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Do Property Characteristics or Cash Flow Drive Hotel Real Estate Value?

The Answer Is Yes

By Crocker Liu and Jack Corgel

EXECUTIVE SUMMARY

Analysts typically use two types of methods to value hotels: comparable sales and the present value of income (sometimes calculated as discounted cash flow). This report explores whether one model is superior to the other, and whether combining both models results in more precise hotel valuations. This evaluation addresses the issue of which property characteristics and income calculations are the most effective in explaining variation in the prices of hotels, how the descending influence of hotel property characteristics and income present value components determine the prices of hotels, and whether hedonic and income-based models produce similar estimates of hotel values. The findings show that using an approach based on comparable sales or one based on incomes results in similar value estimates. Beyond that, the analysis finds that combining both models does not result in more precise hotel valuations.

ABOUT THE AUTHORS

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Jack Corgel, Ph.D., holds the Robert C. Baker Chair (professorship) in Real Estate at the Cornell University School of Hotel Administration (SHA), in the Cornell SC Johnson College of Business and is director of graduate studies for the Baker Program in Real Estate. He was the first director of the Center for Hospitality Research at SHA. After receiving undergraduate and Ph.D. degrees from the University of Georgia in real estate and corporate finance, he held faculty positions in several business schools at major universities before joining Cornell. Corgel serves as senior adviser to PKF Hospitality Research (PKF-HR), where he helps the firm develop products for the hotel industry based on property-level financial and real estate performance information, including Hotel Horizons econometric forecast of U.S. hotel market performance. Corgel has published 80 articles in academic and professional journals, mainly on the subjects of real estate finance, investment, valuation, and hospitality real estate. His research has appeared in the most prestigious journals in real estate (*Real Estate Economics*), urban economics (*Journal of Urban Economics*), insurance (*Journal of Risk and Insurance*), business law (*Journal of the American Business Law Association*), and hospitality management (*Cornell Quarterly* and *International Journal of Hospitality Management*). In addition, he has written for nearly every national journal read by real estate professionals. His textbook, *Real Estate Perspectives* (with Smith and Ling), was used throughout the nation for introductory real estate courses. He co-edited and wrote chapters for *The Cornell School of Hotel Administration on Hospitality: Cutting Edge Thinking and Practice.* Corgel's current research interests include the relationship between the macro-economy and hotel markets and real estate price and capitalization rate forecasting.

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Two models are commonly used in determining the value of a hotel property. In this paper we compare them. One model estimates a property's value based on the number of rooms, hotel market segment, and building age, reflecting the idea that buyers implicitly include significant property characteristics in their price calculations. The alternative approach considers future hotel income estimates as value drivers and uses capital market rates to determine the current value of the expected incomes.[1] Our report examines both hotel valuation models to determine whether one approach is preferable to the other, and whether combining the models results in more accurate hotel valuations.

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[1] Developed for application to the hotel industry by Stephen Rushmore. See, for example: Stephen Rushmore, *The Valuation of Hotels and Motels* (Chicago: American Institute of Real Estate Appraisers of the National Association of Realtors, 1978); and Jan A. deRoos and Stephen Rushmore, Hotel Valuation Software, Version 4.0, Cornell Hospitality Research Tools, Cornell Center for Real Estate and Finance, 2017..

Hedonic pricing models, such as those used to value residential real estate by Zillow, government assessors, and real estate agents, are statistical variants of the comparable sales approach. A separate price is associated with each characteristic from a statistical analysis, although these prices are not observed or generated in market trading. The sum of all these prices times the quantity of the characteristic produces an estimate of the property value.[2]

The Debate

An academic study by Ghysels, Plazzi, and Valkanov suggests that the income-based model is more suitable than the hedonic model in pricing commercial real estate.[3] The study also finds that property and local economic factors account for only a modest portion of the variation in capitalization rates. Their results raise the question as to whether we can improve hotel valuation modeling by combining hedonic property characteristics with capital market variables.

Hotel Sales Data

The hotel sales data primarily come from Real Capital Analytics (RCA). This firm collects transaction prices and associated property characteristics for U.S. commercial property sales greater than $2.5 million. The sample period runs from January 2005 through December 2010. Data from CoStar, CBRE Hotels' Americas Research, and STR augment the RCA data.

Hotel Property Characteristics

Property characteristics that we examine as drivers of hotel value include the effective age (EA), calculated as the year of sale subtracted from the year of most recent renovation, the number of rooms (RM), and a landmark property dummy (DLAND) which equals 1 if the hotel is designated as a historical landmark and 0 otherwise. Two location dummies also enter into the equations. The first of these variables indicates whether the hotel is located next to water (DH2O), such as beachfront property, while the second denotes a CBD hotel location (DCBD). As an alternative to indicator location variables (yes = 1, no = 0), the walk score for each property is introduced as a number between 0 and 100. The walk score measures the walkability of any address: the higher the score, the more walkable the location.[4] We also include a dummy variable to indicate expected and meaningful (i.e., in terms of scale) renovations associated with the sale event (DRENO). If a major renovation to the hotel was made at or near the time of sale then DRENO = 1 and if there was no renovation then DRENO = 0. To measure hotel amenities and service quality, a series of dummy variables is used to differentiate lower from higher quality hotels into market segments (i.e., chain scale delineations of STR). These are: upper upscale hotels (UUPS); upscale hotels (UPS); upper midscale hotels (UMID); midscale hotels (MID); and economy (ECO) hotel market segments (i.e., chain scales). For example, if the hotel is in the upper upscale hotel segment, then UUPS = 1 otherwise UUPS = 0. We measure hotel quality relative to using luxury hotels as the benchmark.[5]

Based on economic institutions and findings in the real estate academic literature, we expect older hotels to have a lower purchase price. A higher purchase price is expected for larger hotels, for hotels designated a historical landmark, hotels located near water or in the CBD, those with a higher walk score, or hotels with prospective major renovations. We expect the hotel prices to decrease as hotel quality declines along the chain scale spectrum.

Capital Market Rates and Economic Drivers

To develop the income calculations, we drew city discount rates from the Real Estate Research Corporation. A city net operating income (NOI) variable is constructed using STR room revenue and CBRE Hotels expense ratio data during each year.[6] We adjust revenue by one minus the expense ratio of the properties' market segment to link the city NOI to each property.[7]

Other Drivers

Beyond property characteristics and calculations, transaction-specific effects may influence hotel sale prices. These include whether a hotel buyer is a real estate investment trust (DREIT) and whether individual hotels changed ownership as part of portfolio transactions

[2] See: Corgel, Jack B., Crocker Liu, and Robert M. White, 2015. Determinants of Hotel Property Prices, *Journal of Real Estate Finance and Economics* 51(3): 415–439

[3] Ghysels, E., Plazzi, A., Valkanov, R., 2007. Valuation in the US Commercial Real Estate, *European Financial Management* 13(3), 472-497.

[4] For details on the methodology that walkscore.com uses, see https://www.walkscore.com/methodology.shtml.

[5] Independent hotels are assigned to a chain scale category.

[6] We note that there is a family of valuation models based on incomes generated by hotel properties. Our income models include components of the widely used discounted cash flow model (DCF). We ran a comparative analysis pitting our income based model against DCF runs, as is standard in the real estate appraisal industry. Our regression analysis uses an income-based variant, and we explain the appendix our income-based model that is not the exact DCF form.

[7] The city NOI is calculated as $NOI_{it} = Rev_{City,t} * (1- OR_{Market\ Segment\ i,t})$ where NOI_{it} is the city NOI assigned to property i in period t, $Rev_{City,t}$ is the city total revenue in period t, and OR is the operating ratio for the applicable chain scale for property i in period t.

Exhibit 1

Two-stage least squares (2SLS) approach

Equation	R-squared	R-squared
Log of Price	.771	.775
Log of NOI	.298	.298
	Model 1	**Model 2**
	Y=Log of Price	**Y=Log of Price**
Hotel Drivers		
NOI (Log of)	Positive; Significant	Positive; Significant
Discount Rate (Log of)		
Number of Rooms	Positive; Significant	Positive; Significant
Effective Age	Negative; Significant	Negative; Significant
Effective Age Squared		
Number of Employees	Positive; Significant	Positive; Significant
Located in CBD	Positive; Significant	
WalkScore (Location)		Positive; Significant
Landmark Status	Positive; Significant	Positive; Significant
Located near Water	Positive; Significant	Positive; Significant
Major Renovation	Positive; Significant	Positive; Significant
Upper Upscale	Negative (-.33); Significant	Negative (-.39); Significant
Upscale	Negative (-.69); Significant	Negative (-.74); Significant
Upper Midscale	Negative (-.97); Significant	Negative (-1.07); Significant
Midscale	Negative (-1.10); Significant	Negative (-1.18); Significant
Economy	Negative (-1.55); Significant	Negative (-1.65); Significant
Buyer is a REIT	Positive; Significant	Positive; Significant
Sold as part of a Portfolio	Positive; Significant	Positive; Significant
Intercept Term	Positive; Significant	Positive; Significant

Notes: Endogenous variables are the log of price and the log of net operating income. Exogenous variables include the hotel drivers listed as well as year of sale dummy variables (2006-2010) which are not reported

(DPORT). To account for these effects, we coded dummy variables as follows: if a hotel buyer is a REIT, then DREIT = 1 otherwise DREIT = 0, and if the hotel sold was part of a portfolio of properties that were sold together, then DPORT = 1, otherwise DPORT = 0.

We examine whether buyers demand discounts if a property is sold as part of a portfolio (DPORT) because the composition of the portfolio may result in a single property's price being different than the price if the hotel were sold independent of other assets. We also evaluate the extent of economic activity in the immediate surrounding area of the sold hotels, focusing on the daytime employment base (i.e., number of employees) within a three-mile radius of the hotel location with data collected by CoStar. The higher the daytime employment base, these data show, the greater the potential demand for hotel rooms and logically higher selling prices.

Model Used for Analysis

The appendix of this report presents a theoretical model of property valuation that supports our empirical specification of blending property characteristics and capital market effects. To test this model, a two-stage least squares (2SLS) approach is used to address potential endogeneity problems that may result from blending these variables in one parameter estimation system. An extension of simple linear regression, 2SLS is used since the dependent variable's error term is correlated with our independent variables. The resulting 2SLS empirical specification also appears in the appendix. To explore which variables are the most important drivers of hotel value in

Exhibit 2

Shapley percentage contributions

Walk Score Model			CBD Proximity Model		
Factor	Shapley Value	Percentage	Factor	Shapley Value	Percentage
Group 1	0.16039	20.47%	Group 1	0.15287	19.56%
Group 2	0.02319	2.96%	Group 2	0.02314	2.96%
Group 3	0.04933	6.30%	Group 3	0.04789	6.13%
Group 4	0.01461	1.87%	Group 4	0.01413	1.81%
Group 5	0.0199	2.54%	Group 5	0.0203	2.60%
Group 6	0.01802	2.30%	Group 6	0.01769	2.26%
Group 7	0.2088	26.65%	Group 7	0.20589	26.34%
Group 8	0.03144	4.01%	Group 8	0.03019	3.86%
Group 9	0.01476	1.88%	Group 9	0.01424	1.82%
Group 10	0.19454	24.83%	Group 10	0.18518	23.69%
Group 11	0.04857	6.20%	Group 11	0.07006	8.96%
Total	0.78354	100.00%		0.78159	100.00%

Notes: Group 1 = Number of Rooms, Group 2 = Effective Age of Hotel (including effective age squared) , Group 3 = Number of employees in a three-mile radius of the hotel, Group 4 = whether the hotel has historical landmark status, Group 5 = adjacency to water, Group 6 = Prospective major renovations, Group 7= Hotel quality relative to the Luxury benchmark (using STR hotel scale designations), Group 8 = transaction based activity, whether buyer is a REIT or hotel is part of a bulk portfolio sale, Group 9 = Dummy for year of sale (2006–2010), Group 10 = capital market factors, including the discount rate and cash flow, and Group 11 is location of hotel, including the walk score for the walk score model and a dummy variable for whether the hotel is located in the central business district for the CBD proximity model.

descending order of importance, we use the Shapley value regression, which decomposes the regression overall R^2 into the relative percentage contribution to R^2 that each hotel value driver makes.

Primary Findings

We find that the hotel valuation model based on property characteristics performs as well as the model that includes only income model variables. Both models explain between 75 and 80 percent of the variation in hotel asset prices. A plausible explanation for this phenomenon is that hotel cash flows reflect the salient property characteristics, so both models result in a similar value for hotels. We also find that the implicit prices of hotel property characteristics, such as the price per room, vary over time. These implicit prices capture fixed location income streams and income streams associated with city and national economic conditions.

Exhibit 1 shows the results of our 2SLS model. We initially estimated the model (model 1) using CBD location and then replaced the CBD location variable with the walk score variable in the second model (model 2), since both location variables are highly correlated to one another (r = .68). We jointly estimate the hotel price regression and the hotel NOI regression since the two regressions are linked (e.g., the hotel price regression contains NOI as an independent variable). Exhibit 1 also shows that both models account for a similar variation in the price of hotels. The CBD model accounts for 77 percent, while the walk score model accounts for 77.5 percent of the variation in hotel prices. The drivers of hotel prices are identical in both models. Drivers of hotel prices that are positive and statistically significant are NOI, the number of rooms, the number of employees, a CBD location or having a high walk score, proximity to water, having historical landmark status, a prospective major renovation, a REIT buyer, and having the hotel sold as part of a portfolio.

Significantly negative hotel price drivers are the effective age of a hotel and hotel quality segments measured relative to the luxury quality hotel benchmark (which is the omitted variable in this dummy variable system). Significantly positive drivers indicate that as that driver increases, so too do hotel prices. For example, as the NOI of the hotel or the number of rooms in a hotel increases, the price of the hotel also rises. Negative drivers move inversely with hotel prices. The greater the effective age of a hotel, the lower the price a buyer is willing to pay. Not surprisingly, all of our hotel quality segments result in a discounted price (compared to the luxury benchmark). This makes sense since hotel quality is measured relative to the luxury hotel segment. Exhibit 1 shows that the hotel sale price discount (number displayed in parentheses) is larger in the lower hotel quality segment.

Exhibit 2 shows the Shapley hierarchy of variable contributions to R^2. The walk score model and the CBD proximity model reflect similar results: 72 percent of the variation in the price paid for a hotel is associated with property attributes, 24 percent of the price variation is due to capital market factors, and the remainder (4 percent) is related to transaction effects. An alternative interpretation is that three drivers each account for at least 20 percent or more of the variation in the price paid for hotel. Of the three drivers, the hotel quality segment of the sold hotel relative to the luxury hotel segment accounts for 26 percent of the price variation. Capital market factors account for an additional 24 percent of the variation, and the number of rooms represents about 20 percent of the price paid for a hotel.

Practical Implications

Our study finds that using an approach based on comparable sales or an approach based on income results in similar hotel value estimates. However, combining the two models does not result in more precise hotel valuations. Regarding which characteristics are statistically significant drivers of hotel price, a hotel sells for a higher price if it has more rooms, is newer, is located in an area that either has a high daytime employment, has a CBD location (or has a high walk score), or is located near water. Hotels also command higher prices if they are historical landmarks, have undergone a major renovation, were purchased by a REIT, were sold as part of a portfolio, or are in a higher quality hotel segment. We found that there is a hierarchy of descending influence of hotel attributes in driving income and price of hotels. The most important driver of price is the hotel quality segment, followed by capital market factors (discount rate and income) and number of rooms.

Application Example

To demonstrate that our proposed model of hotel characteristics results in a similar estimate of value relative to the discounted cash flow approach, we obtained appraised values based on an income approach (specifically discounted cash flow) from an appraisal firm for five hotels located in the South Atlantic region.[8] Exhibit 3 shows the coefficients for our two alternative hedonic models, the CBD model and the walk score model. For each model we used two variations, one that recognizes the different STR hotel segments, from luxury to economy, and one that does not recognize those segments. This results in four estimation equations— **(1)** coefficients with CBD dummy and chain scale, **(2)** coefficients with CBD dummy without chain scale, **(3)** coefficients with walk score number and chain scale, and **(4)** coefficients with walk score number without chain scale. Both sets of coefficients come from a standard hedonic model without two-stage estimation and no financial variables. These coefficients omit time dummies to neutralize the time factor. The DCF appraisal estimates are from 2015-16 reports. This is why the time dummies are excluded, as our results are essentially period specific. Exhibit 3 shows that for all five hotels, the two estimation models without chain scale work fairly well. The estimated value differs between the CBD model and the walk score model, but the percentage difference between the appraised value based on a discounted cash flow approach and the value estimated from either hedonic model without chain scale is reasonably close when considering that the appraised value has an estimation range of ±15 percent. A caveat associated with the applications of hedonic valuation models is that these models perform best in areas where most hotels cluster in the normal distribution of hotel quality. However, the hedonic valuation models are prone to mispricing at the extremes of the normal distribution—very low quality (economy) hotels and very high quality (luxury) hotels. ■

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[8] That is, Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia, and the District of Columbia..

Exhibit 3

Practical application of hedonic model—a DCF comparison

			South Atlantic Region				
Variable	**Coeff CBD**	**Coeff Walk Score**	**Upper Midscale**	**Upscale**	**Upper Upscale**	**Upscale**	**Luxury**
numemplxxx	0.0005267	0.0005306	65.471	94.130	144.143	11	615
unemprt	-0.033937	-0.033709	3.9	5.5	6.9	6.2	7.4
RM	0.0024486	0.0024945	124	156	275	290	259
EA	-0.0088156	-0.009333	7	12	37	37	61
EASQ	0.0000496	0.0000574	49	144	1,369	1,369	3,721
DCBD	0.219129		1	0	0	0	1
walkscore		0.0039419	89	47	63	35	97
DLAND	0.2382087	0.2199185	0	0	0	0	1
DH2O	0.3705189	0.3623386	0	0	0	1	0
DRENO	0.1122003	0.1105495	0	0	1	0	0
UUPS	-0.4707912	-0.500448	0	0	1	0	1
UPS	-0.8697709	-0.885458	0	1	0	1	0
UMID	-1.265725	-1.295854	1	0	0	0	0
MID	-1.407035	-1.421423	0	0	0	0	0
ECO	-1.814385	-1.849842	0	0	0	0	0
DREIT	0.4026687	0.4125143	0	0	0	0	0
DPORT	0.1462326	0.1478358	0	0	0	0	0
DGATE	0.3222897	0.2847995	0	1	1	0	1
constant	16.92915	16.78994					
	DCF Estimate		$27.3K	$29.0K	$50.3K	$41.1K	$69.8K
Hedonic Model							
CBD Model with Hotel Segments			$10.0K	$15.1K	$28.1K	$17.5K	$43.6K
CBD Model without Hotel Segments			$32.4K	$31.4K	$44.9K	$41.7K	$69.9K
Walk Score Model with Hotel Segments			$10.4K	$15.0K	$29.4K	$17.2K	$41.6K
Walk Score Model without Hotel Segments			$32.3K	$36.4K	$48.5K	$41.6K	$68.6K
Percentage Difference (DCF vs Hedonic)							
CBD Model without Hotel Segments			18.8%	8.3%	-10.7%	1.5%	0.1%
Walk Score Model without Hotel Segments			18.3%	25.5%	-3.6&	1.2%	-1.7%

Notes: numemplxxx = Number of Employees, unemprt = unemployment rate, RM = number of rooms, EA = effective age of hotel, EASQ = effective age squared, DCBD = Located in CBD, WalkScore is based on Location, DLAND = Landmark Status, DH2O = Located near Water, DRENO = Major Prospective Renovation, Hotel Quality is relative to Luxury Hotels (based on STR chain scales), DREIT indicates Buyer is a REIT, DPORT = sold as part of a portfolio), and DGATE indicates a Gateway City).

Technical Appendix: Our Econometric Model

Discounting future net rents to generate current present values is deeply rooted in financial economic theory as adapted for CRE valuation. The basic form of the model is

$$V_0 = \sum_{t=1}^{N} \frac{NOIt}{(1+r)t} \quad (1)$$

where NOI_t is the net operating income at the end of period t and r is the risk-adjusted discount rate. Following McDonald (2005) and multiplying by (1+r), gives

$$V_0 (1+r) = NOI_1 + V_1. \quad (2)$$

Rewriting this equation gives

$$V_0 = (NOI_1 + \Delta V) / r, \quad (3)$$

where $\Delta V = V_1 - V_0$

The period-zero capitalization rate, C_0, comes from solving equation (3), as follows

$$C_0 = NOI_1 / V_0 = r - (\Delta V / V_0). \quad (4)$$

The expression for V_0 can be written in the form below assuming the terminal capitalization rate equals the initial capitalization rate and the Gordon Growth Model takes a general form with percent change in value as follows

$$V_0 = (NOI_1 + \Delta V) / [C_0 + (\Delta V / V_0)]. \quad (5)$$

We present NOI_1 as the composite of systematic effects from the local market and idiosyncratic property-specific effects. Thus,

$$NOI_1 = NOI_{m1} + NOI_{i1} = (R_{m1} - E_{m1}) + (R_{i1} - E_{i1}) \quad (6)$$

where NOI_{m1} and NOI_{i1} represent the NOIs of the local market and individual property, respectively. Each NOI has endemic rent (i.e., R_m and R_i) and expense (i.e., E_m and E_i) components.

Unobservable property NOI^*_{i1} is estimated from location and physical property attributes, Z_i, as

$$NOI^*_{i1} = f(Z_i,). \quad (7)$$

The final expression for V_0 becomes

$$V_0 = [NOIm1 + NOI^*_{i1} + \Delta V] / (C_0 + (\Delta V / V_0) \quad (8)$$

Holding to the assumption that the terminal capitalization rate equals the initial capitalization rate the denominator of this equation (equation 8) may be represented by the discount rate, r. All of the parameters in the equation are estimated using a hedonic specification in which the local market NOI effect is represented, the city rate for present valuing captures both national capital market influences and local risk premiums, property NOI effect is included, and trend and transaction specific characteristics are controlled for through the time-series and other dummy variables, D_t, D_k.

$$\ln(P_i) = \alpha + [\beta^*_1(NOI_{m1}) / \beta^*_2(r0)] + \beta_3 Z_i + f(D_t \ldots D_n, D_k) + e_i \quad (9)$$

Because the present value model structure embedded in Equation (9) is non-linear we take the natural logs of both NOI_{m1} and r_0. The final form is,

$$\ln(P_i) = \alpha + \beta^*_1 \ln(NOI_{m1}) - \beta^*_2 \ln(r_0) + \beta_3 Z_i + f(D_t \ldots D_n, D_k) + e_i \quad (10)$$

Econometric issues encountered when estimating Equation (10) arise from the possibility that NOI_{m1} is correlated with e_i.

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