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A Comparison of Hotel Indices with Hotel Properties and Portfolios

Walter I. Boudry Ph.D.
Cornell University, wb242@cornell.edu

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Abstract

Thanks to the availability of transaction data and the work of Real Capital Analytics (RCA), hotel operators and investors now have access to indices that track the price appreciation of hotels.¹ RCA's data is one basis of the recently developed Cornell Real Estate Market Indices, which track hotel transaction prices. While the technology used to create these indices has been around for decades,² the major limitation was the availability of reliable transactions data. Now that we have such indices, the question this paper seeks to address is to determine the extent to which the indices track a hotel investor's portfolio. By determining how representative these indices are of the price appreciation we actually observe in hotels, we can examine the usefulness of these indices for benchmarking a hotel investor's portfolio.

Keywords

Cornell, real estate, finance, Real Capital Analytic, hotels

Disciplines

Real Estate

Comments

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by Walter I. Boudry

EXECUTIVE SUMMARY

The development of hotel real estate indices raises the possibility that investors could benchmark hotel price appreciation using hotel indices. However, individual hotel property transactions are poorly tracked by the aggregate hotel index that is available. Moreover, for individual assets, the level of tracking error is larger for hotels than non-hotel properties. Forming portfolios reduces tracking error quite dramatically, but the level of tracking error for hotel portfolios still appears to be higher than for other commercial properties. These results demonstrate that indexing individual properties is difficult, since any individual hotel investment is unlikely to perform like an aggregate index. However, it may be reasonable to compare a portfolio aggregate hotel indices. In that instance, this would require a fairly large portfolio of hotels where the properties are of approximately the same value.

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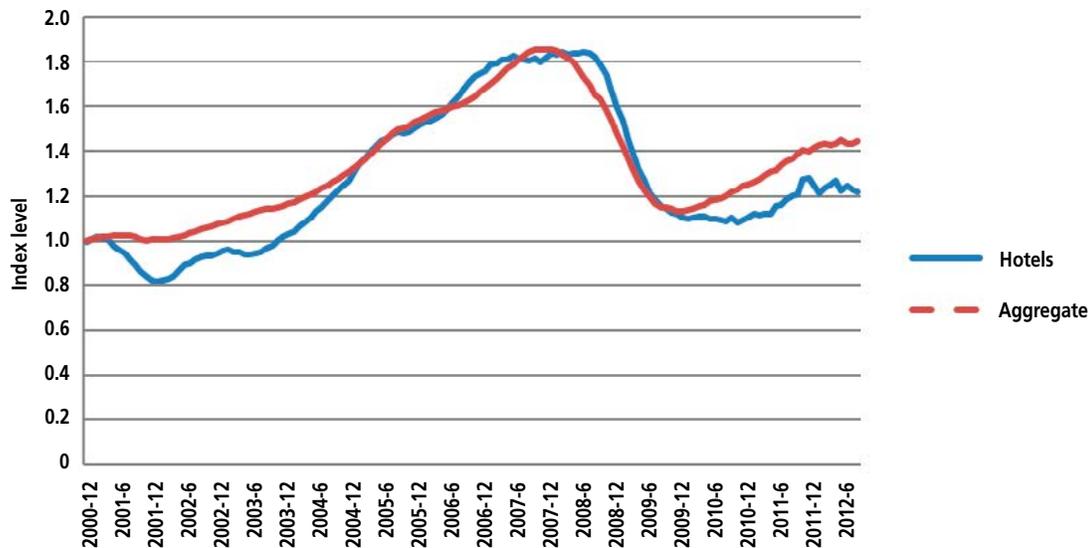
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Thanks to the availability of transaction data and the work of Real Capital Analytics (RCA), hotel operators and investors now have access to indices that track the price appreciation of hotels.¹ RCA's data is one basis of the recently developed Cornell Real Estate Market Indices, which track hotel transaction prices. While the technology used to create these indices has been around for decades,² the major limitation was the availability of reliable transactions data. Now that we have such indices, the question this paper seeks to address is to determine the extent to which the indices track a hotel investor's portfolio. By determining how representative these indices are of the price appreciation we actually observe in hotels, we can examine the usefulness of these indices for benchmarking a hotel investor's portfolio.

¹ See RCA's web page https://www.rcanalytics.com/public/rca_indices.aspx. The Center for Real Estate and Finance at Cornell has also developed its own hotel index: C.H. Liu, A.D. Nowack, and R.M. White Jr., "Cornell Real Estate Market Indices" <http://www.hotelschool.cornell.edu/industry/centers/cref/publications/reindex/indices.html>

² See for example: M. Bailey, R. Muth, and H. Nourse, "A Regression Method for Real Estate Price Index Construction," *Journal of the American Statistical Association*, Vol. 58 (1963), pp. 933-942; K. Case and R. Shiller, "The Efficiency of the Market for Single-Family Homes," *The American Economic Review*, Vol. 79 (1989), pp. 125-137; and S. Rosen, "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition," *Journal of Political Economy*, Vol. 82 (1974), pp. 34-55.

Real Capital Analytics Commercial Property Price Index (CPPI)



Hotel transactions generally track those of other commercial real estate, as shown in Exhibit 1, which shows the RCA Commercial Property Price Index (CPPI) aggregate and hotel indices for the period 2000 to 2012.³ One could say that these indices measure the price appreciation of the theoretical “representative” property over the sample period. In this sense the aggregate index should measure what is happening to commercial real estate in general (office, retail, industrial, and multifamily), while the hotel index should measure what is happening to hotels. With this in mind the two indices appear to be quite reasonable. The effects of the terrorist attacks of September 11, 2001, and the recession of the early 2000s are evident in the hotel index as is the global financial crisis and the subsequent recession, starting in 2008.

One of the motivations for developing indices like these is for industry participants to be able to benchmark the price performance of their properties. Eventually, the indices could be the basis of a fully fledged derivatives market that would allow industry participants to hedge or speculate on underlying properties using these indices. Thinking of the indices in this way naturally brings to the fore the issue of tracking error. Consequently, I study how well the index matches returns on individual properties and on portfolios of properties. Although I have framed the question in terms of tracking error, it can just as easily be thought of from the perspective of whether it makes sense for investors to expect

³ www.rcanalytics.com/public/rca_indices.aspx

their hotels or hotel portfolios to have capital returns that are well approximated by these indices.

Data and Methodology

I obtain property transactions data from Real Capital Analytics and CoStar, the two leading transaction data bases, for the period 2000 through 2012. I then create repeat-sales pairs by matching sales at the same property address over time. As is conventional, I include only sales of complete interests, and exclude portfolio sales, sales of properties that have a resale window of less than 1 year, and non-arm’s length transactions. This methodology is similar to that found in the Cornell Real Estate Indices. This leaves 936 repeat sales in the sample, as described in Exhibit 2. I calculate annualized holding period returns to make the price appreciation of properties held for different lengths of time comparable. The annualized holding period return is calculated for each property as,

$$\left(\frac{P_S}{P_B}\right)^{\frac{1}{i}} - 1,$$

where i is the number of years between the end of the year of purchase and the end of the year of sale, P_S is the price at sale and P_B is the price at purchase.⁴

⁴ The reason for matching on an annual frequency is that later when I estimate portfolios using repeat sales windows, I will require annual matching to obtain enough properties in each window to form portfolios. So while it does create some matching error compared to matching on a quarterly basis, this error should be the same for the hotel and the non-hotel sample.

Sample and index return statistics

	Observations	Mean	Median	Std Dev	Min	Max
Property	936	11.6%	9.9%	21.1%	-63.0%	197.4%
Hotel Index	936	8.4%	10.2%	10.1%	-15.6%	24.6%
Aggregate Index	936	6.1%	10.1%	8.1%	-17.4%	15.0%

Exhibit 2 also reports the return on the RCA CPPI hotel index and RCA CPPI aggregate index over the same holding period as the properties. The row labeled Property reports the returns on individual hotels, while the Hotel Index line provides the return an investor would have received if they instead held the hotel index over the same time. Similarly, the Aggregate Index line provides the returns an investor would have received if they instead held the aggregate RCA index.

A few things are noticeable from Exhibit 2. First, individual hotel returns are larger than index returns on average, and approximately the same for the median. The mean annualized holding period return is 11.6 percent for the individual hotels, only 8.4 percent for the hotel index, and 6.1 percent for the aggregate index (9.9%, 10.2%, and 10.1% for the median.) This difference in average returns between individual properties and indices is similar to that which my colleagues and I observed for non-hotel properties in an earlier study.⁵ It is possible that systematic biases exist between our sample of hotels and those used to construct the hotel index. That is, the representative property in the index doesn't look like the representative property in our repeat sales sample. However, this is the problem that any investor will face, because they will not know the exact composition of the properties underlying the index.

Second, as is to be expected, there is much more volatility at the property level. The standard deviation is over twice as large at the property level as it is at the index level, and both minimums and maximums are more extreme.

The obvious implication of Exhibit 2 is that it appears that trying to benchmark an individual property using an aggregate hotel index is likely to be quite difficult. Average price appreciation appears to be different and the extreme variation in price appreciation at the property level compared

to the index level suggests there is likely to be a large tracking error.⁶ However, it is possible that this variation could be mitigated by forming portfolios of hotels. While the average difference is likely to persist, forming portfolios may reduce volatility through diversification allowing for a better match between the index and the portfolio.

Portfolio Formation

The approach I adopt to examine portfolio returns is the one I developed with my colleagues in the study I just mentioned.⁷ In this study, as previously, I develop random portfolios using the properties that share the same holding period repeat sales window. By this definition, all the properties purchased in 2003 and sold in 2007, for instance, would form one repeat sales window. Within each repeat sales window, random portfolios containing different numbers of properties can then be created from the properties in that window, ranging from one to all of them. The ability to form portfolios containing different numbers of properties is what allows an examination of the issue of diversification because I can examine changes in tracking error as the number of properties in a portfolio increases.

For each repeat sales window and for each level of portfolio diversification (that is, number of properties in the portfolio), the tracking error or root mean squared deviation (RMSD) between the portfolio and the index is calculated as

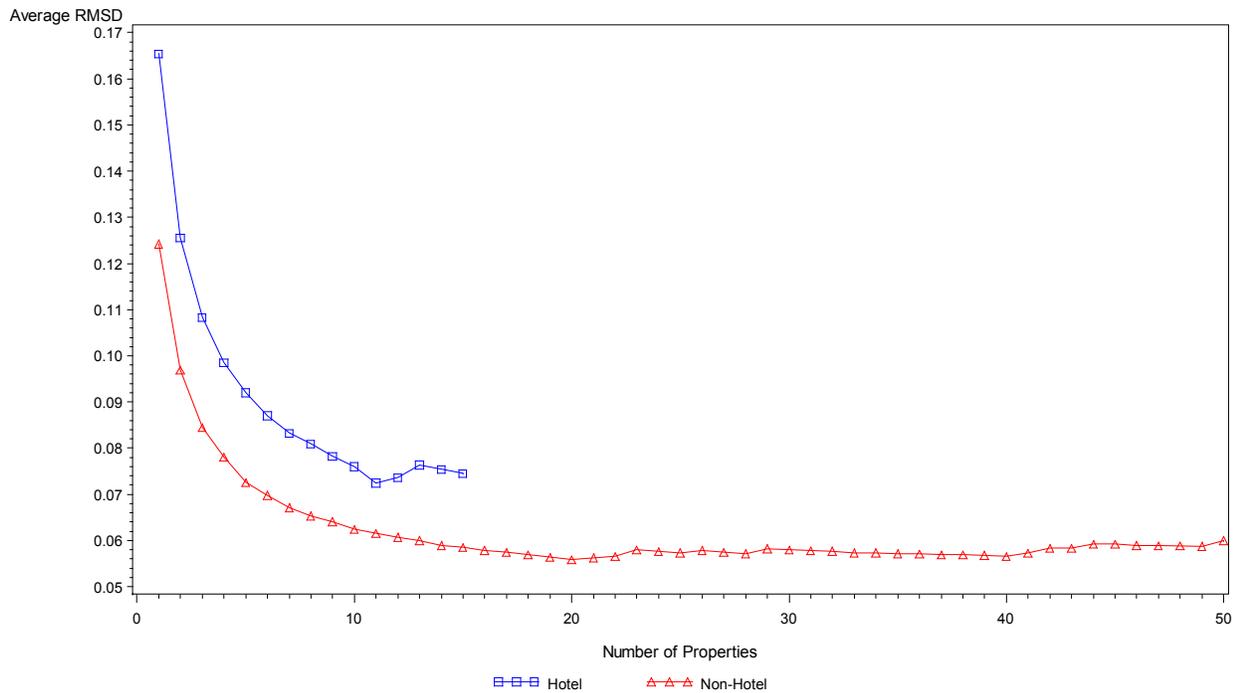
$$RMSD = \sqrt{\frac{1}{1000} \sum_{i=1}^{1000} (R_i^P - R^I)^2}$$

⁶ Note that pricing models have been developed to try and minimize these errors. For example, Cornell's Center for Real Estate and Finance produces the HOTVAL Toolkit <http://www.hotelschool.cornell.edu/industry/centers/cref/publications/tools/> that uses specific hotel characteristics to estimate a hotel's price. However, notice that such a model will also have mispricing, but more importantly, such models aren't designed as transparent public indices with which one could potentially index a property or portfolio.

⁷ Boudry et al., op cit.

⁵ W.I. Boudry, N.E. Coulson, J.G. Kallberg, and C. H. Liu, "On Indexing Commercial Real Estate Properties and Portfolios," *Journal of Real Estate Finance and Economics*, forthcoming (2013).

Tracking error of hotel and aggregate indices, based on portfolio size



where R_i^P is the annualized return on portfolio i and R^I is the annualized return on the matched index in a given repeat sales window.⁸

Having calculated the RMSD for each level of portfolio diversification for each repeat sales window, I then average across the repeat sales windows for a given level of diversification to calculate the average RMSD. Applying this analysis to portfolios that contain different properties and that occur over different calendar periods reduces the likelihood that the results are driven by a small set of properties or individual time periods. Intuitively, the average RMSD measures the average tracking error an average investor is likely to face when benchmarking a buy and hold portfolio of hotels containing a given number of properties.

⁸ The 1,000 appears in the RMSD formula because we form 1,000 random portfolios for each level of portfolios diversification in each repeat sales window. For portfolios of only one property there will obviously be resampling in the 1,000 portfolios. Technically, $n!/k!(n-k)!$ random portfolios containing k properties can be drawn from a window containing n total properties without repetition.

Results

In short, the tracking error was largest for small portfolios, notably, portfolios of one property, as shown in Exhibit 3, which reports the portfolio analysis results. The vertical axis measures the average RMSD or tracking error, while the horizontal axis shows the number of properties in the portfolio. The blue line measures the average RMSD between hotels and the hotel index, while the red line measures the average RMSD between “other” properties and the aggregate index.⁹ The red line provides the benchmark for what we observe in the rest of commercial real estate, so we can compare how a hotel investor would fare compared to an investor in other commercial properties. Because there are more property transactions for non-hotels, we are able to examine portfolios with greater numbers of properties for the non-hotel sample. This is why the red line extends further than the blue line.

Three results are apparent from Exhibit 3. First, as was suggested by the results in Exhibit 2, individual hotel properties are not well tracked by the hotel index, as indicated by

⁹ Other properties include apartment, office, industrial, and retail properties in the CoStar and RCA databases.

the high tracking error for portfolios containing a single asset. Second, portfolio formation helps reduce tracking error quite dramatically, as is evident from the steep downward slope of the blue line. Although I am able to form portfolios only of a modest size for the hotel sample, even a portfolio of 15 hotels cuts the tracking error by 54 percent. This compares to a 52-percent reduction for other commercial properties. Finally, the tracking error for hotels appears to be higher than for non-hotels regardless of the level of diversification, as indicated by the position of the blue line above the red line. So although forming portfolios helps, a hotel investor still fares worse than a non-hotel investor when it comes to tracking error. This may be due to the limitations inherent in constructing the hotel index. Both the hotel index and the hotel portfolios have fewer underlying transactions than the overall indices. This makes the hotel sample more susceptible to individual extreme observations than the non-hotel sample.

Practical Implications

The chief implications of this study involve the effect of portfolio size. For individual hotels, tracking error is significant. This suggests that trying to benchmark price appreciation of individual hotels using a hotel index is going to be fraught with difficulty. These indices appear to capture what is on average happening in the hotel market, but I find a large cross-sectional dispersion in performance at the individual asset level. In short, it would be unwise to expect any individual

hotel to look like the index. The obvious corollary to this is that it also means that there is a great ability through diligent asset selection and management to outperform these indices.

By contrast, the index tracks a reasonably large portfolio of hotels relatively well. The rapid decline in tracking error as more properties are included in the portfolio suggests that hotel index returns may be a reasonable approximation for the returns on fairly large portfolios. There is, however, a serious caveat to this result. All the results presented are for equally weighted portfolios (that is, portfolios where all the properties have the same weight). From a practical perspective, investors are more likely to care about value weighted returns, because these are the returns they actually receive. This necessitates that the portfolio that an investor holds has assets that are of roughly equal value. If a portfolio is dominated by an individual asset, then this is essentially the same as having a portfolio of just one asset, which following the first point above, is unlikely to be well matched by the index.

While the results of the paper may appear rather pessimistic towards the construction and application of aggregate hotel indices, I do not view them in this way. Rather I see these results as being more of a warning against abusing the data—notably to infer the performance of a single hotel investment. We can use the indices to understand what is happening to hotel prices at the aggregate level, for instance. Used in the right way they are likely to be quite useful. Abused, they are likely to lead to spurious conclusions. ■



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Center for Real Estate and Finance
Cornell University
School of Hotel Administration
389 Statler Hall
Ithaca, NY 14853

Phone: 607-255-6025
Fax: 607-254-2922
www.cref.cornell.edu

Robert White
President
Real Capital Analytics

Conley Wolfsinkel
Strategic Management Consultant
W Holdings

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Robert Springer '99
Senior Vice President—Acquisitions
Sunstone Hotel Investors

SushTorgalkar '99
Chief Operating Officer
Westbrook Partners

ABOUT THE AUTHOR



Walter I. Boudry, Ph.D., is an assistant professor of real estate in the School of Hotel Administration. Prior to joining the School of Hotel Administration, he taught both undergraduate and graduate real estate courses at the University of North Carolina at Chapel Hill's Kenan-Flagler Business School and New York University's Leonard N. Stern School of Business. His research interests include real estate and general finance. His most recent works have focused on Real Estate Investment Trusts (REITs) and have examined their repurchase decisions, dividend payout policy, security issuance decisions and price dynamics. A regular presenter and discussant at the annual AREUEA meetings, his papers have been published in *Real Estate Economics*, *Journal of Real Estate Finance and Economics*, *Journal of Corporate Finance*, and *Journal of Business Finance and Accounting*.

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