Journal of International Technology and Information Management

Volume 31 | Issue 1 Article 4

2022

How do Aspects of Chain Restaurants Affect the Overall Rating: Trip-Advisor Multi-dimensional Rating System Analysis

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ABSTRACT

In this study, we analyze the aspect ratings and overall ratings of chain restaurants retrieved from the TripAdvisor multi-dimensional rating system. We gain aspect ratings including food aspect rating, value aspect rating, service aspect rating, and atmosphere aspect rating and their corresponding overall restaurant rating from individual reviews and each restaurant. We build three econometric models to examine how overall rating is affected and found that the food aspect has a significant positive impact on the overall rating. Another interesting finding of our analysis is that the service aspect negatively affects the overall rating. This is explainable under the chain restaurant domain because when these restaurants share the standard menu, close price range, and other similar features, service becomes the most diverse aspect for restaurants under the same brand name. When receiving good service, customers would expect other aspects of this restaurant perceived are of the same quality as the service. However, this is hard to achieve because of the similar evaluation of other aspects from the same chain. Therefore, the overall rating would decrease. In addition, we understand and interpret the value aspect of the chain restaurants. Service, food, and atmosphere ratings influence the value aspect ratings significantly and positively.

Keywords:
Multidimensional Rating, Aspect Rating, Chain Restaurant, TripAdvisor

ISSN: 1941-6679-On-line Copy

INTRODUCTION

How do customers select restaurants to dine in? Nowadays, online word of mouth is gaining major popularity and it has a significant impact on customers' selections in dining (Gan and Yu 2015). With the rapid development of advanced Internet technology, social network (SN) sites offer an essential source of information, because popular platforms (e.g., TripAdvisor[1]) allow consumers to provide, read, and share evaluative feedback about their dining experiences (Potamias 2012) with respect to particular aspects of the restaurant's operations and services (e.g., waiting time, portions), in the form of five-star rating scales. There are two popular rating systems provided on SN sites: the single rating system and the multidimensional rating system. In a single rating system, product quality, in our case, restaurant quality, is presented as a single number (i.e., the overall rating), and the multidimensional rating system allows customers to rate products from different aspects, in addition to the overall rating (Chen et al. 2018). When customers search restaurants on SN, e.g., TripAdvisor.com, the search results highlight the average rating each restaurant earns, in half-star increments. In addition to the integrated overall ratings, TripAdvisor has adopted multidimensional rating systems to gather customers' ratings of prespecified aspects across restaurants: food, service, value, and atmosphere (see Figure 1). These ratings have crucial business implications and customers use these ratings for dining selections. Before determining a restaurant to dine in, customers would search for a restaurant on an SN site and evaluate the restaurant based on the ratings. A half-star increase in the average overall rating is associated with a 19% growth in sales and transactions[2].

Restaurants that earn average overall scores of three stars prompt 384% more calls than their two-star counterparts, and those with four-star ratings attract 294% more views than three-star restaurants[3].

[1] https://www.tripadvisor.com/

[2] See http://news.berkeley.edu/2012/09/04/yelp-reviews-boost-restaurant-business/; accessed on April 15, 2020.

[3] See http://www.chiefingredient.com/2014/05/yelp-ratings-difference-one-star/; accessed on April 15, 2020.

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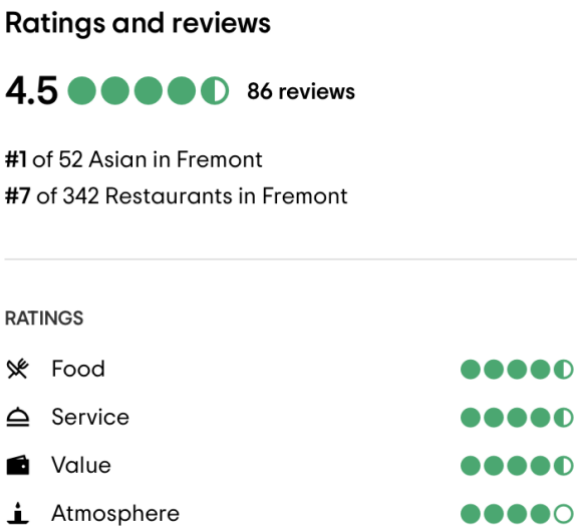
Figure 1. TripAdvisor Restaurant Overall Rating and Aspect Ratings



In this study, we take the advantage of the multidimensional rating system and retrieve the overall rating and aspect ratings (food, service, value, and atmosphere) of chain restaurants from TripAdvisor. Chain restaurants are different from other independent restaurants. Firstly, chain restaurants feature the same brand name and operate in different locations, usually are managed under either shared corporate ownership or franchising agreements (Jakle and Sculle 2002) (see Figure 2). Secondly, they share brand names (e.g., Applebee's, Red Lobster), standardized menus, comparable prices, common food sources, similar interior designs and dining atmospheres (e.g., decorations, settings), and centralized marketing and advertising efforts. Thirdly, chain restaurants pop up in many locations, often across different regions.

In this study, we first analyze the overall and aspect ratings of chain restaurants from TripAdvisor and understand (1). What aspects of the restaurant significantly influence the overall chain restaurant ratings?

Second, given the similar features such as standardized menus, common food sources, similar interior designs, and dining atmosphere, service can be the most diverse dimension out of all the aspects (food, value, service, and atmosphere) amongst restaurants from the same chain. We, therefore, further analyze the "service" aspect and try to answer the following research question: (2). Specifically, how does the "service" aspect influence overall chain restaurant ratings?

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Third, the restaurant's aspect "value" can be understood differently when customers consider providing a rate. It can be comprehended as the proportion or size of the food (Teng and Chang 2013). Or in some cases, it can be interpreted as a cost related factor (e.g., discounts or deals) (Carlos Fandos Roig et al. 2006).
In other cases, it can be evaluated as the interactive effect of food quality, cost, and other factors (Ryu et al. 2012), and customers may wonder whether the food or service is worth the money they paid (Wang et al. 2009). To better understand the "value" aspect given the "value" rating and other aspect ratings from the multi-dimensional rating system, we propose the following research question: (3). In particular, how do customers evaluate and rate the aspect "value"? and What factors affect the "value" rating?

Our study contributes to the existing literature from the following perspectives: First, we explore the customer rating behavior by analyzing the correlation between the ratings of different aspects and the overall rating. Second, we further improve the understanding of how other aspects (food, service, and atmosphere) affect the value aspect and show that customers perceive restaurant value differently from their evaluations of the overall performance. Third, we find the service aspect significantly affects the overall rating negatively, which provides a future research direction for customer psychology. Fourth, we show that the chain restaurant is a good platform for rating behavior research because it can reduce the impact of confounding variables. In addition, our study provides valuable insights for chain restaurant evaluation improvement.

The remainder of the paper is organized as follows. We first review related studies and highlight key differences between our study and representative previous research. We then formally propose the data retrieval process and econometric models we used for rating analysis.
Next, we understand and interpret the detailed model results. We conclude the paper by discussing important contributions, implications, and limitations.

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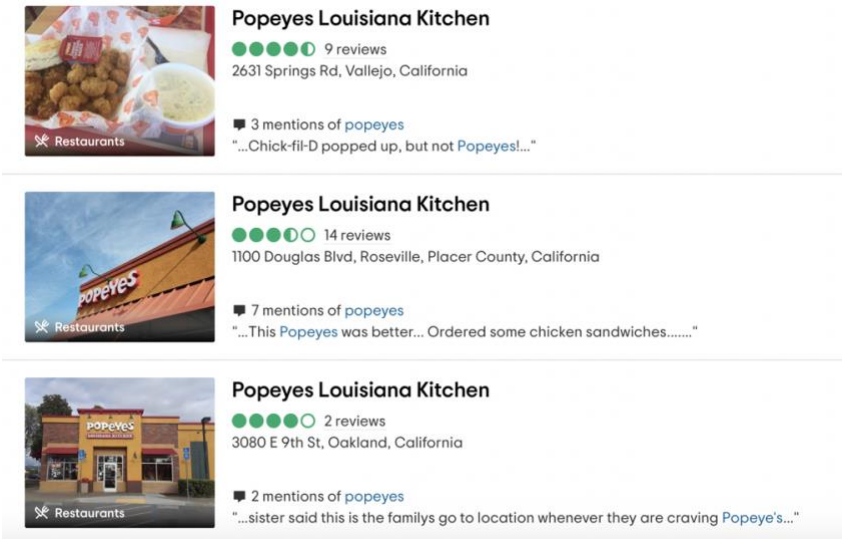
Figure 2. Restaurants from the Same Chain



LITERATURE REVIEW

Several streams of research inform our study, related to restaurant evaluations, customer perceived restaurant value, multidimensional rating systems analysis, and customer rating behavior. We review several representative studies of each stream and elaborate the gaps that motivate our study.

Restaurant Evaluations

Different variables (factors) influence restaurant customers' evaluations, satisfaction, and loyalty, such as those that pertain to the food, service, price, atmosphere, or location. Prior studies develop questionnaires and use surveys to query customers about their experience and evaluation of dining at restaurants. For example, Soriano (2002) conducts a survey evaluating different dimensions of the restaurants and assigns questionnaires to more than 5,000 customers after they finished dining at the restaurants. After conducting multiple range tests, the author cites food quality, service quality, cost, and location as key influences on customers' decisions to revisit a restaurant. Andaleeb and Caskey (2007) organize the questionnaire using seven-point Likert scales assessing cleanliness, atmosphere, space, convenient hours, food quality, staff behavior, price, and responsiveness of a college cafeteria.

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After the data collection, a multiple regression model is adopted. Food quality and selection, staff services and their behavior, and pricing are significant influencers on customers' satisfaction. Another questionnaire designed and assigned by Haghighi et al. (2012) is used to understand how do different aspects, such as food quality, service, environment, and price, influence customer satisfaction, trust, and loyalty. The results demonstrate that food quality, service quality, restaurant environment, and price fairness have positive impacts on customer satisfaction and customer trust. Similarly, food quality, healthiness, atmosphere, food variety, and value are evaluated by Naderi et al. (2018) for restaurant evaluation. The study proposed by Meng and Elliott (2008) develops personal surveys questioning customers' recent experiences with a luxury restaurant. Aspects such as physical environment, food quality, customer orientation, communication, and relationship benefits are measured using a five-point Likert-type scale. Price fairness is measured using the semantic differential scale and relationship quality was assessed using a combination five-point Likert scale (for trust) and a semantic differential scale (for satisfaction). Overall, customers' characteristics and interests explain their loyalty and relationships with restaurants (Meng and Elliott 2008). In addition, Ha et al. (2016) design web-based online survey questions querying customers' willingness to dine in or take out given aspects such as the restaurant's crowdedness and the restaurant evaluations from the overall ratings. They discover the customers' dining preferences are significantly influenced by both ratings and crowdedness. The rating and crowdedness also have significant interactive effects on the restaurant preferences. Besides the above-mentioned aspects, many other factors can affect customers' satisfaction with a particular restaurant, such as food healthiness, the smoking policy, transparency of food preparation (Yüksel and Yüksel 2003), staff behaviors, and business hours (Andaleeb and Caskey 2007).

In addition to survey-based studies mentioned above, which typically involve relatively few customers who provide opinions in response to a prompt or question (Andaleeb and Caskey 2007, Han and Ryu 2009, Kim and Han 2008, Meng and Elliott 2008, Soriano 2002, Ha et al. 2016), researchers have sought to extract evaluations from restaurant ratings on SN sites (Taylor and Aday 2016, Lu et al. 2020). For example, Lu et al. (2020) use restaurant review rating distribution and volume to understand customers' dining decision-making and motivations. In the experiments, customers reviewed different restaurant ratings with different volumes and distribution, and determined their dining preferences. Also, the study proposed by Taylor and Aday (2016) retrieved restaurant ratings of restaurants located in a large metropolitan area from OpenTable.com and analyzed the restaurant ratings and the impact of price and number of meals served daily on the ratings. They discovered the price positively affects the restaurant ratings. However, if more meals were offered daily, the ratings would go down. In addition,

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Li et al. (2021) utilized an SN application called Xiaomishu to collect restaurant ratings, the review temporal distance, which is the time difference between the review time and associated dining time, and the device used for the review, to analyze the impact of review temporal distance on restaurant rating conformity. The results indicate the positive influence of temporal distance on rating conformity.

Customer Perceived Restaurant Value

Prior studies try to understand customer perceived restaurant value from different perspectives. For example, Carlos Fandos Roig et al. (2006) describe the perceived value as "a judgment or a valuation by the customers of the comparison between the benefits or utility obtained from a product, service or relationship, and the perceived sacrifices or costs". Despite other constructs that may be influential, cost remains to be the most important effect on the value. Besides cost, service quality is evaluated and verified as a positive significant factor to impact the value (Wang et al. 2009). Moreover, Food quality is considered as a positive impact on determining restaurant customer affective responses and further promotes their perceived value (Teng and Chang 2013). In addition, Chang (2013) designed a survey and a questionnaire to analyze the causal relationship between corporation reputation and customer perceived value. The result indicates the corporation's reputation has a positive impact on perceived value. Similarly and more specifically, Ryu et al. (2012) interviewed around 300 customers querying whether environment quality, food quality, service quality, and restaurant image have significant influences on customer perceived restaurant value. The perceived restaurant value is measured using the assessments such as "whether the restaurant offered good value for the price" or "whether the restaurant experience was worth the money". The results indicate environment quality, food quality, and restaurant image are significant predictors of the perceived value.

MULTIDIMENSIONAL RATING SYSTEMS ANALYSIS AND CUSTOMER'S RATING BEHAVIOR

When are customers likely to leave a review or rating on an SN website? According to Ho et al. (2017), customers are more likely to post a rating and determine an appropriate rating, when they receive disconfirmation. When the received magnitude of disconfirmation is larger, customers are more likely to leave a rating or a review. Besides the disconfirmation effect, the negative aspects of the restaurant received by customers would influence the overall rating in a single rating system (Chen et al. 2018).

Chen et al. (2018) compare the multidimensional rating system from TripAdvisor

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with the single-dimensional rating system from Yelp[4].
They discover the multidimensional rating system enhances the rating informativeness, helps match customers' preferences with product attributes, and does not have a downward trend, compared to the single-dimensional rating system. Furthermore, Schneider et al. (2021) discover the dimensional rating bias in multidimensional rating systems. If the dimensional ratings are high, the overall rating tends to be higher; if the dimensional ratings are low, the overall rating would be lowered. The multidimensional rating system from TripAdvisor was compared with the single-dimensional rating from Yelp and the results indicated the design of the systems could influence customer rating behavior.

Gap Analysis

After reviewing prior representative studies, we identify a few gaps that have not been addressed by prior studies. First, current studies examining restaurant evaluations mainly focus on general restaurants, while unique characteristics (i.e., shared menu and similar decoration) of chain restaurants may influence the rating evaluations differently. Second, as some of the SN sites, such as TripAdvisor, started to adopt the multidimensional rating system, studies analyzing how the system design theoretically affect the customers' rating behavior (Schneider et al. 2021) and the benefits of using the system (Chen et al. 2018) are gaining attention. Unlike these studies only considering the effect of dimensional rating (as one factor) on overall rating (Schneider et al. 2021), our study specifically delves into the rating of each dimension or aspect, and analyzes the impact of different aspects on the overall rating for chain restaurant evaluations in particular. Third, instead of using survey questions to widely discover significant aspects from customers' answers (Andaleeb and Caskey 2007, Han and Ryu 2009, Kim and Han 2008, Meng and Elliott 2008, Soriano 2002), this study aims to mine customers' opinions from user-generated review ratings. Specifically, it emphasizes two aspects: service and value, because service is the most distinct feature amongst all other aspects in chain restaurants, and prior studies have mixed findings trying to understand customer perceived value (Roig et al. 2006, Wang et al. 2009, Teng et al. 2013, Chang 2013, Ryu et al. 2012). We, therefore, attempt to understand these two aspects in addition to the overall rating, explore their ratings, and interpret their impact explicitly.

[4] https://www.yelp.com/

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DATA COLLECTION AND PRE- PROCESSING

We gathered data from TripAdvisor.com, the world's largest travel platform that allows users to rate their dining experiences in restaurants with a multi-dimensional rating system. We focus on the chain restaurants in six major cities in the United States, Las Vegas, Phoenix, Champaign, Charlotte, Madison, and Pittsburgh, and matched 55 brands based on the top 100 chain restaurant list in the United States available at Nation's Restaurant News[5], such as McDonald's, Burger King, Applebee's, Dairy Queen, and Red Lobster. We first downloaded all webpages containing reviews for these restaurants in the six cities, then wrote python programs (with the package Beautiful Soap and Requests) in PyCharm to retrieve the data used in our analysis. To evaluate the impact of different aspects on the overall rating for restaurants, we extracted the overall ratings and the aspect ratings for all the reviews of the representative chain restaurants from TripAdvisor. The data, spanning between Feb 2000 and Jan 2020, contains 17,492 overall ratings with corresponding four aspect (dimensional) ratings (food, service, value, and atmosphere). Each rating ranges from 1 to 5 stars with a one-star increment (e.g., 1, 2, 3, 4, 5 stars). For the available reviews, the average overall score from the 17,492 ratings is 4.32, the average food score is 4.30, the average service score is 4.29, the average value score is 4.05, and the average atmosphere score is 4.11. Table 1 shows the descriptive statistics of the overall ratings and aspect ratings at the review level.

Table 1. Statistics Analysis of the Overall Ratings and Aspect Ratings at Review Level

	Mean	Std. Deviation	Median
Overall Rating	4.32	0.01	5
Food Rating	4.30	0.01	5
Service Rating	4.29	0.02	5
Value Rating	4.05	0.02	4
Atmosphere Rating	4.11	0.02	4

In order to analyze the aspect rating impacts at both review and restaurant level, in addition to the overall ratings and aspect ratings retrieved from each review, we also aggregate the ratings for each brand. The rating for each restaurant shown on TripAdvisor ranges from 1 to 5 stars, with half-star increments (e.g., 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5 stars).

[5] The full chain restaurant list is available at http://www.nrn.com/us-top-100/top-100-chains-us-sales?full=1

We collected and calculated the average scores from all the restaurants' ratings in the six representative cities under the same brand name for both overall and aspect ratings. These average ratings are used for the restaurant level analysis. Descriptive statistics of the overall ratings and aspect ratings at the restaurant level are shown in Table 2.

Table 2. Statistics Analysis of the Overall Ratings and Aspect Ratings at Restaurant Level

	Mean	Std. Deviation	Median
Overall Rating	4.32	0.01	5
Food Rating	4.30	0.01	5
Service Rating	4.29	0.02	5
Value Rating	4.05	0.02	4
Atmosphere Rating	4.11	0.02	4

DATA DESCRIPTION AND STATISTICS

Besides the aspect and overall review of restaurant ratings, the locations of the restaurants are also retrieved. We compare the aspect ratings of restaurant from different cities. As indicated in Figure 3, the restaurants from Las Vegas achieve the highest atmosphere, food, and value average ratings, while the restaurants from Pittsburgh have a slightly higher average service rating than Las Vegas. Overall, the average aspect ratings are comparable amongst different cities ranging from 3.73 to 4.15, from 3.82 to 4.39, from 4.07 to 4.50, from 3.59 to 4.18 for atmosphere, food, service, and value respectively.

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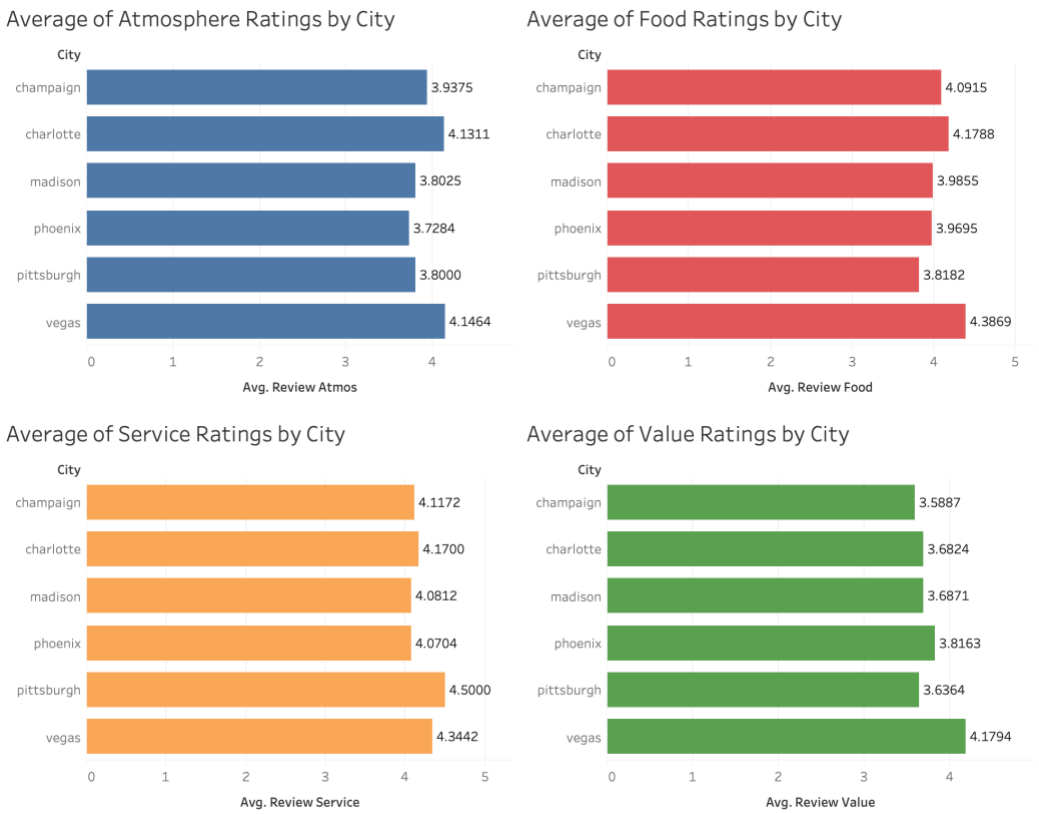
Figure 3. Average of Aspect Ratings by City



We further show statistics from a few representative chain restaurant brands such as McDonald's, Red Lobster, Olive Garden, and In and Out Burger to compare the average aspect ratings amongst various brands. As demonstrated in the following Figure 4, McDonald's has the lowest atmosphere, food, and value average ratings. However, its average service rating is the highest (5/5). Some restaurants, such as Cracker Barrel and Bonefish grill, have consistent higher average ratings in all aspects. Other restaurants, such as In N Out Burger, have lower average ratings in one aspect: atmosphere, but relatively high ratings in other aspects. Some other restaurants, like Olive Garden, Outback Steakhouse, and Red Lobster, have relatively lower ratings in all aspects.

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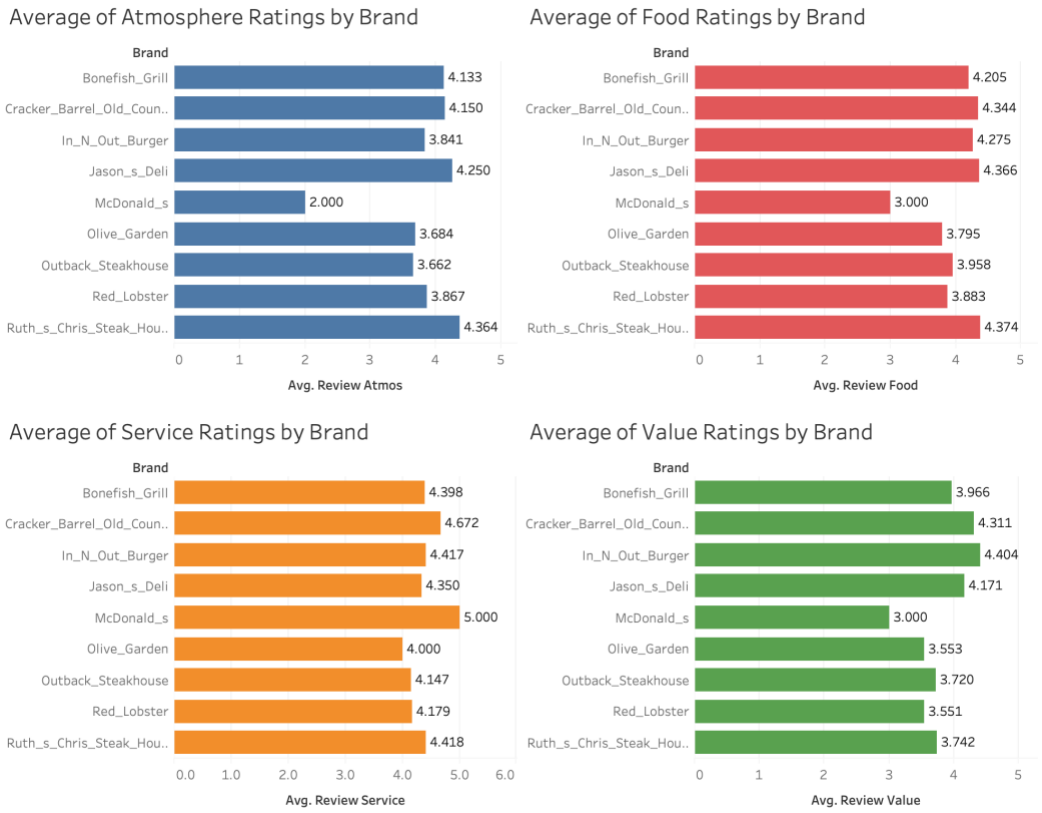
Figure 4: Average of Aspect Ratings by Brand



In addition, we divide the retrieved 55 restaurant brands into two categories: fast-food and mid-scale. Restaurants such as McDonald's, Jason's Deli, and In N out Burger are classified as fast-food. Mid-scale restaurants include brands like Red Lobster, Olive Garden, and Bonefish Grill. The comparison of restaurants' aspect ratings from different categories is demonstrated in the following Figure 5.

Fast-food restaurants receive significantly lower atmosphere average ratings, and slightly lower food and service average ratings than mid-scale restaurants. However, given lower food, atmosphere, and service aspect ratings, customers evaluate the value aspect of the fast-food restaurant higher than the mid-scales restaurants.

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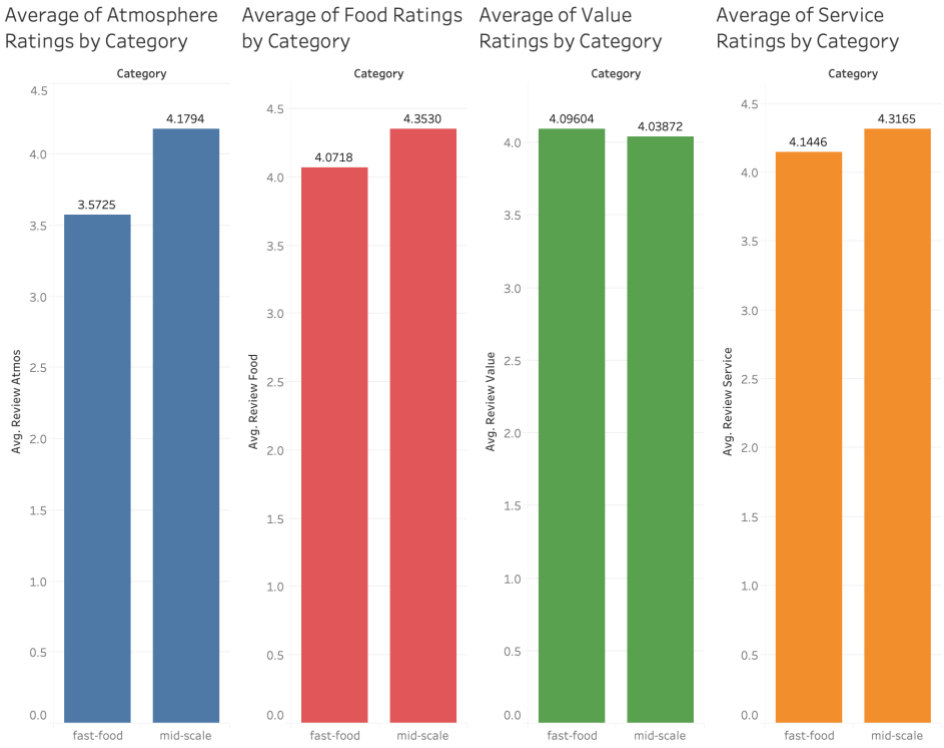
Figure 5. Average of Aspect Ratings by Category



Furthermore, we compare the overall customer-generated ratings of chain restaurants of different brands, from different categories (fast-food v.s.mid-scale), and in different cities in Figure 6. Chain restaurants in Pittsburg and Las Vegas receive the lowest and highest overall rating, respectively. Fast-food restaurants receive a marginally lower average overall rating than mid-scale restaurants. In addition, even though McDonald's receives the lowest food, atmosphere, and service ratings, the average overall rating is the highest (4.5/5) among the representative brands.

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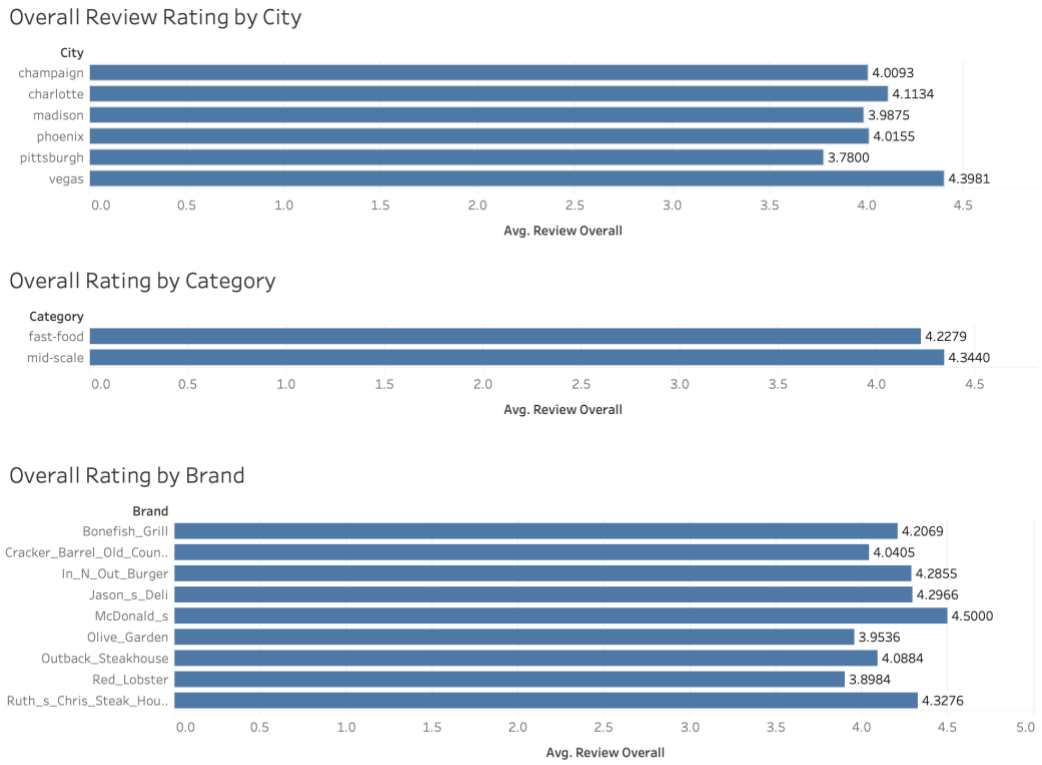
Figure 6: Average of Overall Ratings by City, Category and Brand



MODELS DEVELOPMENT

Our major research interests include (1). modeling the effect between aspects ratings including food rating, service rating, value rating, and atmosphere rating, and the corresponding overall rating; (2). analyzing the service effects specifically; (3) understanding the value aspect and evaluating the factors related to the value. We therefore develop and propose a few models to address the research questions.

Review level analysis

We start with understanding the value aspect. As indicated in the introduction, customers may perceive the value dimension differently. For example, if the value is perceived as the proportion of the food, it may relate to the food dimension.

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While if the value is understood as whether the service and other dimensions are worth the money they paid, it would also relate to the service and other dimensions. Therefore, we propose the following model (1) and evaluate whether the user's perception of the restaurant's value is related to food, service, and atmosphere dimensions.

$$ValueRating_i = \alpha_0 + \alpha_1 FoodRating_i + \alpha_2 ServiceRating_i + \alpha_3 AtmosphereRating_i + \varepsilon_i \quad (1)$$

Model (1) is built at the review level, where each unit of analysis is one individual review's rating. In model (1), $FoodRating_i$ is the rating specifically for the food aspect of the focal review i, $ServiceRating_i$ is the rating of the service aspect, and $AtmosphereRating_i$ is the rating of the atmosphere aspect. Table 3 presents the results for model (1).

Table 3. Impact of Food, Service, and Atmosphere on Value

	coefficient	p-value
Food	0.660	0.000
Service	0.266	0.000
Atmosphere	0.017	0.000
Intercept	0.004	0.262

Results of model (1) indicate all three aspects are related to user's perception of the restaurant's value.

Next, we model the effect between aspects ratings and the corresponding overall rating. Based on the results from model (1), we discover the significant correlations between value and the remaining aspects. Therefore, we exclude aspect value from our main model to avoid the multicollinearity issue. For the retrieved aspect ratings and overall ratings, the following model (2) is applied. Model (2) is also built at the review level.

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$$OverallRating_i = \beta_0 + \beta_1 FoodRating_i + \beta_2 ServiceRating_i + \beta_3 AtmosphereRating_i + \varepsilon_i \quad (2)$$

Where $OverallRating_i$ refers to the overall rating of the focal review i. We present the results of model (2) in Table 4.

As indicated in Table 4, restaurant food has a positive impact on overall rating, service has a negative impact on overall rating, and atmosphere has no impact.

Table 4. Impact of Food, Service, and Atmosphere on Overall Rating

	coefficient	p-value
Food	0.084	0.000
Service	-0.057	0.000
Atmosphere	-0.002	0.750
Intercept	4.283	0.000

Restaurant (brand) level analysis

To further validate our findings, we run a robustness analysis at the chain restaurant level (brand level) with model (3).

$$ROverallRating_r = \gamma_0 + \gamma_1 RFoodRating_r + \gamma_2 RServiceRating_r + \gamma_3 RAtmosphereRating_r + \varepsilon_r \quad (3)$$

$ROverallRating_r$ is the average overall rating of the focal chain restaurant r. For example, if r is Red Lobster, $ROverallRating$ can be calculated as the average overall rating score of all Red Lobsters in the representative six cities. Similarly, $RFoodRating_r$ is the average food score of the focal chain restaurant; $RServiceRating_r$ is the average service score of the focal chain restaurant; $RAtmosphereRating_r$ is the average atmosphere score of the focal chain restaurant.

We summarize the results of model (3) in Table 5. The results indicate at the restaurant level, all three aspects have no significant impact on the overall ratings. We interpret and discuss our results in the following section.

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Table 5. Impact of Food, Service, and Atmosphere on Overall Rating at Restaurant Level

	coefficient	p-value
RFood	0.015	0.886
RService	-0.012	0.898
RAtmosphere	-0.034	0.268
Intercept	4.214	0.000

Comparative analysis amongst different cities

Customers from different cities may have different preferences when dining in a restaurant, as shown in Figure 3. We, thus, do comparative analyses for each of the six cities, Las Vegas, Phoenix, Champaign, Charlotte, Madison, and Pittsburgh. To examine the potential effect of aspect ratings on the overall ratings in different cities, we develop model (4) and (5). Model (4) is used to examine whether the user's perception of the restaurant's value is related to food, service, and atmosphere in each city. The review level analysis is applied to each city.

$$ValueRating_{ic} = \alpha_0 + \alpha_1 FoodRating_{ic} + \alpha_2 ServiceRating_{ic} + \alpha_3 AtmosphereRating_{ic} + \varepsilon_i \quad (4)$$

Where $c \in \{LasVegas, Phoenix, Champaign, Charlotte, Madison, Pittsburgh\}$, $ValueRating_{ic}$, $FoodRating_{ic}$, $ServiceRating_{ic}$, $AtmosphereRating_{ic}$ are the value rating, food rating, service rating, and atmosphere rating of a review from one specific city. The results are summarized in Table 6.

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Table 6. Impact of Food, Service, and Atmosphere on Value Rating in Different Cities

City	Food coefficient	Food p-value	Service coefficient	Service p-value	Atmosphere coefficient	Atmosphere p-value
Las Vegas	0.651	0.000	0.285	0.000	0.018	0.000
Madison	0.679	0.000	0.222	0.000	0.048	0.002
Charlotte	0.647	0.000	0.239	0.000	-0.002	0.807
Champaign	0.575	0.000	0.255	0.000	0.072	0.000
Phoenix	0.711	0.000	0.243	0.000	-0.021	0.089
Pittsburgh	0.903	0.000	0.037	0.664	0.003	0.948

These results indicate that, for customers in various cities, their perceived value is correlated to at least one other aspect. Thus, to avoid the multicollinearity problem, we develop model (5) to evaluate how restaurant overall rating is affected, with value rating excluded.

$$OverallRating_{ic} = \beta_0 + \beta_1 FoodRating_{ic} + \beta_2 ServiceRating_{ic} + \beta_3 AtmosphereRating_{ic} + \varepsilon_i \quad (5)$$

The results of model (5) are summarized in Table 7 and the majority of the results show consistency with our main model (2) regarding the impact direction, e.g., food rating can positively impact the overall rating and service has a negative impact.

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Table 7. Impact of Food, Service, and Atmosphere on Overall Rating for Different Cities

City	Food coefficient	Food p-value	Service coefficient	Service p-value	Atmosphere coefficient	Atmosphere p-value
Las Vegas	0.082	0.000	-0.063	0.000	0.007	0.334
Madison	0.106	0.048	-0.028	0.594	-0.115	0.001
Charlotte	0.018	0.690	0.046	0.300	-0.033	0.115
Champaign	0.098	0.214	-0.065	0.391	0.033	0.469
Phoenix	0.101	0.174	-0.050	0.486	-0.071	0.076
Pittsburgh	0.697	0.051	-0.452	0.136	-0.094	0.547

Comparative analysis between fast-food and mid-scale restaurants

Fast-food and mid-scale restaurants are two categories with distinct dining styles and the aspects customers care about might be different as well, as depicted in Figure 5. Thus, a comparative analysis of these two categories is conducted. To examine the difference between fast-food and mid-scale restaurants, we develop model (6) and (7) to analyze the impacts of different aspects respectively. Same as the previous model, we first evaluate the impact of food, service, and atmosphere on customer perceived value. These analyses are also applied at the review level.

$$ValueRating_{il} = \alpha_0 + \alpha_1 FoodRating_{il} + \alpha_2 ServiceRating_{il} + \alpha_3 AtmosphereRating_{il} + \varepsilon_i \quad (6)$$

Where $l \in \{Fast\_food, Mid\_scale\}$; $ValueRating_{il}$, $FoodRating_{il}$, $ServiceRating_{il}$, $AtmosphereRating_{il}$ are the value, food, service, atmosphere ratings from a specific fast-food or mid-scale restaurant review, respectively. The results are summarized in Table 8 and indicate customer perceived value is significantly related to food, service, and atmosphere for both fast-food and mid-scale restaurants. Therefore, we propose model (7) to examine how the other three aspects affect the restaurant's overall rating.

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Table 8. Impact of Food, Service, and Atmosphere on Value Rating for Fast-food and Mid-scale Restaurants

Restaurant category	Food coefficient	Food p-value	Service coefficient	Service p-value	Atmosphere coefficient	Atmosphere p-value
Fast-food	0.670	0.000	0.309	0.000	0.018	0.004
Mid-scare	0.665	0.000	0.247	0.000	0.026	0.000

$$OverallRating_{il} = \beta_0 + \beta_1 FoodRating_{il} + \beta_2 ServiceRating_{il} + \beta_3 AtmosphereRating_{il} + \varepsilon_i \quad (7)$$

We summarize the results of model (7) in Table 9. Both categories of restaurants show the same results as the main model, except for the atmosphere aspect rating from fast-food restaurants: atmosphere rating can significantly and negatively impact overall rating.

Table 9. Impact of Food, Service, and Atmosphere on Overall Rating for Fast-food and Mid-scale Restaurants

Restaurant category	Food coefficient	Food p-value	Service coefficient	Service p-value	Atmosphere coefficient	Atmosphere p-value
Fast-food	0.146	0.000	-0.120	0.001	-0.059	0.003
Mid-scare	0.055	0.001	-0.031	0.059	0.002	0.735

Comparative analysis among different restaurant brands

Following the last analysis, we further distinguish reviews from different brands in our analysis. Figure 4 and 6 compare average aspect ratings and overall ratings from representative brands. The first step in differentiating the brands is to develop Model (8). Model (8) is evaluating the impact of food, service, and atmosphere aspects on value. For a specific chain restaurant brand, if the value aspect is significantly associated with at least one of the other three aspects, we apply Model (9), otherwise, we apply Model (10) for that brand. In Model (9), we exclude the value aspect to avoid the multicollinearity problem, while in model (10), we incorporate the value aspect as one of the independent variables, because for that particular brand, value is not associated with any other aspects.

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$$ValueRating_{ib} = \alpha_0 + \alpha_1 FoodRating_{ib} + \alpha_2 ServiceRating_{ib} + \alpha_3 AtmosphereRating_{ib} + \varepsilon_i \quad (8)$$

$$OverallRating_{ib} = \beta_0 + \beta_1 FoodRating_{ib} + \beta_2 ServiceRating_{ib} + \beta_3 AtmosphereRating_{ib} + \varepsilon_i \quad (9)$$

$$OverallRating_{ib} = \beta_0 + \beta_1 FoodRating_{ib} + \beta_2 ServiceRating_{ib} + \beta_3 AtmosphereRating_{ib} + \beta_4 ValueRating_{ib} + \varepsilon_i \quad (10)$$

Where $b \in \{55\ Brands\}$. We show the results from representative 9 restaurant brands of model (9) and (10) in Table 10. The results are consistent with our main model for most of the brands.

Table 10. Impact of Food, Service, Atmosphere, and Value on Overall Rating for Different Restaurant Brands

Brand Name	Food coefficient	Food p-value	Service coefficient	Service p-value	Atmosphere coefficient	Atmosphere p-value	Value coefficient	Value p-value
In N Out Burger	0.699	0.000	-0.428	0.000	0.037	0.229	-0.238	0.001
Jason's Deli	0.621	0.007	-0.243	0.119	0.049	0.672	-0.355	0.134
Olive Garden	0.649	0.026	-0.494	0.064	-0.081	0.387	0.004	0.983
Outback Steakhouse	0.294	0.002	-0.276	0.000	-0.076	0.048	0.032	0.748
Red Lobster	0.164	0.359	-0.225	0.055	-0.039	0.554	0.132	0.506
Bonefish Grill	0.071	0.593	-0.128	0.160	-0.121	0.042	0.153	0.226
Ruth's Chris Steakhouse	0.030	0.558	-0.314	0.000	-0.031	0.076	0.397	0.000
Cracker Barrel	0.399	0.011	-0.285	0.055	-0.018	0.794	N/A	N/A
McDonald's	-0.158	0.000	-0.263	0.000	-0.105	0.000	N/A	N/A

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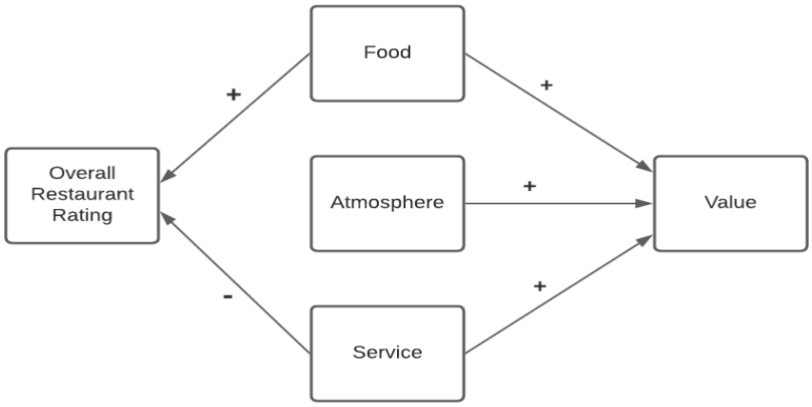
RESULTS ANALYSIS AND DISCUSSION

We depict our major results in Figure 7 and discuss the details in the following.

Figure 7. Major Results from Proposed Main Models



First of all, to better understand the value aspect and analyze the impact of other aspects on the value dimension, we proposed model (1). Model (1) reveals the significant impacts of all other three aspects (food, service, and atmosphere) on the value aspect. This result helps us better understand the value aspect of chain restaurants. The value dimension rating is assessed and provided based on all other evaluated aspects. Food, service, and atmosphere positively and significantly enhance the evaluation of the value aspect. These findings are in accordance with the results from prior literature. Food (Teng et al. 2013) and service quality (Wang et al. 2009) positively and significantly enhance the evaluation of the value aspect. In addition to food and service, our study also confirms the significant positive impact of atmosphere aspect rating on the value rating. In this sense, if customers received good service, enjoyed the dining atmosphere, and ate well-prepared food in a chain restaurant, they would consider this restaurant as a good value restaurant.

Second, after removing the value aspect rating to avoid the multicollinearity issue from the main model (2), in line with prior study (Andaleeb and Caskey 2007, Haghighi et al. 2012, Naderi et al. 2018), we discover that food has significantly positive impact on the overall chain restaurant rating. This finding indicates even

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though the menu and food sources are similar amongst chain restaurants under the same brand, there may be minor or significant differences in terms of the taste and portion of the food, because each individual restaurant hires its own chef.
The better food customers get from the branch of the chain restaurant, the more satisfied they are, and the higher overall rating they give to the restaurant.

Third, unlike the prior results that indicate the positive influence of service or staff behavior on overall restaurant evaluations (Andaleeb and Caskey 2007, Haghighi et al. 2012), our results demonstrate ratings from service aspect have significant negative impact on the overall chain restaurant rating. This finding is very interesting. Restaurants from the same chain may have the standard menu, close price range, and other similar features. However, each restaurant hires its own employees and conducts particular training. The service aspect, therefore, can be very diverse amongst different branches of the same chain restaurants. It's expected that service aspect rating has a significant influence on the overall rating. The negative effect, however, is very surprising. A higher service aspect rating may lead to a lower overall rating. This can be understood as customers evaluate service differently from the overall rating. If the service is good, customers rate the aspect higher, and may give a generous amount of tip to the employee. But the overall cost including the tip exceeds the overall evaluation customers perceived from the restaurant, and therefore reduces the overall restaurant rating. In addition, when customers receive good service in a restaurant, they expect the overall performance of the restaurant should be comparable with the service. However, a chain restaurant branch usually performs similar to other branches with the same brand name. Therefore, customers may feel disappointed with the overall experience in the restaurant, which leads to a lower overall rating.

Last, the atmosphere aspect rating has no significant effect on the overall rating. Since chain restaurants adopt similar interior design and decoration, customers' perception of the overall atmosphere should be consistent amongst different restaurants from the same chain.

The results in Table 5 show that, the impacts of different aspects at the restaurant level actually have the same direction as the findings we received at the review level. However, because of the limited amount of data available at the restaurant level (only 55), the rating impacts are not significant for food and service aspects. In the future, we would like to gather more data and confirm our findings.

Results in Table 6 to Table 10 from multi-level comparative analyses indicate that, our findings are general enough to support the effects between restaurant aspects and overall ratings across different cities, different restaurant categories

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(fast-food versus mid-scale), and different restaurant brands. For example, for the restaurants in Las Vegas, food and service aspects significantly impact the overall ratings, with positive and negative influences.
Similarly, for both fast-food and mid-scale chain restaurants, food positively and service negatively influence the overall rating. Moreover, the results of representative top chain restaurant brands in the individual analyses demonstrate the major contributions of service and food aspect ratings to the overall ratings.

There are a couple of exceptions. For example, the significant levels for different cities are not exactly the same. For the restaurants in Champaign, the service aspect significantly and negatively affects the overall rating, while food is positively, but does not significantly influence the overall evaluation. In Madison, customers evaluate the overall chain restaurant rating based on food significantly and positively. Even though the impact direction of the service aspect is consistent with the main model results (negative), the impact is not significant. These deviations might be caused by the distinct lifestyles of customers living in different cities, which influence their focus points of dining in restaurants.

Besides, the atmosphere rating can negatively affect fast-food restaurants' overall rating. This result might be due to the traits of a fast-food restaurant. Customers do not go to a fast-food restaurant seeking an awesome dining environment and atmosphere. Instead, they may care more about the food. They believe fast-food restaurants' effort put into the atmosphere may limit the effort on food. Thus, the atmosphere has a negative impact on the overall rating. Given these exceptional cases, our results are consistent in different analyses, which suggests the generalization of our findings.

CONCLUSION AND IMPLICATION

In this study, we retrieve the aspect ratings and the overall restaurant ratings from the TripAdvisor multidimensional rating system and propose several models to analyze and understand the aspect ratings and their impacts on the overall ratings from chain restaurants. We discover that the food aspect rating has a significant positive influence on the overall rating, the service aspect rating significantly and negatively affects the overall rating, and the atmosphere aspect rating has no significant impact on the overall rating. These main findings are consistent in different comparative analyses, with the emphasis on cities, brands, and categories, which indicates the generalization of our findings. One interesting finding is that a higher service rating may lead to a lower overall rating. It is because when customers perceive good quality service, they would expect the same level of

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qualities from other aspects. When service is good enough, while other aspects' evaluations remain low or comparable with other restaurants from the same chain, the overall rating would decrease. In addition, we try to understand and interpret the value aspect rating. All the other retrieved aspects: food, service, and atmosphere significantly influence the value dimension rating. In this case, customers assess one focal restaurant's value based on other aspects' particular evaluations. Any positive evaluations of other related aspects would enhance the restaurant's value.

Our study makes academic contributions from the following aspects.
First, it improves the understanding of customers' rating behavior by showing the correlation between the rating of the other aspects and the overall rating. Customers do not rate a restaurant as a concrete object, rather, they decompose the restaurant's performance and evaluate the restaurant from various aspects. This further contributes to the existing multidimensional rating system studies as it shows the validation of such systems. Second, to follow the first contribution, our study further examines the correlation between the aspect value and the other three aspects, food, service, and atmosphere. The findings indicate that, the value aspect, same as the overall rating, is associated with the other three aspects.
However, the correlations between service or atmosphere and value are different from those to the overall rating. This means that, customers treat a restaurant's overall performance differently from its value, and this finding provides an interesting topic for future studies in customer rating behavior. Third, with the surprising finding that the service aspect has a significant negative impact on the overall rating evaluation, researchers in customer psychology and related areas could explore more and examine why customers treat service as a negative factor in chain restaurants' overall performance. Fourth, our study shows that chain restaurants are a good platform for future studies to research on customer rating behavior. Given the chain restaurant setting, customers' rating behavior can be explored and examined without the impact of excessive confounding factors while preserving the necessary diversity, because restaurants that belong to the same chain brand share comparable aspects, such as a standard menu, and service training process, or atmosphere. However, how to practice these standards remains different for each individual restaurant.

Our study also has multiple practical implications. Our study provides valuable suggestions to chain restaurants who want to enhance their overall ratings on SN sites. First, when chain restaurants intend to enhance its overall rating on SN sites, they can improve their food quality as much as possible even with the standard menu and similar dish receipt from the same chain. Second, if chain restaurants

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only train their employees for better customer service, without the improvements from other dimensions, the overall restaurant evaluation may still remain low.
Third, since the "value" aspect rating depends on all other aspects, it could be significantly improved if any of the other dimensions' evaluation, such as food, service, and atmosphere enhanced.

LIMITATION AND FUTURE RESEARCH

One of the limitations of this study is that the available number of chain restaurants from the six representative cities is only 55. Therefore, the robustness analysis model built at the restaurant level doesn't include sufficient sample records. In the future study, we can include other restaurants from more cities nationwide.
With additional cities involved, we will be able to query complementary chain restaurants evaluations.

Another limitation of our study is the limited number of aspects available from TripAdvisor multidimensional rating system. We are only able to retrieve 4 aspects' numeric ratings from the system. Other possible restaurant dimension evaluations may be available in the format of textual review. Our future study could adopt text analytic tools to discover additional restaurant evaluations from written customer reviews. We will collect a comprehensive list of aspects and their corresponding evaluations to conduct more advanced analyses and receive additional insightful results.

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