

1 **Can time soften your opinion? The influence of consumer experience**
2 **valence and review device type on restaurant evaluation**

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49 **Can time soften your opinion? The influence of consumer experience valence and review**
50 **device type on restaurant evaluation**

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Abstract: The objective of this study is to investigate how review temporal distance influences the conformity of consumer restaurant review ratings. By employing an innovative dataset pairing consumer reservation records and consumer online reviews, the findings of this study indicate that (1) in general, temporal distance has a positive influence on restaurant evaluation conformity; (2) consumption experience valence moderates the influence of review temporal distance on restaurant evaluation conformity, with a negative dining experience strengthening the positive effects; (3) review device moderates the influence of review temporal distance on review conformity, with reviews posted via mobile devices weakening the positive effect of temporal distance; and (4) compared to reviews posted via PCs, mobile reviewers appear less likely to be influenced by prior reviews. Findings from this study provide practical insights for restaurants' management of online reviews.

Keywords: temporal distance, review conformity, experience valence, review device, restaurant evaluation

82 **Highlights**

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84 ● Restaurant evaluations posted with longer temporal distance are more likely to conform
85 to the prior average review rating.

86 ● Review device (PC vs. Mobile) and dining experience valence moderate the effect of
87 review temporal distance on conformity of consumer restaurant review ratings.

88 ● Reviews posted via mobile devices weakening the positive effect of review temporal
89 distance.

90 ● A negative dining experience strengthens the positive effect of review temporal distance.

91 ● Consumers who posted reviews via mobile devices are less likely to be socially
92 influenced, and tend to deviate from prior review ratings.

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127 **1. Introduction**

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Online reviews, a form of electronic word-of-mouth (eWOM), has become one of the most powerful tools for influencing consumers' purchase decisions. It has been reported that roughly two-thirds of consumers always or often read online reviews before making the purchase decision (Kats, 2018), and nearly 80% of consumers trust online reviews as much as personal recommendations (BrightLocal, 2018). It is thus critically important for companies to maintain a positive online reputation and persuasive online reviews, which requires a thorough understanding of consumers' review posting behaviors. To date, extensive research has examined the influences of online reviews on consumers as only review readers along with their demand (Ye et al., 2009; Zhu & Zhang, 2010); however, much less scholarly work has investigated consumers' review posting behaviors and influencing factors on their review evaluations.

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Several scholars have identified a tendency to conform among reviewers (e.g., Hong et al., 2016; Lee et al., 2015; Muchnik et al., 2013; Wang et al., 2018). Conformity, a type of social influence, refers to changes in consumers' attitudes and behavior following exposure to reference groups' attitudes and behavior (Lascu & Zinkhan, 1999). In the context of online reviews, conformity captures a phenomenon wherein subsequent reviewers tend to conform to previous reviewers' opinions and ratings, resulting in potentially biased aggregated evaluations of products or services. Conformity to earlier positive online reviews increases the number of such reviews, thus contributing to a more positive online review profile for a product or service over time (Muchnik et al., 2013). It is therefore important to study one's tendency to conform in online reviews; business owners could leverage this propensity to obtain more positive online reviews.

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Research has shown that conformity to prior online reviews can be influenced by the valence of prior reviews (Muchnik et al., 2013), reviewers' cultural backgrounds (Hong et al.,

153 2016), and review posters' tie strength to referenced reviewers (Lee et al., 2015; Wang et al.,
154 2018). In hospitality context, Yang et al. (2018) reported that review-posting time significantly
155 affects review extremity (i.e., the extent to which review ratings deviate from the average,
156 based on online reviews posted prior to and after the focal review); however, review extremity
157 does not equal to conformity, which examines tendency to conform to prior reviews. Hence, the
158 influence of review posting timing on reviewers' tendency to conform remains largely
159 unknown. More recently, Li et al. (2019) uncovered the positive role of "consumption-review"
160 temporal distance in prior review rating's social influence. However, no potential moderators
161 on the role of temporal distance on review conformity have been tested to date; it is still unclear
162 how temporal distance work jointly with other important factors to affect review conformity.
163 Li et al. (2019) further pointed out that experience valence could be a potential moderator on
164 the influence of review timing on review social influence due to the memory decay. More
165 specifically, positivity bias effect suggests that negative memories tend to fade faster than
166 positive ones over time (Huang et al., 2016; Walker et al., 2003). As such, reviews of negative
167 consumption experience are more likely to conform to prior reviews over time than that of
168 positive ones because of the difficulty in retrieving relevant information from memory.

169 In addition, review posting time could be directly related to the type of devices used to
170 submit online reviews. Mobile devices have made it easier and more convenient than personal
171 computers (PCs) for consumers to post online reviews on the move: instantly after
172 consumption, or even during a service consumption (Wang et al., 2013; Yang et al., 2018).
173 Moreover, scholars have reported how online reviews are generated and perceived differently
174 across device types (mobile devices vs. PCs) due to the unique characteristics of mobile devices
175 (Lurie et al., 2014; Mariani et al., 2019; März et al., 2017; Ransbotham et al., 2019). Mobile
176 reviews tend to be more self-focused and less socially oriented (Lurie et al., 2014); hence,
177 regardless of temporal distance, mobile reviews are less likely to conform to prior reviews. In

178 contrast, reviewers using PCs have more convenient access to prior reviews as PC has a larger
179 screen size and information capacity; thus reviewers using PCs are more subject to conformity
180 tendencies. Therefore, review device type could also affect how temporal distance shapes
181 reviewers' tendency to conform.

182 Given the above discussion, the main objective of this study is to test how temporal
183 distance influences review evaluation conformity, i.e., the moderating effects of consumption
184 experience valence and review device type. Review temporal distance in this study is measured
185 by the time interval between review-posting time and consumption time for a specific
186 consumer's consumption experience. Additionally, this study aims to verify the findings
187 regarding the role of temporal distance using a more direct way of measuring review social
188 influence, i.e., review deviation between the current review rating and the average of all prior
189 review ratings before the current one.

190 This work contributes to the online review literature in several ways. First, our study is
191 one of the earliest attempts to investigate the role of temporal distance on review conformity;
192 findings suggest that temporal distance positively influences reviewers' tendency to conform.
193 Second, this study tests the conditions under which the role of temporal distance on review
194 conformity is strengthened or attenuated; our results imply that temporal distance has a stronger
195 impact on review conformity when reviewers had a negative consumption experience (vs. a
196 positive one), and the effect of temporal distance on conformity is significantly weaker for
197 reviews submitted via mobile devices (vs. PCs). Third, we explore the direct effect of review
198 device type on review conformity and discover that this review device factor appears consistent
199 and significant in predicting review conformity. Taking the restaurant industry as a case, our
200 results offer valuable implications for restaurant business owners regarding how to manage
201 online reviews on the basis of reviewers' tendency to conform.

202 **2. Literature Review and Research Hypotheses**

203 **2.1 Temporal distance**

204 Temporal distance refers to the time between a perceiver's direct experience and a
205 stimulus (object or event) (Bar-Anan et al., 2007; Trope & Liberman, 2003). In the context of
206 online consumer reviews, temporal distance, otherwise known as temporal contiguity, can be
207 defined as "the temporal closeness between product/service consumption and the time at which
208 a review is posted" (Li, Xie, & Zhang, 2020, p.1). Consumers may post reviews that reflect
209 their consumption experiences whenever they want (immediately or later) thanks to the mobile
210 technology in today's digital age. However, people only directly experience the present (i.e.,
211 here and now), thus how people transcend their immediate experience and evaluate more
212 distant objects or events becomes a more essential psychology research question (Liberman &
213 Trope, 2008). Temporal distance affects individuals' judgments and decisions by changing their
214 mental representations of events (Trope & Liberman, 2003, 2010). Therefore, temporally
215 distant events are construed in a more abstract manner, which allows people to experience
216 beyond what is present (Liberman & Trope, 2014).

217 Temporal distance is the first proposed dimension in psychological distance studies
218 (Liberman & Trope, 1998). It is an important dimension of psychological distance along with
219 social distance, spatial distance, and hypotheticality (Henderson et al., 2006; Soderberg et al.,
220 2015; Trope & Liberman, 2010). Previous studies have reported that temporal distance not only
221 affects construal level, but also influences other psychological distance dimensions (Huang et
222 al., 2016; Stephan et al., 2011). For example, Stephan et al. (2011) revealed that increased
223 temporal distance affected other psychological distance dimensions such as producing a sense
224 of social distance. Similarly, Huang et al. (2016) demonstrated that temporal distance can
225 amplify the effect of spatial distance on consumer evaluation.

226 Studies in social psychology have documented the effects of temporal distance on

227 mental representations (Trope & Liberman, 2003) and decision making (Ding & Keh, 2017).
228 Temporal distance systematically changes the way people mentally construe events, which in
229 turn influences people's subsequent prediction, evaluation, and behavior (Liberman & Trope,
230 2014; Trope & Liberman, 2003, 2010). In the context of post-purchase evaluations, Pizzi et al.
231 (2015) found that temporal distance affected the overall satisfaction judgments of a service
232 experience. Moreover, recent research revealed that temporal distance had a positive effect on
233 review positivity, mediated by construct level (Huang et al., 2016; Stamolampros & Korfiatis,
234 2018).

235 **2.2 Impact of temporal distance on review conformity**

236 The current study focuses on the role of temporal distance in consumers' rating
237 behavior. Review conformity can be defined as consumers' tendency to conform to prior
238 reviews posted by others (Hong et al., 2016). According to social influence theory, consumer
239 reviews do not exist in isolation; rather, subsequent reviewers tend to conform to prior opinions,
240 driven by a motivation to acquire product information from others (informational influence) or
241 a need for social approval (normative influence) (Deutsch & Gerard, 1955; Zhou, & Guo,
242 2017). In the context of hospitality online reviews, studies have empirically reported the social
243 influence of prior reviews on subsequent reviews (Li et al., 2020; Ma et al., 2013; Sridhar &
244 Srinivasan, 2012). For example, prior research has documented a positive effect of prior
245 average rating on subsequent ratings, as well as the moderating effects of review and reviewer
246 characteristics (Li et al., 2020; Ma et al., 2013). Specifically, Ma et al. (2013) found that
247 reviewers with more experience, more geographic mobility, and a large number of friends
248 relied less on prior reviews. In terms of review characteristics, they found that the impact of
249 prior reviews on subsequent ones was stronger for shorter reviews or for longer time intervals
250 between reviews. Similarly, Li et al. (2020) revealed that reviewers with non-elite status,
251 moderate consumption experience, and less cognitive effort in review writing relied more on

252 prior reviews. They also found that the social influence was weaker when the variance in
253 existing reviews was high. However, there is a lack of study examining how timing of review
254 posting may influence review conformity.

255 This study proposes that review temporal distance could influence review conformity.
256 Construal-level theory (CLT) suggests that distant events are more likely to be represented by
257 higher level of construal with abstract, general, and decontextualized characteristics, whereas
258 psychologically close events are represented by lower level of construal with concrete,
259 incidental, and contextual features (Henderson et al., 2006). The social side of distance and
260 abstraction is similarly pivotal in the extent to which social influence shapes people's
261 evaluations. Specifically, psychological distance and abstraction can broaden individuals'
262 mental horizons and increase the impact of cross-situational information, leading to greater
263 conformity to group opinion (Burgoon et al., 2013; Ledgerwood & Callahan, 2012). When
264 considering more psychologically distant objects, individuals tend to transcend their local
265 context and incorporate more global social information into their evaluations, which reflects a
266 general social influence often encountered across situations (Ledgerwood, 2014). Therefore,
267 when evaluating temporally distant events, reviewers are more likely to be affected by others'
268 prior opinions.

269 In addition, when integrating CLT with social learning theory, research has suggested
270 that distance prompts consumers to acquire information socially that extends beyond the self
271 and one's direct experience (Kalkstein et al., 2016). Learning, as a process of gaining and
272 internalizing new information, can occur through personal experience or from others (Bandura,
273 1977). In a service evaluation context, temporally distant events are more difficult to evaluate
274 than temporally close events due to the intangibility of service products (Ding & Keh, 2017).
275 Therefore, when evaluating temporally distant consumption, consumers tend to rely on external
276 information, such as others' opinions, as an anchor (Yang et al., 2018). Distance and high-level

277 construal thus expand the scope of information from which people learn. Based on the above
278 discussion, we propose that as time passes, consumers are more likely to conform to aggregate
279 prior ratings driven by cross-contextual information and social learning.

280 **Hypothesis 1 (H1):** *Review temporal distance is positively related to review*
281 *conformity: reviewers who review a restaurant at a greater temporal distance are*
282 *more likely to conform to prior consumer review ratings than those who review at a*
283 *smaller temporal distance.*

284 **2.3 Moderating effect of experience valence**

285 Experience valence refers to the positive or negative orientation of information related
286 to an object or consumption experience (Frijda, 1986; Kusumasondjaja et al., 2012). In this
287 study, we propose that experience valence could moderate how temporal distance influences
288 consumers' conformity tendencies. This moderation effect can be explained by the positivity
289 bias effect when consumers make decisions about more temporally distant events (Huang et
290 al., 2016). As temporal distance from an action increases, considerations in favor of the action
291 (pro) become relatively more salient than considerations against the action (con) (Eyal et al.,
292 2004). In decision making, positive aspects of an experience are superordinate to negative
293 aspects and reflect higher-level construal, leading to more prominent pros when an evaluation
294 is temporally distant. Moreover, according to the psychology literature, the positivity bias for
295 distant events is consistent with the fading affect bias in autobiographical memory (Piccoli,
296 2016; Walker et al., 2003). In other words, negative and positive emotions associated with a
297 remembered event fade asymmetrically over time; negative emotional memories tend to fade
298 faster than positive ones (Walker et al., 2003). Scholars (Unkelbach et al., 2008) have also
299 found that positive information has higher density in memory; over time, negative
300 information is discounted more heavily than positive information (Lewin, 1951). Therefore,
301 temporal distance, when interacting with experience valence, may exert an asymmetric effect

302 on consumer evaluations. As temporal distance increases, individuals generate more pros and
303 form more favorable attitudes, which may create greater inconsistency and uncertainty when
304 assessing negative experiences. Following the social influence literature, inconsistency or
305 uncertainty increases social influence (Kim & Hollingshead, 2015) and evokes a higher need
306 for social interaction regarding negative experiences.

307 In the context of this research, the social influence of prior online restaurant reviews
308 over time is thought to be conditioned by experience valence. We incorporate positivity bias
309 into the word-of-mouth literature and presume that the positive effect of temporal distance on
310 review conformity may be amplified for negative experiences compared to positive
311 experiences. Availability/diagnosticity theory posits that word-of-mouth effects are situation-
312 dependent and should be more influential when consumers face ambiguous situations, such as
313 disconfirming events (Bone, 1995). For negative experiences, as review temporal distance
314 increases, positive aspects of the experience become more salient and coexist with the negative
315 nature of the experience. Over time, these contradictory factors lead to inconsistent, vague
316 information and may produce more informational social influences when evaluating distant
317 events. Therefore, for negative experiences, consumers tend to construe distant events as
318 conforming more to prior ratings. Conversely, for positive experiences, the direction of
319 positivity bias over time is consistent with the positive nature of the experience, leading to less
320 ambiguity when evaluating distant events. Positive experiences are therefore subject to fewer
321 social influences in terms of temporal distance, reducing the magnitude of the temporal
322 distance effect on review conformity. Accordingly, we anticipate that the positive effect of
323 review temporal distance on review conformity is stronger for negative dining experiences.
324 The following hypothesis is thus proposed:

325 **Hypothesis 2 (H2):** *Experience valence moderates the effect of review temporal*
326 *distance on review conformity.*

327 **2.4 Moderating effect of review device**

328 Technology access shapes how consumers create eWOM (März et al., 2017). Studies
329 have demonstrated systematic differences in online reviewing behavior via mobile devices
330 and non-mobile devices; distinctions involve review features (Lurie et al., 2014), rating
331 distribution (Mariani et al., 2019), and perceived helpfulness (März et al., 2017). Mobile
332 devices are small computing devices, typically with a touchscreen interface and limited
333 keyboard (Wang et al., 2016), that offer greater portability and accessibility than traditional
334 desktop or laptop computers (Ransbotham et al., 2019). Given these unique features, mobile
335 devices have inherently altered the review creation process (Melumad, 2017). Specifically,
336 mobile devices can be considered extensions of the self; users have strong personal
337 connections with their devices (Brasel & Gips, 2014). Studies of mobile consumer behavior
338 have indicated that mobile-generated customer reviews are often more self-focused, less
339 socially oriented, more affective, and less reflective than non-mobile reviews (Lurie et al.,
340 2018; Lurie et al., 2014; Melumad, 2017; Ransbotham et al., 2019). The self-focused nature
341 of mobile devices affords individuals more personal control and agency, which further
342 influences construal (Spassova & Lee, 2013). Moreover, mobile reviewers tend to think less
343 about others and are less interested in identifying socially with other reviewers, resulting in
344 less need for social approval. Mobile reviewers are therefore less susceptible to normative
345 social influence.

346 The mobile survey literature has revealed another critical factor distinguishing mobile
347 devices from PCs: the need to scroll due to screen size (Couper & Peterson, 2017). Compared
348 to mobile devices, PCs better facilitate information reception and transmission given their
349 larger screens and keyboards (Lurie et al., 2018). Over time, PC reviewers tend to be exposed
350 to more external information (i.e., prior reviews) than mobile reviewers.

351 On this basis, the effect of temporal distance on review conformity may possibly be

352 conditioned by review device. For reviewers using PCs, informational social influence may
353 play a greater role in review creation when constructing mental representations for distant
354 consumption. By contrast, the self-focused nature of mobile devices may weaken the positive
355 effect of review temporal distance on review conformity. When using mobile devices, a more
356 coherent self-mindset for distant events tends to reduce normative social influence. In
357 addition, compared to PCs, the smaller screen sizes and multitasking features of mobile
358 devices limit consumers' exposure to new and external information, including others' reviews
359 (Gutt et al., 2019). Over time, informational social influence may have less effect on
360 reviewers using mobile devices. Therefore, the positive effect of temporal distance on review
361 conformity would presumably be weakened for reviewers using mobile devices compared to
362 reviewers using PCs, hence the following hypothesis is proposed:

363 **Hypothesis 3 (H3):** *Review device moderates the effect of review temporal distance*
364 *on review conformity.*

365 In line with the preceding hypotheses, the research framework guiding this study is
366 illustrated in Figure 1.

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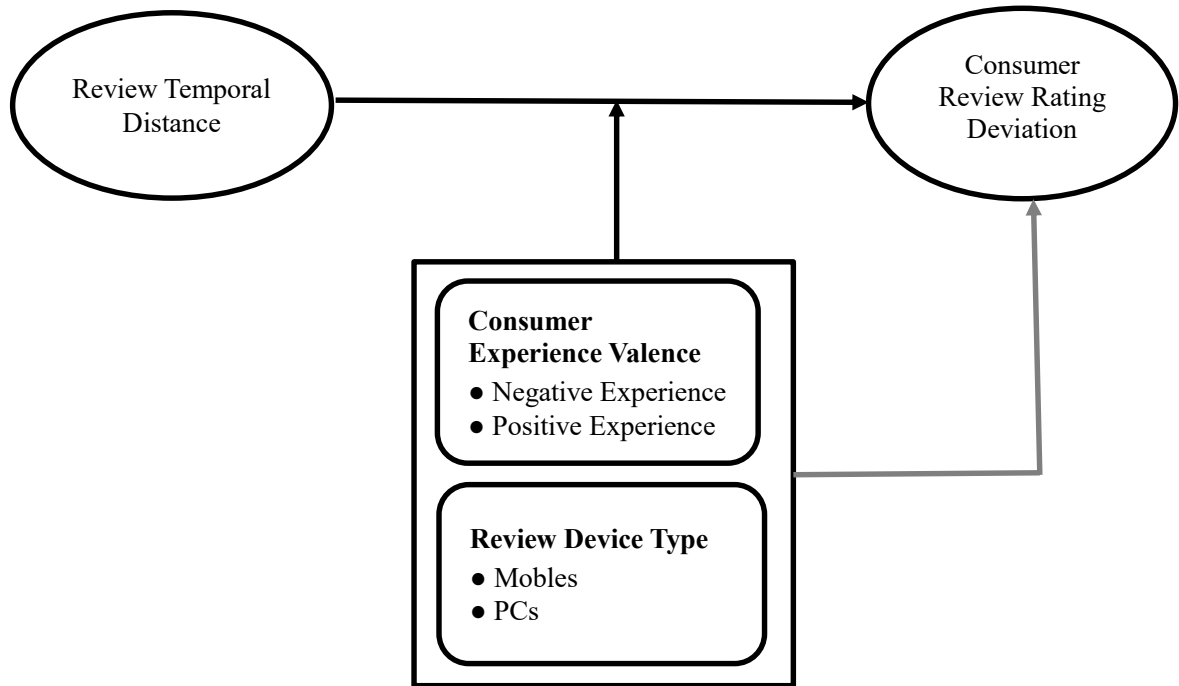
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Figure 1 Conceptual Framework



395 **3. Methodology**

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397 **3.1 Data collection**

398 An innovative dataset collected from a popular restaurant reservation website in China,
399 *Xiaomishu*, was used for data collection. *Xiaomishu* hosts over 3,000,000 members in the year
400 of 2014, and offers restaurant reservation services in more than 350 Chinese cities in the year
401 of 2012 (Xiaomishu, 2018). *Xiaomishu* was chosen as the study context due to the fact that
402 consumers can reserve restaurants via *Xiaomishu* and post reviews about the reserved
403 restaurant on the same website after consumption. When consumers make a reservation, dining
404 information (e.g., dining time, date, and number of diners) is recorded, and this information is
405 appended to the corresponding posted online review. The unique design of the website makes
406 it possible to combine the datasets of dining reservations and dining reviews to calculate the
407 temporal distance between dining time and review time.

408 Shanghai, China was chosen as the target setting because it is the headquarters of
409 *Xiaomishu* and hosts the largest proportion of users on the site. We then developed a crawler
410 and parser to download restaurant webpages into a database, including reservation and review
411 information. There are two different types of online reviews on the website, namely regular
412 reviews and reservation reviews. Reservation reviews contain both reservation information and
413 customer reviews for the reserved dining experience; regular reviews do not. The review
414 information we collected included the review time, review rating, review text, number of
415 embedded photos, and review-posting device. Reservation information included the
416 reservation time, dining time, and number of diners. In addition, we collected the IDs of all
417 individual reviewers/diners in Shanghai along with their historical *Xiaomishu* review data
418 within and outside Shanghai. Regarding restaurant-related variables, the information of the
419 lowest and highest per-capita consumption prices as well as restaurant cuisine style were
420 collected. All restaurant review data in Shanghai from November 2008 to April 2017 were

421 collected, resulting in 4,951 restaurants with a total of 191,668 reservation reviews. The
422 number of reservation reviews for these restaurants ranged from a minimum of 1 to a maximum
423 of 1,211. Among them, 2,974 restaurants had 10 or below 10 reservation reviews, and 1,977
424 restaurants received more than 10 reservation reviews. The average number of reservation
425 reviews for a restaurant was 39 with a standard deviation of 94. Reservation reviews without
426 ratings were not included in the formal data analysis.

427 Regarding the characteristics of the restaurants used in our study, the per capita
428 consumption of these restaurants ranged from 131.06 yuan (i.e., mean of the lowest price) to
429 220.87 yuan (i.e., mean of the highest price). Approximately 37.91% (N=1,877, mean of
430 service ratings ≥ 4) and 37.97% (N=1,880, 4 > mean of service ratings ≥ 3) of these restaurants
431 had high- and medium-level service quality, respectively. Furthermore, these selected
432 restaurants can be categorized into 136 restaurant cuisine style types, such as Cantonese,
433 Japanese, and Korea restaurants, etc.

434

435 **3.2 Variable Measurement**

436 Rating conformity is the dependent variable which was measured by restaurant review
437 rating deviation (*Deviation*). Similar to Hong et al. (2016), *Review rating deviation* was
438 calculated based on the absolute deviation between an individual review rating and the average
439 of all prior review ratings before this specific review of a restaurant. To calculate the average
440 review rating before each review, we firstly sorted all reviews of a restaurant by time. The prior
441 average review rating for the n^{th} review was calculated as the average of ratings from the first
442 to $(n - 1)^{\text{th}}$ review for a specific restaurant j .

443 The independent variable was review temporal distance (*TemporalD*), denoting the time
444 difference between the review time and associated dining time of a specific dining experience.
445 The unit of measurement for this variable was the day, with by-minute accuracy.

446 Moderating variables included experience valence (*ExpValence*) and review-posting
 447 device (*Device*). *ExpValence* was coded as 1 if the review rating was equal to or below 3 (i.e.,
 448 a negative experience) and coded as 0 otherwise (i.e., a positive experience). Restaurant review
 449 rating (*Rating*) was measured by a value from 1 (i.e., very dissatisfied) to 5 (i.e., very satisfied).
 450 *Device* was coded as 1 if a review was posted via a mobile device (i.e., smartphone or tablet)
 451 and 0 if a review was posted via PC. For details about these key variables, please see Table 1.

452

453 **Table 1. Key Variable Description**

| Variable | Description |
|-----------------------------|--|
| Dependent Variable | |
| Deviation | Absolute deviation between the current review rating and the average of all prior review ratings before this specific review of a restaurant |
| Independent Variable | |
| TemporalD | Time interval between review posting time and dining time in the unit of day with accuracy level to minute |
| Moderating Variables | |
| ExpValence | Calculated based on restaurant review rating. A positive dining experience is coded as 0 (i.e., review rating is above 3); a negative dining experience is coded as 1 (i.e., review rating is equal to or below 3) |
| Device | Device is coded as 1 for a review submitted via mobile device (smartphone or tablet) and 0 for a review submitted via PC. |

454

455 We further controlled variables deemed important in prior literature in our econometric
 456 models, including review-, restaurant-, and time-relevant variables (Huang et al., 2016). The
 457 control variables at review level included number of characteristics (*RevText*) and number of
 458 pictures (*RevPic*) in a specific review. To account for the restaurant heterogeneity effect, the
 459 number of reviews and the variance of review ratings before the current review of a restaurant
 460 (*RatingNum* and *RatingVar*), restaurant cuisine style (*CuisineStyle*), as well as the restaurant
 461 lowest and highest price of per capita consumption (*LowPrice* and *HighPrice*) were controlled.
 462 Furthermore, the year and month fixed effects (*Year* and *Month*) were both controlled to

463 account for the temporal heterogeneity effect.

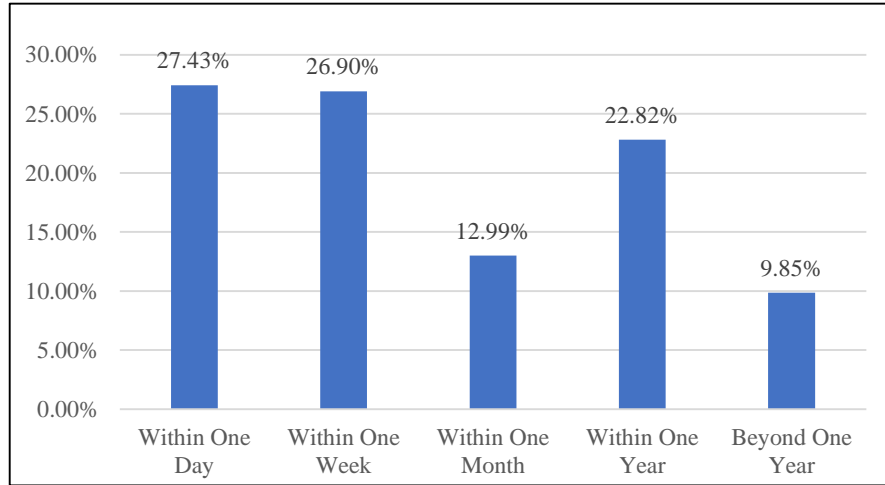
464 Table 2 shows the variables' descriptive analysis, while Figures 2 demonstrates the
465 distributions of review temporal distance, dining experience valence, review device, and the
466 number of reviews written in each year. Figure 2 shows that 27.43% of all reviews were written
467 within 24 hours after customers' dining experiences, and another 26.90% were written between
468 24 hours and one week after their dining experiences. It also indicates that slightly more
469 consumers reported a positive dining experience (53.51%), and most reviews were posted via
470 PC (68.49%).

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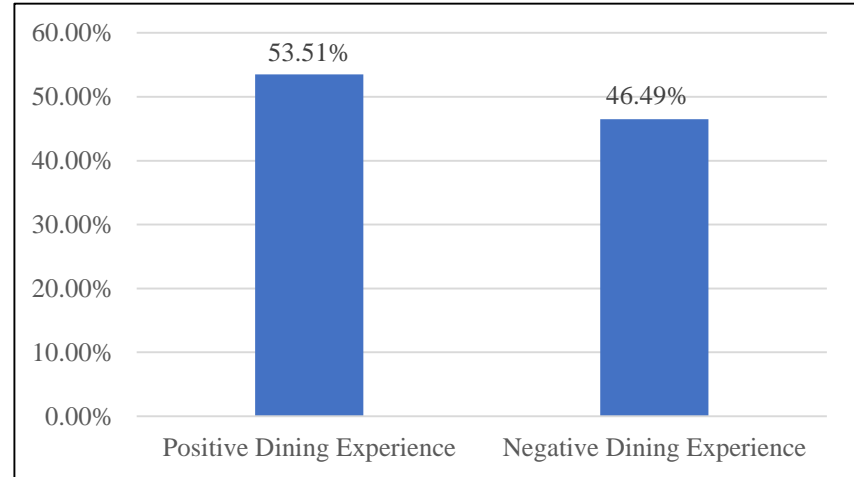
472 **Table 2. Variable Descriptive Analysis**

| Variable | Observations | Mean | Std. Dev. |
|-----------------|---------------------|-------------|------------------|
| Deviation | 182,769 | 0.66 | 0.54 |
| TemporalD | 182,769 | 122.05 | 313.15 |
| RevText | 182,769 | 39.47 | 64.22 |
| RevPic | 182,769 | 0.15 | 0.99 |
| RatingNum | 182,769 | 206.13 | 243.65 |
| RatingVar | 182,769 | 0.76 | 0.30 |
| LowPrice | 182,769 | 131.06 | 86.66 |
| HighPrice | 182,769 | 220.87 | 165.18 |

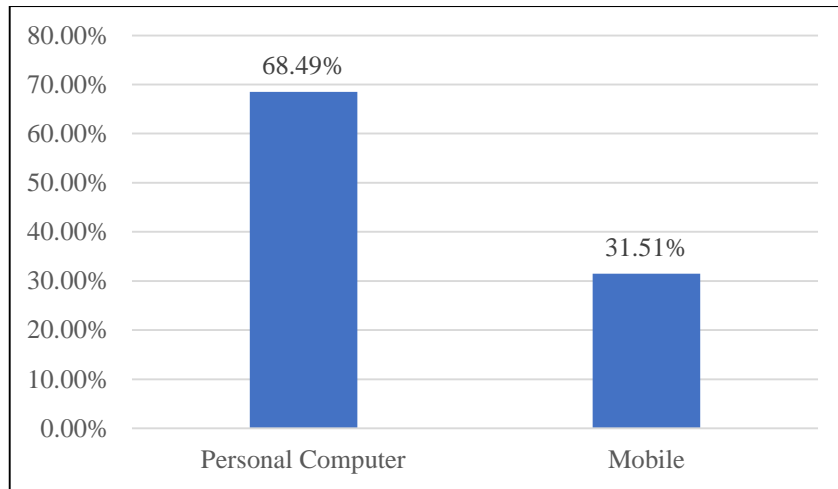
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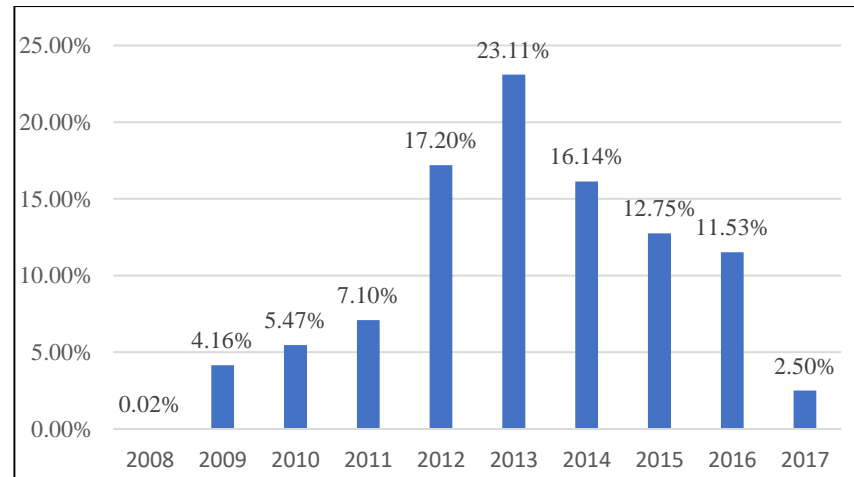
Review Temporal Distance



Dining Experience Valence



Review Device



Review Written Year

Figure 2. Distribution of Key Variables

478 3.3 Econometric Model

479 The following econometric model was established, taking *Deviation* as the dependent
480 variable, *TemporalID* as the independent variable, and *ExpValence* and *Device* as moderating
481 variables:

$$\begin{aligned} 482 \quad & Deviation_{ijt} = \alpha_0 + \alpha_1 TemporalD_{ijt} \\ 483 \quad & + \alpha_2 ExpValence_{ijt} + \alpha_3 Device_{ijt} \\ 484 \quad & + \alpha_4 ExpValence_{ijt} \times TemporalD_{ijt} + \alpha_5 Device_{ijt} \times TemporalD_{ijt} \\ 485 \quad & + \alpha_6 RevText_{ijt} + \alpha_7 RevPic_{ijt} + \alpha_8 RatingNum_{ijt} + \alpha_9 RatingVar_{ijt} \\ 486 \quad & + \alpha_{10} LowPrice_j + \alpha_{11} HighPrice_j + \alpha_{12} CuisineStyle_j \\ 487 \quad & + \sum_{T_1} \lambda_t * Year_t + \sum_{T_2} \tau_t * Month_t + u_{ijt} \end{aligned} \quad (1)$$

489 where i denotes the consumer, j denotes the restaurant, t denotes the time, and u_{ijt} is a normal
490 distribution; *CuisineSyle* represents a number of dummy variables measuring the restaurant's
491 cuisine style; $Year_t$ represents year fixed effects with the reference year as 2011; and $Month_t$ is
492 month fixed effects with the reference month as January.

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503 **4. Results**

504 **4.1 Main results**

505 Estimation results are listed in Table 3. Model 1.1 is the major model estimated based
506 on Equation (1). Compared with the Model 1.1, Model 1.2 included two reviewer-level
507 variables, including (1) the number of prior reviews written by a specific reviewer before the
508 current review (*ConNoRating*), and (2) the average rating of prior reviews written by a specific
509 reviewer before the current review (*ConAveRating*). We added reviewers' past review posting
510 behaviors (i.e., number of reviews written before and average rating of prior reviews) as control
511 variables in Model 1.2 in order to control reviewers' heterogeneity in their review patterns.
512 Furthermore, including these control variables in Model 1.2 would exclude the first-time
513 reviewers whose past reviewing behaviors are not available. The estimation results were
514 consistent between Models 1.1 and 1.2.

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528 **Table 3. Estimation Results (DV = *Deviation*)**

| | Model 1.1 | Model 1.2 |
|------------------------|----------------------------|----------------------------|
| Constant | -.1005845*** (.0214724) | -.1203049*** (.0203987) |
| TemporalD | -.0000319*** (5.15e-06) | -.0000108** (5.31e-06) |
| ExpValence | -.0262375*** (.0027889) | -.0117276*** (.0031606) |
| Device | .0566787*** (.0035524) | .0727281*** (.0038721) |
| ExpValence × TemporalD | -.0000837*** (7.42e-06) | -.0000849*** (7.62e-06) |
| Device × TemporalD | .0000757*** (7.80e-06) | .0000604*** (8.06e-06) |
| ConNoRating | | -.0000122*** (2.49e-06) |
| ConAveRating | | .0205299*** (.0029878) |
| RatingNum | -.0000445*** (5.94e-06) | -.0000489*** (6.44e-06) |
| RatingVar | .1534138*** (.0056919) | .1398118*** (.0062895) |
| RevText | .0005319*** (.0000322) | .0005007*** (.0000345) |
| RevPic | -.0071574*** (.0013056) | -.0059992*** (.0013723) |
| Lowest price | -.0000906** (.0000362) | -.0000806** (.0000385) |
| Highest price | .0000368* (.0000197) | .0000378* (.0000209) |
| CuisineStyle | Yes | Yes |
| Review Year FE | Yes | Yes |
| Review Month FE | Yes | Yes |
| Consumer FE | No | No |
| Observations | 182,769 | 147,792 |
| F | 364.36 | 324.35 |
| Pro > F | 0.0000 | 0.0000 |
| R-squared | 0.0494 | 0.0541 |
| Adj R-squared | 0.0485 | 0.0531 |

529 Note: *, **, and *** indicate the significance level at 10%, 5%, and 1%; Values in brackets
530 are robust standard errors.

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532 The estimation results demonstrated that review temporal distance had a significant and
533 negative (positive) influence on restaurant review rating deviation (conformity)
534 (coefficient_{Model1.1} = -0.0000319, $p < 0.01$; coefficient_{Model1.2} = -0.0000108, $p < 0.05$).
535 Essentially, consumers who posted reviews with greater temporal distance were less likely to

536 deviate from the prior average review rating for a specific restaurant; that is, they were more
537 likely than other reviewers to conform to prior review ratings. Therefore, Hypothesis 1 was
538 supported.

539 We conducted further analysis to test the moderating roles of experience valence and
540 the review posting device. As shown in Table 3, rating deviation (conformity) behavior tended
541 to be negatively (positively) affected by review temporal distance; but this impact was
542 strengthened by experience valence, as shown by a significantly negative coefficient of the
543 interaction term between experience valence and review temporal distance (coefficient_{Modell.1}
544 = -0.0000837, $p < 0.01$; coefficient_{Modell.2} = -0.0000849, $p < 0.01$). In this case, the negative
545 (positive) effect of review temporal distance on review deviation (conformity) was stronger for
546 negative dining experiences; Hypothesis 2 was thus supported.

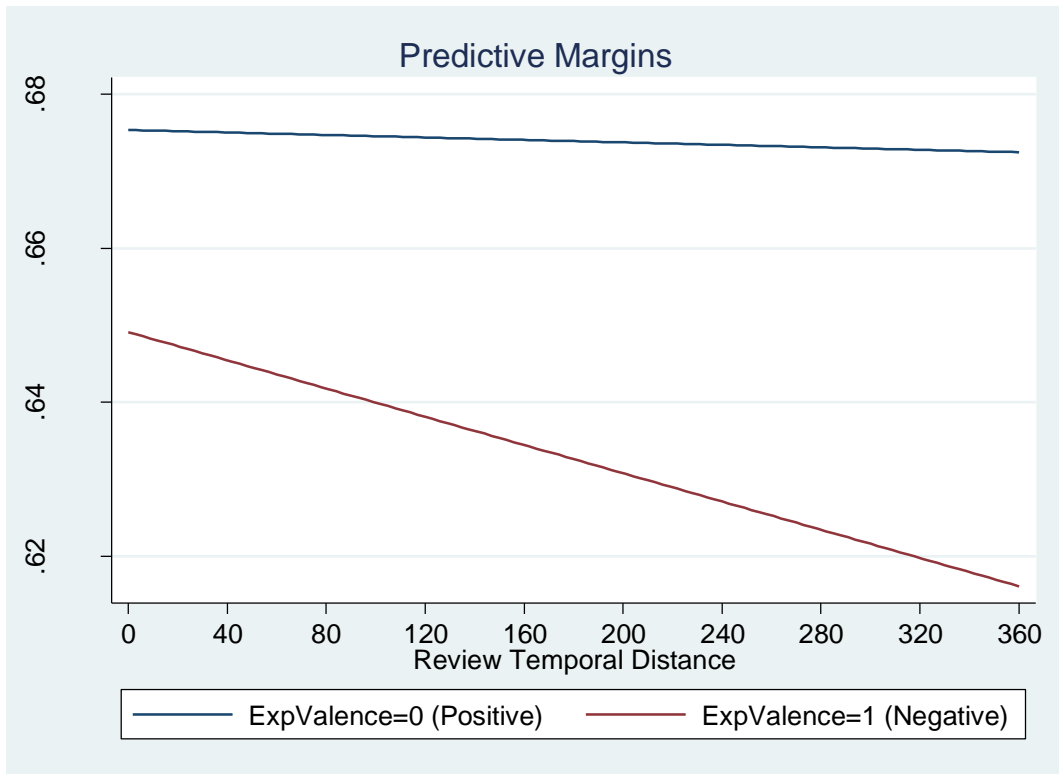
547 Our data analysis also revealed that the negative (positive) influence of review temporal
548 distance on restaurant rating deviation (conformity) was weakened by review device,
549 evidenced by a statistically significant and positive interaction term (coefficient_{Modell.1} =
550 0.0000757, $p < 0.01$; coefficient_{Modell.2} = 0.0000604, $p < 0.01$). For consumers posting
551 restaurant reviews via PCs, review temporal distance exerted a negative (positive) effect on
552 review rating deviation (conformity) behavior. For consumers posting via mobile devices (i.e.,
553 a smartphone or tablet), the negative (positive) effect of temporal distance on review rating
554 deviation (conformity) was weaker. Accordingly, Hypothesis 3 was supported.

555 Regarding the direct effect of moderating variable *Device*, it had a direct positive
556 (negative) influence on consumer restaurant rating deviation (conformity) (coefficient_{Modell.1} =
557 0.0566787, $p < 0.01$; coefficient_{Modell.2} = .0727281, $p < 0.01$), indicating that consumers who
558 posted reviews via mobile devices tended to deviate from prior review ratings; that is, they
559 were less likely to be socially influenced by prior reviews.

560 To illustrate the moderating effects of dining experience valence and review device, a

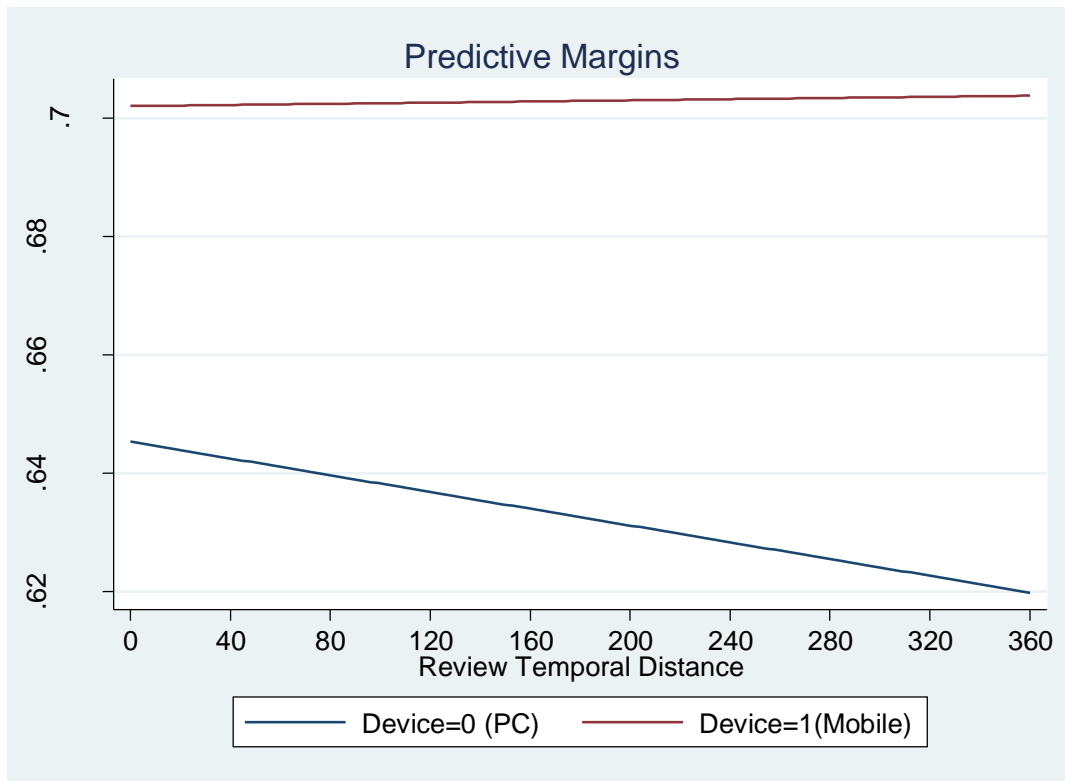
561 marginal effect was calculated using STATA 13 as displayed in Figures 5 and 6. Figure 3
562 indicates that as the review temporal distance increased, restaurant rating deviation (conformity)
563 declined (increased) faster for consumers with negative dining experiences ($ExpVal = 1$) than
564 for those with positive dining experiences ($ExpVal = 0$). Figure 4 displays the degree of change
565 in restaurant rating deviation (conformity) with the change in temporal distance based on
566 review device (PC vs. mobile). As review temporal distance increased, the review rating
567 deviation (conformity) declined (increased) significantly for reviews posted via PC ($Device =$
568 0) but increased (declined) slightly for reviews posted via mobile ($Device = 1$). The negative
569 (positive) influence of review temporal distance on review rating deviation (conformity), when
570 the review was posted via PC, was therefore attenuated when the review was posted via mobile.
571 Moreover, Figure 4 shows that compared to reviews posted via PCs, consumers were more
572 (less) likely to deviate from (conform to) prior average review ratings when posting reviews
573 via mobile devices.

574 The relatively small coefficients in our analyses were unsurprising given our
575 measurements of dependent and independent variables. As presented in Table 3, the dependent
576 variable of review rating deviation had a fairly small value and standard deviation. Conversely,
577 the independent variable, review temporal distance, had a fairly large value and standard
578 deviations.



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Figure 3. Influence of Review Temporal Distance on Review Rating Deviation by Dining Experience Valence Value



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Figure 4. Influence of Review Temporal Distance on Review Rating Deviation by Device Value

588 **4.2 Robustness check**

589 *Robustness check by excluding extreme outliers.* First, we excluded the extreme outliers
590 whose review temporal distance was beyond 366 days; the estimation results were shown in
591 Model 2.1 in Table 4. Second, given that the reviews posted via mobile device became only
592 available since 2010, we removed the extreme outliers whose reviews were posted before the
593 year of 2010, with estimation results displayed in Model 2.2 in Table 4. Both estimation results
594 were found to be quantitatively similar to those in Table 3.

595 *Robustness check by incorporating consumer fixed effects into the econometric model.*
596 Although Model 1.2 in Table 3 controlled for consumers' historical reviewing behavior (i.e.,
597 the number and average rating of all reviews posted by a specific reviewer before his/her
598 current review), the model did not consider other aspects of consumer heterogeneity unlikely
599 to change over time (e.g., gender, income, and education). Another robustness check including
600 consumer fixed effects was therefore conducted to avoid spurious regression. These fixed
601 effects can be used to account for the heterogeneity among different consumers (Rishika et al.,
602 2013). Specifically, consumer fixed effects are measured by a series of dummy variables
603 (number of dummies = $n-1$, n stands for number of consumers), and each dummy is coded as
604 1 (or 0) if the observation falls within (or beyond) a specific consumer (Amato & Amato, 2007).
605 Ultimately, 48,840 consumer dummies (i.e., 48,841 consumers) were incorporated into
606 econometric Model 1.1; estimation results are shown in Model 2.3 in Table 4. Another 25,529
607 dummies (i.e., 25,530 consumers) were incorporated into Model 1.2, with estimation results
608 displayed in Model 2.4 in Table 4. Both estimation results were quantitatively similar to those
609 in Table 3 regarding the coefficients of variables of our interest, except that ConNoRating
610 became not significant in Model 2.4. It was possibly due to a certain collinear relationship
611 between "Consumer Fixed Effects" and the variable "ConNoRating", thus the influence of the
612 latter factor on review deviation was deprived and reduced to be insignificant.

Table 4. Robustness Check — With Consumer Fixed Effects

| | Model 2.1 (≤ 366) | Model 2.2 (≥ 2010) | Model 2.3 | Model 2.4 |
|-------------------------------|-----------------------------|------------------------------|----------------------------|----------------------------|
| Constant | -.1028942*** (.0221647) | .9275393*** (.0097262) | .0086003 (.0981717) | -.0880127 (.0947089) |
| TemporalD | -.0000415* (.0000228) | -.0000211*** (5.15e-06) | -.0000289*** (6.89e-06) | -.0000284*** (6.65e-06) |
| ExpValence | -.0140589*** (.003094) | -.0187709*** (.0028434) | .021868*** (.0038616) | .0225466*** (.0038111) |
| Device | .0503088*** (.0038195) | .0611422*** (.0035623) | .0558962*** (.0062527) | .0624343*** (.0061768) |
| ExpValence \times TemporalD | -.0004056*** (.0000352) | -.0000932*** (7.44e-06) | -.0000605*** (9.00e-06) | -.0000571*** (8.67e-06) |
| Device \times TemporalD | .0002608*** (.0000408) | .0000746*** (7.81e-06) | .00005*** (.0000104) | .0000483*** (.0000101) |
| ConNoRating | | | | -4.47e-06 (3.71e-06) |
| ConAveRating | | | | .0737874*** (.0074013) |
| RatingNum | -.0000448*** (6.43e-06) | -.0000384*** (5.93e-06) | -.0000334*** (7.44e-06) | -.0000312*** (7.27e-06) |
| RatingVar | .1574803*** (.0059208) | .0802591*** (.0059655) | .1221755*** (.0071641) | .1092647*** (.0071067) |
| RevText | .000543*** (.0000331) | .0006499*** (.0000363) | .0007736*** (.0000541) | .0007602*** (.0000536) |
| RevPic | -.0077311*** (.0013096) | -.0085998*** (.001331) | -.0075856*** (.0018872) | -.0074136*** (.0018343) |
| Lowest price | -.0000976** (.0000383) | -.0001154*** (.0000364) | -.0000901** (.0000452) | -.0000842* (.000044) |
| Highest price | .00004* (.0000207) | .0000323 (.0000197) | .0000317 (.0000245) | .0000294 (.0000238) |
| CuisineStyle | Yes | Yes | Yes | Yes |
| Review Year FE | Yes | Yes | Yes | Yes |
| Review Month FE | Yes | Yes | Yes | Yes |
| Consumer FE | No | No | Yes | Yes |
| Observations | 164,759 | 174,774 | 182,769 | 147,792 |
| F | 336.12 | 284.60 | 23.45 | -- |
| Pro > F | 0.0000 | 0.0000 | 0.0000 | -- |
| R-squared | 0.0504 | 0.0440 | 0.4103 | 0.3252 |
| Adj R-squared | 0.0494 | 0.0431 | 0.1943 | 0.1832 |

615 Note: *, **, and *** indicate the significance level at 10%, 5%, and 1%; Values in brackets
616 are robust standard errors.

619 **5. Discussion and Conclusion**

620 This study investigates the effect of review temporal distance on consumer review
621 rating conformity along with the moderating effects of consumer dining experience valence
622 and review device type. Using data from a popular Chinese restaurant reservation website, we
623 tested our research framework using econometric models with and without consumer fixed
624 effects. Findings indicate that the longer the temporal distance between visiting a restaurant
625 and reviewing it, the more likely a consumer's restaurant evaluation is to conform to the prior
626 average rating. More importantly, we uncovered significant moderating effects of experience
627 valence and review device type on the relationship between temporality and review conformity.
628 Specifically, the positive influence of temporal distance on review conformity is stronger for
629 negative experiences than for positive ones, and this effect is attenuated for reviewers using
630 mobile devices (vs. PCs). Furthermore, it was found that compared to reviews posted via PCs,
631 mobile reviewers generally appear less likely to conform to prior reviews.

632 **5.1. Theoretical implications**

633 Theoretically, our study contributes to relevant research in several ways. First, we
634 enrich the online review literature by examining the role of temporal distance on reviewers'
635 conformity behavior. Building on the CLT framework and social influence theory, we found
636 that temporal distance positively influences review rating conformity; in other words, online
637 reviewers are more prone to social conformity when writing a review for temporally distant
638 consumption compared to temporally close consumption. The relationship between review-
639 posting time and consumers' rating behavior found in our study is consistent with Li et al.
640 (2019), who also indicated that the timing of review posting moderates the social influence of
641 prior reviews on subsequent reviews. Furthermore, this study extends previous research (e.g.,
642 Hong et al., 2016) on the factors which affect review rating conformity by directly regressing
643 the social influence outcome – review conformity – on the temporal factor. The findings reveal

644 that as the temporal distance from a dining experience increases, a current reviewer is more
645 likely to conform to the prior average review rating.

646 Second, building on the positivity bias effect (Huang et al., 2016) and fading affect bias
647 in autobiographical memory (Walker et al., 2003), our study unveils asymmetric valence effects
648 over time in the context of hospitality online reviews. As temporal distance increases, reviewers
649 with negative consumption experiences are more likely to conform to prior ratings than
650 reviewers with positive experiences. This pattern coincides with Eyal et al. (2004), who
651 reported differential effects of pros versus cons in decision making. Whereas prior research has
652 suggested an interaction between experience valence and time in terms of individual
653 evaluations (Freling et al., 2014; Yang et al., 2018), findings from our work advance valence–
654 time interaction effects by investigating how experience valence conditions the temporal effect
655 of review rating conformity from a social influence perspective. Results from this study further
656 indicate that over time, consumers with negative dining experiences are more likely to be more
657 socially influenced by the prior average rating, presumably due to more ambiguous situations
658 in decision making as postulated in availability/diagnosticity theory (Bone, 1995).

659 Third, the current research adds to a growing body of literature on the role of review
660 devices in online reviews (Mariani et al., 2019; Ransbotham et al., 2019). Built on these
661 studies, our work documented that review device type exerts a significant positive effect on
662 review conformity. Specifically, compared to reviews posted via PCs, mobile reviewers
663 generally appear less likely to be influenced by prior reviews. This finding corroborates the
664 self-focused nature of mobile devices indicated in previous studies (Lurie et al., 2018). Use of
665 a mobile device (vs. PC) also enhances relative self-importance; thus, mobile reviewers have
666 less of a need to seek approval and information from others, resulting in fewer social
667 interactions during the review creation process. Moreover, this study makes a unique
668 contribution to the online review literature by testing the moderating effect of review device

669 type in the role of temporal distance on review conformity, which has not been explored
670 previously. Mobile reviewers' clearer self-focus weakens the positive effect of temporal
671 distance on social influence.

672 **5.2. Managerial implications**

673 The findings of this study provides important practical implications for restaurants in
674 terms of managing their online review profiles by leveraging social influence. Our results
675 imply that with a larger temporal distance between consumption and review posting,
676 consumers are more likely to conform to prior group opinions. Therefore, temporal distance
677 (or proximity) could be used as an intervention to orient consumers toward a socially shared
678 opinion (or a unique opinion) when writing online reviews. When managers are satisfied with
679 restaurant review ratings, encouraging delayed review-posting behavior could prompt
680 relatively consistent and positive word-of-mouth. Therefore, restaurants with high ratings
681 may not encourage immediate reviews from customers. In other words, these restaurant
682 should avoid posting signs or offering discounts for immediate customer reviews; instead, it
683 is more viable to follow up with customers later to ask for a review. In contrast, when
684 managers wish to collect detailed contextual information and constructive reviews distinct
685 from earlier reviews, encouraging immediate review-posting behavior could immerse
686 consumers within the local context and reflect individualized information. In addition to
687 offering incentives (e.g., freebies or discounts) in exchange for immediate reviews,
688 restaurants may leverage location-based data from online review platforms to identify when a
689 customer completes dining experience and departs the restaurant (Burtch & Hong, 2014). For
690 example, Twitter enables consumers to share location information for individual tweets. As
691 these location-based tweets are more current (Poddar et al., 2019), restaurants can target
692 consumers for immediate reviews when they check-in or tweet with their locations.

693 Our findings also highlight the importance of encouraging delayed review-posting

694 behavior among dissatisfied customers. For negative experiences, consumers were found to
695 be more likely to conform to prior opinions for temporally distant events. Time can facilitate
696 recovery from incidental service failure: as temporal distance increases, consumers tend to
697 move beyond their own negative experiences and incorporate decontextualized information
698 from others. Restaurant managers and social media marketers should therefore consider the
699 role of timing in forming consumers' judgements and capitalize on the timing of reviews as a
700 coping mechanism in memory. When communicating with consumers regarding service
701 recovery, delayed review-posting behavior should be encouraged to trigger psychological
702 immunity and improve customer satisfaction.

703 Lastly, our findings suggest that restaurant managers could use review devices
704 strategically to guide consumers' evaluations of self-perceptions and other-perceptions.
705 Generally, to maximize the social influence of aggregated prior ratings, use of PCs should be
706 encouraged to prompt other-perceptions. When average ratings are favorable, PCs should also
707 be encouraged to facilitate informational interactions and exchanges between previous and
708 future reviewers. For example, restaurants with high ratings may encourage reviewers to use
709 PCs by providing incentives to PC respondents or by sending email invitations rather than
710 short message service (SMS) invitations. On the contrary, restaurants with relatively low
711 ratings may provide incentives to mobile reviewers or send text message invitations.
712 Restaurant managers could further leverage the interaction effect between timing and review
713 device to shape review conformity. For PC users, delayed posting time will more likely
714 protect current word-of-mouth; however, for mobile device users, the temporal effect is
715 weakened such that immediate or delayed review posting does not substantially affect social
716 influence. Therefore, restaurants with high ratings may send out delayed emails rather than
717 text messages when soliciting customer reviews.

718

719 **5.3. Limitations and future study**

720 While this study generated important theoretical and practical implications regarding
721 temporal distance in online review-posting behavior, it is not without limitations. First, similar
722 to earlier literature (Lee et al., 2015; Ma et al., 2013), our study was conducted based on the
723 assumption that consumers are more likely to check publicly available restaurant review
724 ratings. However, we cannot verify this assumption based on secondary online big data; future
725 research could address this limitation by employing the experimental design method. Second,
726 due to limited measures of social influence, we were unable to differentiate between normative
727 social influence and informational social influence. To better understand the social influence
728 process, subsequent studies should measure the effects of these two different types of social
729 influences. Third, this study utilized a dataset from China. Hence, the findings may not be
730 generalizable to other countries or cultures. Existing research indicates that review posting
731 behavior can be impacted by reviewers' cultural background, and Chinese consumers tend to
732 post less negatively extreme reviews and are more likely to conform to prior reviews compared
733 to their western counterparts (Fang et al., 2013; Hong et al., 2016). Therefore, future research
734 should consider cultural difference as a potential moderator in studying the role of temporal
735 distance on review conformity.

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