

Published in Proceedings of the 5th Hospitality Finance & Economics Conference, Virtual conference, 30 June - 1st July 2021, which should be cited to refer to this work.

The Impact of Location on Hotel Transaction Prices

This version: June 4, 2021

Abstract

The aim of this paper is to increase the level of transparency in the European hotel investment industry by developing a transaction-based price index. The hedonic regression method is used to analyze a sample of 1334 hotel transactions across 26 European countries between 2007-2020. This international, multi-currency setting poses several challenges to the reliable estimation of year-over-year changes in hotel transaction price levels. To ensure a constant-quality interpretation of the yearly index results despite time-varying sample characteristics, 14 control variables are used to capture a hotel's location, building quality, size and operational attributes. The resulting transaction price index reveals a 30% drop in price levels during the 2009 Global Financial crisis and an 11% drop in 2020, the year of the Covid-19 pandemic.

Key words: public versus private market arbitrage, net asset value, value versus growth, seasoned equity offerings

1. Introduction

There is a substantial lack of transparency in the European hospitality industry with respect to the development of hotel prices. The real estate, i.e. the physical hotel building, is in general the most valuable part of a hotel business. It is of high relevance for all market participants such as hotel owners, hotel financiers, and potential investors, to be informed about the price development in their industry.

The measurement of price changes is a particular challenge in the area of direct real estate investments. Whereas in the stock markets for example, the shares of a company trade as homogeneous units on public exchanges all around the world and price changes can be tracked on an intra-day basis. This enables the reliable measurement price changes and facilitates the construction of stock market indices. In contrast, publicly available high frequency indices do not exist for real estate. The key difference in real estate is that each property is different from the other, at least with respect to the (micro-) location. The heterogeneity of real estate assets is particularly pronounced in the hotel industry. Advanced empirical methods can account for these heterogeneity issues and facilitate the measurement of real estate price changes at an aggregate level. However, to date there exists no index which reliable tracks the price changes of European hotels.

Traditionally, hedonic models have been used to explain the pricing of heterogeneous goods. On the one hand, this includes the explanation of price differences among the same types of goods (e.g. air quality), whereby the focus is on the explanatory effect of the hedonic characteristic (i.e. the explanatory variables). On the other hand, hedonic models are used to explain price changes over time, i.e. price indices. In the latter case, the focus is on the estimated coefficients for the different time periods, which are the basis for the index construction.

A practical example serves to elaborate the idea of the hedonic price index and demonstrates its superiority over existing indices currently published in the industry. Jones Lang Lasalle (JLL, 2016), publishes a European hotel index based on the average price per room (i.e. hotel transaction price divided by the number of hotel rooms). A problem of this method is that it does not account for differences in the quality of the hotels sold. Whereby the quality could be measured by the different hedonic attributes of the hotels sold. For example, in one year, the share of 5-star hotels in major capitals of Europe may be unusually high. As a reason, a simplistic price per room index would be biased to the upside, because it doesn't control for the differences in the hotel attributes. In a hedonic regression, these hotel attributes are incorporated as control variables. The more relevant hotel attributes variables are included in the model, the more reliable the measured change in the price for the examined hotels.

The academic literature on real estate indices can be separated into two strands: hedonic indices like the Geltner NCREIF index (Geltner, 2011), and repeat sales indices, such as the Case Shiller index (Case and Shiller, 1987). The methodologies of both types of indices cannot be transferred to hotels without adaptations. This article hence develops a tailor-made adoption of general methods of real estate index construction that account for the peculiar characteristics of the European hotel industry.

To date, there exists no European hotel price index that uses generally accepted scientific methods. The developed European hotel price index is hence the first of its kind, thereby closing a gap in the academic literature. The only European hotel price index which is published on a regular basis is based on hotel valuations (also known as appraisals). Appraisals-based real estate indices are known to suffer from a number of weaknesses (see literature review), due to which they have a bad reputation in academia and amongst informed practitioners.

Practitioners often tend to ignore the problem of heterogeneity and calculate an average price per square meter, or in the case of hotels, an average price per room. Then, an index is calculated by tracking changes in the average price per square meter or room over time. The problem with this approach is that it does not account for the heterogeneity of the properties traded in a specific time period. If in one period more luxury properties are sold, then the average price per square meter will be artificially high in that period and the index will show a misleading price increase. It may be argued that no index is better than a biased index.

Fortunately, the real estate research discipline has developed methodologies to get around the issue of heterogeneity: hedonic price indices. Hedonic regression methods control for all the different (or heterogeneous) characteristics of a property. If in a period more luxury apartments are sold, the index accounts for that, because it controls for the variables that characterise a luxury property (e.g. the location, the age of the building, the physical quality, etc.). As a result, the actual price change in a given period is captured by year-dummy variables. Due to the particular importance of the heterogeneity problem in the case of hotels, a transaction-based hedonic price index is the adequate tool to track price changes within the European hotel sector.

The remainder of this paper is organized as follows: Section 2 presents a stylized model of public versus private market arbitrage. Section 3 outlines the empirical strategy and describes the data. Section 4 contains the empirical results and Section 5 concludes.

2. Related Literature on Real Estate Indices

This article aims to contribute to the literature on real estate price indices. The academic literature on real estate price indices can be divided into three strands:

Repeat Sales Indices

Repeat sales indices only use transaction data of real estate properties that were sold at least twice over the sample period. This way, the index solves the problem of heterogeneity, because the characteristics of the same property do not change. A disadvantage of the repeat sales method is that a large number of observations is required, because typically only a small fraction of real estate properties trades at least twice over a sample period (the longer the period, the higher the share of repeat transactions). This required condition is often fulfilled in mass-markets, such as residential real estate, which benefit from wide data coverage and a high number of transactions per year. Unfortunately, the number of hotel transactions is much smaller and coverage of transaction data is typically very limited. Therefore, the repeat sales method is not an option for the construction of hotel price indices.

Repeat sales indices for real estate were first introduced by Case and Shiller (1987), who applied their methodology to residential apartments in the US. Until today, the index is regularly updated and enjoys broad media coverage under the branding: “S&P/Case-Shiller Home Price Index”.

Hedonic Indices

Hedonic real estate indices represent the second major form of real estate indices. Hedonic indexing (based on hedonic price modeling) goes back to general economic price indexing of goods whose quality changes over time (Court, 1939). Kain & Quigley (1970) were the first who related the idea to real estate. With hedonic data one can regress prices onto hedonic characteristics and then compute an index by holding the property characteristics constant. The resulting time dummy variables reveal the pure price changes with respect to the base period, which is typically the first period of the sample.

The NCREIF transaction-based index (or NCREIF-TBI) is famous application of the hedonic real estate price index methodology. The index is applied to data on US commercial real estate properties and was developed by Fisher et. al (2007). Geltner (2011) describes a simplified version of the index, which is regularly published in collaboration with NCREIF.

Appraisal-based indices

Appraisal-based indices are the third major type of real estate indices. Appraisal-based indices are based on regular appraisals of a constant set of properties. Typically, the properties belong to the portfolios of institutional investors who regularly provide their appraisal values to the index provider. Currently, the most famous representant of the appraisal-based index class are the MSCI-IPD indices.

Appraisal-based indices suffer from serious flaws, in particular temporal-lag bias. There are two primary reasons for the temporal lag bias. First, each property is typically only appraised once per year. This means that, if the index is published on a monthly basis, actually only one-twelfth of the index components are updated. Secondly, the appraisal values themselves are temporally lagged. The reason is that appraisers are typically prone to the so-called anchoring bias. That means appraisers go back in time to find good comparable transactions for the property they try to value. Since hotel transactions are infrequent, they must go back in time, often several months, to find good comparables. On an index level, this appraiser behavior induces temporal lag bias. Due to the temporal lag bias, appraisal-based indices are not suited to keep market participants up-to-date. Another problem of appraisal-based indices is the potential sample selection bias, because the institutional investors who report to the index-providers are self-selected and therefore unlikely to represent the whole industry.

Existing Indices on Hotel Prices

To date there exist a number of attempts to construct hotel price indices. Price indices have been created as a bi-product in the works of Corgel et al. (2015), who examine the determinants of hotel prices, and in Das et al. (2017), who examine the pricing impact of extreme attributes on hotels. However, both papers focus on the factors that explain hotel prices, rather than on the index, i.e. the price changes over time. Furthermore, both projects did not result in indices that were regularly updated, so they are not of much use for current industry participants or researchers aiming to work with updated data. Another limitation is that these articles exclusively focus on the US hotel market. Until today, the only hedonic transaction-based hotel price index that is regularly published is based on the work of Liu et al. (2012). Since 2012, the authors publish the “Cornell Real Estate Market Indices” on a regular basis. The index is limited to the US hotel market and is published on the website of the Cornell School of Hotel Administration.

While the mentioned studies result in a satisfactory level of price transparency for the US, the rest of the world is worse off. An early attempt to build a hedonic hotel price index for Europe is from Roubi (2015). The author developed a hedonic hotel price index based on data from 2004-2013. However, the sample is based on only 495 hotels, which constitutes hardly a sufficiently reliable data basis. Furthermore, the author admits that the index is biased towards 3-,4-,and 5-star hotels. Furthermore, to the best of my knowledge, the index construction was a one-time-event, so the project does not inform market participants on an

ongoing basis. There exist two regularly updated European hotel indices. One is an appraisal based index provided by HVS. As discussed, appraisal-based indices suffer from temporal lag bias. The other is based on transaction prices and is published by Jones Lang Lasalle. However, this index is solely based on the average price per room and thereby completely ignores the hedonic attributes of the hotels sold in a given period.

3. Data and Methodology

3.1 Data

This article is based on transaction data provided by Real Capital Analytics (RCA). The core business of RCA is to collect all types of commercial real estate transactions through their deep industry network and by collecting all types of publicly available data. RCA uses several sources to obtain real estate transaction data: "...RCA uses a vast array of reliable sources. Each record is derived from two or more independent reports augmented by our own proprietary research..."¹ From 2007 to 2020, RCA's database is comprised of 7127 European hotel transactions. This represents a strong advantage over the data used by Roubi (2015), which is based on only 495 transactions.

A number of steps are taken to increase the reliability of the index estimates. First, the focus is on confirmed transaction prices of single-hotel transactions from cities with at least five transaction observations. Second, the empirical approach requires the clear attribution of an individual hotel's price to its specific characteristics. Hence, all portfolio transactions are removed in order to exclusively focus on single-hotel transactions. Third, all observations are removed where the transaction price has been "appraised" or is based on "street talk". Fourth, only hotel transactions from cities with at least five observations in total are taken into account to be able to estimate a city's price level reasonably well.

In total, the index is based on 1,334 hotel transaction across 26 European countries between 2007 and 2020. The data basis is representative of the diversity of the European hotel sector. The majority of transactions occurred in the UK (27%), Germany (21%), France (9%) and Spain (7%). 73% of transactions are from metropolises with more than 500,000 inhabitants, with the remaining transactions occurring in smaller cities. The share of full-service hotels as opposed to limited-service hotels is 64%. Most hotels are associated with major brands, while only 38% of them are independent.

3.2 Hedonic Regression Methodology

¹ A complete description of RCA's data collection process is provided on their website: <https://www.rcanalytics.com/our-data/data-process/>

The European Hotel Transaction Price index is estimated based on the following hedonic regression model:

$$\ln(P_{i,t}) = \beta_0 + \sum_j \beta_j H_{i,j} + \sum_t \delta_t D_t + \varepsilon_{i,t}$$

Where $\ln(P_{i,t})$ is the natural logarithm of the transaction price for hotel i sold in year t , β_0 is the intercept of the regression model, δ_t represents the coefficients for the year dummy variables (or index values) for the respective years D_t in which the transaction takes place, β_j represents the coefficients on the effect of the vector of hedonic price attributes H_j , $\varepsilon_{i,t}$ is the error term.

Hedonic regression-based real estate indices pool all observations throughout the sample period and use year-dummy variables D_t to estimate the transaction price level in a specific year relative to the base year. We define 2007 as the base year of the index. The estimated coefficients δ_t for the years 2008 to 2020 thus represent the change in the price level for each year relative to 2007.

To understand the merits of hedonic regression-based indices, consider a simplistic “average transaction price per room”-index as the counter example. In years with many upscale hotel transactions in expensive cities such as London or Paris, such an index will tend to record unusually high levels of average transaction prices. In the given example, this is however largely because of the specific characteristics of the transaction sample in that period, and not necessarily because of the general hotel transaction price level in that year. Note that the latter should be the ultimate objective of a well-constructed index. The hedonic regression approach circumvents this problem by explicitly taking into account the characteristics (e.g. Parisian full-service hotel in a strong location) of any hotel sold in a given year through the vector $H_{i,j}$. As all the hedonic factors are thus implicitly held constant, any changes in price levels is captured only through the year-dummy variables D_t . Table 1 contains a description of the hedonic factors we control for.

The regression results are estimated using ordinary least squares (OLS). The dependent variable is the natural logarithm of the hotel transaction price in EUR. Control variables are CBD, which is a binary variable indicating whether the hotel is located in the Central Business District (micro location). The number of units (or rooms) of the hotel is integrated in the model as quadratic function to capture potential economies of scale. We include an indicator variable if the hotel was built prior to the year 1930 (Before 1930) to capture the appeal of historic buildings. We use an indicator variable if the hotel has recently been renovated (Renovated). This variable aims to capture if the hotel is in a solid physical constitution, despite having a potentially old age. An indicator variable if the buyer of the hotel has the intention to renovate the hotel after the purchase (Renovation). This variable aims to capture if the hotel was sold in a suboptimal physical constitution. An indicator variable if a hotel belongs to the full-service as opposed to limited service

category (Full Service). Full service hotels are often upscale or luxury hotels, whereas economy and midscale hotels tend to fall into the limited service category. In general, full-service hotels are expected to sell for a higher price. The hotel's number of floors relative to the average number of floors in the same city (Floors) is included to capture special building features. An indicator variable if the hotel is independent vs. branded (Independent) is used to account for the potential advantages of branded hotels. The hotel's location rating by online users (Booking_Rating) proxies for the strength of the hotel's location. Moreover indicator variables for the years 2008 to 2020 are included, whereby 2007 is the base year.

Coefficients are estimated using least squares. After estimating coefficients, the index values are calculated using the exponential form:

$$I_t = I_{t-1} \times \frac{\exp^{\delta_t}}{\exp^{\delta_{t-1}}}$$

Where I_{t-1} is the hotel price index of period t-1, I_0 is equal to 100.

4. Hedonic Regression Results

Table 2 contains the hedonic regression results for the sample of 1334 European hotel transaction between 2007 and 2020. Figure 1 as well as Table 3 show European Hotel Transaction Price Index derived from the regression results, in particular the yearly indicator variables that have been transformed using equation (2). Below follows an interpretation of the index results in light of the recent crisis resulting from the Covid-19 pandemic.

In 2020, European hotel transaction prices decreased on average by 11.1% vs. the prior year. The total transaction volume recorded by Real Capital Analytics (RCA) decreased to EUR 10.5 bn, which is 59% lower than the record transaction volume of 2019.

To date, the impact of the Covid-19 crisis on the European hotel real estate sector is significantly smaller than the -30% drop associated with the 2009 global financial crisis. This may be surprising, given the fact that the global pandemic has hit the hospitality industry at its core. Besides the outlook for a recovery on the back of accelerating vaccination campaigns, two major factors have contributed to the relatively modest price declines so far. First, government support for hotel staff and owners in many countries has preserved a more severe wave of bankruptcies and forced selling in the European hotel real estate sector. Secondly, liquidity interventions by central banks and policy makers have led to record high stock market indices and

record low bond yields in the credit markets. As a result, cash rich investors are waiting on the sidelines, ready to invest in higher yielding investment alternatives such as hotels.

On a cautious note, governmental support programs will eventually expire. Moreover, business travel and international travel may be structurally challenged for sustained periods of time. The fundamental recovery of the hotel real estate sector may thus be more bumpy than implied by current transaction price levels. We look forward to providing the next update of the European Hotel Transaction Price Index in spring 2022.

To the best of our knowledge, this is the first transaction-based price index of the European hotel investment market documenting a significant decline of hotel prices following the Covid-19 pandemic. In our sample, the average transaction price per hotel room in 2020 increased by 17% compared to 2019. However, rather than an increase in the price level, this surprising result reflects the higher quality of hotels transacted in 2020. In fact, our 2020 hotel transaction sample is characterized by a higher share of full service vs. limited service hotels, more transactions in the central business districts of a city, and significantly higher location ratings.

The hedonic regression methodology that is the basis for our European Hotel Transaction Price Index allows for the estimation of yearly hotel transaction price levels, while controlling for the qualitative attributes of the hotels sold in a particular year. In turn, we report year-over-year price changes for a constant quality set of hotels.

5. Conclusion

The primary objective of this article is to develop a reliable and repeatable transaction-based hotel index for the European hotel market to increase the level of price transparency in the European hotel real estate sector. Such an increase in transparency would benefit all market participants. Potential applications of the European hotel price index include, but are not limited to:

Hotel investors and owner-operators can reliably track hotel price changes at the aggregate European level. Hotel financiers can track price changes in the underlying collateral values of hotel loans. Investors such as pension funds and insurance companies can evaluate the performance of hotels compared to other (real estate) asset classes, enabling them to conduct more informed investment decisions. With respect to benchmarking a hotel owner can compare its own performance relative to the broad hotel industry. This information could be used to decide about bonus payments and improve incentive contracts. While these

applications are standard in all other asset classes, to date they are not applicable in the European hotel industry, due to the lack of a generally accepted, reliable benchmark index.

The index developed in this article may also serve as a basis of new research projects. As there does not yet exist a reliable hotel price index, there can be no research strand that addresses research questions related to the price development of hotels. For example: Are hotel prices correlated with the stock market? Is there a diversification benefit to adding hotels to a multi-asset portfolio? Are hotel prices driven by the inflation rate? Are hotel prices in countries like Switzerland or the UK affected by the exchange rate with the Euro?

A regularly updated price index for European hotels is therefore very likely to receive strong coverage in hospitality related media, by hotel owners and potential investors, as well as by the academic research industry, and hospitality consultants.

References

- Case, K.E., Shiller, R.J. (1987). Prices of single-family homes since 1970: new indexes for four cities. *New England Economic Review*. 45-56.
- Corgel, J. B., Liu, C., & White, R. M. (2015). Determinants of hotel property prices. *Journal of Real Estate Finance and Economics*, 51, 415-439.
- Court, A.T. (1939). Hedonic price indices with automotive examples. *The dynamics of automobile demand*, ed. General Motors Corporation. 77-99. Detroit, Mich.: General Motors.
- Das, P., Smith, P. Gallimore, P. (2018). Pricing Extreme Attributes in Commercial Real Estate: the Case of Hotel Transactions. *The Journal of Real Estate Finance and Economics*, 57(2), 264-296.
- Fisher, J.D., Geltner, D.M., Pollakowski, H. (2006). A Quarterly Transactions-Based Index (TBI) of Institutional Real Estate Investment Performance and Movements in Supply and Demand. *The Journal of Real Estate Finance and Economics* 17(3), 338-352.
- Geltner, D. (2011). A Simplified Transactions Based Index (TBI) for NCREIF Production. *White paper*.
- Jones Lang Lasalle (2016). Hotel Investment Outlook 2016.
<https://www.hospitalitynet.org/file/152006078.pdf>
- Kain, J.F., Quigley, J.M. (1970). Measuring the value of housing quality. *J. Am. Statist. Assoc.* 65:532–48.
- Liu, C. H., Nowak, A. D., & White, R. M. (2012). Cornell real estate market indices [Electronic article]. *Center for Real Estate and Finance Reports Hotel Indices*, 1(1), 1-13.
- MSCI (2012). IPD Pan-European Quarterly Transaction Linked Indicators.
<https://www.msci.com/documents/1296102/1378010/IPD+TLIs+-+technical+documentation+-+2014+070714/255db5ce-98bd-4551-9aa2-8964e329f36d>
- Shiller, R.J. (1991). Arithmetic repeat sales price estimators. *Journal of Housing Economics* 1(1), 110-126.
- Roubi, S. (2015). Towards a transaction-based hotel property price index for Europe. *Journal of Property Investment & Finance*, 33(3), 256-281.

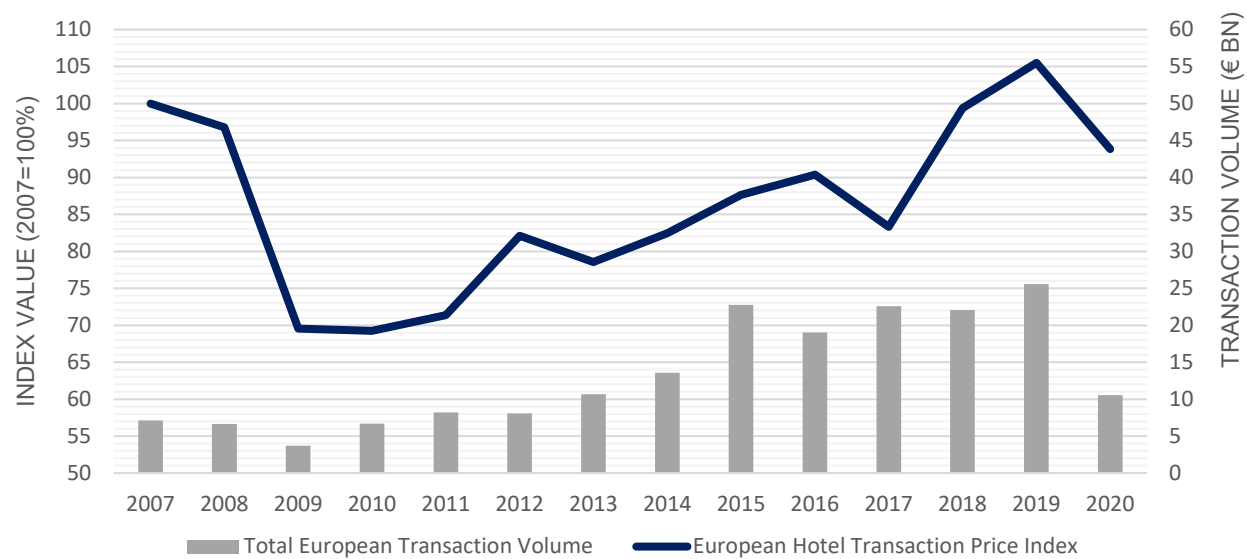


Figure 1: European Hotel Transaction Price Index. This figure shows the yearly index estimates for the European Hotel Transaction Price Index (blue line). The grey bars show the total European Hotel Transaction Volume recorded by RCA.

Table 1: Description of the Control Variables (Hedonic Hotel Attributes)

FACTOR	VARIABLE	DESCRIPTION
Location	CITY	City-level indicator variable (e.g. Amsterdam or Brussels), which accounts for a city's price level.
	CBD	Indicator variable denoting whether the hotel is located in a city's central business district (CBD).
	RATING	User rating of the hotel's location obtained from Google travel.
Quality	AGE	Hotel's age in years, included in the model as a squared term to allow for non-linear aging effects. Moreover, we employ an indicator variable denoting whether the hotel was built before 1930.
	RENOVATED	Indicator variable denoting whether the hotel was renovated within the last three years.
	RENOVATION	Indicator variable denoting whether the new buyer plans a renovation, implying the hotel is currently in need of renovation.
Size	ROOMS	Hotel's number of rooms, included as a squared term to allow for economies of scale.
	FLOORS	Number of floors of the hotel building relative to the average number of floors in the city.
Operations	FULL-SERVICE	Indicator variable denoting whether the hotel provides full- or limited-service.
	INDEPENDENT	Indicator variable denoting whether the hotel is independent or branded.

Table 2: Hedonic Regression Results

Dependent Variable	lnPrice
Constant	14.36*** (55.08)
CBD	0.38 (8.09)
Age	-0.003*** (-3.28)
Age^2	0.000*** (2.75)
Before 1930	0.3596*** (4.01)
Renovated	0.1296** (2.40)
Rooms	0.0052*** (1.84)
Rooms^2	-0.001*** (-1.61)
Renovation	-0.0095 (0.87)
Full Service	0.3829*** (9.20)
Rel_Floors	0.0044 (0.87)
Independent	-0.1883*** (-4.35)
Location Rating	0.1824*** (6.57)
2008	-.0327 (-0.23)
2009	-.3631** (-2.58)
2010	-.3675*** (-2.79)
2011	-.3374*** (-2.79)
2012	-.1974 (-1.60)
2013	-.2412** (-2.10)
2014	-.1932* (-1.78)
2015	-.1316 (-1.21)
2016	-.1013 (-0.94)
2017	-.1824* (-1.68)
2018	-.0063 (0.956)
2019	.0535

	(0.48)
2020	-.0636
	(-0.50)
City Indicator Variables	Yes
Observations	1334
R^2	67.62%

This table reports hedonic regression results for the sample of European hotel transactions. The dependent variable is the natural logarithm of the hotel transaction price in EUR. Control variables are *CBD*, which is a binary variable indicating whether the hotel is located in the Central Business District (micro location), the hotel's age in years (*Age*), the square of the hotel's age (*Age*²), an indicator variable if the hotel was built prior to the year 1930 (*Before 1930*), an indicator variable if the hotel has recently been renovated (*Renovated*), the number of rooms (*Rooms*), the number of rooms squared (*Rooms*²), an indicator variable if the buyer of the hotel has the intention to renovate the hotel after the purchase (*Renovation*), an indicator variable if a hotel belongs to the full-service as opposed to limited service category (*Full Service*), the hotel's number of floors relative to the average number of floors in the same city (*Floors*), an indicator variable if the hotel is independent vs. branded (*Independent*), the hotel's location rating by online users (*Booking_Rating*), as well as indicator variables for the years 2008 to 2020, whereby 2007 is the base year.

Table 3: Index Results and Transaction Volume

	<i>Index</i>	<i>y-o-y change in %</i>	<i>No. of obs.</i>	<i>Total Volume in € bn.</i>
2007	100,0		59	7,1
2008	96,8	-3,2%	51	6,7
2009	69,5	-28,1%	49	3,7
2010	69,2	-0,4%	57	6,7
2011	71,4	3,1%	87	8,2
2012	82,1	15,0%	82	8,1
2013	78,6	-4,3%	112	10,7
2014	82,4	4,9%	153	13,6
2015	87,7	6,3%	160	22,8
2016	90,4	3,1%	173	19,0
2017	83,3	-7,8%	163	22,6
2018	99,4	19,3%	124	22,0
2019	105,5	6,2%	146	25,6
2020	93,8	-11.1%	76	10,5

This table shows the index estimates derived from the hedonic regression results in table 2. In addition to the index, the year-over-year change, the number of observations used in the regression for the specific year, as well as the total European hotel transaction volume from RCA are presented.