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Financial Impact of LEED and Energy Star Certifications on Hotel Revenues

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ABSTRACT

This paper examines the topline performance of a cross-section of hotels in the United States from 2009-2013 to test whether green certified properties, LEED or Energy Star, generated revenue performance premiums over non-certified hotels. In other words, does it pay to be green? Regressions included regional, class, chain scale, size, and location controls. Custom comparable clusters were also separately tested. Results show that LEED labeled hotels experience higher ADR but lower occupancy rates, resulting in a statistically insignificant difference in RevPAR. Energy Star labeled buildings consistently showed higher occupancy.

Keywords: LEED, Energy Star, Green, financial performance, hotels, sustainability

Financial Impact of LEED and Energy Star Certifications on Hotel Revenue

ABSTRACT

This paper examines the topline performance of a cross-section of hotels in the United States from 2009-2013 to test whether Eco-labeled (LEED or Energy Star, in particular) properties generated revenue performance premiums over non-certified hotels. In other words, does it pay to acquire these labels? Regressions included regional, class, chain scale, size, and location controls. Custom comparable clusters were also separately tested. Results show that LEED labeled hotels experience higher ADR but lower occupancy rates, resulting in a statistically insignificant difference in RevPAR. Energy Star labeled buildings consistently showed higher occupancy.

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1 INTRODUCTION

Consciousness about sustainability has widened from environmental sciences to the disciplines of engineering, public policy, energy and more recently, into business. Earlier perception of sustainability was dominated by the notion of corporate social responsibility (CSR). However, positive "bottom-line" and "top-line" impacts of sustainability were established soon after[1]. Real estate sector, for example, has shown value-enhancing impacts of sustainability ("green" attributes in particular) on price, rental, occupancy rate and capitalization rates[2]. However, most of these studies are based on office buildings. In social sciences, tourism researchers were among the earliest to examine the business benefits of green practices[3]. Since 21% of carbon emissions in the tourism sector are attributed to hotels (Han, Hsu, Lee & Sheu, 2011), several studies have focused on green attributes in the hospitality sector. A large segment of research in this area examines customer attitude and willingness-to-pay for green features in hotels.

In the commercial real estate sector, CSR and business performance are closely intertwined. Enterprises with sustainability agendas are willing to offer green premium on rents as tenants. Increased appetite for sustainability also enhances occupancy rates and suppresses capitalization rates. These are the top-line enhancing phenomena. From the green price premium standpoint, however, hotels are different. First, hotel customers, leisure as well as business, consider the price as one of the strongest criteria for hotel selection (Lockyer, 2002; Lockyer, 2005). Second, hotel leases are very short (one or more nights)

[1] For example, see Elkington (1997), Simons, Robinson and Lee (2014)
[2] Studies are discussed in the following section.
[3] E.g. Branwell and Lane (1993)

compared to office leases which are typically 3-5 years, but may have terms as long as 20 years. Therefore, customers may not perceive substantial CSR-related benefit from price premiums in green hotels. However, frequent travelers and business customers may have some preference for green hotels and the overall impact on the prices will depend on the representation of such customers.

It must be noted that LEED and ES are real estate eco-labels focusing on the construction and operation of the physical real estate asset. ES focuses particularly on energy-saving features[4]. LEED focuses on additional aspects such as storm water management, waste management, regional materials, heat island effect, open spaces, etc[5]. Although these labels lack sufficient focus on hospitality specific services such as food supply chain, socio-ethnic components, etc., LEED and ES offer a globally recognized tool to identify properties based on their respective sustainability criteria and substantially remove the subjectivity in classifying buildings as "sustainable" or "green". Besides, most empirical studies on sustainability have adopted these "eco labels" for measuring the economic implications of sustainability. Remainder of this paper refers to ES or LEED "eco labeled" hotels as "green" or "sustainable".

In earlier studies (Manaktola and Jauhari, 2007; Han, Hsu and Lee, 2009; Han and Kim, 2010; Lee, Hsu, Han & Kim, 2010), hotel customers show their preference for green hotels. However, the financial implications of these findings are ambiguous. One source of ambiguity stems from the fact that "saying is one thing; doing is another", as reported in Boote and Mathews (1999), Bosson, Haymovitz and Pinel (2004) and Pager and Quillian (2005).

[4] http://www.energystar.gov/buildings/about-us/energy-star-certification
[5] http://www.concretethinker.com/solutions/LEED-Certification.aspx

Besides, the definition of "sustainable" or "green" hotels may be fluid rendering it difficult to statistically observe the premiums in a controlled environment. Concurrently with this study, Walsman, Verma and Muthulingam (2014), published a report titled: "The impact of LEED Certification on Hotel Performance" using Smith Travel Research Data. Recognizing the data limitations, the researchers make some tentative conclusions indicating a RevPAR[6] premium for the LEED[7] hotels in the sample compared to the non-LEED hotels. The researchers make some tentative conclusions indicating a RevPAR premium for the LEED hotels in the sample compared to the non-LEED hotels. However, acknowledging limited sample, they encourage further research on the subject, such as segmenting the sample and longer period of analysis.

1.1 Purpose of the Study

The inconclusive evidence on a hotel's ability to command revenue premiums and the emergence of substantial anecdotal evidence (presented above) related to improved demand for green hotels leaves a gap in the understanding of the impact of green labels on the performance of hotels which this study seeks to fill. This study exploits the relatively recent growth[8] of eco-labels (certifications) such as LEED and Energy Star (ES) in the hotel sector as well as detailed financial statement data on hotels provided by the Smith Travel Research (STR). The purpose of this paper is to examine the topline performance of a cross-section of hotels in the United States from 2009-2013 to test whether green certified properties, LEED or Energy Star, generated revenue performance premiums over non-certified hotels. In other words, does it pay to be green? In particular, this study examines the RevPAR,

[6] REVenue Per AvailableRroom
[7] Leadership in Energy and Environmental Design; a green building certification
[8] Houdre and Singh (2002)

occupancy rate and average daily rate (ADR) performance of 1,540 US hotels between 2009 and 2013; 268 of which are "eco-labeled". The study controls for known determinants of hotel pricing in a series of fixed-effects and random-effects panel data models. It also uses STR comparable sets to analyze differences of means between green and non-green hotels.

The study includes all LEED and ES certified hotels through 2013 and has multiple year observations where possible. Repeat-observations are controlled econometrically as described later. This study differs from Walsman, Verma and Muthulingam (2014) in several aspects. First, Walsman, et al. (2014) includes 93 LEED-labeled hotels and 514 comparables while our sample size is substantially larger: we examine 259 Eco-labeled hotels (which also includes 55 ES-labeled hotels in addition to LEED) against their 1,272 non-labeled comparable hotels. We are able to examine the green-premium phenomena in fine granularity in the presence of a set of known determinant variables of hotel performance. Second, while Walsman et al. (2014) is primarily based on descriptive statistics; we build further on it by applying inferential statistics. We do so to appreciate that hotel performance metrics (ADR, RevPAR and Occupancy rate) evolve in a complex set of multivariate environment where the impact of other variables must be controlled for before drawing inferences about the association between eco-labels and hotel performance. Our study explains that although eco-labeled hotels may, in preliminary observation, seem to enjoy higher RevPAR on average, such a premium may not be necessarily attributed to their green labels. In contrast, we show that eco-labeled hotels have significantly higher ADR, but significantly lower occupancy rate. As a result, the RevPAR premium is insignificant in eco-labeled hotels.

1.2 Definitions for Eco Label Used in the Study

Energy Star (ES) for Hospitality is a voluntary program sponsored by the Environmental Protection Agency (EPA) and the Department of Energy (DOE) which offers benchmarking services to encourage hotels to improve their energy efficiency. High performing hotels have the potential to earn an ES label and recognition by being listed on the program's website. In addition ES labels act as qualifiers for some other certification programs (Berg, 2012). The Leadership in Energy & Environmental Design (LEED) is a green building rating system sponsored by the US Green Building Council (USGBC). As a third party certification program and an internationally recognized benchmark for the design, construction, and operation of high performance green buildings, LEED promotes a whole-building approach to sustainability which recognizes building environmental and energy performance in five areas: sustainable site development and management, water usage, energy efficiency, material selection and indoor air quality (Berg, 2012).

The remainder of this paper is structured as follows: the next section offers a detailed literature survey in the area of sustainability premiums in real estate as well as hospitality sectors. The following section describes the sources and the nature of data which is followed by a section that describes our methodology. The last two sections offer discussion and conclusions respectively from our analyses.

2 Literature Review

2.1 Environmental Management in Hotel Industry

In an early study, Chan and Lam (2002) estimates the quantity of pollutants that the hotel industry produces through electricity consumption and points out its inadequacy of green

measures in dealing with pollutants. Since then, a number of internationally based studies have built the ground work for research in this area. Rivera (2002) shows that hotels which adopted a voluntary environmental program in Costa Rica experienced price premiums. Through a survey of 349 hoteliers in Sweden and Poland, Bohdanowicz (2006) shows increased recognition for environmental protection needs. Based on a study of Spanish hotels, Claver-Cortès, Molina-Azorin, Pareira-Moliner and Lopez-Gamero (2007) show that hotel performance levels is not associated with the degree of environmental proactivity, but by growth in it. Ergodan and Baris (2007), through interviews, point out that hoteliers in Ankara (Turkey) exhibit lack of environmental awareness. Tzschentke, Kirk and Lynch (2008) study decisional factors in small hospitality operators in Scotland. They report that accreditation to the Green Tourism Business Scheme (GTBS) is value-driven and influenced by environmental consciousness. A survey of 73 accommodation managers (Erdogan and Tosun, 2009) finds low environmental performance and lack of awareness about environmental protection in Goreme Historical National Park (Turkey). Using cluster analysis and ANOVA of 301 3-to-5-star hotels in Spain, Tari, Claver-Cortes, Pereira-Moliner and Molina-Azorin (2010) report that hotels performance are influenced by environmental practices. Garay and Font (2012) conducted a survey of accommodation managers in Spain. They report that while the corporate social responsibility (of which environmental responsiveness is a part) is mostly altruistically motivated, competitiveness also plays some role in it. Rahman, Reynolds and Svaren (2012) show that compared to independent hotels, chain hotels were more likely to adopt green practices. Leonidou, Leonidou, Fotiadis and Zeriti (2013) show that environmentally-friendly marketing strategies in Greek hotels depend on sufficiency of physical and financial resources. Besides, such strategies become

stronger in competitive situations. Gao and Mattila (2014) find a moderating effect of green hotels on customer satisfaction. Blackman, Naranjo, Robalino, Alpizar and Rivera (2014) state: "…we know little about tourism operators' economic incentives to get (green) certified." They apply panel data analysis and find that green certification spurs new hotel investments in luxury hotels. Investigating the hotel guests' intention formation when selecting an environmentally responsible hotel, Han and Yoon (2015) offer a model with superior prediction model compared to the "Model of Goal-directed Behavior."

2.2 Direct Financial Impact of Green Certifications

Several empirical attempts have been made on examining the operational and financial premiums of green buildings. These studies recognize green buildings based on their certifications such as ES or LEED. Some studies (e.g. Eichholtz et al. 2010; Fuerst et al., 2011; Das et al. 2014) report price premium enjoyed by green buildings, with some evidence of differential premiums in different value categories (Robinson and McAllister, 2015). Despite a widespread finding about higher operating costs in green buildings and their higher development costs (Nikodem and Fuerst (2013), Kok and Jennen (2012), Miller, Pogue, Saville and Tu (2010) and Wiley et al., 2010), the key to price premiums must lie in substantially higher rental and occupancy rates. The intangible branding or psychological aspect is an additional explanation offered in Das et al. (2014) and Reichardt (2013). The impact of economy and local attitude is explored in Dippold, Mutl, and Zietz (2014).

There is a stronger empirical support for rental premium in green buildings. Eichholtz, Kok and Quigley (2010) and Fuerst and McAllister (2011) show that ES labeled office buildings enjoy significant rental premium compared to otherwise identical buildings in the

same locality. In particular, Eichholtz et al. (2010) and Wiley et al. (2010) reports rental rate, occupancy rate and selling price premiums in green buildings. Das et al. (2011) find that rental premium on green buildings is significantly higher (2.4%) during down-markets but shrinks substantially during up markets, thus offering a hedge against the market-wide movements. Robinson and Reichert (2015) find that green labels nominally impact appraisal values. Kok and Jennen (2012) observe that buildings which do not have an energy-performance certificate command significantly lower (by 6.5%) rental rates in the Netherlands.

Commercial office buildings offer convenient samples for testing the premiums enjoyed by green buildings. However, there is no statistical evidence that green certification is constrained to specific attributes of properties (Robinson and Sanderford, 2015). Clearly, hotels and office buildings operate differently (deRoos, Liu, Quan and Ukhov, 2014). Yet, whether the underlying phenomena should apply to all property types is an open question. Some studies such as Brounen and Kok (2011) have established green price premiums in homes and some have identified mortgage benefits to green labels (Sanderford, et al 2015). However, literature on green premium in prreseoperty types other than commercial offices is limited.

3 Data and Descriptive Statistics

STR Global, a leading hotel information services provider, supplied monthly RevPAR, occupancy rate and ADR data of 268 green (LEED or ES labeled) hotels for the period of 2009 to 2013. In addition, STR Global provided anonymized monthly performance of a set of comparable hotels to each of the 268 green hotels. Comparable hotels are selected based on

proximity, pricing (ADR) and hotel features (e.g. size) using STR Global's internal algorithm. The final data includes 1,540 US hotels of which 268 were green and the remaining 1,272 were non-green. Within the "green" category, 204 were reported to STR as LEED-certified, 55 were ES-certified and 9 were dual, having both the certifications. Time series data for a green hotel does not precede the hotel's acquisition of eco labeling (ES or LEED). In other words, only the observations subsequent to a hotel's acquisition of ES or LEED labeling are included in the data, if the hotel is recognized as "green."

Insert Table 1 here

One potential weakness with this data is that the data set provided by STR lists 204 hotels as LEED certified which may exceed the actual certified number. As shown in **Table 1**, the USGBC lists 252 U.S. hotels as submitted for LEED certification. Only 72 of them have a corresponding certification date.

It can be safely assumed that of the 190 New Construction, only completed hotels would be able to provide data, but it cannot safely assumed that *all* hotels completed the certification process. The authors recognize the possibility that some properties identified by STR as LEED-certified may not have completed the process. Due to confidentiality concerns of the individual properties, the data may not be cross-referenced on a property level. Regardless of this potential limitation, the data provided for analysis represents, to the best of our knowledge, the most comprehensive data for eco-label analysis available. **Table 2** provides an overall summary of the data.

Insert Table 2 here

Green hotels over the sample period, on average, enjoy higher RevPAR ($105 vs. $99) and ADR ($152 vs. $140) although similar occupancy rates (68%) when compared with non-green hotels in general. Remarkably, the three measures (RevPAR, ADR and occupancy rate) are consistently higher in dual-labeled hotels ($140, $182 and 75%) compared to the overall sample ($99, $141 and 68%). However, this description should be interpreted with caution as dual certified properties represent only 0.6 % of the total sample. Among singly-labeled hotels, compared to ES, LEED-labels enjoy higher RevPAR ($105 vs. $101) and ADR ($$157 vs. $135), but substantially lower occupancy rate (65% vs. 72%). Mean occupancy levels in LEED-labeled hotels (65%) are lower than the mean of the overall sample (68%) and all other sub-samples including non-green hotels.

3.1 Descriptive Analysis Segmented by Hotel Attribute

In order to further understand sources of revenue differences between green and non-green hotels the sample is segregated into various subsample characteristics. **Tables 3 to 6** present performance data summaries segmented by chain scale, operational model (e.g. franchised, independent), size (number of rooms), and location. The analyses reveal the following interesting insights on the performance differences between Green and Non-Green hotels.

From **Table 3,** the largest absolute revenue performance differential between green and non-green hotels exist in the Upper-Upscale chain scale segment. This is partially in line with Kang, Stein, Yoonjoung and Lee (2012). The ADR for hotels in this segment is about $157, with a RevPAR of $114. While non-green hotels tend to command a slightly lower ADR ($156) than the segment average, green hotels command a sizeable price premium with an ADR of

$166, driven primarily by ES certified hotels. Furthermore, ES hotels have an average occupancy of 79%, compared to the category average of 71%.

It is interesting to note that two chain scale segments: Luxury and Upscale show negative revenue differential between green and non-green hotels. This finding is in contrast to Kang, Stein, Yoonjoung and Lee (2012). Luxury hotels have a category average of $283 and Upscale hotels $118. Green hotels in the Luxury segment had and ADR of $261 whereas non-green hotels achieved $288. For Upscale hotels non green hotels achieved a slightly lower ADR than green hotels ($118 versus $119).

3.1.1 Descriptive Revenue Performance Difference: by Chain Scale

Insert Table 3 here

This phenomenon is more intriguing when reviewing the price differential further down the chain scale to Upper Midscale, where green hotels command a price premium over non-green hotels ($104 vs. $102). For this segment, LEED label was the primary driver for the rate differential. While green hotels in the sample are less, the green hotels have a higher ADR than non-green hotels for both Midscale and Economy hotels.

3.1.2 Descriptive Revenue Performance Difference: by Operating Model

Insert Table 4 here

In **Table 4** the sample is sub categorized by those properties which were either owned or managed by a hotel chain, had a franchise affiliation with a hotel brand or were independently owned and operated without an affiliation. Properties which are independently operated are closer in profile to Upper Upscale or Luxury properties as their

average daily rate is about $197. For these properties green hotels have a room rate premium driven primarily by their LEED certification compared with their non-green counterparts. ($209 vs. $197).

Franchised properties in the sample are similar in rate profile to upscale properties with an ADR of about $113. For franchised properties, green hotels achieve a room rate premium of $7 over their non-green counterparts ($120 vs. $113) with an even higher spread for LEED certified hotels. Chain managed or owned properties do not display a performance premium for green properties compared to their non-green counterparts.

3.1.3 Descriptive Revenue Performance Difference: by Hotel Size

Insert Table 5 here

Based on **Table 5**, large hotels over 500 rooms and small hotels under 150 rooms experience the highest rate premiums by being green. Large green hotels have a RevPAR premium of approximately $14 ($127 vs. $141). This is driven mainly by ES certification and not LEED. Conversely the rate premium for smaller hotels was driven by LEED certification and not ES. **Table 6** displays performance summaries of hotels based on their location. With the exception of resort locations all locations show a clear room rate premium of green versus non-green hotels. The highest rate premiums are for small metro locations, suburban and urban, locations ($32, $16 and $11) respectively. Urban, suburban and small metro hotels are similar to upscale and upper upscale hotels in their rate profile. LEED certification seems to be the primary driver for the room rate premiums for these properties.

3.1.4 Descriptive Revenue Performance Difference: by Location

Insert Table 6 here

4 Research Method

4.1 Dependent Means Test of Green and Non-green Hotel Sets

The descriptive analyses presented above are based on simple means across various subsamples. In the following step, green hotels (subject) are compared to their comparable set of (two to fourteen) hotels on various performance measures (RevPAR, occupancy rate and ADR). In particular, each green subject hotel, H_S, is compared to the mean of its non-green comparable set, H_{CM} as provided by STR[9]:

H_{Si} = Subject Hotel performance measure (e.g. RevPAR, occupancy rate or ADR) of i^{th} green hotel

$H_{Ci,n}$= Comparable Hotel performance measure for n^{th} hotel in the comparable set for Hs_i.

H_{CMj}= Comparable Hotel *mean* performance measure, or $\{H_{Ci,1}, H_{Ci,2},...H_{Ci,N}\}$/ N for the i^{th} subject hotel

Once all the comparable hotel means are calculated, two data sets remain,

$\{H_{S1}, H_{S2}, ..., H_{SN}\}$ and $\{H_{CM1}, H_{CM2}, ..., H_{CMN}\}$

These two data sets are then compared using dependent paired T-Test to examine differences between the means. In many ways this could be considered the most accurate statistical measure for differences between green and non-green hotels. STR Global has already created comparable property sets using generally accepted methods. Well known issues with broad-based regressions such as heterogeneity, multi-collinearity, or omitted

[9] Eco-labeled hotels, if any, from the set of comparables were removed.

variables need not be considered. This process compares whether a green hotel outperforms (underperforms) its local comparable hotels.

4.2 Multivariate Random Effects Regression

Yet, there could be additional confounding factors such as, the dimension of time. Since the time-frame of data collection across hotels is not the same, it is an unbalanced panel data set. Beyond time-dependent variables (such as RevPAR, ADR and Occupancy rate), valuable cross-sectional attributes of the hotels (such as class, segment, size etc.) are also available. Such a data may be analyzed using either fixed-effects or a random-effects model. Therefore, in the next step, our analysis is based on the econometrics appropriate for multivariate, panel-data.

In a fixed-effect model, a hotel's characteristics will be considered to be perfectly correlated with its corresponding dummy variable. By design, all observable as well as unobservable individual effects of hotels in this model will be controlled for using dummy variables which will control for the time-invariant hotel attributes. In random-effects model, the variation between hotels is assumed to be random (rather than specific levels suggested by a fixed-effects model) and uncorrelated with other hotel attributes. In other words, the intercept is permitted to vary with each observation rather than remaining static as in a fixed effect model.

In balanced panels, Hausman tests are often used to determine the appropriateness of fixed or random effects models. Since this is an un-balanced panel, Hausman tests may not be properly implemented. However, analysis of the data shows distinct differences in a number of control measures. As the effect of these controls may vary across regions, sizes,

classes or other control variables; random effects models most appropriately account for these variant differences.

Occupancy rate ($OCC_{i,t}$) and natural logarithms of RevPAR and ADR $\{Ln(RevPAR)_{i,t}$ and $Ln(ADR)_{i,t}\}$ are modeled as the dependent variables $\left(Y_{i,t}\right)$ in variations of the following random-effects model:

$$Y_{i,t} = \alpha + \beta_1 LEED_i + \beta_2 . ES_i + \beta_3 . DUAL_i + \beta_4 . AGE_{i,t} + \sum_{i=1}^{5} \beta_{4+i} CLASS_i + \sum_{j=1}^{5} \beta_{10+j} SEG_i + \sum_{k=1}^{7} \beta_{14+k} REG_i + \sum_{l=1}^{4} \beta_{21+l} SIZE_i + \sum_{m=1}^{2} \beta_{25+m} OPR_i + \beta_{27+p} Y)_{t-1_{t-12}} + \varepsilon_{i,t}$$

Here, subscripts i and t denote individual hotel and time respectively. CLASS refers to various dummy variables specifying the market chain scale (e.g. economy, luxury, etc.) of hotels. The reference dummy with which others are compared is the 'Economy' chain scale. SEG represents dummy variables for location segment (e.g. airport, resort, etc.). The reference category for SEG is 'Urban' hotels. REG refers to geographic regions wherein the 'North-East' region serves at the reference[10]. Hotel sizes in terms of number of rooms are divided into five categories, with the largest ('>500') serving as the reference category. Operational models (OPR) are controlled by two dummies ('Chain Owned and/or Managed' and 'Franchises') compared with the reference 'Independent' hotels. Finally, a trailing twelve month moving average of the dependent variable, occupancy, average daily rate, or RevPAR is included.

Table 7 shows results from a means-comparison examining performance measures between green labeled hotels and the average of their non-labeled comparable set. All

[10] STR lists geographic region definitions on its website

comparisons except one (RevPAR in LEED-labeled hotels) are statistically significant. In general, green-labeled hotels (LEED or ES) enjoy 5% higher RevPAR, 8% higher ADR but, 1% lower occupancy rates compared to similar non-green counterparts. This suggests significantly higher nominal rates and higher overall performance. However, the rate increase may cause the slight discount in occupancy relative to less expensive non-green hotel rooms.

5 RESULTS AND DISCUSSION

5.1 Results from Dependent Means Test of Green and Non-green Hotel Sets

Insert Table 7 here

The tradeoff between occupancy rate and rental rate (ADR, in hotels) in commercial real estate is well documented [11]. An exogenous factor that improves the overall market performance may, however, improve both these measures. An analysis of LEED and ES hotels independently shows substantially different performances between the two. ES labels enjoy 5% higher ADR, 4% higher occupancy rate and 12% higher RevPAR compared to non-green counterparts. Energy Star may be a proxy for superior management (Robinson and Jain, 2015), which could potentially explain the superior RevPAR.

While LEED-labeled hotels enjoy 9% significantly higher ADR, they also experience 3% lower occupancy rates. Roughly, RevPAR may be estimated as ADR*OCC. In this case, the RevPAR in LEED-labeled hotels should be nearly (1+8.8%)*(1-2.7%) ≈1.06 times (i.e. 6% higher than) the RevPAR in non-green counterparts. This is close to the 5% premium found in the comparison. However, the net effect on the RevPAR is statistically insignificant

[11] E.g. see Voith and Crone (1988).

suggesting that the negative effects of lower occupancy rates in LEED-labeled hotels offset the premiums enjoyed in the ADR. It seems that many green hotels may be pursuing premium rents at the expense of occupancy. This contrasts the finding in ES-labeled hotels. A similar finding has been reported by Das and Wiley (2013). The lack of statistical significance on RevPAR at conventional levels, coupled with an economically significant difference of nearly 5%, is likely due to a small number of underperforming hotels increasing the standard deviation. The findings reported above substantiate previous research conducted by Walsman, Verma and Muthulingam (2014) by confirming a positive effect on revenue from both ES and LEED certifications. From a management perspective the results bring us closer to providing evidence of the positive price premium for green hotels.

5.2 Results from Multivariate Random Effects Regression

Table 8 presents the results of multivariate regression analysis using random-effects models using generalized linear model (GLM) procedure. The first column presents results with the logarithm of ADR as the dependent variable. Results indicate LEED-labeled hotels enjoy a nearly 4% premium compared to non-labeled hotels. This suggests that ADR premiums on LEED-labeled hotels may be attributed to a general momentum in ADR for similar hotels. No significant premium on ADR is detected for ES or dual-labeled hotels.

Model 2 examines occupancy rates in a similar model specification. Interestingly, LEED-labeled hotels experience a discount of 1.3% in the occupancy rate. On the other hand, ES labeled hotels enjoy 2.2% occupancy premiums. The final column uses the natural logarithm of RevPAR. No significant premiums or discounts on any labeled hotels are detected.

Insignificant results in dual-labeled hotels may be attributed to a poor representation of such hotels in the dataset. However, despite relatively small representations (204 and 55

hotels respectively) of LEED and ES labeled hotels in the sample, significant findings for ADR or occupancy rates are detected in various models. Findings suggest that while LEED-labeling allows hotels to increase their room-rates; the increased rates, in turn, have an offsetting effect on occupancy rates. The end-result is that the revenues do not exhibit any significant premiums in LEED-labeled hotels. Unlike LEED, Energy-star labels do not enjoy an ADR premium. However, they have significantly higher occupancy rates which are insufficient to translate into significantly higher RevPAR.

Insert Table 8 here

This study also provides some generic insights about the association between various hotel attributes and performance. For example, results show hotel age has a marginally diminishing, but significant negative impact (less than -0.2% per year) on ADR, occupancy rate and RevPAR of hotels. Compared to independent hotels of similar characteristics and locality, chain-operated hotels enjoy 6.2% higher ADR, 5.3% higher occupancy rate and 14.9% higher RevPAR. Franchised hotels do not enjoy a significant ADR premium. However, they experience 4.2% higher occupancy rates and 9.8% higher RevPAR. No significant difference is found between the occupancy rates of economy and midscale hotels. Otherwise, compared to economy hotels, hotels of all classes, similar in other characteristics and location enjoy significant premiums in all measures (ADR, occupancy rate and RevPAR). For example, luxury hotels enjoy 3 times[12] the ADR, 5% higher occupancy rate and 3.3 times[13] the RevPAR compared to economy hotels. Compared to urban hotels, suburban hotels experience substantially lower ADR (-13%), occupancy rate (-7%) and RevPAR (-23%). The [ADR,

[12] $e^{1.09} = 2.98$
[13] $e^{1.2} = 3.32$

occupancy rate, RevPAR] differences compared to urban hotels in airport and interstate hotels are roughly [-19%, 0, -18%] and [-15%, -3%, -18%] respectively. After controlling for other hotel characteristics such as class, segment, location etc., hotel size is broadly insignificant in determining ADR, occupancy rates or RevPAR.

Differing regions are well known to have distinct revenue and occupancy means for their markets. Although results are not displayed, the regression specification controls for regional effects. Broadly, Mid-Atlantic hotels have higher ADR, occupancy rates and RevPAR whereas East South Central the lowest[14].

6 CONCLUSIONS

This paper is aimed at comparing the top-line financial performance of green hotels with their non-green counterparts. A dataset comprised of 1,540 US hotels is analyzed of which 204 are LEED labeled and 54 are Energy Star labeled. Monthly time series data of the anonymized hotels are analyzed using non-parametric comparable analysis and random-effects panel regression models. Regression results suggest varying consumer demand for green labels. In particular, Energy Star labeled hotels enjoy 2% higher occupancy rates and LEED labeled hotels enjoy 4% higher ADR. However, neither premium translates into significantly higher RevPAR. LEED labels also experience significantly (-3% to -1%) lower occupancy rates, potentially impacted by higher room rates (ADR).

6.1 Implications of This Study

[14] Detailed findings for each region are available upon request.

This study has academic as well as industry implications for hotel managers. Academically, we show that analysis of green premium must be conducted with extreme care. Cross-sectional as well as time-series confounds need to be controlled for before drawing inferences regarding the impact of eco-labels on hotel performance. For example, while the descriptive analysis in this study (Table 7) shows significant RevPAR premium in LEED as well as ES-labeled hotels, quickly drawn inferences (such as "LEED label leads to higher RevPAR") may be potentially misleading. When we control for time series and cross-sectional confounds in our panel data analysis (Table 8), the RevPAR premium becomes insignificant.

For hotel managers, the results may offer guidelines for prudent RevPAR-maximization strategies. We understand that RevPAR is broadly the product of ADR and occupancy rates (i.e. RevPAR = ADR*Occupancy). Our study shows that LEED-labeling has opposite impacts on the variables in the right hand side of the equation. Yet, positive impact on the ADR arguably, is driven by revenue managers. On the other hand, negative impact on the occupancy rate is driven by hotel guests who respond negatively to the increased ADR. Arguably, the ADR (supply) response to LEED-labels is optimistic. Strengthening room prices (i.e. ADR) may eventually lead to significant revenue premiums. While strengthening room prices (ADR) may eventually lead to significant revenue premiums, results of the current study should serve as a cautionary note to revenue managers who may assume that green labeled hotels will may be demand inelastic.

6.2 Limitations of This Study

This study has several limitations. Exact timing of when a hotel went green is not available to us. Thus, for some green hotels, some earlier months when it was not green may have added noise to the data. Further, ADR and occupancy rates may suffer endogeneity issues

which may deserve special econometric treatment in addition to those already prescribed. As discussed above, the possibility exists that some LEED hotels are included in the sample which have not completed their LEED certification.

Also, as discussed in the introduction, while there are specific provisions for hotel sector in the LEED system, LEED and ES are not particularly hotel-focused green labels. On the other hand, several regional hotel/tourism-specific eco-labels have evolved in recent years such as Green Key, BIO Hotels, EarthCheck and Steinbock[15]. To the best of our knowledge, none of these certifications is purely an asset level label and this study is limited to LEED and ES certifications as an asset level label, and also due to data availability.

Despite these limitations the study offers robust initial evidence on the top-line performance of green hotels. Although the results offer compelling insights into green hotel performance, they also raise a number of questions for future research.

6.3 Opportunities for Future Research

From an economic standpoint, the results confirm the findings of earlier studies regarding hotel consumer sensitivity to pricing and sustainability. With a view of finance or investment, the study offers an incomplete story. Investors are more sensitive to net incomes than revenues. Arguably green hotels also enjoy lower operating expenses, especially in terms of energy costs. Therefore, whether green hotels enjoy significant income premiums and/or operating efficiencies could be the question of following empirical inquiry. Although this

[15] See: http://www.ecolabelindex.com/ecolabels/?st=category,tourism. Green Key is Canadian based self-reported and focuses primarily on management techniques; they do state they have a 20% building audit rate. Bio-Hotels has a comparatively small footprint exclusively in Europe and primarily focuses on organic food with some energy requirements such as the use of green energy. Earthcheck, an Australian non-profit maintains a tourism certification that appears to focus on management. Steinbock has a five tier "Capricorn" system based on operational criteria.

study employs numerous controls to isolate the green effect on the broad asset class of hotels, it does not offer more than descriptive differences for various segments. Therefore, other potential research questions include the localized effect of green hotels to specific chain scale, location, or size classifications. Further, the potentially offsetting effects of ADR and occupancy shown in the study raise questions regarding the underlying consumer driven factors behind them. What factors cause the ADR to increase? Are they localized to specific business or luxury segments and, if so, what marketing strategies would effectively reach those customers?

It also suggests the market should consider whether LEED and Energy Star are sufficiently branded sustainability labels in the hospitality sector and if the industry should consider developing hospitality specific green labels that may generate more clear value premiums. Future research should explore the interplay between more management focused certifications and building level certifications considering the possibility of a joint or more comprehensive eco-label. That said, given the mixed results provided by recent research on green labels and financial performance, the study provides additional evidence to tilt the argument that there is a higher revenue premium for green hotels. The results could serve as a guide to management revenue decisions when contemplating price changes for green versus non green hotels.

Also, some experts suggest the focus of research in the field of environmental management is gradually shifting from “does it pay to be green” towards “when does it pay to be green.” This shift emphasizes the need for a contingent view of the influence of environmental management on firm performance. For example, there may be some

moderating factors in green premiums such as market cycle or attribute level consumer sustainability preferences.

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Table 1: US LEED Hotel Properties

Type	Listed	Certification Date
New Construction	190	52
Existing Building	38	10
Commercial Interiors	14	4
Core and Shell	3	0
Homes*	6	5
Mid-Rise*	1	1
Totals	252	72

Data source: USGBC Database of LEED Properties (May 2015);
*Version 2008

Table 2. Data Summary of the Full Sample of Hotels in the US (2009-2013)

	All	Non-Green	Green	ES	LEED	Dual
N	1,540	1,272	268	55	204	9
RevPAR	$98.71	$97.7	$105.4	$101.42	$104.8	$139.4
OCC	67.7%	67.7%	67.6%	72.1%	65.3%	74.9%
ADR	$141.29	$139.61	$151.97	$135.16	$156.83	$181.52

Notes: N= number of observations, RevPAR = revenue per available room, OCC = occupancy rate, ADR =average daily rate. Non-Green → hotels with neither LEED nor ES labels. Green → hotels with either LEED or ES label. ES→'Energy Star' labeled hotels; LEED →'LEED' labeled hotels; Dual →Hotels with both 'Energy Star' and 'LEED' labels.

Table 3. Revenue Performance of Green vs. Non Green Hotels: Chain scale (2009-2013)

Segment		All	Non-Green	Green	Dual	LEED	ES
Economy	N	40	36	4	0	2	2
	RevPAR	$38.63	$37.91	$47.36		$75.01	$36.22
	OCC	56%	56%	57%		57%	57%
	ADR	$67.32	$66.74	$74.44		$101.86	$63.40
Midscale	N	105	98	7	0	5	2
	RevPAR	$52.43	$51.51	$65.53		$60.77	$75.91
	OCC	59%	58%	66%		64%	70%
	ADR	$85.92	$85.19	$96.34		$92.60	$104.48
Upper Midscale	N	363	320	43	0	32	11
	RevPAR	$69.43	$69.26	$71.34		$75.05	$65.94
	OCC	66%	66%	67%		67%	67%
	ADR	$102.53	$102.37	$104.37		$109.98	$96.19
Upscale	N	460	362	98	3	76	19
	RevPAR	$84.52	$84.94	$82.16	$78.12	$81.93	$83.29
	OCC	70%	70%	68%	63%	68%	70%
	ADR	$118.34	$118.46	$117.63	$124.59	$117.54	$116.79
Upper Upscale	N	395	320	75	2	53	20
	RevPAR	$113.98	$112.67	$121.32	$167.67	$105.90	$144.35
	OCC	71%	71%	71%	83%	67%	79%
	ADR	$157.34	$155.85	$165.69	$200.18	$156.29	$179.06
Luxury	N	177	136	41	4	36	1
	RevPAR	$198.20	$201.22	$183.94	$171.60	$187.38	$152.79
	OCC	69%	69%	69%	81%	67%	78%
	ADR	$283.28	$287.92	$261.35	$210.21	$272.95	$193.15

Notes: N= number of observations, RevPAR = revenue per available room, OCC = occupancy rate, ADR =average daily rate. Non-Green → hotels with neither LEED nor ES labels. Green → hotels with either LEED or ES label. ES→'Energy Star' labeled hotels; LEED →'LEED' labeled hotels; Dual →Hotels with both 'Energy Star' and 'LEED' labels.

Table 4. Revenue Performance of Green vs. Non Green Hotels: Operating Model (2009-2013)

Segment		All	Non-Green	Green	Dual	LEED	ES
Chain Owned and/or Managed	N	414	323	91	4	68	19
	RevPAR	$124.55	$124.990	$122.60	$180.75	$113.85	$132.95
	OCC	72%	72%	70%	81%	67%	77%
	ADR	$170.40	$170.457	$170.15	$221.65	$166.83	$168.18
Franchised	N	909	773	136	2	101	33
	RevPAR	$77.97	$ 77.46	$ 82.16	$74.03	$82.22	$82.48
	OCC (%)	66%	66%	67%	64%	66%	69%
	ADR	$113.29	$112.544	$119.59	$115.99	$122.00	$115.42
Independent	N	217	176	41	3	35	3
	RevPAR	$131.85	$132.170	$130.14	$121.34	$134.56	$91.06
	OCC	65%	66%	64%	72%	62%	71%
	ADR	$197.21	$196.825	$199.25	$165.10	$209.93	$123.22

Notes: N= number of observations, RevPAR = revenue per available room, OCC = occupancy rate, ADR =average daily rate. Non-Green → hotels with neither LEED nor ES labels. Green → hotels with either LEED or ES label. ES→'Energy Star' labeled hotels; LEED →'LEED' labeled hotels; Dual →Hotels with both 'Energy Star' and 'LEED' labels.

Table 5. Revenue Performance of Green vs. Non Green Hotels: Hotel Size (2009-2013)

Segment		All	Non-Green	Green	Dual	LEED	ES
<75	N	139	121	18	0	12	6
	RevPAR	$77.14	$75.30	$92.46		$123.52	$54.79
	OCC	62%	62%	63%		63%	63%
	ADR	$119.70	$117.31	$139.61		$186.15	$83.17
75-149	N	605	491	114	4	90	20
	RevPAR	$82.17	$80.98	$89.71	$111.60	$92.07	$77.81
	OCC	67%	67%	65%	73%	64%	68%
	ADR	$119.94	$117.63	$134.67	$150.09	$141.03	$112.13
150-299	N	470	399	71	1	62	8
	RevPAR	$105.99	$106.45	$102.58	$91.58	$107.02	$81.46
	OCC	67%	68%	66%	83%	65%	71%
	ADR	$152.16	$152.01	$153.28	$109.08	$162.42	$112.43
300-500	N	208	177	31	1	21	9
	RevPAR	$121.54	$121.42	$122.32	$213.29	$121.71	$113.17
	OCC	70%	70%	70%	79%	68%	73%
	ADR	$168.79	$168.56	$170.37	$268.18	$174.95	$151.33
>500	N	118	84	34	3	19	12
	RevPAR	$130.63	$127.30	$140.52	$165.46	$115.91	$161.79
	OCC	74%	73%	76%	73%	71%	82%
	ADR	$173.42	$170.56	$181.91	$216.39	$161.80	$195.98

Notes: N= number of observations, RevPAR = revenue per available room, OCC = occupancy rate, ADR =average daily rate. Non-Green → hotels with neither LEED nor ES labels. Green → hotels with either LEED or ES label. ES→'Energy Star' labeled hotels; LEED →'LEED' labeled hotels; Dual →Hotels with both 'Energy Star' and 'LEED' labels.

Table 6. Revenue Performance of Green vs. Non Green Hotels: Location (2009-2013)

Segment		All	Non-Green	Green	Dual	LEED	ESTAR
Urban	N	442	364	78	6	57	15
	RevPAR	$124.24	$123.00	$132.70	$140.88	$128.10	$138.76
	OCC	73%	72%	74%	77%	71%	79%
	ADR	$165.34	$163.93	$174.93	$181.21	$174.49	$173.30
Suburban	N	592	488	104	2	85	17
	RevPAR	$82.76	$81.67	$89.74	$74.03	$94.10	$75.22
	OCC	65%	65%	64%	64%	63%	67%
	ADR	$124.90	$122.84	$138.03	$115.99	$146.25	$109.83
Airport	N	128	109	19	0	14	5
	RevPAR	$81.52	$81.77	$79.76		$82.67	$73.86
	OCC	72%	72%	70%		71%	68%
	ADR	$111.06	$110.93	$112.00		$115.75	$104.42
Interstate	N	57	50	7	0	7	0
	RevPAR	$63.62	$62.97	$69.77		$69.77	
	OCC	66%	66%	66%		66%	
	ADR	$93.89	$93.04	$101.95		$101.95	
Resort	N	183	151	32	1	21	10
	RevPAR	$132.54	$132.33	$133.66	$234.98	$129.67	$129.77
	OCC	67%	67%	71%	82%	65%	79%
	ADR	$193.02	$194.09	$187.21	$287.92	$196.75	$162.20
Small Metro/Town	N	138	110	28	0	20	8
	RevPAR	$69.38	$66.98	$82.41		$96.42	$59.83
	OCC	61%	61%	59%		57%	61%
	ADR	$111.39	$106.34	$138.76		$166.38	$94.24

Notes: N= number of observations, RevPAR = revenue per available room, OCC = occupancy rate, ADR =average daily rate. Non-Green → hotels with neither LEED nor ES labels. Green → hotels with either LEED or ES label. ES→'Energy Star' labeled hotels; LEED →'LEED' labeled hotels; Dual →Hotels with both 'Energy Star' and 'LEED' labels.

Table 7. Performance of Green Labeled Hotels versus Others

Variable	Difference of Means		t Value	DF	Pr > |t|
	Subject Hotel Label : LEED or Energy Star				
Ln(RevPAR)	**0.047**	***	2.84	254	0.0049
Occ	**-0.014**	**	-2.53	254	0.0119
Ln(ADR)	**0.079**	***	7.33	260	<0.0001
	Subject Hotel Label : Energy Star Only				
Ln(RevPAR)	**0.117**	***	4.98	52	<0.0001
Occ	**0.035**	***	4.62	52	<0.0001
Ln(ADR)	**0.047**	**	2.6	54	0.0120
	Subject Hotel Label : LEED and Dual Only				
Ln(RevPAR)	0.047		1.45	201	0.1480
Occ	**-0.027**	***	-4.16	201	<0.0001
Ln(ADR)	**0.088**	***	6.87	205	<0.0001

Notes: The table lays out the difference of means (Labeled Hotels – Other Hotels) in various performance measures (namely, natural logarithms of RevPAR and ADR and OCC rate) across green labeled hotels and their comparable non-labeled counterparts. *** and ** imply statistical significance at 1% and 5% levels respectively.

Table 8. Green Labeling Premiums in Hotel RevPAR, OCC Rate and ADR

Dependent Variable	Model1 **Ln(ADR)**	Model 2 **Occ**	Model3 **Ln(RevPAR)**
LEED	**0.039****	**-0.013***	0.014
	(2.225)	(-1.755)	(0.664)
ESTAR	0.002	**0.022***	0.037
	(0.063)	(1.809)	(1.072)
Dual	-0.087	0.016	-0.06
	(-1.242)	(0.57)	(-0.714)
Intercept	**3.979*****	**0.383*****	**2.848*****
	(73.262)	(15.716)	(41.858)
Age	**-0.001*****	**-0.000*****	**-0.002*****
	(-4.476)	(-4.059)	(-5.897)
Chain Operated	**0.062*****	**0.053*****	**0.149*****
	(3.123)	(6.432)	(6.329)
Franchised	0.027	**0.042*****	**0.098*****
	(1.344)	(4.952)	(4.046)
Luxury	**1.094*****	**0.048*****	**1.153*****
	(26.82)	(2.816)	(23.44)
Upper Upscale	**0.630*****	**0.073*****	**0.754*****
	(16.42)	(4.548)	(16.39)
Upper	**0.417*****	**0.087*****	**0.574*****
	(11.25)	(5.630)	(12.92)
Upper Midscale	**0.318*****	**0.060*****	**0.434*****
	(8.737)	(4.011)	(9.976)
Mid	**0.169*****	0.012	**0.199*****
	(4.247)	(0.749)	(4.195)
Airport	**-0.192*****	0.002	**-0.177*****
	(-8.812)	(0.186)	(-6.805)
Interstate	**-0.149*****	**-0.026****	**-0.180*****
	(-4.635)	(-1.977)	(-4.662)
Resort	**0.070*****	**-0.042*****	-0.019
	(3.545)	(-5.25)	(-0.817)
Small Metro	**-0.124*****	**-0.087*****	**-0.267*****
	(-5.219)	(-8.812)	(-9.363)
Suburban	**-0.132*****	**-0.069*****	**-0.229*****
	(-8.683)	(-10.92)	(-12.54)
12 Mo Mvg Avg Lag	**0.099*****	**0.052*****	**0.229*****
	(26.251)	(17.791)	(32.636)
Region	*Included*	*Included*	*Included*
Time	*Included*	*Included*	*Included*
Hotel Size	*Included*	*Included*	*Included*
AIC	-172,109	-194,740	-21,498
BIC	-171,886	-1945,17	-21,275
N	97,285	97,285	97,285

Notes: This table presents results from a series of generalized least squares regression including random effects controls for regional and time effects. Dependent variables are the natural log of ADR, percentage occupancy and the natural log of RevPAR.