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Decision-making in cruise operations management: A double-hurdle approach

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ABSTRACT

In the cruise operations management literature, scant knowledge is available regarding the choice of ports-of-call. Hence, insight into cruise lines' decisions to visit a given port (or not) through a two-step decision-making process may provide an effective means to inform cruise operations management. Based on a novel perspective on cruise online ratings and reviews, this research applied a Heckman double-hurdle approach to 505 global cruise ports to analyze the patterns of cruise visits. Results revealed that the number of cruise visits were significantly related to cruise port ratings, excursion ratings, and the number of reviews. Next, Sobel-Goodman mediation tests showed that online platforms had substantial mediating effects on cruise port ratings. Further, robustness checks based on two sub-samples demonstrated that the empirical results of the double-hurdle models were reliable. This paper provides the first empirical attempt to demonstrate the nexus between cruise lines and ports in an online platform context. The empirical findings provide implications for source credibility theory and cruise operations management. They are also believed to be useful for researchers in operations management studies, business practitioners in international cruising, policymakers, and port authorities.

1. Introduction

The Internet has played an increasingly important role in business development and has been found to be widely used for service operations management (Liu, Ke, Wei, Gu, & Chen, 2010; Lu & Reardon, 2018; Lu, Reardon, & Zilberman, 2016). As a result of recent digital technological developments, new devices and smartphone applications have spawned influential online communities (e.g. Facebook), also known as online platforms (Kaplan & Haenlein, 2010). In this vein, Zhang, Craciun, and Shin (2010) found that the consumer-generated online content can significantly influence potential demand for products and services. Additionally, various online platforms (e.g. a specific travel service like Traveladvisor.com) that provide for peer-to-peer information sharing have been found to influence companies' electronic reputations (Chen, de Groote, Petrick, Lu, & Nijkamp, 2020; Sotiriadis & Van Zyl, 2013). For cruising, an important contemporaneous source of information consists of online posts regarding the attractions of ports and related excursions (Buzova, Sanz-Blas, & Cervera-Taulet, 2019; Chen et al., 2020).

The Florida-Caribbean Cruise Association (FCCA, 2017) found that 68% of cruise consumers identified cruise ports as the most important factor influencing their vacation choice. Consequently, cruise companies should do all they can to understand the roles that specific ports have on cruisers' decision-making processes. Hence, cruise demand is likely affected by the ports included in cruise itineraries, and potential cruisers' choices may also be influenced by port-related ratings and online reviews through sites such as Cruisecritic.com.

Although the dramatic growth of information technology has attracted considerable attention in business innovation (Reardon, Lu, & Zilberman, 2019; Zilberman, Lu, & Reardon, 2019), it has also been argued that cruise-related studies in an online platform context are still underdeveloped (Buzova et al., 2019). The term “online platform” in this study refers to a particular cruise-related website (Cruisecritic.com) with customer-generated content (i.e. ratings and reviews). In order to provide insight into cruise lines' operational decisions in an online platform context, this study applies empirical modeling approaches based on source credibility theory (Ayeh, Au, & Law, 2013; Brown,

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Broderick, & Lee, 2007) and is believed to be the first attempt to analyze the effect of online platforms on cruise lines' decision-making. More specifically, this study aims to examine the effects of online platforms on cruise lines' decisions related to the choice of which ports to visit, and how frequently to visit the ports selected. Findings may provide a better understanding of the cruise lines' global operations management based on the effects of the online platform in the era of digital business.

2. Literature review

In recent years, the global cruise market has become increasingly competitive (FCCA, 2017). Cruise operations management of spatial itineraries is important for cruise lines to achieve optimal revenues (Lee & Ramdeen, 2013). In terms of operations management, cruise lines often make decisions to select distinct ports of call with interesting port excursions in order to differentiate themselves from competitors (Pallis, Rodrigue, & Notteboom, 2014). For instance, a decision to visit ports that are rich in attractions may provide diverse shore excursions and thus warrant an increase in cruise lines' lengths of stay (Chen, Petrick, Papathanassis, & Li, 2019).

A seven-day cruise itinerary normally represents a loop with the same beginning and ending home port, and usually three to five ports of call in between (Marti, 1990). The cruise lines' itinerary in ports-of-call should also be geared towards meeting the customers' needs (Petrick, Li, & Park, 2007). Cruise lines' decision-making regarding a well-organized cruise itinerary is essential for both the leisure industry and the port authorities (Chen & Nijkamp, 2018). Yet, the literature on the cruise decision-making process, regarding the choice of ports-of-call, has been scarce (Papathanassis & Beckmann, 2011). This study aims to fill this research gap by identifying the determinants of cruise decision-making in visiting a port or not, and by providing recommendations for related port policies in the era of digital business.

In the digital world, online ratings and reviews regarding an enterprise or its product are often expressed prevalently (Bronner & de Hoog, 2011; Zhang et al., 2010). These online ratings and reviews have been found to influence customers' attitudes and intentions (Ayeh et al., 2013), and to have a substantial effect on consumers' purchasing behavior and companies' sales (Chevalier & Mayzlin, 2006). In the cruise industry specifically, cruise visits can be affected by cruise customers' satisfaction of port destinations (Chen, Neuts, Nijkamp, & Liu, 2016). Furthermore, Parola, Satta, Penco, and Persico (2014) found that cruise visits were significantly related to shore excursions on the mainland. In the light of the burgeoning evidence, the following hypotheses were formulated:

H1. Port ratings are positively related to the number of cruise visits to a port.

H2. Excursion ratings are positively related to the number of cruise visits to a port.

In the context of digital business, the number of online reviews a company receives has been widely used as a sign of electronic popularity (Bronner & de Hoog, 2011). According to CLIA (2016), the most influential cruise attribute is ports, and cruise customers count on port websites as their major information sources of eWOM (electronic word-of-mouth). It has also been argued that cruise lines should adjust their itineraries to obtain additional revenues through on-board sales and shore excursions (Chen, Lijesen, & Nijkamp, 2017). Based on these considerations, the number of port reviews and the number of excursions are likely determinants of the number of cruise visits to that port. Therefore, the following two additional hypotheses were formulated:

H3. The number of port reviews is positively related to the number of cruise visits to a port.

H4. The number of excursions is positively related to the number of cruise visits to a port.

It should be recognized that the quality and reliability of information on digital platforms are important to consumers. In particular, source credibility as an established theory in psychology research (Hovland & Weiss, 1951) has been widely applied in management science (Gotlieb & Sarel, 1991). With the increasing use of the Internet, it has been suggested that online peer-to-peer recommendations have a greater influence than those of professional editorial sources on consumers' decision-making (Smith, Menon, & Sivakumar, 2005). Brown et al. (2007) further suggested that online platforms' recommendations might be less reliable, as most of them provide advertisements promoting specific products. However, Zhang et al. (2010) revealed that in the hospitality sector online ratings were highly correlated with the number of customers and restaurants' popularity. It has also been argued that online platforms mediate customers' experiences (Tussyadiah, Fesenmaier, & Yo, 2008), and therefore the potential mediation effects of online platforms on their ratings and reviews should be considered as well. Therefore, the following interconnected hypotheses concerning the relationship between online platforms' recommendations, the number of cruise visits, and their ratings and reviews were formulated:

H5. Online platforms' port ratings are positively related to the number of cruise visits to the port.

H6a. Online platforms have a mediation effect between port ratings and the number of cruise visits to the port.

H6b. Online platforms have a mediation effect between excursion ratings and the number of cruise visits to the port.

H6c. Online platforms have a mediation effect between the number of port reviews and the number of cruise visits to the port.

H6d. Online platforms have a mediation effect between the number of excursions and the number of cruise visits to the port.

It has further been suggested that port locations affect cruise lines' selection and their scheduling process (Chen & Nijkamp, 2018; Marti, 1990). Thus, the geographical location of cruise ports and their network configuration are likely also important for cruise operations management. This research will thus analyze the ratings and reviews of cruise ports based on their main cruise itineraries rather than considering each port independently. Accordingly, the conceptual research framework shown below is proposed (see Fig. 1). This framework will be put in a more operational context in the next section.

3. Research design

3.1. Data

This study is based on responses to the online platform "Cruisecritic.com". Cruisecritic, which originally started in 1995 and was acquired by TripAdvisor in 2007, is a major cruise-rating website, specifically for cruise customers to post reviews and share insights. Cruisecritic features a variety of filtering cruise services designed to help potential cruise customers narrow their search selections of cruise services, and hyperlinks to dedicated websites for more detailed information about ports. This online platform has a membership requirement to help ensure the quality and the authenticity of cruise ratings and reviews. As of the end of 2018, there were 1.6 million active members, whose ratings and reviews had generated 20.7 million posts for more than 120 major cruise lines and 2.9 million posts regarding over 500 worldwide ports. This website applies a 5-star bubble plot system to allow cruisers to evaluate the major attributes of on-board experiences and shore excursions. This research utilized all the port-related ratings and reviews from the Cruisecritic website captured during November and December 2017.

According to the categories presented by the website, there were 505 worldwide cruise ports representing nearly all the active ports in the cruise market. Tables 1 and 3 showed that the review analysis was

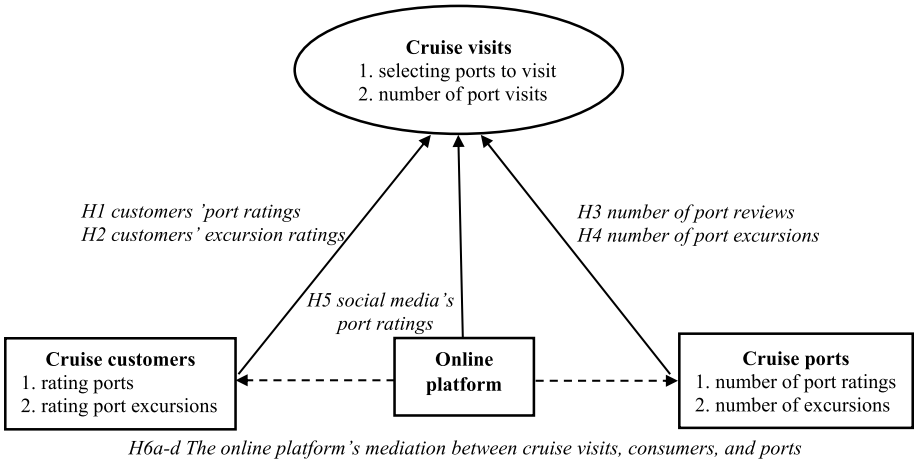

Fig. 1. Operational framework of cruise decision-making process.

Table 1
Summary of cruise port characteristics (by geographical location).

Cruise itinerary	Destination code	Number of ports	%
Africa	1–4	7	1.39
Alaska	5–6	17	3.37
Asia Pacific	7–20	35	6.93
Canada and New England	21	11	2.18
Caribbean	22–44	64	12.67
Eastern Mediterranean	45–57	38	7.52
Middle East	58–62	10	1.98
North American	63–64	41	8.12
Northern Europe	65–76	46	9.11
River Cruise	77–89	45	8.91
South America	90–94	12	2.38
South Pacific	95–104	78	15.45
Transatlantic	105–110	21	4.16
Western Mediterranean	111–121	80	15.84
Total	121	505	100

further coded into 14 global cruise itineraries (e.g. North American and Western Mediterranean) and 121 cruise destinations (countries/regions). The three geographical variables observed in this research were: cruise itinerary, cruise destination codes, and number of cruise ports. However, information on the sociodemographic characteristics of the reviewers was not available on the website, so sociodemographic characteristics of respondents are not included in the study. Geographical details about the codes related to destinations and their corresponding ports refer to the Appendix.

The current study employed electronic data with detailed information about cruise ports on the website that include the ports' names, the platform's overall port ratings for recommendations, cruise ratings regarding the port quality, number of reviews indicating the port popularity among cruise customers, number of excursions featuring the port attractions, and number of cruises to visit the port. The number of future cruise visits to a given port (mainly over the year 2018) may reflect the potential cruise demand for that port, and it is therefore used as the dependent variable to examine the determinants of cruise port eWOM.

Table 2 shows the 448 ports identified to be visited by cruise lines. A total of 505 port observations were collected in the full data set (including 57 cruise ports without any cruise visit in 2018, about 10% of the total observations). Thus, the number of cruise visits ranged from 0 to 908 (mean = 90, median = 58). The ratings of the online platform and cruise customers on ports and shore excursions were examined on a 5-point rating scale, from 1 (poor) to 5 (excellent). In comparison to the average value of the Cruisecritic website's port rating (mean = 4.11), cruise customers evaluated both the ports (mean = 3.83) and the port shore excursions (mean = 2.72) considerably lower. Cruise customers' reviews were utilized as a proxy of the port's popularity; the maximum number of cruise reviews in a port (i.e. Cozumel) was 5657 (mean = 263, median = 64). The maximum excursions in a port (also Cozumel) was 54 choices, and the average number of shore excursions in each port was about six.

3.2. Modeling

As noted above, the dataset had high heterogeneity (i.e. the

Table 2
Summary of observed variables.

Observed variables	Obs.	Mean	Std. dev.	Min.	Max.
The number of cruise visits scheduled per port[a]	448	101.35	112.19	1	908
The online platform's overall ratings	448	4.13	0.68	0	5
Cruise port ratings	448	3.84	0.57	0	5
Cruise excursion ratings	448	2.89	1.77	0	5
The number of cruise reviews	448	293.23	603.34	0	5657
The number of excursions	448	6.50	7.56	0	54
The number of cruise visits scheduled per port[b]	505	89.91	110.42	0	908
The overall ratings of social media	505	4.11	0.72	0	5
Cruise port ratings	505	3.83	0.59	0	5
Cruise excursion ratings	505	2.72	1.86	0	5
The number of cruise reviews	505	263.02	574.86	0	5657
The number of excursions	505	5.94	7.34	0	54

[a] The port (No. of Obs. = 448) is the one at least visited by one cruise in 2018.
[b] The port (No. of Obs. = 448) includes the one without cruise visits in 2018.

Table 3
Results of two-stage double-hurdle models.

Independent variables	Probit model	Truncated model
H1: Port ratings (benchmark)[a]		
Rate scale (low)	29.43 (12.53)**	18.05 (11.41)
Rate scale (medium)	50.07 (12.53)***	38.40 (11.49)***
Rate scale (high)	64.77 (16.50)***	45.43 (15.00)***
H2: Excursion ratings (benchmark)[a]		
Rate scale (low)	55.78 (12.60)***	52.31 (11.66)***
Rate scale (medium)	64.63 (16.01)***	60.52 (14.87)***
Rate scale (high)	41.46 (16.49)**	35.79 (15.21)**
H3: Number of port reviews	0.10 (0.01)***	0.10 (0.01)***
H4: Number of port excursions	−0.14 (0.88)	0.04 (0.82)
H5: Online platform's port ratings	10.29 (5.74)**	7.81 (5.04)
Sobel-Goodman mediation tests		
H6a: Online platform's mediation on port ratings	0.22 (1.83)*	0.22 (1.87)**
H6b: Online platform's mediation on excursion ratings	0.01 (0.34)	0.01 (0.35)
H6c: Online platform's mediation on the number of port reviews	0.01 (0.01)	0.01 (0.01)
H6d: Online platform's mediation on the number of port excursions	0.01 (0.07)	0.01 (0.06)
Port location dummies (North America, benchmark)[b]		
Africa markets	22.17 (35.76)	19.71 (31.75)
Alaska markets	−1.47 (24.58)	−10.49 (22.45)
Asia Pacific markets	75.84 (19.56)***	60.57 (17.85)***
Canada and New England markets	16.76 (28.77)	8.37 (26.27)
Caribbean markets	−14.08 (17.42)	−27.22 (15.87)*
Eastern Mediterranean markets	3.11 (19.47)	−1.38 (17.56)
Middle East markets	10.50 (30.41)	7.39 (27.35)
Northern Europe markets	49.61 (18.39)***	34.40 (16.78)**
South American markets	38.04 (27.62)	23.81 (25.55)
South Pacific markets	22.69 (16.74)	9.99 (15.11)
Transatlantic markets	52.02 (22.74)**	37.99 (20.90)*
Western Mediterranean markets	55.31 (16.52)***	43.38 (14.96)***
River cruise markets	−34.41 (21.07)	−4.35 (17.71)
Number of observations	505[c]	505

[a] These two dummies were generated as benchmark for fewer than 20 reviews.
[b] These dummy variables were added to correct for the imbalance of the dataset on cruise visits.
[c] It includes 57 left-censored observations (i.e. dependent variable = 0).
* $p < .1$.
** $p < .05$.
*** $p < .01$.

numbers of cruise visits and cruise reviews), leading to difficulties in understanding the determinants of cruise lines' operations management. Concerning the two-step nature of the cruise decision-making process (i.e. to visit a given port and the number of port visits), the double-hurdle approach seems to be appropriate for conducting statistical analyses (see Heckman, 1979).

The double-hurdle approach starts by estimating the probability of the cruise lines' decision to visit a port or not:

$$y_i^* = 1 \; if \; y_i > 0$$

$$y_i^* = 0 \; if \; y_i \leq 0$$

Next, a truncated regression is used to correct for sample selection bias and to estimate the frequency of cruise port visits. The related econometric models were formulated as follows:

$y_i^* = X_i\beta_i + \epsilon_i$, $\epsilon_i \sim N(0, \sigma^2)$where y_i^* is a latent variable, X_i is the vector of independent variables, β_i is the vector of independent variables' coefficients, and y_i is the observed variable.

Thus, based on a Probit estimation, the omitted variable is obtained as follows:

$$\lambda = \varnothing(X_i\beta_i)/\Phi(X_i\beta_i)$$

where $\varnothing$ is the standard normal density function, and Φ is the standard normal cumulative density function.

In the subsequent, truncated regression, λ is added as an instrument indicating that a significant result for λ means a corrected sample selection bias. STATA 14 was used to estimate the coefficients of the double-hurdle models.

4. Empirical results

4.1. Distributions of ratings and reviews of cruise ports

The number of port reviews, the distribution of ratings and the number of excursion reviews for each port are shown in Fig. 2. To help provide a more clear picture of the port excursions in the 505 global

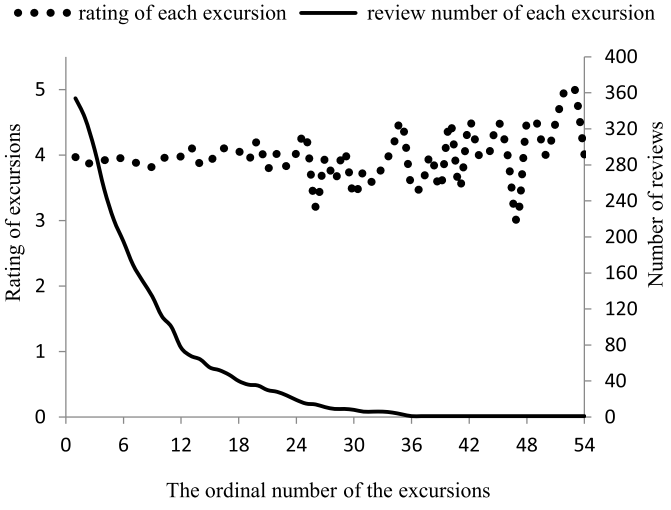

Fig. 2. Distributions of cruise ratings and reviews of each excursion.

cruise ports, the excursions was listed according to their number of reviews. It was found that the top ten excursions (i.e. number 1–10) had more than 100 reviews each, while the number of reviews decreased to about 40 for excursions 11–20. Compared with the large variation in their reviews, the ratings of shore excursions were quite robust with an approximate 4.0 average for the first 20 excursions. However, the average ratings declined to 3.5 for the remaining excursions, although several excursions (number 50–54) had comparatively high ratings at about 4.5. Since ports with few reviews might bias the actual ratings, port and excursion ratings with a small number of reviews (< 20 reviews) were discarded in the subsequent analyses. In light of the geographical location of the 505 global ports, dummy variables were added to correct for the potential imbalance of cruise visits. Compared with the case of no review, the cruise port ratings of 1.0–3.5, 3.6–4.4, and 4.5–5.0 (each rating category had about 25% of the reviews) were found to be significantly related to the increase of cruise visits, respectively.

4.2. Results of double-hurdle models

Since a high percentage of port observations (10%) had no cruise visits at all (i.e. the minimum number of cruise visits = 0), the double-hurdle models were believed to provide a suitable two-stage approach to examine the cruise decision-making process. Accordingly, a Probit model (i.e. the first-stage Probit regression) was used to examine how the various relevant factors influenced the cruise lines' decisions, and the truncated model (i.e. the second-stage truncated regression) was further estimated in order to capture the sample selection bias. The results of the Probit model presented in Table 4 indicate that port ratings (H1), excursion ratings (H2), the number of port reviews (H3), and the online platform's ratings (H5) were highly related to the choice whether a cruise line visited a given port.

In comparison, the number of excursions (H4) were likely not to be related to the cruise lines' decisions. Furthermore, the results of the truncated model revealed that the online platform's ratings (H5) were not significant in explaining the cruise decision-making, thus rejecting hypothesis 5. Meanwhile, the recommendations of the online platform were found to have significant mediation effects on the cruise ratings (H6a was not rejected in the two-stage double-hurdle models), but not statistically significant for excursion ratings, the number of port reviews, and the number of port excursions (H6a-b-c were rejected in the two-stage double-hurdle models). Similar to earlier research, it is possible that the online platform has reduced effects on cruise decision-making due to the negative perception of their credibility (Tussyadiah et al., 2008).

It is very likely that there are more reviews from cruise tourists with the increase of cruise ship visits to a given port. Although the number of port reviews may be biased by the ports themselves, it is still interesting to note that every increase of 100 cruise reviews was related to 1 more port visit. However, the truncated model also showed that the online platform's port ratings were not highly correlated with cruise visits, though the Probit model was significant ($p < .1$). In conclusion, the hypotheses of cruise port ratings (H1), excursion ratings (H2), and the number of port reviews (H3) were confirmed, while the hypotheses of the number of port excursions (H4) and the platform ratings (H5) were rejected.

Moreover, it has been argued that the online platform's ratings can have mediation effects on the consumers' ratings and reviews (Zhang et al., 2010). Thus, Sobel-Goodman mediation tests (Baron & Kenny, 1986) were applied to measure the online platform's mediation effects on port ratings, their excursion ratings, and the number of port reviews. It was found that the online platform's ratings were related to a 22% positive effect on cruise port ratings concerning whether or not to visit a port and whether or not to increase the number of cruise port visits. Yet, the results also showed that the online platform had non-significant mediation effects on the cruise excursion ratings, the number of port reviews, and the number of port excursions.

Table 4
Results of robustness check.

Independent variables	Logit model	OLS model
H1: Port ratings (benchmark)^		
Rate scale (low)	0.94 (0.55)*	18.98 (7.05)***
Rate scale (medium)	1.92 (0.83)**	38.29 (8.45)***
Rate scale (high)	1.09 (0.93)	51.85 (22.83)**
H2: Excursion ratings (benchmark)[a]		
Rate scale (low)	1.90 (0.70)***	50.41 (15.08)***
Rate scale (medium)	0.86 (0.70)	58.92 (19.51)***
Rate scale (high)	0.86 (0.98)	36.43 (14.94)**
H3: Number of port reviews	0.01 (0.01)**	0.09 (0.02)***
H4: Number of port excursions	−0.10 (0.07)	0.10 (1.46)
H5: Online platform's port ratings	0.26 (0.28)	8.60 (5.74)
Port location dummies (North America, benchmark)[b]		
Africa markets	0.67 (1.25)	29.71 (16.67)*
Alaska markets	1.71 (0.56)***	−13.26 (15.77)
Asia Pacific markets	3.12 (1.06)***	61.22 (15.74)***
Canada and New England markets	1.61 (0.33)***	7.41 (11.20)
Caribbean markets	3.14 (1.28)**	−28.81 (19.46)
East Mediterranean markets	0.69 (1.18)	6.51 (15.59)
Middle East markets	0.78 (1.09)	12.79 (24.47)
North Europe markets	–	32.60 (14.23)**
South American markets	–	22.88 (17.06)
South Pacific markets	2.12 (0.47)***	10.85 (14.02)
Transatlantic markets	–	36.24 (22.55)
West Mediterranean markets	2.60 (0.92)***	42.39 (15.50)***
River cruise markets	−0.50 (0.73)	0.65 (17.29)
Number of observations	426 (88 country IDs)	448 (100 country IDs)
R^2	0.39	0.49

[a] These two dummies were generated as benchmark for fewer than 20 reviews.

[b] These dummy variables were added to correct for the imbalance of the dataset on cruise visits.

* $p < .1$.

** $p < .05$.

*** $p < .01$.

4.3. Robustness check

In order to test the performance of the double-hurdle models, two sub-samples: 426 (i.e. randomly excluded cruise itineraries in North Europe, South America, and Transatlantic) and 448 (i.e. the number of cruise visits > 0), were selected. Accordingly, Logit and OLS models were further conducted (see Table 4). It is worth noting that the results were generally not affected by the change of the samples, indicating the robustness of the empirical findings.

5. Discussion

This research, to the best of our knowledge, is the first attempt to understand cruise lines' operations management regarding their choice of ports-of-call from the perspective of the cruise online platform's effects. It was found that cruise ports' eWOM generated from the online ratings and reviews was highly correlated with the number of cruise visits. This suggests that port authorities should pay more attention to consumers' online behavior, in order to leverage the emerging online platforms for a better e-marketing performance. More specifically, port ratings and excursion ratings were found to be positively related to the number of cruise visits to a given port, which indicates that high-quality things to do in ports and visitors' satisfaction with offerings may influence the cruise lines' decision-making regarding their visiting frequency. Nevertheless, the number of port excursions was not found to play a major role, which might be explained by the cruise lines' lengths of stay in ports influencing cruise customers' demand for port excursions (Chen & Nijkamp, 2018).

It was further found that online platforms ratings had a limited relationship with the cruise port visits. Although the online platform's ratings had significant mediation effects on the cruise ratings, these effects were not statistically significant on excursion ratings, the number of port reviews, and the number of port excursions. A possible explanation is that the online platform (i.e. Cruisecritic in this study) is basically advertiser-supported (e.g. providing hyperlinks to some specific products), and thus the website's recommendations may not be assumed to be credible (Tussyadiah et al., 2008), which confirms the validity of credibility theory.

5.1. Managerial implications

It is believed the empirical findings of the study could aid ports and cruise lines' operations management. This research leads to the decision whether or not to continue with the current cruise itinerary, so the ratings and reviews are a tool for the incremental adjustments of cruise visits. For instance, cruise port authorities could improve the port eWOM by increasing cruise ratings and reviews such as providing high quality shore excursions to satisfy cruise customers' needs. Meanwhile, findings also revealed that about 10 shore excursions (i.e. number 1–10) on average in each port had a high popularity (i.e. > 100 reviews for each excursion), and their ratings were also kept at a stable high level (rated 4 out of 5 on a Likert scale). In comparison, the remaining shore excursions received uneven rating levels for a limited number of cruise reviews. Hence, cruise ports might work on limiting the number of excursions offered, by choosing only those that provide the best quality and potential for future positive eWOM.

As ports are facing intensive competition from neighboring ports and emerging areas in global markets (Chen et al., 2017), it is important for cruise ports to offer cruise customers a satisfying experience (e.g. high quality excursions) in order to aid in getting high ratings and more reviews. These good ratings and reviews are likely to be related to the port eWOM, leading to future cruise visits. The challenge of such an approach is that the related public sectors and stakeholders need to identify the best platforms for a long-term marketing strategy. For example, port authorities may collaborate with some travel services (e.g. Cruisecritic and TripAdvisor) and more general online platforms (e.g. Twitter and Facebook) to improve their e-marketing practices. Meanwhile, port destinations could also encourage cruise customers to share their experiences online via incentive policies (e.g. coupons or other rewards) in order to gain higher online exposure than their competitors. However, it is worth noting that consumers might be hesitant to trust the online platform's reliability, which were found to have a limited contribution to cruise visits in the current study.

5.2. Theoretical contributions

It is also believed this research advances the theoretical understanding of how cruise demand and cruise ports' supply interact through online rating systems. It has been argued that platforms could change the travelers' decision-making process (Nugroho, Whiteing, & de Jong, 2016), which could eventually influence cruise lines' operations management. This is in line with research that has suggested online platforms can challenge traditional management and marketing (Budd & Vorley, 2013). It is thus believed that the current findings help to explain how online platforms are related to the process of cruise port selection in terms of whether a cruise line decides to visit a port and the number of cruise lines' visits.

The finding that the online platform had a mediation effect on cruise ratings towards cruise visiting or not visiting a port is similar to past results from a restaurant-related eWOM study (Zhang et al., 2010). The online platform's influence concerning whether or not to visit a port suggests that the cruise industry would be better served to have eWOM from peer-to-peer sources (i.e. cruise port ratings and excursion ratings) rather than from online platforms (Hyung-Park, Lee, & Han, 2007). From the perspective of source credibility theory, consumers are likely to be skeptical about forms of communication that are perceived to be skewed towards the interests of the information resource (Senecal & Nantel, 2004), so user-generated ratings and reviews are likely going to be perceived as more reliable (Ayeh et al., 2013).

It is also believed that the present study has shed some light on source credibility theory in the context of online platforms across multiple facets of the decision-making, including consumer behavior, cruise operations management, and port e-marketing. Findings from this research contribute to the cruise decision-making process literature by examining the relationships between cruise visits to a given port and the port eWOM generated from cruise online ratings and reviews. The results provide a potential understanding of cruise operations management, and in particular the importance of reliable and trusted online information sources (i.e. cruise ratings and reviews as peer-to-peer recommendations).

5.3. Limitations and future research

The data used in this study were collected at the end of 2017 through a single online platform (Cruisecritic), where all the ratings and reviews were from cruise customers. The number of cruise visits are future estimates, which may not be available for some regional cruises as they have a comparatively shorter scheduling process than international cruises. This study conducted correlation tests between port eWOM and the number of cruise visits; actual tests of causality such as hypothesized experiments in operations management might be applied in future research (Elbakidze, Lu, & Eigenbrode, 2011; Mantel, Tatikonda, & Liao, 2006). To understand further theoretical causal relationships, it is suggested that future research should employ panel or dynamic models to examine more fully two types of datasets: cruise ships' detailed scheduling information from specific cruise lines; and cruise ports' longitudinal review data from multiple online platforms (e.g. TripAdvisor and Expedia). Concerning the online platform's mediation effects on the cruise port ratings towards a cruise visiting a port, it would be interesting to explore the reasons for this in a specific geographic market segment and to further analyze it with comparative references (Chen, Zhang, & Nijkamp, 2016; Neuts, Chen, & Nijkamp, 2016).

Furthermore, detailed content analysis of the reviews could be pursued in future studies to elucidate a better understanding of potential critical factors that could influence the causal relationships between cruise tourists' experience, cruise ports' destination image, and cruise lines' decision-making (Toudert & Bringas-Rábago, 2016). Thus, diverse data from multiple online platforms are needed to draw more clear conclusions regarding the online platform's mediation role between cruise customers, cruise ports, and cruise lines. Future research could iterate support for the formulated hypotheses and might further consolidate the theoretical framework in order to examine the diversity of the cruise decision-making process when selecting ports of call, as part of a more comprehensive system of cruise lines' operations management. Future research should also interview operations management to determine the factors they consider when designing supply chain (Du, Ifft, Lu, & Zilberman, 2015; Du, Khanna, Lu, Yang, & Zilberman, 2017; Du, Lu, Reardon, & Zilberman, 2016).

6. Conclusions

The current study examined the relationships among variables that potentially determine cruise lines' decision-making to visit a given port and the number of cruise visits in the context of social media. Based on the proposed conceptual framework, it was found that the port eWOM was highly related to the number of cruise visits to the port. Also, according to the results of the Probit and truncated models, the cruise port ratings, the cruise excursion ratings, and the number of port reviews were significantly related to cruise visits. The number of port

excursions, however, was not found to be related to cruise port visits. Furthermore, it is likely that the online platform's ratings had a limited influence on cruise visits but had substantial mediation effects on port ratings. Yet, this study provides an initial research framework for cruise lines' operations management in the context of online platforms concerning cruise ratings, reviews, and eWOM. It suggests information variations from online platforms have a mediation effect on whether a cruise line will visit a port and has a potentially positive effect on increasing the number of cruise visits.

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Appendix I. Global cruise port information

Code	Destination	Port
1	Mozambique	Maputo
2	Seychelles	Mahe
3	South Africa	Cape Town, Port Elizabeth, Durban, Richards Bay
4	Spain oversea	La Palma
5	Canada	Vancouver, Victoria, Prince Rupert
6	US	Skagway, Glacier Bay, Homer, Anchorage, Ketchikan, Sitka, Icy Strait, Seward, Petersburg, Juneau, Wrangell, Haines, Kodiak, Whittier
7	Cambodia	Sihanoukville
8	China	Hong Kong, Shanghai, Beijing
9	Japan	Tokyo, Kobe, Hiroshima, Nagasaki, Osaka, Kagoshima
10	India	Mumbai (Bombay), Cochin
11	Indonesia	Bali, Komodo Island, Lombok
12	Malaysia	Kelang (Kuala Lumpur), Penang, Langkawi, Malacca
13	Myanmar	Yangon (Rangoon)
14	Philippines	Manila
15	Singapore	Singapore
16	South Korean	Seoul (Incheon)
17	Sri Lanka	Colombo
18	Taiwan	Kaohsiung, Taipei (Keelung), Hualien
19	Thailand	Phuket, Koh Samui, Bangkok (Laem Chabang)
20	Vietnam	Hanoi, Halong Bay, Ho Chi Minh City (Saigon), Nha Trang, Da Nang
21	Canada	Charlottetown (Prince Edward Island), Corner Brook, Gaspe, Halifax, Lunenburg, Montreal, Quebec City, Saguenay, St. John (New Brunswick), St. John's (Newfoundland), Sydney (Nova Scotia)
22	Antigua and Barbuda	Antigua, Puerto Quetzal (Antigua)
23	Barbados	Barbados
24	Bahamas	CocoCay, Princess Cays, Nassau, Freeport
25	Belize	Harvest Caye
26	Costa Rica	Quepos, Puntarenas (Puerto Caldera), Puerto Limon
27	Cuba	Havana, Cienfuegos, Santiago de Cuba
28	Dominica	Dominica, La Romana (Casa de Campo), Samana and Cayo Levantado, Amber Cove, Santo Domingo
29	France oversea	Martinique, St. Maarten, St. Barts, Guadeloupe
30	Honduras	Belize City, Roatan
31	Jamaica	Ocho Rios, Montego Bay, Falmouth
32	Mexico	Playa del Carmen (Calica), Cozumel, Cabo San Lucas, Progreso, Costa Maya
33	Netherlands oversea	Aruba, Bonaire, Curacao, St. Martin, Saba
34	Panama	Colon (Cristobal), Fuerte Amador
35	Puerto Rico	San Juan
36	Spain oversea	Isla Culebra, Port of Spain (Trinidad)
37	St. Kitts and Nevis	St. Kitts, Nevis
38	St. Lucia	St. Lucia
39	St. Vincent and Grenadines	St. Vincent, Bequia, Tobago Cays
40	Honduras	Banana Coast (Trujillo)
41	Grenada	Grenada
42	UK oversea	Tortola, Virgin Gorda, Grand Cayman, Jost Van Dyke, Grand Turk, Montserrat
43	US Virgin	St. Thomas, St. Croix, St. John
44	Private Island	Half Moon Cay, Castaway Cay, Great Stirrup Cay, Labadee
45	Albania	Sarande
46	Algier	Algiers
47	Bulgaria	Varna
48	Croatia	Argostoli, Athens (Piraeus), Corfu, Crete (Heraklion), Dubrovnik, Gythion, Hvar, Hydra, Katakolon (Olympia), Mykonos, Montevideo, Nafplion, Rovinj, Patmos, Korcula
49	Cyprus	Limassol
50	Greece	Rhodes, Split, Skiathos, Santorini, Volos, Zadar

51	Hungary	Budapest
52	Israel	Jerusalem (Ashdod), Haifa
53	Montenegro	Kotor
54	Slovenia	Koper
55	Tunisia	Tunis (La Goulette)
56	Turkey	Antalya, Bodrum, Kusadasi, Istanbul, Izmir
57	Ukraine	Odessa, Yalta
58	Bahrain	Bahrain
59	Egypt	Alexandria, Luxor, Cairo (Port Said), Safaga
60	Jordan	Aqaba
61	Oman	Muscat, Salalah
62	UAE	Abu Dhabi, Dubai
63	Mexico	Acapulco, Huatulco, Manzanillo, Ixtapa-Zihuatanejo, Puerto Vallarta, Ensenada, Mazatlan, La Paz
64	US	Baltimore, Bar Harbor, Bayonne (Cape Liberty), Boston, Canaveral (Orlando), Catalina Island (California), Charleston, Chicago, Denali National Park and Preserve, Eastport, Fort Lauderdale (Port Everglades), Galveston, Greenville, Houston, Jacksonville, Key West, Los Angeles, Miami, Mobile, Newport, New York (Brooklyn, Red Hook), New York (Manhattan), Norfolk, Philadelphia, Portland (Maine), Port of Palm Beach, Port Rockland, San Francisco, San Diego, New Orleans, Monterey, Seattle, Tampa
65	Belgium	Antwerp, Brugge (Bruges), Ghent
66	Denmark	Aalborg, Aarhus, Copenhagen, Ilulissat, Skagen
67	Denmark oversea	Torshavn
68	Finland	Tallinn, Helsinki
69	Germany	Berlin, Bremerhaven, Gdansk, Kiel, Rostock (Warnemunde), Travemunde (Lubeck), Wurzburg
70	Iceland	Akureyri, Isafjord, Reykjavik
71	Latvia	Riga
72	Lithuania	Klaipeda
73	Netherlands	Amsterdam, Rotterdam
74	Norway	Andalsnes, Alesund, Bergen, Eidfjord, Flam, Geiranger, Gravdal, Honningsvag, Kristiansand, Molde, Olden, Oslo, Skjolden, Spitsbergen (Svalbard), Stavanger, Tromso, Trondheim
75	Russia	Moscow, St. Petersburg
76	Sweden	Gothenburg, Stockholm, Visby
77	Austria	Durnstein (Krems), Vienna, Linz (Salzburg), Melk
78	Bulgaria	Veliko Tarnovo
79	Cambodia	Phnom Penh, Siem Reap
80	Czech	Cesky Krumlov, Prague
81	Germany	Bamberg, Bernkastel-Kues, Cochem, Cologne, Dresden, Dusseldorf, Frankfurt, Heidelberg, Koblenz, Mainz, Miltenberg, Passau, Speyer, Trier
82	Netherlands	Arnhem
83	Myanmar	Bagan, Mandalay
84	Portugal	Pinhao
85	Romania	Bucharest
86	Slovakia	Bratislava
87	Spain	Vega de Terron (Salamanca)
88	Switzerland	Basel, Lucerne
89	US	Baton Rouge, Hannibal, Houmas House Plantation and Gardens, Kalosca, Memphis, Natchez, Nottoway, Oak Alley, St. Louis, St. Francisville Vicksburg
90	Argentina	Buenos Aires, Stanley, Ushuaia
91	Brazil	Corinto, Manaus, Rio de Janeiro, Santos (Sao Paulo)
92	Chile	Puerto Montt, Punta Arenas, Santiago (Valparaiso)
93	Colombia	Cartagena (Colombia)
94	Peru	Lima
95	Australia	Adelaide, Albany (Australia), Brisbane, Broome, Bunbury, Burnie, Busselton, Cairns, Cooktown, Darwin, Eden (Australia), Esperance, Exmouth, Fraser Island, Geelong, Geraldton, Gladstone, Hobart, Kangaroo Island, Melbourne, Mooloolaba, Moreton Island, Mornington Newcastle (Australia), Peninsula, Perth (Fremantle), Port Arthur, Port Douglas, Portland (Australia), Sydney (Australia), Thursday Island, Whitsundays, Willis Island
96	Fiji	Nadi, Port Denarau, Dravuni Island, Lautoka, Suva
97	France oversea	Bora Bora, Huahine, Isle of Pines (New Caledonia), Lifou Moorea, Noumea, Raiatea, Rangiroa, Tahiti (Papeete)
98	Kiribati	Fanning Island
99	New Zealand	Akaroa, Auckland, Bay of Islands, Christchurch, Dunedin, Napier, Picton, Stewart Island, Tauranga, Wellington
100	Papua New Guinea	Alotau, Conflict Islands, Kiriwina and Kitava (Trobriand Islands), Madang, Port Moresby, Rabaul
101	Solomon	Honiara
102	The Cook	Rarotonga
103	US Overseas	Hilo, Maui, Honolulu, Kauai, Kona, Pago Pago, Saipan
104	Vanuatu	Champagne Bay (Vanuatu), Luganville, Mystery Island, Pentecost Island, Port Vila
105	Belgium	Brussels
106	Bermuda	Hamilton, King's Wharf, St. George's
107	Ireland	Belfast, Cobh (Cork), Dublin
108	Scotland	Greenock (Glasgow), Invergordon
109	UK	Dover, Harwich, Holyhead, Liverpool, Newcastle (England), Southampton
110	UK oversea	St. Peter Port (Guernsey)
111	France	Arles, Avignon, Bordeaux, Cannes, Cherbourg, Corsica (Ajaccio), Honfleur, La Rochelle-La Pallice, Le Havre, Lyon, Marseille, Nice, Paris, Port Vendres (Carcassonne), Rouen, Saint-Malo, Saint-Tropez, Sanary-Sur-Mer, Sete, Toulon, Villefranche
112	Germany	Hamburg, Nuremberg, Regensburg, Rudesheim
113	Italy	Ancona, Bari, Brindisi, Catania, Capri, Elba, Florence (Livorno), Genoa, Giardini Naxos, La Spezia (Cinque Terre), Naples, Olbia, Palermo, Portoferraio, Portofino, Positano (Amalfi), Ravenna, Rome, Salerno, Sardinia, Savona, Taormina (Messina), Rome (Civitavecchia), Trapani, Sorrento, Trieste, Venice
114	Malta	Malta (Valletta)
115	Monaco	Monaco (Monte Carlo)

116	Morocco	Agadir, Casablanca, Tangier
117	Portugal	Lisbon, Porto (Leixoes), Ponta Delgada
118	Portugal oversea	Madeira (Funchal)
119	Spain	Almeria, Barcelona, Bilbao, Cadiz, Cartagena (Spain), Ferrol, Fuerteventura, Ibiza, La Coruna, Lanzarote, Malaga, Palma de Mallorca, Palamos, Port Mahon, Seville, Valencia, Vigo
120	Spain oversea	Las Palmas, Tenerife
121	UK oversea	Gibraltar

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