

ERASMUS UNIVERSITY ROTTERDAM

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[International Economics and Business Economics]

**Unraveling the Relationship Between Online Reviews,
Sentiment, and Hotel Pricing: A Study in the Dutch
Hospitality Sector**

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Introduction

Online reviews have become an increasingly important source of information for consumers in the travel and hospitality industries. With the growing use of the Internet and social media, travelers now have access to a wealth of information about hotels, restaurants, and tourist destinations at their fingertips. Based on current figures, 71 per cent of independent travel is booked through the Internet as a platform, which allows surfers to communicate quickly with relative ease, a phenomenon that has formed a contemporary version known as the "Internet word of mouth", which is an important marketing communication channel (Goldenberg et al., 2001).

The importance of online reviews for the hospitality industry has led to a growing body of research exploring the relationship between the number and type of online reviews and hotel performance. Many studies have found a positive relationship between online reviews and hotel ratings, occupancy rates, and room prices (Vermeulen and Seegers, 2009; Xie et al., 2014; Hu et al., 2008). For example, Hu et al. (2008) found that a one-point increase in a hotel's rating on TripAdvisor led to an average increase of 11.2 percent in room rates. However, a study by Litvin et al. (2008) finds that no significant relationship between online reviews and hotel performance. These mixed findings suggest that there may be other factors that influence the relationship between online reviews and hotel performance.

The importance of understanding the impact of online reviews on hotel prices has been recognized by researchers and practitioners in the hospitality industry. This study will contribute to the existing literature by providing insights into how user-generated content affects consumer behavior in the hotel industry by answering the main research question that " What is the relationship between the number of consumer reviews and room prices in Dutch hotels and how is this relationship moderated by the score and sentiment of the reviews?" The study will focus on the three-star hotel market and will evaluate the effect of three indicators that influencing the consumer behaviors on the relationship between online reviews and Dutch hotel prices. The number of reviews, the sentiment of the reviews, and the score of the reviews, affect consumers' overall impression, quality, and credibility of a hotel, respectively. Unlike previous studies, this study will conduct regression analysis and incorporate a sentiment analysis of users' online comments. The inclusion of sentiment analysis enables me to go beyond numerical ratings and delve into qualitative aspects of customer

feedback by identifying positive, negative or neutral emotions conveyed in reviews to gain a more comprehensive understanding of guest perceptions and experiences. This additional layer of information can help explain the variations and contradictions observed in previous studies that solely rely on average ratings, which addresses the potential limitations of studies that solely rely on average ratings, offering valuable insights that may have been missing in previous research and contributing to a more nuanced and accurate understanding of the impact of online reviews on pricing decisions in the hotel industry.

By investigating the impact of sentiment in online reviews on hotel prices, this study provides valuable insights for hotel owners and managers in setting appropriate pricing strategies. Recognizing the correlation between positive sentiments expressed in reviews and higher prices can guide hotel managers in leveraging positive guest experiences to justify premium pricing. On the other hand, identifying the influence of negative sentiments on pricing can help managers identify areas for improvement and make necessary adjustments to remain competitive in the market. Furthermore, the findings of this study contribute to the broader understanding of the dynamics between consumer sentiments, online reviews, and pricing decisions. By uncovering the specific ways in which sentiment affects hotel prices, this research offers a deeper understanding of consumer behavior and preferences. It helps bridge the gap in previous studies that may have focused solely on average ratings, providing a more comprehensive view of the factors that drive consumer choices in the hotel industry. Ultimately, this study's societal relevance lies in its practical implications for hotel owners and managers who seek to optimize their pricing strategies and enhance guest satisfaction. By considering the sentiment of reviews, they can harness the power of guest sentiments to make informed decisions and maintain a competitive edge in the marketplace.

Scientifically, the study contributes to the understanding of the role of online reviews in shaping consumer behavior and hotel pricing strategies. The study attempts to reconcile contradictory findings in the literature by using a combination of sentiment analysis and regression analysis to investigate the relationship between online reviews and Dutch hotel prices. Overall, the findings of this study will be useful for hotel managers and policymakers who are interested in

understanding the impact of online reviews on hotel pricing strategies and also has the potential to benefit both consumers and hotels, as well as the broader Dutch economy.

Theoretical background

Online reviews are also increasingly important in consumer decision-making. Consumer decision-making theory provides a theoretical framework for understanding how consumers make choices among different options. In the context of hotel booking, consumers often rely on online reviews to inform their decision-making process. The theory suggests that consumer decision-making is influenced by various factors, including individual preferences, social influences, and cognitive processes (Grewal et al., 2009).

Online reviews have become a critical source of information for consumers when choosing a hotel, and they have a significant impact on the reputation and pricing strategies of hotels. Both positive and negative reviews can improve consumers' awareness of the hotel, while positive reviews can also improve their attitude towards the hotel (Vermeulen & Seegers, 2009). According to Gretzel and Yoo (2008), the vast majority of review readers believe that online reviews increase their confidence and help reduce risk by making it easier for people to imagine what a place would be like. Comments are also thought to help make the decision-making process more efficient because they make decisions easier and reduce the likelihood of later regrets. Specifically, I propose that the number and average rating of online reviews are key factors that influence hotel prices. Furthermore, according to social proof theory, consumers tend to rely on the opinions and behaviors of others to guide their own actions (Cialdini & Goldstein, 2004). Hotels with a higher number of positive reviews are perceived to be more popular and desirable, leading to higher demand and thus higher prices.

From the perspective of operators, the online reputation created by customers' online reviews represents their core competitiveness and thus attracts more customers. (Schuckert et al., 2015) Signaling theory suggests that companies may use various signals to communicate their quality to consumers, and that these signals can affect consumer behavior and willingness to pay (Spence, 1973). In the context of the hotel industry, online reviews can serve as a signal of hotel quality and influence consumer decision-making. According to signaling theory, online reviews can act as a

"cheap talk" signal, where the hotel is able to communicate its quality to potential guests without incurring the cost of expensive advertising (Connelly et al., 2011). Higher ratings and positive reviews can indicate a higher quality hotel, leading to an increase in consumer willingness to pay for the hotel room. Through this cycle, online reviews become more popular and influential on the platform, playing the most important role between buyers and sellers, enhancing the consideration of consumers, and benefiting hoteliers.

However, it is important to note that not all online reviews are created equal. The research shows that online reviews can be used as a tool for price discrimination in the hotel industry. A study by Ögüt and Taş (2012) found that hotels with higher online ratings were able to charge higher prices than hotels with lower ratings, indicating that customers were willing to pay a premium for perceived quality.

It is obvious that investigating the relationship between online reviews and hotel prices is crucial, hence I propose the following three hypotheses in order to gain insight into how hotels price their services and how online reviews affect consumer behavior:

According to the economic theory of supply and demand, when demand for a product or service increases, prices tend to rise. In the case of hotels, the number of online reviews can be seen as a proxy for demand. Blal (2014) shows that there is a positive relationship between the number of online reviews and hotel prices and the number of reviews has a bigger impact on lower-end hotels. As the number of reviews increases, it creates a sense of social proof and credibility for potential customers. Consumers are more likely to trust and consider hotels with a higher volume of reviews, leading to increased demand. In the context of lower-end hotels, where price is a more critical factor for consumers, the impact of the number of reviews on prices is even more pronounced. This finding suggests that the number of reviews serves as an indicator of demand and influences hotel prices accordingly. The positive relationship between the number of reviews and hotel prices supports the notion that higher demand, reflected in the form of more reviews, leads to increased prices. Hence, In the Dutch context, I would expect a similar positive relationship between the number of online reviews and hotel prices. However, it is essential to note that each context may

have its unique characteristics, such as market dynamics, consumer preferences, and competitive landscape, which could influence the magnitude or nature of the relationship.

H1: There is a significant positive relationship between the number of online reviews and Dutch hotel prices.

The quality of service provided by a hotel is an important factor in determining hotel prices. Customers are willing to pay more for higher-quality services. The average rating of a hotel is a digital indicator of quality and one of the indicators consumers use to evaluate a hotel, which can be seen as a reflection of the quality of service provided by a hotel. Specifically, the quality of a hotel includes comments on room cleanliness, location convenience, value for money and staff friendliness (Choi & Chu, 2001). Based on the score of the hotel quality assessment, consumers can perceive their value by determining the quality (Briggs et al., 2007). A higher average rating of online reviews indicates that a hotel provides better service, which can lead to higher prices (Öğüt & Taş, 2012).

Meanwhile, sentiment analysis is a technique used to measure the polarity of online reviews. Positive sentiment indicates that the review is favorable, while negative sentiment indicates that the review is unfavorable. Online reviews with positive sentiment can enhance the reputation of a hotel and increase its attractiveness to potential customers (Sparks & Browning, 2011). Furthermore, the sentiment of online reviews, which refers to the positive or negative tone of the reviews, has also been found to have an impact on hotel prices. The study Ye et al. (2009) shows that positive online reviews can significantly increase the number of hotel bookings, a 10% improvement in reviewers' rating can increase sales by 4.4%. Positive sentiment in reviews is associated with higher hotel prices as consumers are willing to pay more for better experiences, while negative sentiment is associated with lower prices as consumers are likely to seek lower-priced options.

H2: The average score and sentiment of reviews both hold a positive relationship with Dutch hotel prices.

In addition, the impact of online reviews on hotel prices may be influenced by the overall rating of the hotel. It is anticipated that the relationship between the number of reviews and prices will be stronger for hotels with lower average ratings compared to those with higher average ratings. For hotels with lower average ratings, an increase in the number of reviews may carry more weight in influencing consumer perceptions and decision-making. Potential guests may rely heavily on reviews to form opinions about these hotels, and a larger volume of reviews could contribute to increased attention and consideration. As a result, these hotels may have to adjust their prices to align with the perceived value reflected in the reviews. In contrast, for hotels with higher average ratings, the impact of additional reviews on prices may be less pronounced. These hotels have already established a positive reputation and are likely to benefit from repeat customers and positive word-of-mouth recommendations. While additional reviews can still contribute to their overall image and credibility, the effect on pricing decisions may be relatively smaller.

H3: There is a significant interaction effect between the number of online reviews and average rating on Dutch hotel prices.

In this context, I anticipate that a high sentiment score in conjunction with a large number of reviews will have a stronger positive impact on hotel prices. This is because a substantial number of positive reviews, coupled with a positive sentiment score, may create a sense of trust and confidence among potential customers, leading to a higher willingness to pay for the hotel's services. However, it is important to consider that the effect of the sentiment score on hotel prices may vary depending on other factors such as hotel characteristics, market conditions, and customer preferences. Therefore, while I expect a positive interaction effect, it is crucial to empirically test this hypothesis to determine the specific nature and magnitude of the relationship between the number of reviews, sentiment score, and hotel prices.

H4: There will be a significant interaction effect between the number of reviews and the sentiment score on hotel prices.

Data

This study explores the relationship between online reviews and hotel prices in the Netherlands by collecting hotel data from the online platform Booking.com. The information was collected about hotel names, prices, ratings, and the number of online reviews as well as the location of the hotel. It was decided to include these variables because they are all potential factors that could affect hotel rates and can easily be accessed online.

This study exploits the 110 three-star Dutch hotels and their prices on May 21st, 2023. The sample included hotels near the city centers of seven tourist cities in the Netherlands: Amsterdam, Rotterdam, The Hague, Utrecht, Maastricht and Eindhoven. The hotels were selected based on their star ratings as well as the availability of data on the online platform that allows users to search for hotels. I will pay special attention to three-star hotels in particular, as they represent a mid-range option among a wide range of accommodation options and represent a good option that is within many budgets. I chose to collect data from Booking.com because it is a popular and reputable platform used by both domestic and international tourists to book accommodation in the Netherlands.

The study by Hu et al. (2013) collected reviews from the previous six months in order to examine the relationship between online reviews and hotel prices, which is a good way to ensure that the analysis accurately reflects the current review situation, this timeframe was chosen to account for the potential delayed impact of the review on prices. Therefore, as part of my research, I conducted a sentiment analysis of the English-language online reviews of each hotel during the past six months.

May 21st was chosen as a reference price date because it is not a holiday, weekend, high or low tourism season, but rather shoulder season, which better represents the normal hotel rate. Sentiment analysis is performed to assess the polarity of the reviews (positive, negative, or neutral) and to provide insight into the overall mood of each hotel review. Regarding the criteria for assigning reviews to each category, I used a sentiment analysis tool to analyze the text of the reviews and determine whether they were positive, negative, or neutral. The tool I used considered the language used in the review and assigned a score to each review based on the sentiment conveyed in the text. Since the sentiment analysis techniques used in this study are specifically designed and trained on

English language data. Therefore, applying these techniques to comments in different languages may introduce errors or misinterpretations. Sentiment expressions, nuances, and cultural references can vary across languages, making it challenging to capture the true sentiment accurately. If the dataset contains a significant number of comments in languages other than English, it is crucial to acknowledge this limitation and its potential impact on the results. However, the findings may be more applicable to English-speaking customers or those who primarily interact with English-language reviews. The generalizability of the results to a broader population or to hotels catering to non-English speaking customers may be limited. The details will be discussed in the limitation section.

Examples of positive reviews might include comments such as "excellent service," "clean and comfortable room," or "friendly staff." Negative reviews could include comments like "dirty room," "unhelpful staff," or "poor service." Neutral reviews might contain comments that are more factual in nature, such as "decent location" or "average amenities."

To aggregate the information from 50 reviews, I would calculate the average sentiment score across all 50 reviews. This would give a measure of the overall sentiment of the reviews for a particular hotel.

The information captured by the sentiment variable is different from the average rating variable in that the sentiment variable takes into account the language used in the reviews to determine the sentiment, whereas the average rating variable is based solely on the numeric rating given by the reviewer. While it is true that negative ratings can also have a low rating, positive ratings a high rating, and neutral ratings a medium rating, the sentiment analysis allows me to capture the nuances of language used in the reviews that might not be captured by a simple numeric rating.

In order to examine the relationship between online reviews and hotel prices, sentiment scores from sentiment analysis were used as part of the regression analysis. It is critical to note that the rates in this article are taken from the Booking website and are calculated using the price of a standard double room.

Table 1

Descriptive Statistics for variables

Variables	N	Mean	SD	Min	Max
Price	110	197.43	87.27	66	409
Number of Reviews	110	2005.54	1557.21	50	9181
Average Score	110	7.92	0.804	5.20	9.50
Avg_sentiment_score	110	6.91	0.28	5.50	7.63

Note. SD represents the standard deviation.

Table 1 presents the descriptive statistics for four main variables: 'Number of Online Reviews,' 'Average Rating,' 'Sentiment Score,' and 'Price.' Regarding the 'Price' variable, it represents the hotel prices. The mean price is 197.43 euro, indicating the average price per room. The standard deviation is €87.27 and the minimum and maximum prices of €66 and €409, respectively.

For the variable 'Number of Reviews,' the mean value is 2005.54, indicating an average number of reviews per hotel. The standard deviation of 1557.21 suggests a dramatic level of variation in the number of reviews across the sample. The minimum and maximum values of 50 and 9181, respectively, reflect the range within which the number of reviews falls.

The variable 'Average Rating' exhibits a mean value of 7.92, indicating a relatively high overall rating for the hotels in the dataset. The standard deviation of 0.7 suggests a low level of variation in the ratings. The minimum and maximum ratings of 5.2 and 9.5, respectively, show the range of ratings provided by customers.

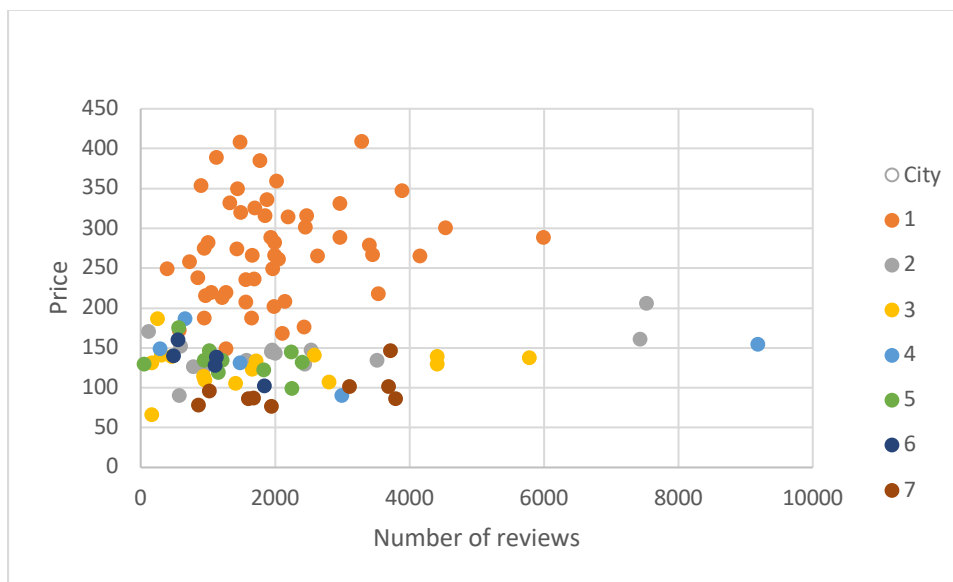
The 'Sentiment Score' variable captures the sentiment expressed in the online reviews. The mean sentiment score is 6.91, indicating a generally positive sentiment among reviewers. The standard deviation of 0.28 suggests a relatively consistent sentiment across the dataset. The minimum sentiment score of 5.50 and the maximum score of 7.63 demonstrate the range of sentiment expressed in the reviews.

In addition, three scatter plots show the trends in Y-axis prices and X-axis number of reviews, average rating and average sentiment scores, respectively. According to the distribution of scatter

points in Figure 1, the overall hotel price in City 1 (Amsterdam) is higher than that in other cities, ranging from 200 euros to 400 euros. Prices in other cities generally range from 50 euros to 200 euros. However, the figure does not show a significant linear relationship that conforms to the hypothesis. Therefore, I will make further statistical analysis on it. Similarly, Figure 2 and Figure 3 only show hotel price differences in different cities, but the average rating and average sentiment score are not clearly correlated with price trends. The scattered points in the figure cluster on an average, rather than trending, meaning that further exploration is warranted.

Figure 1

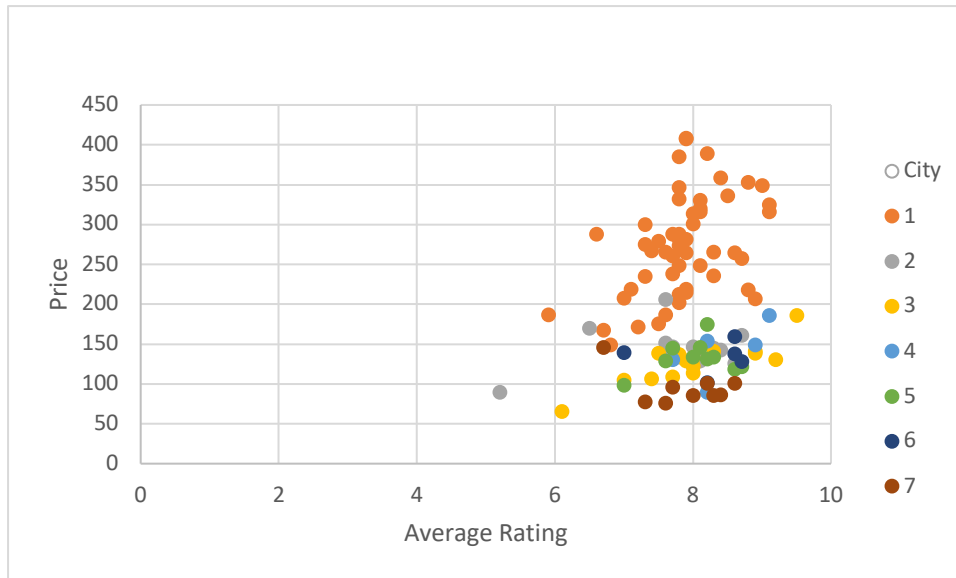
The relationship between the Dutch hotel price and the number of review



Note. This figure demonstrates the number of reviews and hotel prices for different cities in the Netherlands. The numbers 1 to 7 represent Amsterdam, Rotterdam, The Hague, Utrecht, Delft, Maastricht and Eindhoven, respectively.

Figure 2

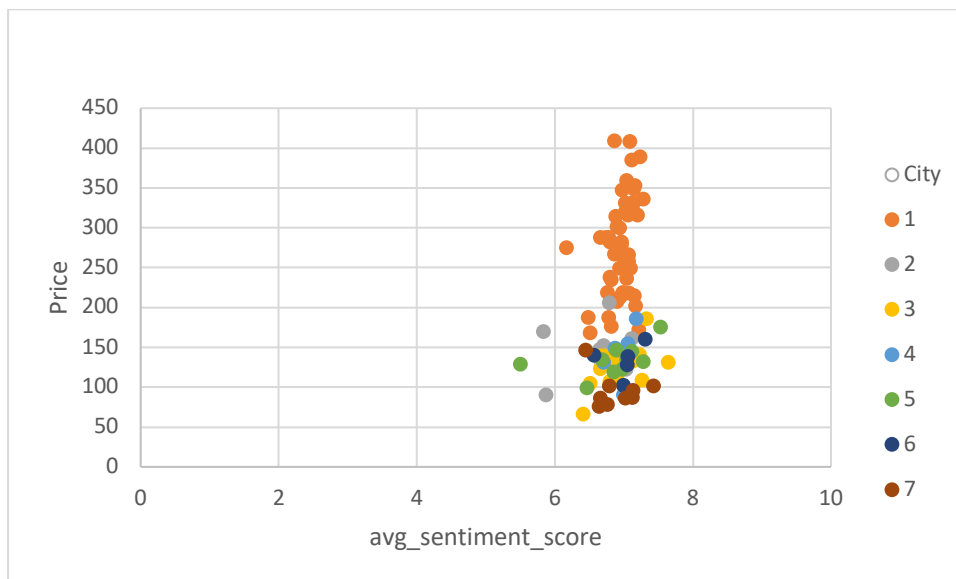
The relationship between the Dutch hotel price and the average rating



Note. This figure represents the distribution of average rating and hotel prices for different cities in the Netherlands. The numbers 1 to 7 represent Amsterdam, Rotterdam, The Hague, Utrecht, Delft, Maastricht and Eindhoven, respectively.

Figure 3

The relationship between the Dutch hotel price and the average sentiment score



Note. This figure shows the distribution of the average sentiment score and hotel prices in different cities in the Netherlands. The numbers 1 to 7 represent Amsterdam, Rotterdam, The Hague, Utrecht, Delft, Maastricht and Eindhoven, respectively.

Methodology

To test three hypotheses, multiple regression analysis as a commonly used statistical method allows researchers to examine the relationship between the dependent variable and several independent variables while controlling for the other variables in the model that will be used. In this study, I employ this method to investigate the relationship between online reviews and hotel prices in the Netherlands. The use of multiple regression analysis in this study enables me to estimate the independent effect of each variable on the hotel price while controlling for the other variables in the model.

In this study, the dependent variable is the hotel price, while the independent variables are the number of reviews, the average rating, and the sentiment of the reviews. The inclusion of these variables allows me to investigate their potential influence on the hotel price.

The information captured by the sentiment variable is different from the average rating variable in that the sentiment variable takes into account the language used in the reviews to determine the sentiment, whereas the average rating variable is based solely on the numeric rating given by the reviewer. While it is true that negative ratings can also have a low rating, positive ratings a high rating, and neutral ratings a medium rating, the sentiment analysis allows me to capture the nuances of language used in the reviews that might not be captured by a simple numeric rating. Therefore, regarding the criteria for assigning reviews to each category, I used a sentiment analysis tool to analyze the text of the reviews and determine whether they are positive, negative, or neutral. The tool I used considered the language used in the review and assigned a score to each review based on the sentiment conveyed in the text.

The process of sentiment analysis in my study begins with crucial data preprocessing steps to ensure the accuracy and relevance of the analysis. This involves the elimination of stop words, including common articles and prepositions, as well as the removal of non-informative or noise words specific to the hotel domain. By filtering out these words, the focus is directed towards those that significantly contribute to sentiment analysis, mitigating any potential distortions in the results. Next, I utilize a sentiment lexicon or dictionary that comprises words or phrases along with preassigned sentiment scores. This lexicon acts as a reference for determining the sentiment

intensity of each word. The positive reviews might include comments such as "excellent service," "clean and comfortable room," or "friendly staff." Negative reviews could include comments like "dirty room," "unhelpful staff," or "poor service." Neutral reviews might contain comments that are more factual in nature, such as "decent location" or "average amenities." To aggregate the information from several reviews, I would calculate the average sentiment score which would give a measure of the overall sentiment of the reviews for a particular hotel. Positive words are assigned positive scores, negative words are assigned negative scores, and neutral words have scores close to zero. This step allows me to categorize the words in the reviews based on their sentiment orientation.

Once the sentiment lexicon is in place, I proceed with sentiment scoring. Each word in a review is assigned a sentiment score based on the lexicon. By summing up the scores of all the words in a review, I obtain the overall sentiment score for that particular review. This scoring process allows me to quantify the sentiment expressed in each review accurately.

To provide a comprehensive measure of sentiment at the hotel level, I calculate the average sentiment score. This involves aggregating the sentiment scores of all the reviews associated with a specific hotel and dividing it by the total number of reviews. By doing so, I obtain the average sentiment score, which reflects the overall sentiment associated with the hotel's services and customer experiences.

Once the sentiment of the reviews has been analyzed, the impact of sentiment on Dutch hotel prices can be examined using regression analysis. The sentiment score can be included as an independent variable in the regression model, along with the number of reviews and the average rating. The regression analysis can then be used to estimate the effect of sentiment on hotel prices, while controlling for other factors that may influence hotel prices.

Then I conducted a multiple regression analysis to explore the relationship between hotel prices and several potential factors, including the number of online reviews, the average rating and the sentiment of reviews. Additionally, the model includes control variables for different cities, namely Amsterdam, Rotterdam, The Hague, Utrecht, Delft, Maastricht, and Eindhoven. The interaction

term between Number of Reviews and Average Score is also included in the model, which is represented by the equation:

$$\begin{aligned} \text{Price} = & \beta_0 + \beta_1 (\text{Number of Reviews}) + \beta_2 (\text{Average Score}) \\ & + \beta_3 (\text{Sentiment Score}) + \beta_4 (\text{City}) + \beta_5 (\text{Number of Reviews} \\ & * \text{Average Rating}) + \beta_6 (\text{Number of Reviews} * \text{Sentiment Score}) + \varepsilon \end{aligned}$$

where Price is the price of the hotel, Number of Reviews is the total number of online reviews for the hotel, Average Rating is the average rating of the hotel based on the online reviews, Sentiment of Reviews is the sentiment score of the online reviews for the hotel.

β_0 represents the intercept, which indicates the expected Price when all the independent and control variables are zero. In this case, it represents the baseline Price for a hotel located in a reference city. β_1 , β_2 , and β_3 are the coefficients associated with the Number of Reviews, Average Score, and Sentiment Score, respectively. These coefficients estimate the expected change in Price for a one-unit increase in each of these variables, holding all other variables constant. A positive coefficient indicates that an increase in the respective variable is associated with higher Price, while a negative coefficient suggests the opposite.

β_4 represents the coefficient of the city variable, which is used as the control variable in the regression model. In this study, the city variable consists of seven cities: Amsterdam (code 1), Rotterdam (code 2), The Hague (code 3), Utrecht (code 4), Delft (code 5), Maastricht (code 6) and Eindhoven (code 7). By including city variables as control variables in the regression model, I aim to consider the potential impact of city-specific factors on hotel prices, allowing me to isolate and examine the impact of other independent variables on hotel prices.

Lastly, β_5 represents the coefficient for the interaction term between the number of reviews and average rating. This coefficient measures how the relationship between the number of reviews and hotel prices changes based on the average rating. A positive coefficient would suggest that the positive effect of the number of reviews on prices is stronger for hotels with higher average ratings, while a negative coefficient would indicate the opposite.

I chose these variables as they are all potential factors that can influence a hotel's price and are readily available on the online platform. The number of online reviews and average rating reflect the reputation of the hotel, which can impact the demand for the hotel and, in turn, the price. The sentiment of reviews measures the overall positive or negative tone of the online reviews, which can influence the perceived value of the hotel.

Results

The analysis revealed a modest positive correlation between the price of hotels and the number of reviews in Table 2. However, it is important to note that this correlation did not reach statistical significance ($p > 0.05$). Therefore, based on these findings, I cannot conclusively support the first hypothesis, which proposed a significant positive relationship between the number of reviews and hotel prices. Similarly, a similar pattern can be observed in Table 3 regarding the average rating variable. Despite a negative correlation between the average rating and hotel prices, the relationship did not reach statistical significance ($p > 0.05$). Hence, I cannot provide conclusive evidence to support the second hypothesis, which proposed a significant positive relationship between the average rating of online reviews and hotel prices.

However, it is worth noting that the average sentiment score exhibited a relatively strong positive correlation with hotel prices and showed a trend towards significance ($p < 0.5$). This suggests that there may be some meaningful association between the sentiment expressed in online reviews and the pricing of hotels.

These findings highlight the complexity of the relationship between review characteristics and hotel prices. The lack of statistical significance in the correlation between those variables and prices may imply that there are additional factors at play or that the relationship is contingent upon specific circumstances. The lack of a significant relationship may be attributed to various factors. One possible explanation could be the presence of confounding variables that were not accounted for in the analysis. In particular, the influence of different cities where the hotels are located could have a significant impact on hotel prices. Therefore, it is imperative to introduce city as a control variable in further investigation.

Table 2

Regression Coefficients for Dutch Hotel Prices and Number of Online Reviews Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	188.665	13.628		13.844	<.001
	Number of reviews	.004	.005	.078	.813	.418

a. Dependent Variable: Price

Note. N=110. I examined the impact of the number of online reviews on the Dutch hotel price. I used the number of reviews as the independent variable.

Table 3

Regression Coefficients for Dutch Hotel Prices: Number of Online Reviews, Average Score, and Sentiment Score Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-257.020	187.033		-1.374	.172
	Number of reviews	.003	.005	.061	.642	.522
	Average Rating	-4.115	15.392	-.033	-.267	.790
	avg_sentiment_score	69.600	35.102	.247	1.983	.020*

a. Dependent Variable: Price

*Note. N=110. The average rating and average sentiment score are independent variables. * Indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$.*

According to Table 4, the coefficient estimates provide insights into the relationships between the independent variables and the dependent variable, taking into account the control variables. Firstly, the coefficient for the number of reviews indicates the extent to which changes in the number of reviews impact hotel prices when controlling for the effects of city. In this analysis, the number of

reviews was found to be statistically insignificant ($\beta = 0.02$, $p > 0.05$), suggesting that changes in the volume of reviews do not have a significant effect on hotel prices, even after accounting for the differences among cities.

Moving on, the coefficient for the average score reveals the relationship between the average rating of online reviews and hotel prices, while controlling for the effects of city. The estimated coefficient of 14.94 ($p < 0.05$) signifies a statistically significant positive relationship. This implies that, on average, a one-unit increase in the average score is associated with a 14.94 euro increase in hotel prices, holding the city constant. The magnitude of this coefficient is noteworthy as it suggests that the average score has a considerable impact on hotel prices. Therefore, hotels with higher average scores tend to command higher prices, independent of the city in which they are located.

Similarly, the coefficient for the average sentiment score indicates the impact of the overall sentiment expressed in online reviews on hotel prices, while controlling for the effects of city. With a coefficient estimate of 181.23 ($p < 0.05$), a statistically significant positive relationship is observed. The positive relationship between the average sentiment score and hotel prices implies that as the overall sentiment expressed in online reviews becomes more positive, hotels tend to charge higher prices. This finding aligns with previous research, which suggests that positive sentiment in reviews is associated with customer satisfaction and perceived value, leading to increased pricing. This suggests that positive sentiment in reviews serves as an indicator of customer satisfaction, which influences perceived value and justifies higher pricing, irrespective of the specific city context.

Controlling for the city variable, which aimed to account for potential variations across different cities, was found to be statistically significant at the 5% level (β_4) ($p < 0.05$). This indicates that different cities had a significant effect on hotel prices even after considering the effects of online reviews. The city variable captured the contextual differences in hotel markets, such as location-specific demand and competition, which could influence pricing decisions independently of online reviews.

Table 4

Regression Coefficients for Dutch Hotel Prices: Number of Online Reviews, Average Score, and Sentiment Score (controlling the city)

Coefficients^a

Model		Unstandardized		Standardized	t	Sig.
		Coefficients		Coefficients		
		B	Std. Error	Beta		
1	(Constant)	277.075	9.831		28.185	<.001***
	City	-30.421	2.984	-.700	-10.195	<.001***
2	(Constant)	86.473	66.128		1.308	.090
	City	-30.759	2.908	-.708	-10.579	<.001***
	Number of reviews	.002	.004	.038	.573	.568
	Average Rating	14.944	10.910	.121	1.370	.040*
	Avg_sentiment_score	181.229	123.699	.128	1.465	.030*

a. Dependent Variable: Price

Note. N=110. I examined the impact of the online reviews on the Dutch hotel price. In Model 1, I entered the control variable city to predict the price. In Model 2, I used the number of reviews, average rating and average sentiment score as independent variables. * Indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$. City Amsterdam=1, City Rotterdam= 2, City the Hague= 3, City Utrecht= 4, City Delft= 5, City Maastricht= 6 and City Eindhoven= 7.

Additionally, the coefficients for reviews and average rating are both positive in Table 5, which means that the prices increase with reviews and average rating. The interaction term, however, is negative, which is 0.009. Meaning that the effect of number of reviews (or of average rating) is smaller in magnitude for hotels with a higher rating (or higher number of reviews), the additional impact is diminished.

Besides, the interaction effect between the number of reviews and sentiment score, as shown in Table 6, revealed a positive but small coefficient. However, the relationship was not statistically significant ($p > 0.05$). Consequently, I cannot support the third hypothesis, which proposed a significant interaction effect between the number of reviews and sentiment score on hotel prices.

The non-significant nature of this interaction effect suggests that the combined influence of the number of reviews and sentiment score does not significantly impact hotel prices in the context of this study. It is important to acknowledge that while the coefficient was positive, indicating a potential positive association, its small magnitude and lack of statistical significance indicate that the relationship may be weak or influenced by other factors that were not accounted for in the current analysis.

Table 5

*Regression Coefficients for Dutch Hotel Prices: Number of Online Reviews, Average Score, and Sentiment Score (controlling the city and add Number*Rating)*

Coefficients^a

Model		Unstandardized		Standardized	t	Sig.
		Coefficients		Coefficients		
		B	Std. Error	Beta		
1	(Constant)	277.075	9.831		28.185	<.001***
	City	-30.421	2.984	-.700	-10.195	<.001***
2	(Constant)	-167.954	141.813		-1.184	.239
	City	-30.780	2.896	-.709	-10.628	<.001***
	Number of reviews	.073	.052	1.298	1.392	.167
	Average Rating	27.514	14.288	.222	1.926	.007**
	Avg_sentiment_score	32.268	24.816	.114	1.300	.040*
	Number*Rating	-.009	.007	-1.265	-1.355	.020*

a. Dependent Variable: Price

*Note. N=110. I added an interaction variable of Number*Rating. * Indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$. City Amsterdam=1, City Rotterdam= 2, City the Hague= 3, City Utrecht= 4, City Delft= 5, City Maastricht= 6 and City Eindhoven= 7.*

Table 6

*Regression Coefficients for Dutch Hotel Prices: Number of Online Reviews, Average Score, and Sentiment Score (controlling the city and add Number*Sentiment)*

Coefficients^a

Model		Unstandardized		Standardized	t	Sig.
		Coefficients		Coefficients		

		B	Std. Error	Beta		
1	(Constant)	277.075	9.831		28.185	<.001***
	City	-30.421	2.984	-.700	-10.195	<.001***
2	(Constant)	89.288	75.824		1.178	.242
	City	-30.754	2.922	-.708	-10.524	<.001***
	Number of reviews	-.006	.112	-.115	-.058	.954
	Average Rating	14.833	11.056	.120	1.342	.030*
	Avg_sentiment_score	176.120	140.876	.125	1.250	.040*
	Number*Sentiment	.001	.016	.154	.077	.939

a. Dependent Variable: Price

Note. $N=110$. I added an interaction variable of *Number*Sentiment*, which aim to study the interaction effect. * Indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$.

Discussion

While investigating the relationship between hotel rates and online reviews is an emerging field of research, it is indeed an important factor affecting hotel pricing as the era of big data develops. To achieve this goal, four relevant hypotheses are proposed in this study, which uses online data collection as a method to study correlations through the results of regression analysis.

For instance, Blal (2014) found a positive relationship between the number of online reviews and hotel prices, with a stronger impact observed for lower-end hotels. However, this study did not find a statistically significant relationship between the number of reviews and hotel prices, this suggests that there may be contextual factors or specific characteristics of the Dutch hotel market that contribute to the findings in the study.

There could be several reasons for this non-significant finding. Firstly, it is possible that other factors, such as hotel amenities, location, or pricing strategies, have a stronger influence on hotel prices than the sheer quantity of online reviews. These factors may have a more direct and immediate effect on consumer perceptions and willingness to pay. Second, the effect of the number of reviews on hotel prices may be nonlinear or subject to diminishing returns, where the initial

increase in reviews has a larger impact on prices, but as the number of reviews becomes saturated, its influence diminishes.

Furthermore, it is important to consider the quality and credibility of the reviews themselves. While the number of reviews may indicate the popularity or visibility of a hotel, it does not necessarily reflect the quality or accuracy of the information provided. Consumers may place greater trust in reviews with detailed descriptions, specific experiences, and verified authenticity. Therefore, it is possible that the quality and content of the reviews, rather than their sheer quantity, play a more significant role in influencing hotel prices. Another factor to consider is the nature of the Dutch hotel market itself. It is possible that the market is saturated with a wide range of accommodation options, leading to intense competition among hotels. In such a competitive market, factors beyond the number of reviews may be more influential in determining hotel prices, such as location, brand reputation, or unique selling points.

While the non-significant relationship between the number of reviews and hotel prices may seem counterintuitive, it provides valuable insights into the complex dynamics of pricing decisions in the Dutch hotel market. It highlights the importance of considering multiple factors and their interactions when analyzing the determinants of hotel prices. Online reviews still play a crucial role in shaping consumer perceptions, influencing purchase decisions, and providing valuable feedback to hotel management for service improvements. These findings suggest that hotel managers and marketers should not solely rely on increasing the number of online reviews to justify higher prices. Instead, they should focus on other aspects of their offerings, such as service quality, amenities, and differentiation strategies, to create value and attract customers.

This finding suggests that the number of online reviews may not be a strong driver of hotel prices in the Dutch hotel market. The absence of a significant positive relationship challenges the notion that as the number of reviews increases, hotel prices will also increase due to higher demand. It is possible that other factors beyond the scope of this study, such as location, amenities, and reputation, play a more influential role in determining hotel prices.

The results of the regression analysis support my second hypothesis, which proposed a significant positive relationship between the average rating of online reviews and Dutch hotel prices, which suggests that hotels with higher average ratings tend to command higher prices in the Dutch hotel market. It aligns with the expectation that As the average rating of online reviews increases, there is an expected increase in hotel prices. This relationship can be attributed to the influence of positive reviews on consumer perceptions and their willingness to pay a premium for hotels with a good reputation, which in turn leads to higher pricing power for hotels. The result is consistent with the existing body of literature. Prior research has shown that positive online reviews and higher ratings are associated with increased trust, improved reputation, and higher customer demand for hotels. Customers are more likely to choose hotels with positive reviews and higher ratings, which can drive up prices due to increased demand and perceived value.

Meanwhile it underscores the importance of online reviews and their influence on hotel pricing decisions. By considering the average rating as a key determinant of hotel prices, hotel managers can gain valuable insights into how customer perceptions and satisfaction impact their pricing strategies. They can also focus on improving service quality to enhance customer experiences and, in turn, potentially command higher prices in the market. The findings of my study contribute to the existing literature by providing empirical evidence specifically in the context of the Dutch hotel market. They reinforce the notion that online reviews and ratings play a significant role in shaping hotel prices. Furthermore, the significant positive relationship between average rating and hotel prices highlights the importance of managing and maintaining a positive online reputation for hotels, as it can directly impact their pricing strategies and overall competitiveness.

The result also suggests that positive sentiment expressed in online reviews plays a crucial role in influencing hotel prices. When customers perceive hotels to provide a positive experience, reflected in the sentiment of their reviews, they are more willing to pay higher prices. Positive sentiment is often associated with favorable aspects of the hotel, such as excellent service, comfortable accommodations, and memorable experiences. These positive perceptions contribute to a higher perceived value for customers, which justifies the higher pricing observed.

The impact of sentiment on hotel prices is not limited to specific cities but holds true across different locations. This implies that regardless of the city in which the hotel is situated, a positive sentiment expressed in online reviews tends to have a consistent effect on pricing. It suggests that customers place value on positive experiences and are willing to pay more for hotels that are associated with a higher level of customer satisfaction, regardless of the geographic context.

Hotels that consistently receive positive sentiment scores in their online reviews are likely to build a positive reputation among customers. Positive sentiment acts as a form of social proof, influencing potential guests' perceptions and decisions. When customers encounter positive reviews highlighting exceptional service, pleasant ambiance, or delightful amenities, they develop higher expectations and are more willing to pay a premium for those experiences.

The observed positive relationship between the average sentiment score and hotel prices underscores the importance of managing and monitoring online reviews. Hoteliers should strive to provide exceptional experiences that generate positive sentiment among guests, as it has a direct impact on pricing strategies. By focusing on delivering high-quality service, addressing customer concerns, and actively managing their online reputation, hotels can enhance their overall sentiment scores and potentially command higher prices.

Furthermore, the significant negative interaction effect between the number of reviews and average rating suggests that the relationship between the number of reviews and hotel prices is influenced by the average rating. This finding supports my third hypothesis, indicating that the impact of the number of reviews on hotel prices depends on the average rating given by the reviewers. A higher number of reviews combined with a higher average rating may lead to decreased hotel prices. In some cases, hotels with a high number of positive reviews and a favorable average rating may lower their prices to attract a larger customer base and maintain high occupancy rates. By offering competitive pricing, these hotels aim to leverage their positive reputation to capture a larger market share and maximize revenue through increased occupancy levels. These findings align with previous studies (Blal, 2014) that have emphasized the importance of considering both the number of reviews and the average rating in understanding their influence on hotel prices.

On the other hand, the non-significant interaction effect between the number of reviews and sentiment score suggests that the relationship between the number of reviews and hotel prices is not significantly influenced by the sentiment expressed in the reviews. This finding does not support my fourth hypothesis, indicating that the sentiment score does not play a significant role in moderating the relationship between the number of reviews and hotel prices.

The positive coefficient for the interaction effect implies a potential positive association between the number of reviews and sentiment score in influencing hotel prices. However, the lack of statistical significance suggests that this relationship may be weak or influenced by other factors not accounted for in the current study. It is possible that factors such as hotel amenities, location, or pricing strategies may have a more significant impact on hotel prices, overshadowing the influence of the sentiment score.

These findings highlight the complexity of the relationship between online reviews, sentiment, and hotel prices. While the average rating appears to have a significant influence on the relationship between the number of reviews and hotel prices, the sentiment score does not demonstrate a similar effect. This indicates that the average rating provides more valuable information for pricing decisions compared to the sentiment expressed in the reviews.

Although the study attempted to explore some of the findings by referring to a new variable, many limitations affected the accuracy of the results. The reliance on online reviews as the primary data source introduces the selection bias and omitted variable bias, affecting both the internal and external validity of the results, as not all hotel guests may leave reviews. This could lead to a biased sample of reviews that may not accurately represent the overall customer experience or sentiment. Therefore, the causal effect cannot be proved.

One potential selection effect is the tendency for individuals with extreme experiences to be more motivated to leave reviews. Guests who have exceptionally positive or negative experiences may be more inclined to share their opinions, while those with average or moderate experiences may be less likely to do so. This could lead to an overrepresentation of extreme sentiments in the review data, which may influence the observed relationships between online reviews and hotel prices.

Additionally, there may be differences in the characteristics and preferences of guests who choose to leave reviews compared to those who do not. Guests who actively engage in reviewing hotels may have different motivations, expectations, or experiences compared to non-reviewing guests. This self-selection process could introduce bias and affect the relationships between online reviews and hotel prices. Moreover, the selection of the specific hotels included in the analysis may also introduce potential biases. The dataset used in this study was limited to a specific set of hotels in Dutch cities, which may not be fully representative of the broader hotel industry. The characteristics of these hotels, such as their location, size, or target market, may impact the relationships observed between online reviews and hotel prices. Therefore, caution should be exercised when generalizing the findings to other hotel contexts or geographical areas. Secondly, the data used in this study was collected from a single online platform, which may not accurately represent all hotels in the selected cities. Additionally, the study only includes hotels with an online presence, which may exclude smaller hotels or those without an online presence, potentially leading to a biased sample. Future research should consider utilizing multiple sources of data or alternative sampling techniques to obtain a more representative sample.

Meanwhile, although sentiment analysis is a valuable tool for understanding the emotional tone of online reviews, its limitations impact the interpretation and reliability of sentiment analysis results. One limitation is the challenge of contextual understanding. Sentiment analysis algorithms may struggle to accurately interpret the meaning of words and phrases within their specific context. This can lead to inaccuracies in sentiment classification, particularly when dealing with subtle nuances, sarcasm, or irony expressed in the reviews. Another limitation is the limited scope of emotion detection. Sentiment analysis primarily focuses on classifying text into positive, negative, or neutral sentiments, overlooking a wider range of emotions that users may express. This omission hinders a comprehensive understanding of consumers' experiences and emotions, which are crucial factors in influencing their decision-making.

Additionally, user bias and manipulation pose potential limitations. Online reviews are subjective and can be influenced by users' biases, motivations, or even hidden agendas. Some users may intentionally manipulate their reviews to promote or discredit a hotel, which can skew sentiment analysis results and compromise their reliability.

In addition, due to the small sample size I collected, the generalizability of the findings may be limited. The study may not have had enough power to detect mild or moderate effects, resulting in no significant findings. A larger, more diverse sample can better represent the population, reduce the risk of bias, and improve the external validity of the results.

There are several avenues for further research that can deepen the understanding of this complex phenomenon and provide more comprehensive insights. Firstly, exploring the impact of additional variables on the relationship between online reviews and pricing could be valuable. Factors such as hotel amenities, location, customer demographics, or even external events like local attractions or festivals may influence the pricing decisions of hotels. Investigating how these factors interact with online reviews and sentiment can uncover more nuanced pricing strategies. Secondly, conducting comparative studies across different geographical regions or hotel categories can help identify contextual variations in the relationship between online reviews, sentiment, and pricing. Cultural, economic, or market-specific factors may influence the importance of reviews and sentiment in pricing decisions. Examining these variations can inform tailored pricing strategies for different contexts. Longitudinal studies tracking changes in online reviews and pricing over time can capture dynamic patterns and uncover trends in consumer behavior and pricing strategies. Analyzing how online reviews and sentiment evolve and influence pricing decisions can provide valuable insights into the long-term impact of customer feedback on hotel pricing. Additionally, considering the influence of online review platforms and the challenges associated with review manipulation or fake reviews is an area worth exploring. Understanding the extent to which review authenticity and credibility affect pricing decisions can help hoteliers navigate the complexities of online reputation management.

By addressing these areas of further research, we can deepen the understanding of the relationship between online reviews, sentiment, and hotel prices. This knowledge can assist hotel owners and managers in making more informed pricing decisions and enhancing customer satisfaction.

Conclusion

In conclusion, this thesis investigated the relationship between online reviews, sentiment, and hotel prices in the Dutch hotel industry. The findings shed light on the factors that influence hotel pricing decisions and contribute to a better understanding of consumer behavior in the digital era.

The results revealed several important insights. Firstly, the number of online reviews was found to have a small positive correlation with hotel prices, although the relationship was not statistically significant. This suggests that while online reviews may play a role in shaping hotel prices, other factors such as location, amenities, and brand reputation may have a stronger influence. Secondly, the average rating of online reviews exhibited a significant positive relationship with hotel prices. This indicates that hotels with higher average ratings tend to command higher prices, reflecting the importance of customer satisfaction and positive feedback in pricing decisions. Furthermore, the study examined the impact of sentiment in online reviews on hotel prices. The regression analysis indicates that the average sentiment score of online reviews has a significant positive effect on hotel prices, even after considering the variations among cities. Positive sentiment reflects customer satisfaction and contributes to a higher perceived value, justifying higher pricing. Hoteliers should recognize the importance of cultivating positive sentiment through outstanding customer experiences, as it can directly influence their pricing strategies and overall profitability.

Additionally, the analysis explored the interaction effects between the number of reviews and average rating, as well as the interaction between the number of reviews and sentiment score. The findings revealed a significant negative interaction effect between the number of reviews and average rating, suggesting that the influence of the number of reviews on hotel prices depends on the average rating provided by reviewers. However, the interaction effect between the number of reviews and sentiment score was not statistically significant, indicating that sentiment may not significantly moderate the relationship between the number of reviews and hotel prices.

Overall, this thesis contributes to the existing literature by providing insights into the factors that influence hotel pricing decisions in the digital era. The findings emphasize the importance of considering both the quantity and quality of online reviews, particularly the average rating, in understanding their impact on hotel prices. It is important to note that this study has limitations. The analysis focused on a specific time period and a sample of Dutch hotels, which may limit the

generalizability of the findings. Future research could explore other geographical regions, consider additional variables, and examine the dynamics of online reviews and pricing decisions over time to provide a more comprehensive understanding of the factors that influence hotel prices and to ensure more robust and reliable findings.

This research underscores the relevance of understanding the relationship between online reviews, sentiment, and pricing decisions for hotel owners and managers. By leveraging these insights, they can make informed pricing strategies, optimize revenue, and enhance customer satisfaction, ultimately contributing to the long-term success and profitability of their establishments. By recognizing that a higher number of reviews combined with a higher average rating may lead to decreased hotel prices, managers can strategically leverage this information in their pricing strategies. Additionally, understanding the role of sentiment in pricing decisions can help hotel owners and managers refine their pricing strategies further. The positive correlation between sentiment score and hotel prices suggests that hotels with more positive sentiment in their reviews tend to command higher prices. This indicates the importance of not only focusing on the quantity of reviews but also the overall sentiment expressed by customers. By monitoring and addressing customer sentiment, hotels can identify areas for improvement and prioritize efforts to enhance guest experiences, ultimately leading to increased customer satisfaction and the potential for higher prices. By considering the average rating and other factors that influence hotel prices, they can make informed pricing strategies to optimize revenue and enhance customer satisfaction.

In conclusion, this thesis contributes to the growing body of knowledge on online reviews and hotel pricing decisions. It provides valuable insights for practitioners, researchers, and policymakers interested in understanding the complex dynamics of the hospitality industry in the digital age. Further research in this area will continue to enhance our understanding of consumer behavior and inform effective pricing strategies in the ever-evolving hospitality landscape.

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