How does review disconfirmation influence customer online review behavior? A mixed-method investigation

Hengyun Li*, Ph.D., Assistant Professor
School of Hotel and Tourism Management,
The Hong Kong Polytechnic University,
Hong Kong SAR, China
Email: neilhengyun.li@polyu.edu.hk

Fang Meng, Ph.D., Associate Professor
School of Hotel, Restaurant and Tourism Management,
University of South Carolina
Columbia, SC 29208, United States
Email: fmeng@hrsm.sc.edu

Bing Pan, Ph.D., Associate Professor
Department of Recreation, Park, and Tourism Management,
School of Health and Human Development,
Pennsylvania State University, University Park, USA
Email: bingpan@psu.edu

*Corresponding Author: Hengyun Li
Corresponding Email Address: neilhengyun.li@polyu.edu.hk

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Abstract:

Purpose: With the growing online review manipulation and fake reviews in the hospitality industry, it is not uncommon that a consumer encounters disconfirmation when comparing the existing online reviews with his/her own product or service evaluation. This objective of this study is to investigate the influence of review disconfirmation on customer online review writing behavior.

Design/methodology/approach: This study used a mixed-method combining online secondary big data modeling and experimental design.

Findings: (1) Review disconfirmation influences customers' emotional responses embedded in the review; (2) A customer who encounters review disconfirmation tends to exert more reviewing effort, manifested by writing longer reviews; (3) Negativity bias exists in disconfirmation effects, in that negative review disconfirmation shows more significant and stronger effects than positive review disconfirmation.

Practical implications: Findings from this study provide important managerial implications for business owners and marketers who attempt to influence online reviews. The study suggests that fictitious online review manipulation might be detrimental to the business.

Originality/value: This research contributes to two literature streams, including research on social influence of online consumer reviews, and the relationship between disconfirmation and consumers' post-consumption behavior, by extending the influence of disconfirmation from the offline context to online context.

Keywords: review disconfirmation; customers' emotional response; reviewing effort; negativity bias; restaurant

1. Introduction

Online consumer review platforms commonly include information such as ratings, textual reviews, and occasionally business rankings. Online consumer-generated reviews are often considered a truthful and unbiased reflection of consumers' product or service experiences (Hu et al., 2011). An increasing number of consumers have come to rely on online reviews when making purchase decisions (Chakraborty, 2019). Extant literature suggests that online reviews can positively influence product sales and firms' financial performance. For example, Yacouel and Fleischer (2012) noted that positive consumer reviews lent hotels a price premium on the websites of online travel agencies (OTAs).

Previous literature on services marketing suggests that word-of-mouth (WOM) can build up and affect customer expectations (Zeithaml et al., 1993). Customers normally gather information on a product/service from different sources, including traditional and electronic WOM (eWOM). Thus, eWOM, which is largely represented by online reviews, is a source for building customer expectations. Positive eWOM increases consumer expectations, whereas negative eWOM decreases them (Mauri and Minazzi, 2013). In particular, online reviews often shape consumers' product/service expectations before making a final purchase decision (Mauri and Minazzi, 2013). Review disconfirmation thus refers to the difference between a consumer's own evaluation and the pre-purchase expectation set up by other consumers' prior average review rating online.

Upon purchase and consumption, a consumer forms his/her post-consumption evaluation of the specific product/service and possibly encounters a certain degree of disconfirmation when comparing his/her pre-purchase expectations and post-consumption evaluation of a product/service (Ho et al., 2017). Positive disconfirmation (i.e., when the experience is more positive than the expectation) normally increases customer satisfaction, whereas negative disconfirmation reduces it (Anderson and Sullivan, 1993). However, given

either positive or negative review disconfirmation, the consumer faces the decision on how to write and what to write in his/her own corresponding review if he or she chooses to do so.

Although previous literature has explored the influence of disconfirmation on customer satisfaction and post-purchase behaviors in the offline context, the relationship between review disconfirmation and consumers' online review behavior has been largely overlooked. Only very limited studies have examined the review disconfirmation under the online review context. For example, Ho et al. (2017) reported the impact of review disconfirmation on consumers' propensity to post online reviews as well as their review rating behavior for manufacturing products. Li et al. (2020b) investigated the impact of review disconfirmation on an individual consumer's online review posting speed. However, no previous research has investigated the influence of review disconfirmation on customer online textual review writing behavior, i.e., how to write and what to write in a review.

Furthermore, in the meantime, an increasing number of companies have begun to manipulate online reviews in various ways, for example, by posting deceptive positive reviews for their own products, posting deceptive negative reviews for their competitors' products, or both (Anderson and Simester, 2014). It is not uncommon that a consumer encounters a certain degree of disconfirmation when comparing the existing online review with his/her own product/service evaluation. Therefore, it is important and meaningful to test the review disconfirmation effects for experience-oriented hospitality products.

To address the above mentioned research gaps, the objective of present study is to empirically test the effect of review disconfirmation on customers' online review writing behavior, specifically customers' emotional responses embedded in the review and their reviewing efforts. Customers' emotional responses embedded in the review and their reviewing effort are important to consumers and businesses. First, a significant and strong relationship exists between positive emotion and customer satisfaction (Han et al., 2009), and

customers' emotional response is the most important determinant of customer behaviors (Bagozzi et al., 1999). Moreover, customers' emotional response is the basis for their future judgments towards the product/service (Turley and Fugate, 1992), and leads consumers to spend more money (Donovan et al., 1994). Second, a user's reviewing effort is important given that higher reviewing effort generates higher quality reviews and more helpful reviews (Xu et al., 2020). Reviews involving high user reviewing effort contain more relevant, comprehensive, and accurate product/service information; therefore, such reviews are more persuading and impose a greater influence on consumer purchase intention.

Therefore, this research contributes to two literature streams, including research on social influence of online consumer reviews, as well as research on the relationship between review disconfirmation and consumers' post-consumption behavior. In particular, this study further extends the understanding of the influence of disconfirmation from an offline context to an online context, which is significant and meaningful for the fast-growing online review platforms in hospitality and tourism. This study provides insights on the outcome of consumers' review disconfirmation, which possibly caused by review manipulation or deceptive reviews. Therefore, this study particularly benefits the companies and online review platforms on managing online reviews and reducing unnecessary review disconfirmation.

2. Literature Review

This study is grounded in the following two fundamental theories: (1) Expectancy-disconfirmation theory; and (2) social influence theory. Expectancy-disconfirmation theory, as one of the most widely accepted frameworks in consumer behavior, is often applied in customer satisfaction research (Oliver, 1981; Liu and Jang, 2009). Substantial research has empirically tested this theory in different fields and determined that customer satisfaction/dissatisfaction is derived from the comparison between customer expectations and perceived product performance (Woodruff et al., 1983). Consumers' expectations are confirmed when the perceived product performance just meets their expectations, and they experience indifference; consumers experience a positive disconfirmation when the perceived product performance exceeds their expectations; when performance fails to meet expectations, consumers are faced with negative disconfirmation (Oliver, 1981).

More recent literature examines the consumers' expectancy-disconfirmation in the online review setting. For example, Hu et al. (2017) reported that product quality is inferred from online reviews, and the prior reviews' average rating is often used as a proxy for product quality. Qazi et al. (2017) also found that prior online reviews posted by other consumers have a positive effect in raising people's expectations. Expectancy-disconfirmation theory is applied in this study to examine the review disconfirmation between post-consumption evaluations and the average of prior review ratings, as well as its influence on consumers' online review-posting behavior.

Social influence theory indicates that individuals may exhibit conformity and uniqueness needs (Sherif, 1936; Fromkin, 1970), as well as normative conflict (Packer, 2008), in social groups . More specifically, people tend to conform to others in their social groups (Darley and Latané, 1968). When people think that they are too similar with others, their uniqueness motivations are activated (Snyder and Fromkin, 1980). Particularly,

normative conflict emerges when a large deviation exists between an individual's own opinion and the group opinion which he/she deems harmful; the individual tends to neglect the pressure to conform in this situation (Hornsey et al., 2002). This study focuses on the effect of consumers' disconfirmation between their own post-consumption evaluations and other consumers' prior average review ratings, therefore, social influence theory is incorporated into this study as one of the supporting theories.

2.1 Review Disconfirmation

The literature on review disconfirmation has been summarized in Table 1. Generally, this topic has not attracted enough scholarly attention. Two major research streams are presented, including (1) the antecedents of review disconfirmation (Hong et al., 2016; Qazi et al., 2017; Yang et al., 2018); and (2) consequences of review disconfirmation (Hong et al., 2016; Yin et al., 2016; Ho et al., 2017; Qazi et al., 2017; Li et al., 2020b; Nam et al., 2020). Several research gaps are found. **First**, previous studies have only examined the effects of review disconfirmation on perceived review helpfulness (Hong et al., 2016; Yin et al., 2016), willingness to write reviews, review rating and negative eWOM (Ho et al., 2017; Nam et al., 2020), review posting speed (Li et al., 2020b), and distrust of the eWOM and review website (Nam et al., 2020). No research has investigated the influence of review disconfirmation on the characteristics of online textual review content posted by consumers, which is also an essential component of online review behavior. The only exception is a study conducted by Qazi et al. (2017), who found that disconfirmation leads consumers to use more sentiment words in a review. The limitation of this study lies in its methodology, which employed structural equation modeling based on cross-sectional survey data only. **Second**, all previous studies applied either the econometric method using online secondary data (Hong et al., 2016; Yin et al., 2016; Ho et al., 2017; Li et al., 2020b) or structural equation modeling using survey data (Qazi et al., 2017; Nam et al., 2020). Due to these methodological limitations,

prior studies either cannot verify whether individuals were aware of the review disconfirmation (between their own evaluations and prior average review ratings) or cannot address the potential endogenous issues, possibly leading to spurious regression and relationship. This study overcomes this limitation by using a mixed-method, combining the econometric modeling and an experimental design, which better examines consumers' review disconfirmation and its influences.

----------<Insert Table 1 Here>----------

2.2 Effect of Review Disconfirmation on Customers' Emotional Response

According to expectancy-disconfirmation theory, disconfirmation leads to the formation of emotions (Westbrook, 1987), deemed either satisfaction or dissatisfaction (Woodruff et al., 1983). Oliver (1993) stated that satisfaction/dissatisfaction is a combination of cognition and emotion; that is, satisfaction can be divided into two components: (1) cognitive beliefs about product consumption outcomes, and (2) affective responses to the outcome. Westbrook (1987) and Oliver (1993) pointed out that the frequency of positive product/consumption affect is related to judgments around product satisfaction. When satisfied, a consumer will express positive consumption emotions; when dissatisfied, he/she will express negative or ironic ones.

Westbrook and Oliver (1991) stated that disconfirmation is positively associated with the pleasant surprise dimension of emotion and negatively associated with the hostility dimension. Similarly, Oliver et al. (1997) addressed that positive emotion is determined by how much the consumption experience exceeds one's expectations and how pleasantly surprising the experience is. On the contrary, confirmation is more likely to lead to a neutral or weak emotional response. Thus, the larger the disconfirmation, the stronger emotion is expressed in consumer reviews online. Similarly, based on survey data, Qazi et al. (2017) demonstrated that online reviews influences users' expectations, and there is a strong connection among expectation, disconfirmation, and performance. In addition, review disconfirmation is positively associated with sentiment words, which in turn helps predict consumer satisfaction with the purchased product/service (Qazi et al., 2017). Specifically, when consumers experience positive disconfirmation, they are more likely to post reviews with positive sentiment words (e.g., happy and excited). When consumers meet negative disconfirmation, they tend to write reviews with more negative sentiment words (e.g., unhappy and sad).

Similar to previous studies (Ho et al., 2017; Yin et al., 2016), the gap between the average rating of previous reviews and the current review was adopted as the surrogate for the expectation-experience difference. Occasionally, a consumer may acquire a product/service directly without checking online product reviews prior to making the purchase. In this case, the consumer may later see prior reviews and encounter a certain degree of disconfirmation when he/she decides to post an online review by visiting the online review webpage (Moe and Schweidel, 2012). Thus, the following hypothesis is proposed:

Hypothesis 1 (H1): Review disconfirmation between an individual's own experience and average prior review rating affects customers' emotional response embedded in a review. Specifically, with the review disconfirmation becoming negative, consumers tend to express less positive emotional responses in reviews.

2.3 Effect of Review Disconfirmation on User Reviewing Effort

Other social and psychological factors may also impact the nature and characteristics of online reviews. Social influence theory (Sherif, 1936) suggests that people simultaneously experience conformity and a "being-different" motivation. Similarly, Dichter (1966) and Ho and Dempsey (2010) stated that an important driver behind individuals' WOM behavior is self-expression and the need to be different. According to Snyder and Fromkin (1980), this motivation for uniqueness becomes dominant when individuals perceive themselves as overly similar to others in a social group. For instance, Duval (1976) discovered that group members tend to contribute less to a specific task if they perceive other members highly similar to themselves. As such, it is reasonable to assume a consumer may contribute less to a review task, or even refuse to write a review when the product consumption experience is similar to other consumers' online ratings. However, consumers tend to show strong conflicts, when they perceive a high level of deviance from others' or the social group's norms or standards, particularly when they believe other members' opinions are incorrect or harmful (Hornsey et

al., 2002). These dissenters can alienate themselves from the group norm by expressing different opinions with the attempt to persuade others to change their behavior (Packer, 2008). Therefore, dissenting behaviors induced by normative conflict are prominent when people have the opportunity to make their behaviors highly visible and to explain why they have deviated from the group norm or other group members (Packer, 2008).

Similarly, based on expectancy-disconfirmation theory, Santos and Boote (2003) reported that the sameness between predicted expectations and perceived product performance may lead to no affective action on the consumer's part. However, if a product's performance is better than predicted or even desired, the consumer will consequently feel satisfied and delighted (i.e., positive disconfirmation). In this case, the consumer is likely to compliment the business on its product/service. The intensity of the compliment will also increase, corresponding to the degree of positive disconfirmation. In contrast, if negative disconfirmation occurs (i.e., the perceived product performance is below a consumer's expectations), he/she will feel dissatisfied, sad, angry, or anxious.

Extending Oliver's (1980) study, Bearden and Teel (1983) incorporated consumer complaint behavior into the expectancy-disconfirmation model as a post-satisfaction behavior. They reported that expectation and positive disconfirmation are positively related to satisfaction, which negatively influences subsequent complaints. Cho et al. (2002) also revealed that unmet consumer expectations are the primary drivers behind consumers' complaint behavior. Thus, the consumer will be more likely to complain to the business under negative disconfirmation. The intensity of the complaint increases with an increase in negative disconfirmation.

In addition, people tend to make sense of their past experience to better prepare for the future (Park, 2010; Pennebaker, 1997), especially when they encounter unexpected, emotional, or negative experiences (Wilson and Gilbert, 2008). These efforts involve several

cognitive processes, including explaining (Malle, 2004) and analytical writing (Lyubomirsky et al., 2006). These cognitive processes help people come to an understanding of their overall experience and assess the causes and outcomes of this experience (Wilson and Gilbert, 2008). Accordingly, the following hypothesis is proposed:

> Hypothesis 2 (H2): *A consumer who encounters review disconfirmation tends to allocate more effort in writing reviews, manifested by writing longer reviews.*

3. Methodology

This study adopted a mixed research method including online secondary data modeling and an experimental design via survey research. Previous literature has validated that triangulation from different data sources and methods can improve the reliability and validity of a study (Meijer et al., 2002). Therefore, compared with previous studies relying on a single data source or single method, findings from this study are more robust and valid as they can be validated from other data sources and different methods. Figure 1 shows the methodology roadmap.

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3.1 Methodology for Online Secondary Big Data Modeling

3.1.1 Sample

Data used in this study were collected from a popular online review website, Yelp.com. Reviews of restaurants represent the largest category on Yelp. The most popular 300 restaurants in a metropolitan city of the US, were selected based on the total number of reviews and a sufficient number of reviews per restaurant. All restaurant reviews published before October 2018 were obtained from the website. The establishments ranged from casual to fine dining, limited service to full service, and included all restaurant styles. The total sample consisted of 600,686 reviews. Data on the reviews include a numerical rating on a 5-star scale, timestamps, review text, and the number of pictures embedded in the review. All reviews on any individual restaurant were arranged in chronological order. Each reviewer's yearly online status (elite or non-elite) was also collected.

3.1.2 Variables Operation and Summary Statistics

Independent Variables. *Review Disconfirmation* ($Disconfirmation_{ijt}$). Following Hong et al. (2016), review disconfirmation was measured as the difference between a focal review's rating and the average of prior ratings before this review. Review disconfirmation was coded as 0 if the rating of a focal review being equal to the prior average rating (i.e., confirmation); coded as 1 if the rating of a focal review was lower than the prior average rating (i.e., negative disconfirmation); and coded as 2 if the rating of a focal review was higher than the prior average rating (i.e., positive disconfirmation). The average review rating prior to the focal review (i.e., the *n*th review) was calculated as the average of the first, second, …, $(n-1)^{\text{th}}$ review ratings for restaurant j ($AveOthers_{jt}$). It measures pre-purchase expectations for the n^{th} review author. Rather than using the exact average rating of a restaurant, the rounded average to the nearest half-star was employed in this study as publicized by Yelp (Ma et al., 2013). The rounded average was in accord with what was displayed on the platform.

Dependent Variables. First, customers' emotional response was measured by positive emotional intensity embedded in the textual review. *Positive emotions intensity* ($Posemo_{ijt}$) was measured as the percentage of positive emotional words in a review, such as "good", "pretty", and "happy". Linguistic Inquiry and Word Count (LIWC) was employed to analyze this variable. LIWC is a text mining software, which is used to calculate the percentage of words in a specific review matched to pre-defined dictionaries. The LIWC program has its frequent use in psychology but becomes increasingly common in marketing studies and information systems research. Second, following Xu et al. (2020), the user reviewing effort was measured by review length; thus *Review length* ($Length_{ijt}$) was the second dependent variable. The total number of words in a review was used to measure review length.

Control variables. The authors controlled for the average review rating prior to the publication of the focal review as a proxy for consumer expectations of the restaurant. According to expectancy-disconfirmation theory (e.g., Oliver, 1980), expectation and disconfirmation both affect customer satisfaction along with consumption experience. At the review level, the number of pictures embedded in the review was included as a control variable, as review photos could influence consumers' review evaluation. Reviewers' online status was also controlled, as reviewers' review-writing styles could evolve as they accumulate review experience or become affiliated with different online status (Huang et al., 2016). Restaurant popularity was controlled to account for unobserved restaurant heterogeneity (Li et al., 2019), measured by the number of reviews for restaurant j at time t (prior to the focal review). Moreover, restaurant fixed effects and consumer fixed effects were included in the model to control unobserved restaurant heterogeneity and consumer heterogeneity, respectively, which do not vary over time.

The variable descriptions and descriptive analysis of the independent, dependent, and control variables are summarized in Table 2. Moreover, Figure 2 shows the distribution of review disconfirmation, i.e., the independent variable. The figure indicates that 47.21% of consumers encountered positive disconfirmation, 30.02% of consumers encountered negative disconfirmation, and only 22.74% of consumers reached confirmation with prior consumers.

----------<Insert Figure 2 Here>----------

----------<Insert Table 2 Here>----------

3.1.3 Econometric Specifications

This study examined disconfirmation influence by using ordinary least squares regression with two-way fixed effects, including restaurant fixed effects and consumer fixed effects. Unobserved heterogeneity possibly occurred at the restaurant level and consumer level; therefore, the identification strategy relied on the application of two-way fixed effects, which was the most conservative estimation (Huang et al., 2016). Therefore, the following econometric models were established:

$$Posemo_{ijt} = \alpha_1 Disconfirmation_{ijt} + \sum_I \rho_{1i} * C_i + \sum_J \lambda_{1j} * R_j + Control_{ijt} + \varepsilon_{ijt} \quad (1)$$

$$Length_{ijt} = \alpha_2 Disconfirmation_{ijt} + \sum_I \rho_{2i} * C_i + \sum_J \lambda_{2j} * R_j + Control_{ijt} + \varepsilon_{ijt} \quad (2)$$

Subscript i represents consumers, j represents restaurants, and t represents time; C_i refers to consumer fixed effects; R_j refers to restaurant fixed effects; and $Control_{ijt}$ refers to the control variables introduced above.

3.2 Methodology for Experimental Design

3.2.1 Design and Participants

The above study based on online secondary data modeling cannot verify whether consumers were aware of review disconfirmations between their own evaluations and prior average review rating when posting their reviews; therefore, a second study based on an experimental method was used to further explore the influence of disconfirmation on customers' emotional responses and user reviewing efforts. An experimental comparison among different disconfirmation groups will help address the abovementioned limitation.

This experiment employed a 2 (review disconfirmation: confirmation vs. disconfirmation) × 2 (experience valence: positive vs. moderate) between-subjects design.

Similar to the above study, the experiment also tested hypotheses in a restaurant service context. In this experiment, Qualtrics, a survey design and distribution platform, was used to collect data; a total of 216 completed and useable responses were collected and employed in the analysis. These 216 participants were randomly assigned to one of the above four experimental conditions. Participants' demographics profile showed that 50.9% of the participants were female, evenly distributed across different age groups, and most were Caucasians (87%); 54.2% of participants reported an annual household income of $40,000 or higher, and 43.5% of participants held bachelor's degree or higher.

3.2.2 Stimuli and Procedures

The participants were asked to imagine that they checked an online review platform named "RestaurantFinder" before dining in a restaurant called *Franco's*. The platform showed that *Franco's* received either a positive (5 out of 5 stars) or moderate (3 out of 5 stars) average review rating by past consumers. A positive average review rating also says that "*According to the reviews from other consumers, the food is 'tasty', the service is 'excellent', and the environment is 'good'. Overall, this is 'an amazing restaurant'.*" The moderate average review rating also said that "*According to the reviews from other consumers, the restaurant is 'acceptable but not perfect', the food is 'a little greasy' and the service is 'not that fast', but the environment is 'overall good'.*"

After checking the online reviews, participants decided to dine at *Franco's*. Then participants were asked to imagine that they had either a moderate or an extremely enjoyable dining experience at *Franco's*. In the extremely enjoyable dining experience condition, participants were told that "*Your dining experiences were excellent. Everything in the restaurant, including the food, service, and environment, was perfect!*" On the contrary, participants were told that "*Your dining experiences were just OK. The food and the service were average.*" in the moderate dining experience condition.

After completing the above scenario, participants were asked to write a review for the restaurant *Franco's*, as if they were posting it on the online review website "RestaurantFinder". The demographic information of participants was also collected.

3.2.3 Measurements

The two dependent variables were analyzed using LIWC software from the textual contents of the reviews submitted by participants. Similarly, positive emotional intensity was used to measure customers' emotional responses. The intensity was defined as the percentage of positive emotional words in a specific review. Review length was used to measure user reviewing effort, defined as the total number of words in a review.

4. Results

4.1 Results of Online Secondary Data Analysis

Table 3 presents the estimation results for the models of disconfirmation effects, controlling for the two-way restaurant and consumer fixed effects. Model 1 in Table 3 displays the estimation results of the disconfirmation effect on review positive emotional intensity. It showed that compared to confirmation (i.e., the rating of a focal review is equal to the prior average rating before this focal review), negative disconfirmation had a significantly negative effect on review positive emotional intensity (coefficient = -1.154, $p < 0.01$). This result suggests that a consumer whose product evaluation negatively disconfirmed that of prior reviewers is more likely to write a review containing lower positive emotional intensity. In other words, negatively disconfirmed consumers tend to be less satisfied. In addition, the estimation results of Model 1 also showed that compared to confirmation, positive disconfirmation had a significantly positive influence on review positive emotional intensity (coefficient = 0.267, $p < 0.01$), indicating that a consumer whose product evaluation positively disconfirmed that of prior reviewers is more likely to write a review containing higher positive emotional intensity. That is, positively disconfirmed consumers tend to be more satisfied. Furthermore, the adjusted R^2 was 0.374 for Model 1, indicating that 37.4% of positive emotional intensity variation was explained by disconfirmation and other control variables. Therefore, Hypothesis 1 was supported.

----------<Insert Table 3 Here>----------

Model 2 in Table 3 shows the estimation results of the disconfirmation effect on review length. Compared with the group of confirmation, both negative disconfirmation and

positive disconfirmation positively influenced review length, suggesting that a consumer whose product evaluation disconfirmed that of prior reviewers was more likely to write a longer review. In other words, disconfirmed consumers tend to invest more in reviewing efforts. In addition, the estimation results of Model 2 also showed that compared to the group of positive disconfirmation (coefficient of positive disconfirmation= 0.429, *NS*), negative disconfirmation had a much stronger and significant influence on review length (coefficient of negative disconfirmation= 14.464, $p < 0.01$), indicating a potential negativity bias effect. Despite that the coefficient of positive disconfirmation was not significant, the positive coefficient (i.e., 0.429>0) indicated that a consumer who encountered positive review disconfirmation tended to allocate effort in writing longer reviews. Furthermore, the adjusted R^2 was 0.453 for Model 2, indicating that 45.3% of review length was explained by disconfirmation and other control variables. As such, Hypothesis 2 was partially supported in that negative disconfirmation influenced consumers to write longer reviews.

4.2 Experimental Results

Manipulation Check. To verify the effectiveness of the manipulation, the authors asked participants to answer two true-or-false questions: "In the above scenario, my dining experience at *Franco's* was excellent" and "In the above scenario, my dining experience at *Franco's* was similar to the prior online reviews I saw." All participants included in the formal data analysis passed these two questions.

To test Hypotheses 1 and 2, the authors employed independent-samples *t*-test to analyze the effect of review disconfirmation on positive emotional intensity and review length, and experimental results are presented in Figures 3 and 4. As shown in Figure 3, the independent-samples *t*-test demonstrates that in the positive restaurant experience scenario, there was no significant difference between confirmation and disconfirmation groups in terms of positive emotional intensity (t=0.567, p=0.572). However, a significant difference existed

between these two groups under the negative restaurant experience scenario (t=3.159***, p=0.002). Specifically, participants in the negative review disconfirmation group tended to write reviews with much lower positive emotional intensity than that of review confirmation group ($Mean_{disconfirmation} = 4.63 < Mean_{confirmation} = 9.58$). As shown in Figure 4, the independent-samples t-test demonstrates that in both positive and negative restaurant experience scenarios, there were significant differences between disconfirmation and confirmation groups regarding review length (Positive experience scenario: t=-2.655***, p=0.010; Negative experience scenario: t=-3.864***, p=0.000). Specifically, participants in disconfirmation group tended to write longer reviews than that of confirmation group (Positive experience scenario: $Mean_{disconfirmation} = 27.27 > Mean_{confirmation} = 17.4$; Negative experience scenario: $Mean_{disconfirmation} = 34.13 > Mean_{confirmation} = 19.04$).

----------<Insert Figure 3 Here>----------

----------<Insert Figure 4 Here>----------

Univariate regression was further employed to test Hypotheses 1 and 2. The estimation result of univariate regression is shown in Table 4, and is generally consistent with the result shown in Table 3 with the secondary online big data modeling. **First**, the result demonstrates that compared with the review confirmation group, participants in negative disconfirmation group tended to post online reviews with lower positive emotional intensity, that is, they were less satisfied with their dining experience. However, there was no significant difference between the confirmation group and positive disconfirmation group regarding the positive emotional intensity in reviews they submitted, demonstrating a potential negativity bias effect. Furthermore, the adjusted R^2 was 0.138, indicating that 13.8%

of positive emotional intensity variance was explained by review disconfirmation and experience valence. Therefore, Hypothesis 1 was partially supported in that with the disconfirmation becoming negative, consumers tended to be more dissatisfied by expressing less positive emotions. **Second**, the result in Table 4 also demonstrates that participants in both negative disconfirmation and positive disconfirmation groups tended to submit longer reviews than those submitted by the confirmation group. On average, compared to the confirmation group, the negative disconfirmation group tended to write 15 more words in the review, whereas the positive disconfirmation group tends to write close to 10 more words in the review. This result indicates that a consumer who encounters disconfirmation is likely to allocate more effort in writing reviews, manifested by writing longer reviews. Furthermore, the adjusted R^2 was 0.106, indicating that 10.6% of review length was explained by review disconfirmation and experience valence. As thus, Hypothesis 2 was supported.

----------<Insert Table 4 Here>----------

5. Discussion and Conclusion

5.1 Conclusions

By using a mixed-method including online secondary big data modeling and experimental design, this study examined the effects of review disconfirmation on customers' emotional responses and using reviewing efforts based on their submitted online review content. There are three major findings in this empirical study. **First**, review disconfirmation is an independent factor that can influence customers' emotional responses embedded in the review. **Second**, a consumer who encounters review disconfirmation tends to exert more reviewing effort, manifested by writing longer reviews. By employing econometric methods based on online secondary data, past studies discussed the effects of review disconfirmation on perceived review helpfulness (Yin et al., 2016; Hong et al., 2016), willingness to post online reviews and review rating (Ho et al., 2017), and review posting speed (Li et al., 2020b). Based on the survey method, previous studies also found that disconfirmation can influence the distrust of eWOM and review website itself (Nam et al., 2020), as well as the usage of sentiment words in a review and user satisfaction with a purchased item (Qazi et al., 2017). Different from previous studies, this current study applies a mixed-method combining econometric modeling and experimental design to overcome the method limitation in the extant literature, and fills in the missing link via testing the influence of review disconfirmation on the characteristics of online review textual content.

Third, negativity bias exists in disconfirmation effects, in that negative review disconfirmation shows more significant and stronger effects than positive review disconfirmation. Regarding the asymmetrical effect of positive and negative review disconfirmation, this study's finding is consistent with the prospect theory. Prospect theory proposes an S-shaped utility function in which loss curves are steeper than gain curves (Kahneman and Tversky, 1979). In other words, people tend to be loss-aversive and exhibit

negativity bias, which is also consistent with previous literature in the offline context (e.g., Anderson and Sullivan, 1993), reporting that negative disconfirmation demonstrates a stronger effect than positive disconfirmation on satisfaction and repeat purchase intention. Regarding the reasoning, contrary to positive disconfirmation, negative disconfirmation is often connected with product/service failure, dissatisfaction, and emotion of sadness, anger, anxiety, and hostility (Westbrook and Oliver, 1991; Oliver et al., 1997). Customers tend to be reacting to negative review disconfirmation more strongly and emotionally than to positive review disconfirmation.

5.2 Theoretical Implications

This current research advances theoretical knowledge of consumer disconfirmation effects and contributes to the literature in several ways. **First**, this study contributes to research on the relationship between disconfirmation and consumers' post-purchase behaviors by extending the influence of disconfirmation from an offline context to an online context. Prior literature focused largely on the effect of consumer disconfirmation in offline contexts, except for two recent studies that examined the impact of review disconfirmation on consumers' review-posting propensity and rating behavior (Ho et al., 2017), as well as review posting speed (Li et al., 2020b). However, the influence of review disconfirmation on online user-generated review content has been largely neglected in extant literature. Moreover, due to the limitation of relying on online secondary data, prior studies failed to verify whether individuals were aware of the review disconfirmation between their own evaluations and prior average review ratings. Based on a mixed-method combining econometric modeling and experimental design, this study marks the first attempt to investigate the effect of review disconfirmation on customers' emotional response and user reviewing effort, which are manifested in the textual characteristics of consumers' online reviews.

Second, this study enriches the research stream on social influence effects on consumers' online reviews. Extant research states that online review information is truthful reflections of consumers' product/service experiences (Hu et al., 2011). In contrast, recent work has addressed that subsequent reviews can be influenced by prior reviews posted by others (Ho et al., 2017). An emerging literature stream counters that consumers' online review behavior is influenced by review rating environments, including prior average review ratings and variance in prior ratings (Ho et al., 2017; Li and Hitt, 2008; Li et al., 2020a; Moe and Schweidel, 2012). Li et al. (2020a) contended that the online review rating of a product reflects not only consumer product experience but also prior reviews' social influence. In summary, a consumer's own experience and prior reviews will both affect his/her review behavior. This study contributes to this literature stream by investigating the influence of review disconfirmation, i.e., the interaction effect between prior reviews and a consumer's own product evaluation, on consumers' online review-writing behavior.

5.3 Practical Implications

Findings from this study provide important managerial implications for online reputation systems, business owners, and marketers who attempt to influence online reviews. **First**, online review manipulation in the hospitality industry is growing. In recent years, many business owners with a presence on third-party websites have posted fraudulent positive evaluations of their own products and/or negative reviews and ratings of competitors' products, so as to better control their online reputation (Gormley, 2013). Meanwhile, more and more consumers tend to browse online reviews prior to purchase and form their pre-purchase expectations of a product. Therefore, it is unsurprising that consumers are increasingly confused by deceptive review ratings and may make erroneous purchase decisions. According to current findings, review disconfirmation, especially negative disconfirmation, lead consumers to be less satisfied and to invest more reviewing

effort by writing longer reviews with lower positive emotional intensity. These disconfirmed reviews will stand out and exert adverse effects on the reputation of a product/service in the long run. Therefore, fictitious online review manipulation might be detrimental to the business, and business owners/marketers should stop applying the excessive online review manipulation strategy.

Second, the findings of this research present managerial implications to the third-party online review platform. The prime function of online review platforms is to disclose the true evaluations of products and services through the past consumers' reviews. Given the growing online review manipulation and fake reviews in the hospitality industry, these platforms should construct indices to rank the reliability of each review and employ relevant filtering techniques to screen out the reviews with a high possibility of being fraudulent. Moreover, it is also important for these platforms to highlight representative and authentic reviews, and at the same time, identify and filter out the fraudulent online reviews. Placing authentic reviews in prominent locations on the business page will help consumers make better purchase decisions. In summary, these measures would avoid the occurrence of review disconfirmation, and thus will benefit online review platforms in providing the best consumer experience and improving the platforms' credibility and reputation.

5.4 Limitations and Future Research

This study has several limitations that can be addressed in future research. **First**, this study measured review length as the total number of words in a review. However, some reviews may have more stop words and become less informative. Therefore, future research should check if the results in this study are still tenable if review length was measured by excluding the stop words from the reviews. **Second**, following the previous literature, this study measured customers' emotional response and user reviewing effort using positive emotional intensity and review length, respectively. Future studies can test the robustness of

this study's empirical results by using other measurements when data are available. Furthermore, it would be interesting to test and compare the effects of review disconfirmation on customers' emotional response s versus on review sentiment in future studies. **Third**, the empirical approach used in this study did not reveal the underlying mechanism explaining why disconfirmation affects customers' emotional response and consumers' reviewing efforts. Future studies can investigate this phenomenon by using qualitative methods such as interviews. The concepts identified in qualitative studies can be further empirically tested via an experimental design to determine the underlying mechanisms of disconfirmation effects. **Fourth**, this study tested the effect of review disconfirmation in a general restaurant context. Future studies should further explore the disconfirmation effects under different restaurant segments. Moreover, the experiment design was completely scenario-based with stated preferences. Future studies should include some behavioral realism to reach higher external validity. **Lastly**, this research was conducted based on a Western business setting. Culture has been found to influence online reviews in previous literature (Hong et al., 2016). Therefore, it is important and meaningful to conduct a study comparing different cultures on this topic in the future.

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Table 1. Literature review on review disconfirmation

	Author	Research context	Method	Main findings
Antecedents of review disconfirmation	Hong et al. (2016)	Online restaurant reviews from TripAdvisor	Econometric modeling: (1) Regression with fixed effects, and (2) SUR model as a robustness check	Consumers from an individualism culture are more likely to deviate from average prior ratings.
	Qazi et al. (2017)	General public's opinion of online reviews	Equation modeling using Partial Least Squares (Based on survey data)	Online reviews can influence users' expectations, and strong connections exist among expectation, disconfirmation and performance.
	Yang, Wu, and Yang (2018)	Online hotel review data from TripAdvisor	Econometric modeling: (1) Hierarchical linear model, and (2) ordinary least squares regression as a robustness check	A positive association exists between review disconfirmation (i.e., review extremity in this article) and temporal contiguity, and this positive relationship only exists for negative experience, and decreases as reviewer expertise increases.
Consequences of review disconfirmation	Yin, Mitra, and Zhang (2016)	Online reviews from Apple's App Store	Econometric modeling: Mixed effects generalized linear models	Reviews with low disconfirmation are perceived as more helpful, and this tendency is moderated by individuals' confidence in their initial beliefs.
	Hong et al. (2016)	Online restaurant reviews from TripAdvisor	Econometric modeling: (1) Regression with fixed effects, and (2) SUR model as robustness check	Reviews with high disconfirmation are perceived as more helpful.
	Qazi et al. (2017)	General public's opinion of online reviews	Equation modeling using Partial Least Squares (Based on survey data)	Review disconfirmation is positively associated with sentiment words, which in turn can help predict consumer satisfaction with the purchased product/service.

	Ho, Wu, and Tan (2017)	Purchase history data and online reviews from an online e-commerce website similar to Amazon	Econometric modeling based on secondary online data: Hierarchical Bayesian model	(1) An individual is more likely to post an online review with the increase of the degree of review disconfirmation. (2) The review rating posted by an individual cannot neutrally reference her/his post-purchase evaluation, and the bias is consistent with the sign of review disconfirmation. (3) The effects of review disconfirmation are moderated by the time gap between product purchase and receipt, review ratings' variance among past consumers, and an individual's reviewing experience.
	Nam et al. (2020)	Hotel online reviews on TripAdvisor	Structural equation modeling using Partial Least Squares (Based on survey data)	Consumer disconfirmation of previous eWOM can cause the distrust of the eWOM, which in turn leads to negative eWOM and the distrust of the review website.
	Li, Xie, and Zhang (2020)	Purchase history data and online restaurant reviews from a leading restaurant reservation website, *Xiaomishu*	Econometric modeling based on online secondary data: Regression with fixed effects	The review disconfirmation negatively influences an individual consumer's review posting speed, and this effect is substantial when his/her consumption experience is strongly satisfying or dissatisfying.

Table 2. Operationalization of Key Variables

Variables	Description	Mean	Std. Dev.	Min	Max
Dependent Variables					
Posemo	**Customer emotional response**, measured by positive emotional intensity in a review; Measurement: Percentage of positive emotion words in a review; $\frac{\text{Number of positive emotion words}}{\text{Total number of words in a review}} \times 100$	6.43	4.22	0	100
Length	**User reviewing effort**, measured by review length; Measurement: The total number of words in each specific review	115.31	103.17	0	1031
Independent Variables					
Disconfirmation	Review disconfirmation, measured by the difference between the focal review's rating and the prior average rating of a restaurant; Measurement: 0=confirmation; 1=negative disconfirmation; 2=positive disconfirmation.	---	---	0	2
Control Variables					
AveOthers	Prior average review rating, measured by average rating prior to the focal review for a specific restaurant	3.99	0.33	1.5	5
Picture	The number pictures embedded in a specific review	0.51	1.44	0	50
Status	Consumer online status, measured by a dummy variable to denote whether the reviewer was "Elite" when a specific review was written, with '0 = no' and '1 = yes'	---	---	0	1
Popularity	Restaurant popularity, measured by number of review ratings for restaurant j at time t (prior to the focal review)	1327.09	1342.49	1	9902
Restaurant Fixed Effects	$n-1$ dummy variables, where n represents the restaurant number. As the dataset included 300 restaurants, 299 dummies were included.	---	---	---	---
Consumer Fixed Effects	$n-1$ consumer dummy variables, where n represents the consumer number. As the dataset included 253,488 consumers, 253,487 dummies were included.	---	---	---	---

Table 3. Empirical Results—Positive Emotional Intensity and Review Length

	Model 1 **Positive Emotional Intensity**	**Model 2** **Review Length**
Constant	4.0843*** (13.44)	118.948*** (16.95)
Disconfirmation		
Negative Disconfirmation	**-1.154***** **(-58.83)**	**14.464***** **(30.17)**
Positive Disconfirmation	**.267***** **(14.02)**	**.429** **(0.97)**
AveOthers	.557*** (8.14)	-7.822*** (-4.87)
Picture	-.031*** (-6.70)	9.304*** (40.92)
Status	-.403*** (-13.15)	17.816*** (21.50)
Popularity	-8.39e-06 (-1.00)	-.0003 (-1.53)
Restaurant fixed effects	Yes	Yes
Consumer fixed effects	Yes	Yes
Observations	592,859	592,859
F	52.88***	73.58***
R^2	0.642	0.687
Adj R^2	0.374	0.453

Note: *, **, and *** indicate significance level at the 10%, 5%, and 1%.

Table 4. Experimental Results—Positive Emotional Intensity and Review Length

	Positive Emotional Intensity	**Review Length**
Constant	9.579*** (7.658)	19.036*** (7.682)
Disconfirmation		
Negative Disconfirmation	**-4.949***** **(-2.701)**	**15.089***** **(4.157)**
Positive Disconfirmation	**-1.089** **(-0.617)**	**9.871***** **(2.822)**
Experience Valence	5.048*** (2.970)	-1.636 (-0.486)
Observations	216	216
F	12.472***	9.479***
R^2	0.150	0.118
Adj R^2	0.138	0.106

Note: *, **, and *** indicate significance level at the 10%, 5%, and 1%.

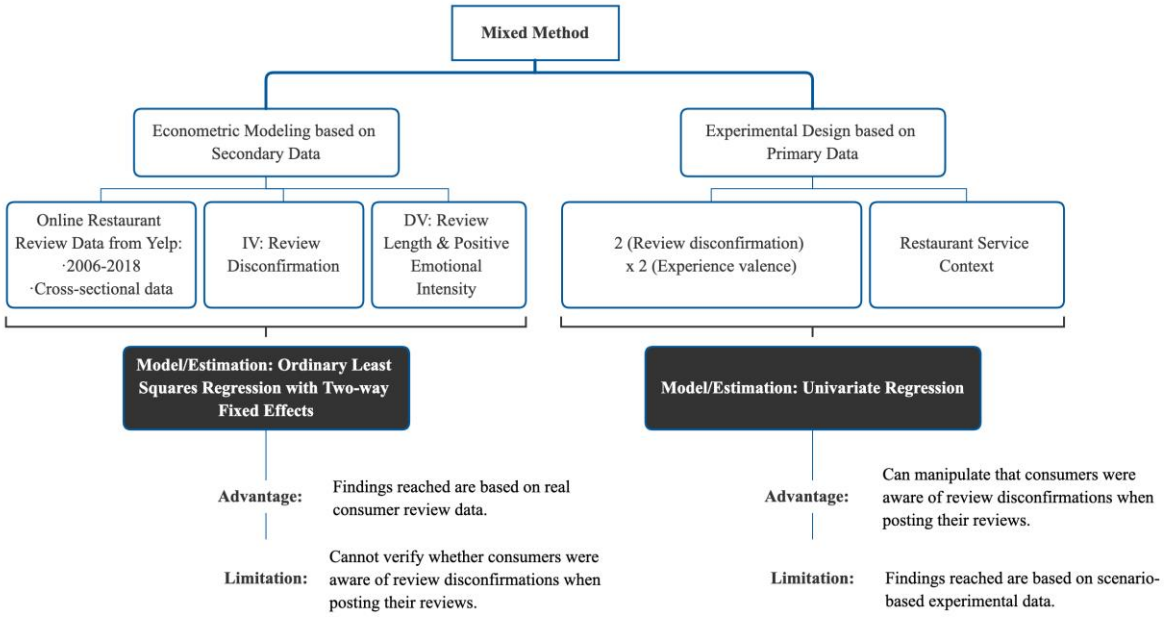

Figure 1. Research Methodology Framework

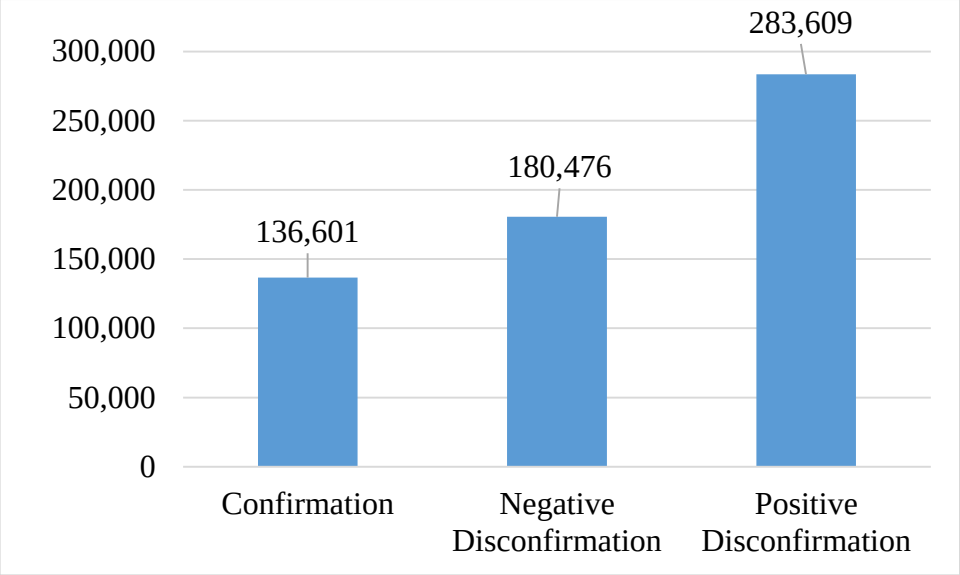

Figure 2. Distribution of Review Disconfirmation

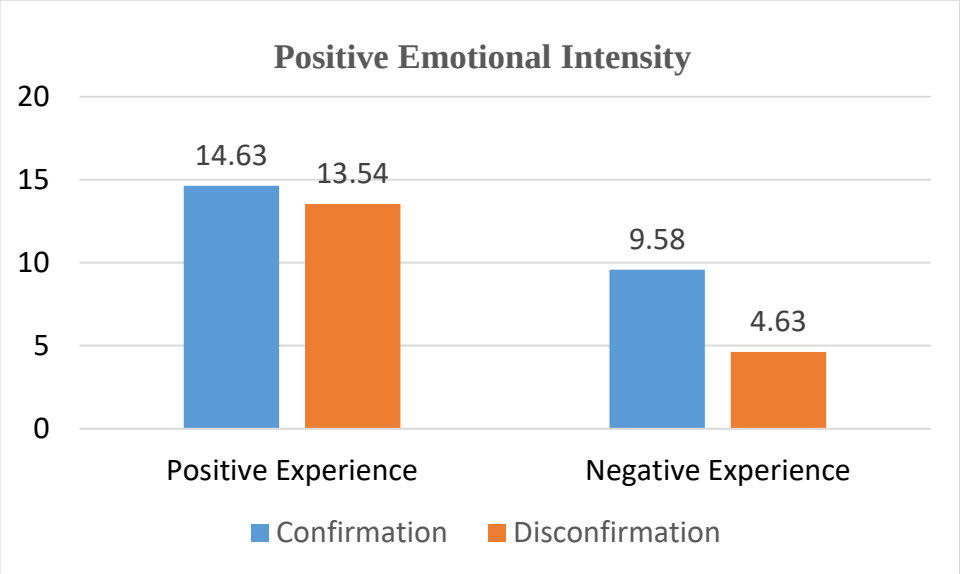

Figure 3. Effect of Review Disconfirmation on Positive Emotional Intensity

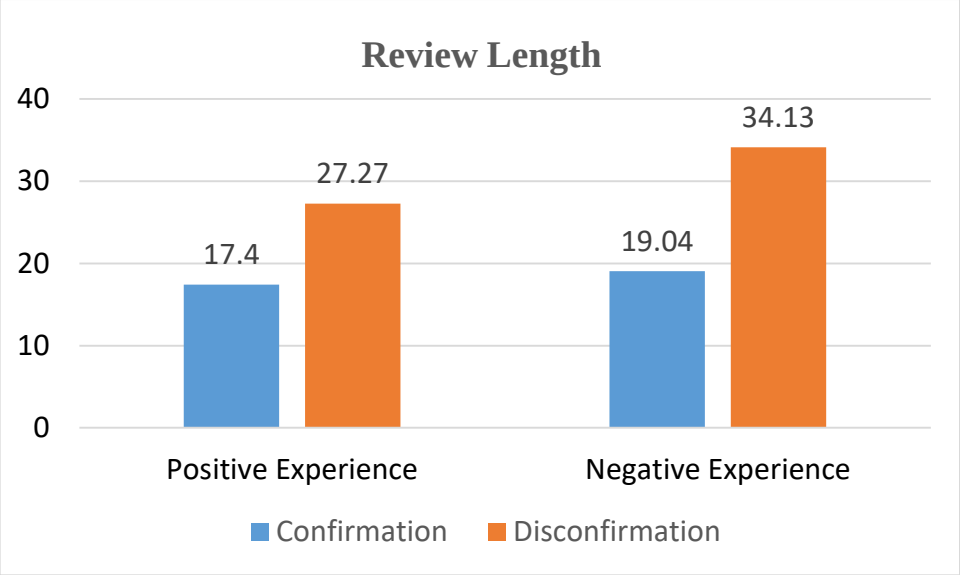

Figure 4. Effect of Review Disconfirmation on Review Length