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Projecting economic cycles in the lodging industry

By John O'Neill, PhD, Pennsylvania State University

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Projecting economic cycles in the lodging industry

Various stages of the economic cycle have been a popular discussion topic at many hotel investment conferences in recent years. These discussions have included hypothesizing by panel participants regarding what is the current phase of the cycle (sometimes likening economic growth cycles to a baseball game, and conjecturing what "inning" of the game we may be in), particularly in panels of hotel company CEOs (e.g., Wallis, 2019; Brandau, 2016; Sullivan, 2016). In such discussions, the panelists' bases for determining the current stage of the cycle have not usually been discussed, i.e., what are the economic variables that predict growth and decline in lodging demand, and that lodging prognosticators and other analysts should be tracking to predict lodging industry trends. In other words, it would be beneficial for hotel industry practitioners as well as academics to know what economic variables have been the strongest predictors of lodging industry trends in recent years. The purposes of this research project are to analyze recent economic cycles in the United States and identify and analyze variables that may have predictive power regarding U.S. lodging demand, and to make practical recommendations.

The U.S. hotel industry has been shown to follow an average seven-year economic cycle (Choi, Olsen, Kwansa, & Tse, 1999; Higley, 2016). However, there is limited knowledge regarding indicators that would be worth relying on to project fluctuations in the hotel economic cycle. The current study contributes to the hotel real-estate literature by providing practical and current information for better forecasting national lodging demand trends in the United States. The quarterly nature of the data allows deep analysis of the demand cycles within a macro-economic context.

Studying economic trends in real estate

In the United States, the National Bureau of Economic Research (NBER) is the primary reference organ timing and measuring general economic trends based on the work of Burns and Mitchell (1946) - "Measuring Business Cycle." The NBER has been defining the U.S. business cycles through the release of research since the 1930s, and scholars and practitioners have analyzed business cycles using a variety of variables and methods since then (Niemira & Klein, 1994). The work of Berman and Pfleeger (1997) suggests that different industries are unique and have dissimilar connections to the national trends, and certainly, the lodging industry is unique.

Within the real estate industry, economic trends have been studied through various approaches. A high correlation between commercial real estate asset performance with GDP (Gross Domestic Product) growth has been shown (Case, Goetzmann, & Rouwenhorst, 2000; Lieser & Groh, 2014).

Unlike other commercial assets, hotel assets by nature are more reactive to economic trends because their rental period is much shorter which implies relatively more rapid adjustments (Gallagher & Mansour, 2000; Manning, et al., 2018). However, the reactivity of the hotel industry to economic variables has not been extensively, empirically tested. From this information, one may anticipate that hotel performance data may be much more related to U.S. business trends than other real-estate assets and may adjust to equilibrium more rapidly following economic shocks.

In the hotel industry, some research studies suggest a link between hotel industry demand and general economic trends, with GDP generally identified as being a particularly strong predictor of lodging demand trends (Berman & Pfleeger, 1997; Choi et al., 1999; Corgel & Woodworth, 2012; Gallagher & Mansour, 2000; Hood, 2016; Ismail, Dalbor, & Mills, 2002; O'Neill & Carlbäck, 2011; Sohn, (Hugo) Tang, & (Shawn) Jang, 2014; Wheaton & Rossoff, 1998;

Woodworth & Mandelbaum, 2010). However, there appears to have been limited research in this regard in the past five to ten years.

Using annual hotel revenue in the U.S. and based on the Niemira and Klein (1994) definition of cycles, Choi et al. (1999) concluded that the U.S. hotel industry peaked in 1967, 1973, 1980 and 1989. Findings revealed that on average, hotel cycles lasted 7.3 years with 5.7 years of expansion and 1.7 years of contraction. While this study provides insight regarding hotel economic cycles, it used annual data which did not permit a more detailed analysis of hotel demand fluctuations. Some other research projects have studied different features of the hospitality industry through the different phases of U.S. business cycles. Sohn et al. (2014) analyzed the impact of an asset-light and fee-oriented strategy at the hotel corporate level on different phases of the economic cycle. O'Neill and Carlbäck (2011) found that branded hotels have less volatility of NOI through different phases of the economic cycle. Choi analyzed restaurant financial practices during different periods of the economic cycle (Choi, 2010; 2007). Ismail et al. (2002) studied RevPAR volatility in the hotel industry and concluded that luxury properties are more volatile, suggesting a stronger link of this segment with the economic cycle, and supporting the trade-down theory (i.e., luxury properties may be the first affected by national economic recessions). Enz, Canina, and Lomanno (2009) studied the pricing strategy of hotels during both good (2004-2007) and bad (2001-2003) economic periods. These research projects emphasized the interest of scholars regarding the link of the hotel industry to economic trends. However, limited recent empirical studies have extensively examined the determinants of lodging demand trends using quarterly data which provides justification for the subject study.

What are the predictors of lodging demand?

Some studies have focused on understanding economic cycles, but there appears to have been only limited research regarding predicting lodging demand trends in recent years, or analyzing whether different determinants of the economic trends may be more or less relevant during different periods of time (Song & Li, 2008). As previously discussed, when lodging demand trends have been analyzed in the United States in general, GDP has usually been cited as a strong, or the strongest predictor of lodging demand. Also, some research studies related to the hospitality field have focused on demand forecasting in the revenue management literature (Anderson & Xie, 2010; Pereira, 2016; Song & Li, 2008). Tourists' income, tourism prices at destinations, prices in competing destinations and exchange rates are determinants of tourism demand in recurrent studies (Karima, Khan, & Karamelikli, 2019; Song & Li, 2008). U.S. hotel demand has been shown to be correlated with personal income and corporate profits, skilled workers' unemployment and the state of the global economy (Corgel & Woodworth, 2012; Ongan & Özdemir. 2017). When these indicators are forecasted to remain strong, the hotel industry has been shown to remain in an expansion mode.

In addition to GDP, in analyzing hotel demand trends both within and outside the hotel industry, macro-economic data such as employment, personal income, industrial production, inflation, and interest rates have been studied as independent variables (Aalen, Iverson, & Jakobsen, 2019; Berman & Pfleeger, 1997; Corgel & Woodworth, 2012; Gouveia & Rodrigues, 2005; Kling & McCue, 1987; O'Neill & Carlbäck, 2011; Ongan & Özdemir. 2017; Quigley, 2002; Wheaton, 1987; Wheaton & Rossoff, 1998). In perhaps the most recent study in this area, O'Neill and Ouyang (2020) related lodging demand to several economic variables, and that study showed correlations were substantial between lodging demand and GDPI (Gross Domestic Private

Investment, sometimes referred to as Gross Private Domestic Investment, or the portion of GDP generated by private business investment).

Using annual data, Choi's (2003) study showed that some determinants may be leading cyclical changes in national hotel revenues (American Stock Exchange index, number of business failures, CPI for motor fuels, GDP of service, and wages/salaries), coincide with hotel cycles (consumer confidence, GDP, hotel occupancy percentage, consumer expenditures in service industries) or lag it (GNP, total employment, interest rate in the hotel industry). This knowledge provides understanding regarding the potential determinants of lodging demand fluctuations. The subject study evaluates the forecasting power of each of these potential determinants of lodging demand trends, and detects the determinants that most influence lodging demand in recent years. Since previous research indicates industry-level variables including average daily rate (ADR) and lodging supply may significantly influence lodging demand, those variables are included in these analyses too.

Most of the academic research studies focusing on demand have been more concerned with tourist flows rather than hotel demand from a performance standpoint (e.g., Khalid, Okafor, & Shafiullah, 2019; Witt & Witt, 1995; Zhu, Lim, Xie, & Wu, 2018). Variables such as population at origin, income at origin, price at competitive destination or marketing spending are examples of variables taken into account in these models. However, they focused on the determinants of tourism flow from one country to another.

Kulendran and Wong (2011) showed that income, prices at the destination, prices at substitute destinations, and oil prices predicted tourism industry trends. (Smeral, 2012) conducted similar research and showed that households did not consume similarly during different periods of

time. By using tourism demand from a particular origin, it was shown that income and price effects were asymmetric at different time periods.

The Subject Study: Data Studied

For the subject study, STR provided data regarding lodging-industry-specific variables, with a sample period from the first quarter of 1990 through the fourth quarter of 2018, totaling 116 lines of data. This study focused on long-run fluctuations of the lodging industry and the nature of the quarterly data allowed detection of the movement of the data within each year. Quarterly and seasonally-adjusted data regarding economic variables were obtained from different governmental departments as summarized in Table 1. Lodging demand was deseasonalized for the analyses with seasonally-adjusted, pre-selected economic variables. For deseasonalizing demand, quarterly moving average and centered moving average over the whole time period for each variable were calculated. Then, each quarterly moving average was divided by the centered moving average for generating factors which explain seasonal trends, depending on each quarter. As a final step for obtaining the deseasonalized data set, each quarter's data was divided by each factor calculated by the previous step.

Table 1. Variables studied

Variable	Unit	Obs.	Mean	Std. Dev.	Source
Demand	Number of room nights within a quarter	116	245,421,359	40,681,362	*STR*
GDP	Billions of USD	116	12,401.02	4,336.16	*Bureau of Economic Analysis*
CPI	Index (2015=100)	116	80.75	15.50	*Bureau of Labor Statistics*
Employment	Thousands of persons	116	129,374.55	11,173.92	*Bureau of Labor Statistics*
Income	Billions of USD	116	10,400.47	3,789.95	*Federal Reserve Economic Data*
Wages	Billions of USD	116	5,466.48	1,797.75	*Federal Reserve Economic Data*
National Consumption	Billions of USD	116	8,309.32	3,044.18	*Bureau of Economic Analysis*
Corporate Profit	Billions of USD	116	1,262.63	602.29	*Bureau of Economic Analysis*
GPDI	Billions of USD	116	2,144.81	752.05	*Bureau of Economic Analysis*
Interest Rate	Percentage	116	4.60	1.91	*Federal Reserve Economic Data*
Exchange Rate	Index (1997=100)	116	105.01	15.34	*Federal Reserve Economic Data*
S&P 500	Index	116	1,208.88	609.03	*Yahoo Finance*
Production Output	Index (2012=100)	116	91.14	13.69	*Federal Reserve Economic Data*
Consumer Sentiment	Index (1966=100)	116	87.26	12.13	*Federal Reserve Economic Data*
ADR	USD	116	90.21	21.57	*STR*
Supply	Number of room nights within a quarter	116	393,614,908	53,086,084	*STR*

How the data were analyzed

In this study, a series analysis using multiple approaches was implemented to determine what individual or combination of independent variables best predict U.S. lodging demand trends and to work towards identifying a model for projecting future U.S. lodging demand trends.

Effect of Each Economic Factor

Lodging demand was regressed both one and two quarters (three months each) into the future based on each pre-selected independent variable and analyzed whether there was a significant relationship between each independent variable and future hotel demand. Based on the results of the univariate linear regressions, each independent variable was compared and ranked based on each independent variable's effect on lodging demand using standardized beta coefficients. Further, to explore whether the effects of the independent variables on lodging demand have changed over time, the sample period was divided into four approximately equal segments (i.e., quartiles), among which the first three segments included 29 quarters (three months each) and the last segment included 28 quarters, and the changes in each independent variables' impact size on each time segment were analyzed.

In addition, the quarterly change in each independent variable was analyzed relative to the change in lodging demand one and two quarters into the future. For example, the change in GDP (and other independent variables) between Quarter 1 and Quarter 2 was used to predict the change in hotel demand between Quarter 2 and Quarter 3, and between Quarter 3 and Quarter 4.

Effect of Economic Factors in Regression Models

Table 2 shows the results of univariate linear regression analyses by regressing hotel demand one and two quarters into the future on each pre-selected independent variable and ranks each independent variable, depending on its impact size (the absolute value of its standardized coefficient) on lodging demand. When analyzing the one-quarter-lag, GDPI had the highest standardized coefficient (0.977) with a t-value of 48.669. Wages had the second highest standardized coefficient (0.971). Income, GDP and ADR followed with the relatively high standardized coefficients of 0.968, 0.969 and 0.966, respectively. Interest rate, as previously discussed, showed a negative and significant effect on lodging demand one quarter into the future,

with a standardized coefficient of -0.885. Of all of the independent variables, only consumer sentiment had an insignificant effect on lodging demand one quarter ahead, at a 5% confidence level. All other independent variables were significantly correlated with lodging demand one quarter ahead with relatively high standardized coefficients of more than 0.6.

When regressing lodging demand two quarters into the future with each independent variable, similar results were obtained. All of the independent variables excluding consumer sentiment showed a significant association with lodging demand two quarters ahead. However, compared to the regression analyses with lodging demand one quarter ahead as a dependent variable, the absolute values of all standardized coefficients were smaller. For example, while the standardized coefficient of GDPI when regressed with lodging demand one quarter ahead was 0.977, it was 0.968 with lodging demand two quarters ahead. To summarize, Table 2 presents the ranking of independent variables in terms of impact size on lodging demand. In addition, the results of linear regression analyses with the different time lags of lodging demand (i.e. 1-quarter and 2-quarters ahead) provide empirical evidence that all independent variables better predict lodging demand one quarter than two quarters into the future.

Table 2. Linear regression analyses between independent variables and lodging demand

DV: Deseasonalized lodging demand one quarter ahead				DV: Deseasonalized lodging demand two quarters ahead			
Variable	Std. Coef.	t	Rank	Variable	Std. Coef.	t	Rank
GDPI	0.977	48.669***	1	GDPI	0.968	40.685***	1
Wages	0.971	43.274***	2	Wages	0.966	39.660***	2
Income	0.969	41.937***	3	Income	0.965	38.933***	3
GDP	0.968	40.999***	4	Consumption	0.962	37.311***	4
ADR	0.985	39.039***	5	ADR	0.959	35.752***	5
Consumption	0.965	39.321***	6	GDP	0.965	38.774***	6
S&P 500	0.955	34.055***	7	Profit	0.951	32.500***	7
CPI	0.950	32.464***	8	CPI	0.948	31.596***	8
Profit	0.949	32.101***	9	S&P 500	0.946	31.037***	9
Supply	0.931	27.089***	10	Supply	0.933	27.496***	10
Employment	0.930	26.995***	11	Employment	0.919	24.677***	11
Production	0.893	21.087***	12	Interest rate	-0.893	-21.024***	12
Interest rate	-0.885	-20.161***	13	Production	0.883	19.864***	13
Exchange rate	0.609	8.157***	14	Exchange rate	0.598	7.901***	14
Consumer sentiment	0.060	0.635	-	Consumer sentiment	0.040	0.424	-
N	115			N	114		

Table 3 provides the changes in the effect of each predictor on lodging demand over time after the sample period was divided into four equal segments to test the robustness of each independent variable. The impact size of each predictor changed considerably over time. In the first time segment (1990 Quarter 1 - 1997 Quarter 1), all economic factors significantly influenced

lodging demand one quarter ahead: among the 15 predictors, the standardized coefficients of 12 predictors were larger than .888 with t values larger than 10; even the least significant predictor, Interest Rate had a significant standardized coefficient of -.552 associated with lodging demand one quarter ahead at a 1% confidence level.

The effect of all predictors diminished to some extent in the second time segment (1997 Quarter 2 – 2004 Quarter 2). Particularly, the rank of impact size of Profit dropped from number 1 to number 11. Exchange Rate, the second strongest predictor in the first segment, became insignificantly correlated with lodging demand one quarter ahead. GDPI, Production and Wages turned into the most significant predictors of future lodging demand with the largest impact sizes in the second segment.

In the third segment (2004 Quarter 3 – 2011 Quarter 3), the impact of all predictors continued to diminish except Profit and S&P 500 whose impact sizes increased slightly from the second time segment (std. Profit = .711; std. S&P500 = .683). Additionally, Production, GDPI and Consumer Sentiment also significantly influenced lodging demand one quarter ahead. The other pre-selected independent variables were insignificant to predict future lodging demand in the third segment.

In the fourth segment (2011 Quarter 4 – 2018 Quarter 4), all pre-selected independent variables were again significant to predict lodging demand. Also, the impact of all predictors became stronger compared to the third segment, except Profit whose standardized coefficient decreased slightly from .711 to .671. Ten predictors had a standardized coefficient larger than 0.9 with a t-value larger than 10. These analyses indicate that overall, GDPI, Profit, Production, S&P 500, and Consumer Sentiment are relatively robust predictors of lodging demand trends at different time periods throughout the sample period.

Table 3. Independent variable effect sizes over time

	1990Q1-1997Q1			1997Q2-2004Q2			2004Q3-2011Q3			2011Q4-2018Q4		
Variable	Std. Coef.	t	Rank	Std. Coef.	t	Rank	Std. Coef.	t	Rank	Std. Coef.	t	Rank
Profit	.949	15.574***	1	.457	2.667*	11	.711	5.259***	1	.671	4.611***	14
Exchange rate	.948	15.549***	2	.253	1.357	-	-.246	-1.319	-	.887	9.811***	11
GDP	.948	15.521***	3	.719	5.380***	4	.099	.519	-	.969	20.114***	3
GDPI	.947	15.278***	4	.858	8.685***	1	.481	2.852**	4	.955	16.398***	7
Consumption	.946	15.094***	5	.702	5.122***	6	.082	.427	-	.968	19.795***	5
Income	.945	15.001***	6	.696	5.041***	7	.067	.348	-	.969	19.842***	4
Wages	.945	14.986***	7	.739	5.708***	3	.045	.233	-	.971	20.618***	2
Production	.937	13.954***	8	.841	8.092***	2	.501	3.008**	3	.810	7.045***	13
CPI	.924	12.524***	9	.646	4.392***	9	-.021	-.111	-	.946	14.947***	8
Employment	.921	12.294***	10	.685	4.890***	8	-.004	-.019	-	.972	21.281***	1
ADR	.896	10.483***	11	.711	5.258***	5	-.072	-.374	-	.937	13.725***	9
S&P 500	.888	10.049***	12	.390	2.204*	12	.683	4.858***	2	.959	17.313***	6
Consumer sentiment	.795	6.812***	13	-.132	-.694	-	.402	2.280*	5	.906	10.935***	10
Supply	.767	6.207***	14	.606	3.963***	10	-.076	-.396	-	.811	7.068***	12
Interest rate	-.552	-3.444**	15	-.331	-1.826	-	.186	.986	-	.399	2.221*	15
N	29			29			29			28		

Note: *, **, *** represent $p < .05$, $p < .01$, $p<.001$, respectively.
The dependent variable of this analysis is de-seasonalized lodging demand one quarter ahead.

Table 4 provides the results of analyses using the quarterly change in independent variables as predictors of the future quarterly change in lodging demand trends. We conducted regression analyses with two different time periods of the independent variables relative to the dependent variable of lodging demand, i.e., lodging demand one to two quarters, and two to three quarters ahead. For simplicity, we refer to the first analysis as the change in lodging demand one quarter ahead, and the second as two quarters ahead. These two different analyses showed very different results in terms of each predictor's standardized coefficient estimates and t-statistics. Among the 15 predictors, the change in ADR, GDPI, S&P 500, Production, Consumer Sentiment, and Consumption showed a significant effect on the change in lodging demand one quarter ahead.

Only the change in Supply showed a significant effect on the change in lodging demand two quarters ahead. Other independent variables' change had an insignificant effect on the change in future lodging demand. In summary, as with our previous analyses, the quarterly change in independent variables better predicted the quarterly change in lodging demand one than two quarters ahead.

Table 4. Regression analyses between change in an economic factor and change in lodging demand

DV: Lodging demand changes between 1Q ahead and 2Q ahead				DV: Lodging demand changes between 2Q ahead and 3Q ahead			
Variable	Std. Coef.	t	Rank	Variable	Std. Coef.	t	Rank
Δ ADR	-.266	-2.918**	1	Δ Supply	.213	2.294*	1
Δ GDPI	.227	2.472*	2	Δ Profit	.182	1.951	-
Δ S&P 500	.225	2.445*	3	Δ ADR	.143	1.524	-
Δ Production	.224	2.430*	4	Δ Consumption	.142	1.516	-
Δ Consumer sentiment	.209	2.267*	5	Δ Production	.136	1.447	-
Δ Consumption	.187	2.012*	6	Δ GDP	.121	1.289	-
Δ GDP	.165	1.774	-	Δ GDPI	.073	.775	-
Δ Supply	-.153	-1.634	-	Δ Income	-.073	-.775	-
Δ Wages	.133	1.415	-	Δ Interest	-.071	-.750	-
Δ Profit	.130	1.390	-	Δ CPI	-.055	-.579	-
Δ Interest	.099	1.058	-	Δ Exchange rate	-.047	-.492	-
Δ Employment	.079	.834	-	Δ Wages	-.038	-.403	-
Δ Exchange rate	-.037	-.395	-	Δ Consumer sentiment	-.026	-.272	-
Δ CPI	-.031	-.331	-	Δ Employment	.025	.265	-
Δ Income	.031	.323	-	Δ S&P 500	.021	.225	-
N	114			N	113		

Note: *, **, *** represent p < .05, p < .01, p<.001, respectively.
The dependent variable of this analysis is de-seasonalized lodging demand.

Criterion-based Stepwise Linear Regression Analysis for Model Selection

Table 5 presents the results of the fifteen best subsets of variables, from a subset that contains one predictor variable to one that contains all fifteen variables, to predict lodging demand

one quarter into the future. Due to the correlation between the predictors, collinearity was tested for each of the fifteen best regression models. Table 6 provides model selection statistics of the fifteen best regression models.

Models with more than three predictors suffer from multicollinearity issues. Thus, the three-predictor-model that includes Profit, S&P 500, and Exchange Rate appears to be an excellent regression model to predict lodging demand one quarter ahead as a result of the model selection using the criterion-based stepwise linear regression approach.

Table 5. 15 best subsets of variables for lodging demand prediction

Model Index	Predictors
1	GDPI
2	Profit S&P500
3	Profit `Exchange rate` S&P500
4	Income GDPI `Consumer sentiment` ADR
5	Wages Profit S&P500 `Consumer sentiment` ADR
6	Income Profit GDPI S&P500 `Consumer sentiment` ADR
7	Income Profit GDPI `Interest rate` S&P500 `Consumer sentiment` ADR
8	Wages Profit GDPI `Interest rate` S&P500 `Consumer sentiment` ADR Supply
9	GDP Income Consumption Profit GDPI `Interest rate` S&P500 `Consumer sentiment` ADR
10	CPI Income Consumption Profit `Interest rate` S&P500 Production `Consumer sentiment` ADR Supply
11	GDP Income Consumption Profit GDPI `Interest rate` S&P500 Production `Consumer sentiment` ADR Supply
12	GDP CPI Income Consumption Profit GDPI `Interest rate` S&P500 Production `Consumer sentiment` ADR Supply
13	GDP Employment Income Wages Consumption Profit GDPI `Interest rate` S&P500 Production `Consumer sentiment` ADR Supply
14	GDP CPI Employment Income Wages Consumption Profit GDPI `Interest rate` S&P500 Production `Consumer sentiment` ADR Supply
15	GDP CPI Employment Income Wages Consumption Profit GDPI `Interest rate` `Exchange rate` S&P500 Production `Consumer sentiment` ADR Supply

Table 6. Model Selection Criterion for 15 Best Subsets of Regression Models

Model	Adj. R-Square	R-Square
1	0.9545	0.9531
2	0.9798	0.9787
3	0.9843	0.9832
4	0.9865	0.9849
5	0.9882	0.9868
6	0.9891	0.9874
7	0.9897	0.9880
8	0.9899	0.9880
9	0.9904	0.9881
10	0.9905	0.9881
11	0.9908	0.9881
12	0.9908	0.9881
13	0.9909	0.9881
14	0.9909	0.9881
15	0.9909	0.9881

Time-series Analysis

Time-series analysis was implemented because of the fact that the quarterly data for each variable are typically highly correlated with the prior quarter. Using time-series data analysis methods, the original lodging demand data were regressed on each of the fifteen best subsets of economic factors. After removing the insignificant predictors in each of the models and adjusting the SARIMA structure of residuals, Table 7 provides a summary of eight well-fitted models with their economic predictors, the SARIMA structure for residuals, and model fitting statistics. When lodging demand was regressed on different combinations of predictors, the residuals followed different SARIMA structures.

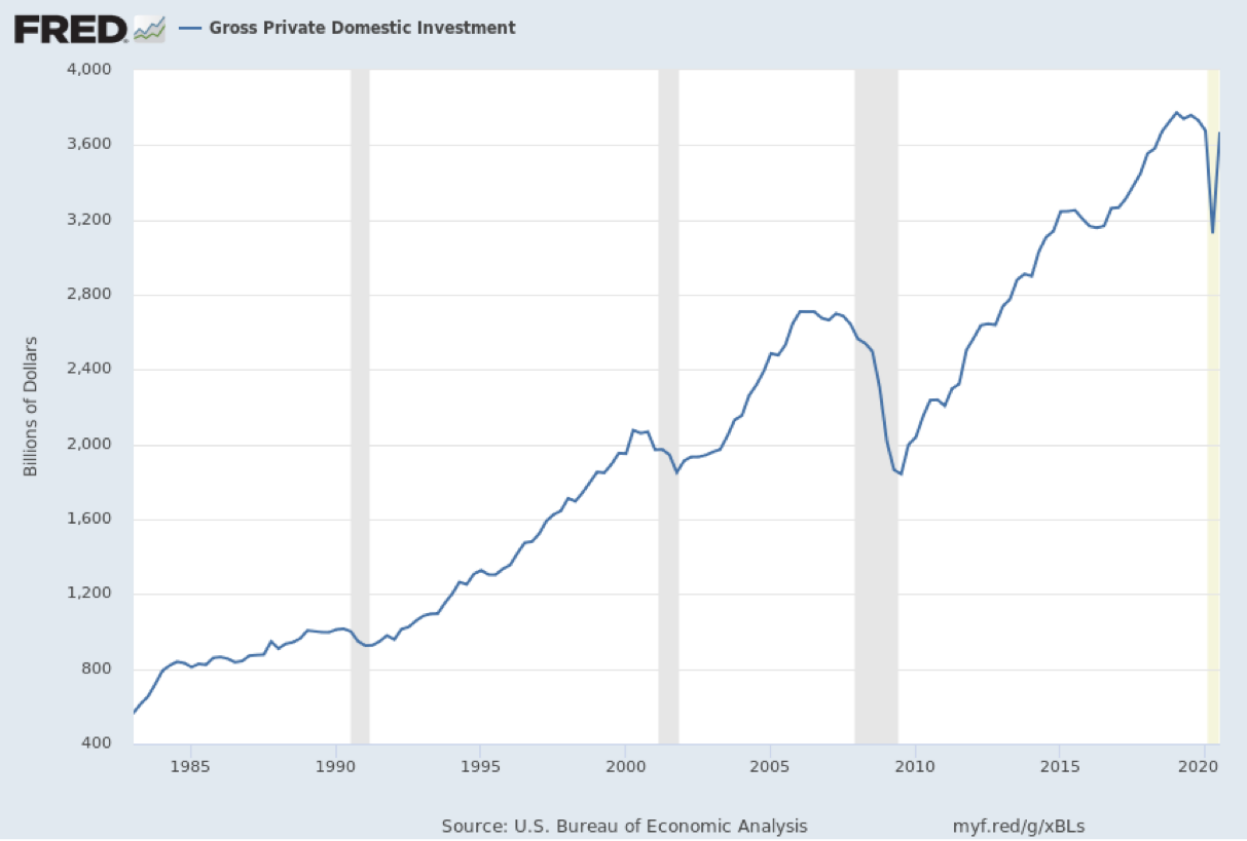
Table 7. Fitting of time series models

Predictor(s)	SARIMA Residuals	Sigma^2 (smaller is better)	AIC (smaller is better)	BIC (smaller is better)	Multicollinearity
GDPI	$(1,0,0)(0,1,1)_4$	$7.881*10^{12}$	31.784	31.902	No
S&P500	$(2,0,0)(0,1,0)_4$	$9.624*10^{12}$	31.978	32.097	No
GDPI, ADR	$(2,0,1)(0,1,0)_4$	$6.237*10^{12}$	31.616	31.781	No
Profit, S&P500, ADR	$(1,0,0)(1,1,1)_4$	$6.108*10^{12}$	31.593	31.783	No
GDPI, S&P500, ADR	$(2,0,2)(1,1,1)_4$	$5.27*10^{12}$	31.541	31.801	No
CPI, Consumption, Production, ADR	$(1,0,0)(1,1,1)_4$	$5.46*10^{12}$	31.503	31.715	No
GDP, Employ, Production, ADR	$(1,0,0)(1,1,1)_4$	$5.107*10^{12}$	31.439	31.651	Vif(Employ)=6.14
CPI, Employ, Consumption, GDPI, Production, ADR	$(1,0,0)(1,1,1)_4$	$4.793*10^{12}$	31.410	31.670	Vif(Employ)=10.016 Vif(Production)=10.341

Updated Findings

Since GPDI was found to be such a strong predictor of lodging demand trends, the most recent available GPDI data from the U.S. Bureau of Economic Analysis were analyzed. These data are presented in Exhibit 1. The data show that GPDI has fairly consistently declined prior to economic recessions in the United States (highlighted by the gray bars in Exhibit 1), illustrating its efficacy of predicting the early months of recessions which also corresponds with the time period when lodging demand declines occur. Further, the data show that GPDI declined greatly prior to the most recent recession in 2020 (notably, even prior to the ill effects of COVID-19), as well, which substantially affected the U.S. lodging industry. Taken together, these findings appear to demonstrate the continued strength of GPDI in predicting lodging demand trends. Also, given the very recent and very sharp rebound in GPDI, these updated findings provide rationale for optimism in the U.S. lodging industry in 2021.

Exhibit 1. Gross Private Domestic Investment (GPDI) Trends



Limitations

Since this research focused on overall lodging demand in the U.S., it did not analyze various regions of the country or segments of demand, such as corporate, leisure or group demand. Future research could study such demand segments to determine whether certain independent (predictor) variables are relatively stronger predictors within certain regions or of certain segments of lodging demand.

Discussion and Conclusions

The focus of this project was on evaluating the ability of 15 economic indicators to predict lodging demand trends in recent years. Of the 15 variables studied, the analyses indicate that quarterly GDPI is generally the strongest predictor to forecast lodging demand. Analysts seeking a single variable to predict lodging demand trends one quarter into the future should consider

tracking GDPI, based on our analyses. This finding is notable because most previous research on the U.S. hotel industry has focused on GDP, not GDPI.

Also, the sample time frame was divided into four segments to estimate which economic variables may have been relatively robust predictors of lodging demand trends in recent years. GDPI, Profit, Production, S&P 500, and Consumer Sentiment (in that order) have been particularly strong predictors of quarterly lodging demand trends during all time periods studied. When the quarterly change in each of the 15 independent variables was studied, I found similar results, with six variables, namely ADR, GDPI, S&P 500, Production, Consumer Sentiment, and Consumption (in that order) to be the strongest predictors of the change in lodging demand trends, i.e., the only difference was that ADR ranked slightly ahead of GDPI, though both variables were significant predictors of lodging demand in this analysis.

A criterion-based stepwise model selection analysis was also conducted to identify a group of potential lodging demand predictors. This analysis also identified GDPI as having the strongest predictive ability in a one-predictor-regression model. In addition, a three-predictor model, including Profit, S&P 500 and Exchange Rate comprised a highly predictive model based on model selection criteria. This three-predictor-model would be accurate and parsimonious for analysts interested in projecting lodging demand trends.

Also, seasonal time-series models (SARIMA) were implemented to understand the autoregressive and moving average features of lodging demand trends. Eight, well-fitted regression models with SARIMA structured residuals resulted. A model that included detrended CPI, Consumption, Production, ADR, and residuals with a SARIMA $(1,0,0)(1,1,1)4$ structure was determined to be excellent at predicting lodging demand. This model may be beneficial to academics and researchers.

Ultimately, the findings of this research recommend that practitioners track GDPI (Gross Domestic Private Investment), sometimes referred to as Gross Private Domestic Investment, or the portion of GDP generated by private business investment) as a relatively simple and accurate way to predict lodging demand trends one quarter into the future. This recommendation is made considering all of the analyses described herein, and that GDPI was a robust predictor of lodging demand trends during all of the different recent time periods studied.

References

Aalen, P., Iversen, E. K., & Jakobsen, E. W. (2019). Exchange rate fluctuations and demand for hotel accommodation: panel data evidence from Norway. Scandinavian Journal of Hospitality and Tourism, 19(2), 210-225.

Anderson, C. K., & Xie, X. (2010). Improving hospitality industry sales: Twenty-five years of revenue management. Cornell Hospitality Quarterly, 51(1), 53–67. https://doi.org/10.1177/1938965509354697

Berman, J., & Pfleeger, J. (1997). Which industries are sensitive to business cycles. Monthly Lab. Rev., 120, 19.

Brandau, M. (2016, June 6). Hilton CEO, Hotel executives tout "Golden Age of Travel" at NYU Hospitality Conference. Retrieved June 4, 2017, from http://duettoresearch.com/hilton-ceo-nassetta-golden-age-travel/

Case, B., Goetzmann, W. N., & Rouwenhorst, K. G. (2000). Global real estate markets-cycles and fundamentals. National bureau of economic research. Retrieved from http://www.nber.org/papers/w7566

Choi, J.-G. (2003). Developing an economic indicator system (a forecasting technique) for the hotel industry. International Journal of Hospitality Management, 22(2), 147–159. https://doi.org/10.1016/S0278-4319(03)00015-X

Choi, J.-G. (2007). Developing restaurant industry business cycle model and analyzing industry turning point. Journal of Global Business and Technology, 3(1), 40.

Choi, J.-G. (2010). Analysis of the financial practices of high and low performing firms over periods of peaks and troughs of the restaurant industry cycle. International Journal of Hospitality Management, 29(1), 53–61. https://doi.org/10.1016/j.ijhm.2009.05.005

Choi, J.-G., Olsen, M. D., Kwansa, F. A., & Tse, E. C.-Y. (1999). Forecasting industry turning points: the US hotel industry cycle model. International Journal of Hospitality Management, 18(2), 159–170.

Corgel, J., & Woodworth, M. (2012). Why hotels? Economy weakens but hotels remain relatively strong—What Gives? And What Might Give? Cornell Hospitality Quarterly, 53(4), 270–273.

Enz, C. A., Canina, L., & Lomanno, M. (2009). Competitive pricing decisions in uncertain times. Cornell Hospitality Quarterly, 50(3), 325–341.

Gallagher, M., & Mansour, A. (2000). An analysis of hotel real estate market dynamics. Journal of Real Estate Research, 19(2), 133–164.

Gouveia, P. M., & Rodrigues, P. M. (2005). Dating and synchronizing tourism growth cycles. Tourism Economics, 11(4), 501–515.

Higley, J. (2016). 5 signs point to cycle's grand finale in mid-2017. Retrieved June 4, 2017, from http://hotelnewsnow.com/Articles/76301/5-signs-point-to-cycles-grand-finale-in-mid-2017.

Hood, S. (2016). HDC Data Dive - Leading Indicators of RevPAR. Study presented at the 2016 Hotel Data Conference, Nashville, TN.

Ismail, J. A., Dalbor, M. C., & Mills, J. E. (2002). Using RevPAR to analyze lodging-segment variability. The Cornell Hotel and Restaurant Administration Quarterly, 43(6), 73–80.

Karimi, M. S., Khan, A. A., & Karamelikli, H. (2019). Asymmetric effects of real exchange rate on inbound tourist arrivals in Malaysia: An analysis of price rigidity. International Journal of Tourism Research, 21(2), 156-164.

Khalid, U., Okafor, L. E., & Shafiullah, M. (2019). The effects of economic and financial crises on international tourist flows: a cross-country analysis. Journal of Travel Research, 0047287519834360.

Kling, J. L., & McCue, T. E. (1987). Office building investment and the macroeconomy: Empirical evidence, 1973–1985. Real Estate Economics, 15(3), 234–255.

Kulendran, N., & Wong, K. K. F. (2011). Determinants versus composite leading indicators in predicting turning points in growth cycle. Journal of Travel Research, 50(4), 417–430.

Lieser, K., & Groh, A. P. (2014). The determinants of international commercial real estate investment. The Journal of Real Estate Finance and Economics, 48(4), 611-659.

Manning, C., deRoos, J., O'Neill, J. W., Bloom, B. A., Agarwal, A., & Roulac, S. (2018). Hotel/lodging real estate industry trends and innovations. Journal of Real Estate Literature, 26(1), 13-41.

Niemira, M. P., & Klein, P. A. (1994). Forecasting financial and economic cycles. John Wiley & Sons.

O'Neill, J. W., & Carlbäck, M. (2011). Do brands matter? A comparison of branded and independent hotels' performance during a full economic cycle. International Journal of Hospitality Management, 30(3), 515–521.

O'Neill, J. W., & Ouyang, Y. (2020). Predicting lodging demand trends in the U.S. hotel industry. Cornell Hospitality Quarterly.

Ongan, S., Işik, C., & Özdemir, D. (2017). The effects of real exchange rates and income on international tourism demand for the USA from some European Union countries. Economies, 5(4), 51.

Pereira, L. N. (2016). An introduction to helpful forecasting methods for hotel revenue management. International Journal of Hospitality Management, 58, 13-23.

Quigley, J. M. (2002). Real estate prices and economic cycles. Berkeley Program on Housing and Urban Policy. Retrieved from https://escholarship.org/uc/item/58c6v2kx.pdf

Smeral, E. (2012). International tourism demand and the business cycle. Annals of Tourism Research, 39(1), 379–400.

Sohn, J., (Hugo) Tang, C.-H., & (Shawn) Jang, S. (2014). Asymmetric impacts of the asset-light and fee-oriented strategy: The business cycle matters! International Journal of Hospitality Management, 40, 100–108.

Song, H., & Li, G. (2008). Tourism demand modelling and forecasting—A review of recent research. Tourism Management, 29(2), 203–220.

Sullivan, M. (2016, September 30). Lodging conference: A view from the C-suite. Retrieved from http://lodgingmagazine.com/lodging-conference-a-view-from-the-c-suite/

Wallis, G. (2019). Meet the money: Sunny skies continue, Hotel Business, 28(8), 20.

Wheaton, W. C. (1987). The cyclic behavior of the national office market. Real Estate Economics, 15(4), 281.

Wheaton, W. C., & Rossoff, L. (1998). The cyclic behavior of the US lodging industry. Real Estate Economics, 26(1), 67–82.

Witt, S. F., & Witt, C. A. (1995). Forecasting tourism demand: A review of empirical research. International Journal of Forecasting, 11(3), 447–475.

Woodworth, R. M., & Mandelbaum, R. (2010). Seventy-five years of U.S. hotel revenues, expenses, and profits. Cornell Hospitality Quarterly, 51(1), 20–26.

Zhu, L., Lim, C., Xie, W., & Wu, Y. (2018). Modelling tourist flow association for tourism demand forecasting. Current Issues in Tourism, 21(8), 902-916.

Professor John O'Neill is Professor of Hospitality Management and Director of the Hospitality Real Estate Strategy Group at the Pennsylvania State University. He conducts research, outreach and teaching in the areas of real estate, asset management and strategic management in the hotel industry.