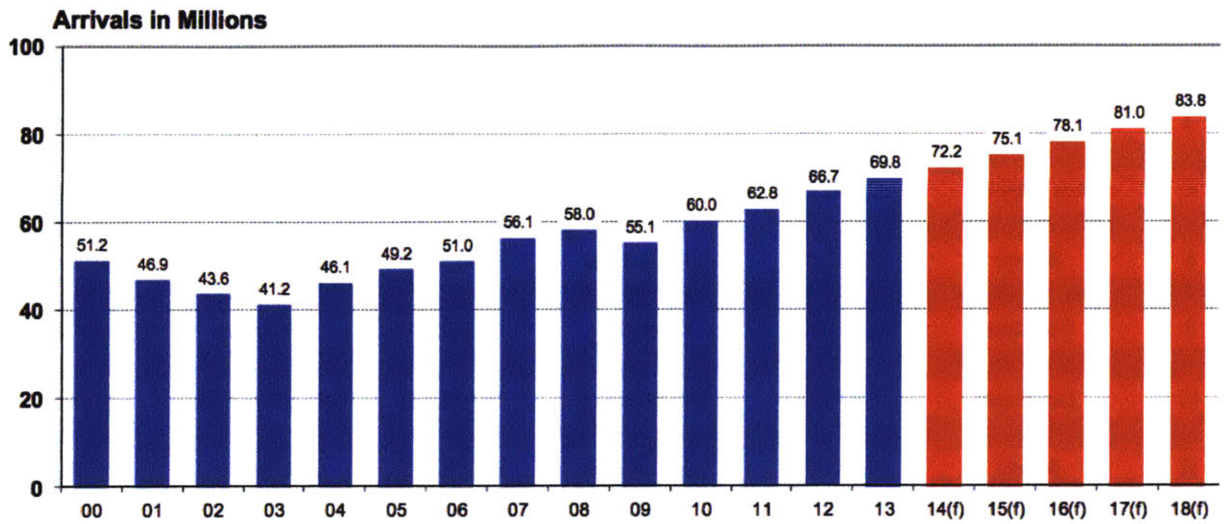

Demand & Enplanement Growth - West Palm Beach
FS / LS Demand Growth
Domestic Enplanement Growth
International Enplanement Growth
15% 10% 5% 0% -5% -10% -15%
120% 80% 40% 0% -40% -80% -120%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Year

Appendix E Top 20 Enplanement MSAs

Rank	Total Enplanement MSA	Total Enplanement 2013	Domestic Enplanement MSA	Domestic Enplanement 2013	International Enplanement MSA	International Enplanement 2013
1	Atlanta	45,272,211	Atlanta	40,328,584	New York	13,903,024
2	Chicago	42,098,437	Chicago	36,582,761	Miami	9,826,088
3	New York	38,388,810	Dallas/Fort Worth	25,805,745	Los Angeles	8,586,189
4	Los Angeles	32,404,808	Denver	24,503,444	Newark	5,609,854
5	Dallas/Fort Worth	29,015,324	New York	24,485,786	Chicago	5,515,676
6	Denver	25,467,417	Los Angeles	23,818,619	Atlanta	4,943,627
7	San Francisco	21,690,907	Charlotte	19,826,421	San Francisco	4,726,383
8	Charlotte	21,327,657	Phoenix	18,410,076	Houston	4,347,706
9	Washington, DC	20,362,766	Las Vegas	18,400,926	Washington, DC	3,551,864
10	Las Vegas	19,839,722	San Francisco	16,964,524	Dallas/Fort Worth	3,209,579
11	Phoenix	19,504,057	Washington, DC	16,810,902	Honolulu	2,374,690
12	Miami	19,053,402	Minneapolis	15,113,915	Boston	2,040,625
13	Houston	18,905,946	Seattle	14,949,556	Philadelphia	1,932,265
14	Newark	17,513,451	Orlando	14,939,193	Orlando	1,915,976
15	Orlando	16,855,169	Houston	14,558,240	Fort Lauderdale	1,786,538
16	Seattle	16,641,706	Detroit	14,054,198	Seattle	1,692,150
17	Minneapolis	16,248,994	Philadelphia	12,753,499	Detroit	1,612,281
18	Detroit	15,666,479	Boston	12,713,807	Charlotte	1,501,236
19	Boston	14,754,432	Newark	11,903,597	Las Vegas	1,438,796
20	Philadelphia	14,685,764	Baltimore	10,689,524	Minneapolis	1,135,079

Rank	Total Enplanement MSA	Total Enplanement 2012	Domestic Enplanement MSA	Domestic Enplanement 2012	International Enplanement MSA	International Enplanement 2012
1	Atlanta	45,712,837	Atlanta	40,937,424	New York	13,046,527
2	Chicago	41,478,278	Chicago	36,238,586	Miami	9,315,561
3	New York	37,203,543	Dallas/Fort Worth	25,103,054	Los Angeles	8,260,802
4	Los Angeles	31,280,414	Denver	24,906,331	Newark	5,577,135
5	Dallas/Fort Worth	27,996,215	New York	24,157,016	Chicago	5,239,692
6	Denver	25,775,666	Los Angeles	23,019,612	Atlanta	4,775,413
7	San Francisco	21,291,846	Charlotte	18,567,536	San Francisco	4,554,495
8	Washington, DC	20,236,656	Phoenix	18,439,079	Houston	4,230,464
9	Charlotte	20,016,419	Las Vegas	18,381,095	Washington, DC	3,405,807
10	Las Vegas	19,774,021	Washington, DC	16,830,849	Dallas/Fort Worth	2,893,161
11	Phoenix	19,536,904	San Francisco	16,737,351	Honolulu	2,175,234
12	Houston	19,001,869	Orlando	15,267,141	Boston	2,017,018
13	Miami	18,569,117	Minneapolis	14,834,920	Philadelphia	1,857,199
14	Orlando	17,087,248	Houston	14,771,405	Orlando	1,820,107
15	Newark	17,024,217	Seattle	14,537,720	Fort Lauderdale	1,681,772
16	Seattle	16,084,545	Detroit	14,014,335	Detroit	1,567,832
17	Minneapolis	15,916,740	Philadelphia	12,698,222	Seattle	1,546,825
18	Detroit	15,582,167	Boston	12,254,591	Charlotte	1,448,883
19	Philadelphia	14,555,421	Newark	11,447,082	Las Vegas	1,392,926
20	Boston	14,271,609	Baltimore	10,827,723	Phoenix	1,097,825

Appendix F International Visitors to the U.S. and Projections (2000-2018)



Sources: U.S. Department of Commerce, ITA, National Travel and Tourism Office; Secretaria de Turismo (Mexico); Statistics Canada. -- Spring 2014 Travel Forecast