The influence of reviewers' uncertainty in measuring touristic destinations reputation: an empirical application to Venice.

Nicola Camatti[a], Isabella Procidano[b], Luca Salmasi[c], Jan Van der Borg[a]

[a] Department of Economics, Cà Foscari University of Venice.

[b] Department of Management, Cà Foscari University of Venice.

[c] Department of Economics and Finance, Catholic University, Rome.

Abstract

The use of online reviews has become very popular to measure a destination reputation. For instance, TripAdvisor's data are often used to obtain indicators measuring how a city compares with respect to other destinations, or to provide rankings of different areas within the same destination. These measures are generally obtained by aggregating ratings assigned by reviewers to a variety of attractions belonging to the area of interest. However, it may be that reviewers use different scales to rate attractions, or that the rating is assigned with a certain degree of uncertainty.

We propose to isolate reviewers' rating uncertainty from real preferences by using CUB models, recently proposed by Iannarino and Piccolo et al (2011). We assume that the distribution of ratings of a certain attraction can be modelled as a mixture of distributions, one capturing informed evaluations and another associated to ratings assigned with uncertainty. Applying CUB models we are able to isolate the two effects and obtain a measure of reputation that does not depend on uncertainty.

In this work we use data from TripAdvisor for the city of Venice. We collected information about ratings assigned to museums, churches, historical buildings and places of interest for each review assigned since the first available review. Moreover, we also collected information about reviewers (e.g., age, gender, nationality and interests). We use this hitherto unexploited data source to obtain a dynamic measure of reputation for various areas of Venice. Then, we apply the CUB model to isolate true ratings, netting out the effect of reviewers' uncertainty, and compare the two indicators.

We find that uncertainty plays an important role in reviewer's judgements with different effects across time periods. According to our results uncertainty in reviewer's ratings affects significantly the distribution of ratings and should be accounted for in order to obtain more precise measures of reputation for touristic destinations.

1. Introduction

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1.1 Web 2.0: On-line reviews and tourist's choices

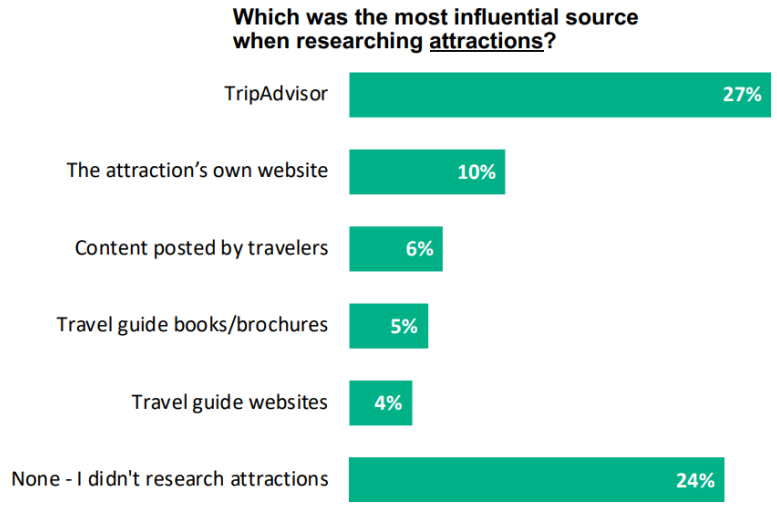
In the last few decades, the various review or online ranking platforms such as TripAdvisor and other Web 2.0 related social networks have become increasingly used by tourists, proliferating as popular tools for sharing tourist opinions and experiences (Sparks and Browning, 2011; Vermeulen and Seegers, 2009).

These platforms provide tourists with insights into the reputation of travel destinations and therefore help them to decide which destination to choose, what to visit and how to spend their time in the chosen place. They can look for reviews to know which destination suits their needs best and later on they can write a detailed review with feedback about their experience for other tourists who want to visit the same destination. Substantially, they can compare different destinations through the system of rankings provided by such platform and see the rankings of different areas or sights within the same destination (Litvin, Goldsmith, & Pan, 2008; Leung, Xue, & Bai, 2015; Kucukusta, Law, Besbes, & Legohérel, 2015; Kwok & Xie, 2016; Kwok, Xie, & Richards, 2017).

TripBarometer reports that in a survey conducted between June 21 - July 8 2016 in 33 countries covering around 36.444 interviews, 73% of travelers used online sources when deciding on their destination and 86% when deciding on their accommodation. As for the choice of attractions, TripBarometer, through a survey conducted in 2017, confirmed TripAdvisor's influence as a support for the discovery of attractions, confirming it as the most popular source of information to get an idea

of the attractions to visit, beating the official websites and the more traditional tourist guides for several percentage points.

TripAdvisor platform and reviews



Source: TripBarometer-2017-2018 https://www.tripadvisor.it/TripAdvisorInsights/w4594

In addition to TripAdvisor, other web portals are also establishing themselves as a reference point for users interested in reviews and sharing tourist experiences such as, for example, Holidaycheck, Smartertravel, Trivago or even Booking, each with its own different thematic knowledge and online services.

The influence that such reviews and rankings can have on the choice of a destination is so significant that the new phenomena of online interpersonal influence and word of mouth (eWOM), as described by Senecal & Nantel (2004) and Litvin, Goldsmith, & Pan (2008), are becoming increasingly important. Indeed, as Pan & Chiou (2011) already pointed out, tourism is an experience that is consumed only when it reaches its destination so that any additional information to the destination that can decrease the risk (Casaló et al., 2011) takes on a fundamental value enough to push eWOM, easily accessible to all, to become an important tool to reduce these limits.

Word of mouth is defined as any informal communication directed to other consumers about the possession, use or characteristics of particular goods or services or their retailers (Westbrook, 1987). In the field of web 2.0, however, word of mouth becomes electronic (eWOM) and refers to any positive or negative statement issued by potential customers, current or past, about a product or company, which becomes available for a multitude of people via the internet (Hennig-Thurau, Gwinner,Walsh, & Gremler, 2004) reaching global extents and becoming indelible over time. Due to the different facets and solutions of the internet, eWOM takes shape through the combination of several elements of the web 2.0 uniting reviews to written opinions, but also video, memories and personal or professional blogs (Benckendorff, Sheldon, Fesenmaier, 2014). Hennig-Thurau et al. (2004) also identified 8 motivations consumers may have in engaging in eWOM communication on Web-based opinion: 1. platform assistance, 2. venting negative feelings, 3. concern for other customers, 4. extraversion / positive self-enhancement, 5. social benefits, 6. economic incentives, 7. helping the company, 8. advice seeking.

Most of the research focuses on the relationship between eWOM and the level of purchase (See-To and Ho, 2014) focusing on the impact of eWOM on consumers' trust (Bailey, 2004, Xia and Bechwati, 2008, Chan & Ngai, 2011). However, to the best of our knowledge, the issues of the actual reliability and precision of the reviews considering the multiple available sources does not seem still explored although it represents a necessary precondition in view the interest and repercussions on this phenomenon.

This research intends to develop a method that helps to analyze the evaluations of online reviews by isolating reviewers' rating uncertainty from real preferences by using CUB models so that to allow tourism stakeholders to more effectively exploit the information value that reviews can provide for destination management as well as enable tourists to have more precise information on a destination or local attractions to visit.

2 Data and Statistical model

2.1 Statistical model for ratings

Customer Ratings are the most frequent approach to customer analysis. They are made by evaluating an item/object/service by selecting a number in an ordered scale. We have decided to adopt the model formulated by D'Elia and Piccolo (2005), as it seemed to be one of the most attractive in the scientific literature. It is extremely flexible for two main reasons. First, it deals directly with the probability distribution of a choice among a set of ordered alternatives, and second, it is possible to insert covariates of raters in the model in order to evaluate whether there is heterogeneity, and if so to what extent, in the assessment of perceived quality stemming from the covariates themselves (D'Elia and Piccolo, 2008).
Two fundamental components of the decision process – feeling and uncertainty – are represented by a linear combination Y of two random variables: a shifted Binomial variable and an Uniform;

$$P(Y = y) = \pi \left[\binom{m-1}{y-1} (1-\xi)^{y-1} \xi^{m-y} \right] + (1-\pi)\frac{1}{m} \qquad \text{(A)}$$

y = 1,2, ..., m, with *m*> 3, represents the number of modalities available to the rater for evaluating the service. The parameters, $\xi \epsilon [0,1]$ e $\pi \epsilon (0,1]$, characterize the shape of the probability distribution of the mixture model. The model postulates the existence of two subgroups of raters whose evaluation is characterised by a different weight attributed respectively to the feeling and uncertainty component: the informed/reflective (feeling) group and the non-informed/instinctive group, which allows π and 1-π to be interpreted, respectively, as a measure of their proportion in the population.
Briefly:

1. If π = 0, the MUB collapses to a Uniform distribution, which is to say that the assessment of the rater is attributable to that secondary component defined by the term uncertainty; therefore 100% of the raters are uncertain.
2. If π = 1, the MUB collapses to the shifted Binomial distribution, which is to say that the assessment of rater is attributable exclusively to the primary component of feeling in the population and that there are no uncertain raters.
3. ξ characterises the weight of the shifted Binomial distribution in the mixture: the higher the value of this parameter, the smaller the contribution of this distribution in the mixture. It is a measure of the feeling that the rater manifests in regard to the item. It follows that if ξ = 0, we

find ourselves in a situation where the rater expresses maximum satisfaction with the service/object/item, while $\xi = 1$ when the rater expresses minimum satisfaction.

That said, it follows that in an evaluation process (1-π) can be interpreted as a measure of uncertainty (1 maximum uncertainty, 0 no uncertainty), and (1-ξ) as a measure of feeling (0 no feeling, 1 maximum positive feeling).
The main characteristics of the distribution of *Y* are:

1. the mode of the distribution is $1 + [m(1 - \xi)]$; in case of absence of feeling, the mode is equal to 1;
2. the queues of the distribution depend on $\frac{1-\pi}{m}$; in the case of total uncertainty the value is *1/m*;
3. if $\xi = 1/2$ the distribution is symmetrical;
4. the mean of Y is given by the following expression $E[Y] = \frac{m+1}{2} + \pi(m-1)(\frac{1}{2} - \xi)$; fixed π E[Y] increases with the increase in feeling; while in case of total uncertainty one obtains $E[Y] = \frac{m+1}{2}$; the expected value of *Y* decreases when both π and ξ both approach 1.

In order to define a more general and flexible version of (A), the inclusion of covariates characterizing raters had been proposed by D'Elia e Piccolo (2008) . This model is known by the acronym CUB (Covariates Uniformal Binomial)
Let i = 1,2, ..., n the i-th statistical unit, $\boldsymbol{z}_i$ a row vector *(1xp + 1)* of the matrix **Z** *nx(p+1)* containing the covariates relating to the secondary component (uncertainty), a row vector $\boldsymbol{w}_i$ (1xq + 1) of the matrix **W**, *nx(q+ 1),* covariates relating to feeling and $\boldsymbol{\beta}$ and $\boldsymbol{\gamma}$ vectors of the dimension *p+1x1)* and (q+1x1) of the coefficients, so one can determine the following relationships:

$$\pi_i = (\pi/\boldsymbol{z_i}) = \frac{1}{1 + \exp(-\boldsymbol{z_i\beta})}$$
$$\zeta_i = (\zeta/\boldsymbol{w_i}) = \frac{1}{1 + \exp(-\boldsymbol{w_i\gamma})}$$

It is thus possible to rewrite the (A) as follows (corrected):

$$P(Y = y) = \pi_i \left[\binom{m-1}{y-1} (1 - \xi_i)^{y-1} \xi_i^{m-y} \right] + (1 - \pi_i) \frac{1}{m}$$

The marginal effects of the j-th coefficient depend on the sign of the coefficients β_j e γ_j : under equal conditions, if z_{ij} ↑, uncertainty (1-π) decreases if the sign of the estimated coefficient is positive and vice versa; while if w_{ij} ↑, the degree of preference (1-ξ) decreases if the sign of the coefficient is positive and vice versa.
The parameters π, ξ and the vectors of coefficients **β** and **γ** are estimated by the method of maximum likelihood through the implementation of an extended version of the E-M algorithm, Piccolo (2006).
For each model estimated, D'Elia and Piccolo suggest evaluating the degree of fitting to the data by computing not only the traditional values *AIC* and *BIC*, but also a number of other indices including: *Diss:* a normalized index of dissimilarity, Leti (1979), Simonoff (2003); $G=2(l_{p0}-l_{00})$, where l_{p0} is the log-likelihood calculated with reference to the free model, while l_{00} indicates the likelihood calculated in reference to the restricted model and ICOMP Bozdogan, H. (1990) On the information-based measure of covariance complexity and its application to the evaluation of multivariate linear models. Communications in Statistics, Theory and Methods, 19(1), 221–278 (1990).

Good fitting of the estimated model is associated with low values for indices *DISS*, *G* (as well as *AIC* and *BIC*) and *ICOMP*)

2.2 Data

2.2.1 Sample characteristics

Ducale Palace (n=14760)

Variables	**Mean**	**St. Dev.**	**Min**	**Pctl(25)**	**Pctl(75)**	**Max**
Review rate	4,598	0,680	1	4	5	5
Reviewer level	5,097	1,129	1	4	6	6
Number of reviews	178,309	346,956	1	40	186	9920
Reviewer votes	95,265	381,60	1	17	85	14939
Number of cities visited by reviewer	133,797	186,836	1	30	165	5428

Variables	**%**
Age 18 24	2,6
Age 25 34	14,9
Age 35 49	33,6
Age 50 64	36,8
Age 65+	12,1
Female	53,3
Male	46,7

Peggy Guggenheim Collection
(n=641)

Variables	**Mean**	**St. Dev.**	**Min**	**Pctl(25)**	**Pctl(75)**	**Max**
Review rate	4,412	0,747	1	4	5	5
Reviewer level	5,008	1,105	1	4	6	6
Number of reviews	129,246	166,965	3	39	158	2082
Reviewer vote	64,658	83,806	1	19	79	792
Number of citeies visited by reviewer	117,086	130,492	1	30	149	786

Variables	**%**
Age 18 24	1,2
Age 25 34	6,2
Age 35 49	32,9
Age 50 64	43,6
Age 65+	16,1
Female	50,4
Male	49,6

Arsenale (n=932)

Variables	**Mean**	**St. Dev.**	**Min**	**Pctl(25)**	**Pctl(75)**	**Max**
Review rate	4,282	0,737	1	4	5	5
Reviewer level	5,490	0,887	2	5	6	6
Number of reviews	376,499	731,036	5	69	366	10046
Reviewer vote	230,488	1007,841	1	26	176	15123
Number of cities visited by reviewer	191,297	302,532	1	39	223	3289

Variables	**%**
Age 18 24	1,5
Age 25 34	14,6
Age 35 49	31,0
Age 50 64	35,5
Age 65+	17,4
Female	65,6
Male	34,4

Campo Santa Margherita (n=592)

Variables	**Mean**	**St. Dev.**	**Min**	**Pctl(25)**	**Pctl(75)**	**Max**
Review rate	4,304	0,665	1	4	5	5
Reviewer level	5,432	0,961	2	5	6	6
Number of reviews	399,929	848,335	6	64,8	399,8	10046
Reviewer vote	298,091	1331,757	1	24	163	15129
Number of citeies visited by reviewer	201,693	300,534	3	48,8	226	2965

Variables	**%**
Age 18 24	2,7
Age 25 34	17,6
Age 35 49	30,1
Age 50 64	34,5
Age 65+	15,2
Female	55,7
Male	44,3

La Biennale (n=916)

Variables	**Mean**	**St. Dev.**	**Min**	**Pctl(25)**	**Pctl(75)**	**Max**
Review rate	4,216	0,976	1	4	5	5
Reviewer level	5,269	1,043	1	5	6	6
Number of reviews	224,852	377,625	4	48	242	4715
Reviewer vote	116,325	348,298	1	20	116	6338
Number of cities visited by reviewer	154,347	194,045	2	37	192	1424

Variables	**%**
Age 18 24	1,5
Age 25 34	9,8
Age 35 49	26,6
Age 50 64	45,9
Age 65+	16,2

Female	54,8
Male	

Ca d'Oro (n=689)

Variables	**Mean**	**St. Dev.**	**Min**	**Pctl(25)**	**Pctl(75)**	**Max**
Review rate	3,858	1,150	1	3	5	5
Reviewer level	5,642	0,481	2	6	6	6
Number of reviews	455,657	872,267	2	102	468	10069
Reviewer vote	328,909	1159,071	1	42	179	15145
Number of cities visited by reviewer	210,194	353,563	1	43	212	3289

Variables	**%**
Age 18 24	1,6
Age 25 34	11,0
Age 35 49	27,9
Age 50 64	45,9
Age 65+	13,6
Female	67,1
Male	32,9

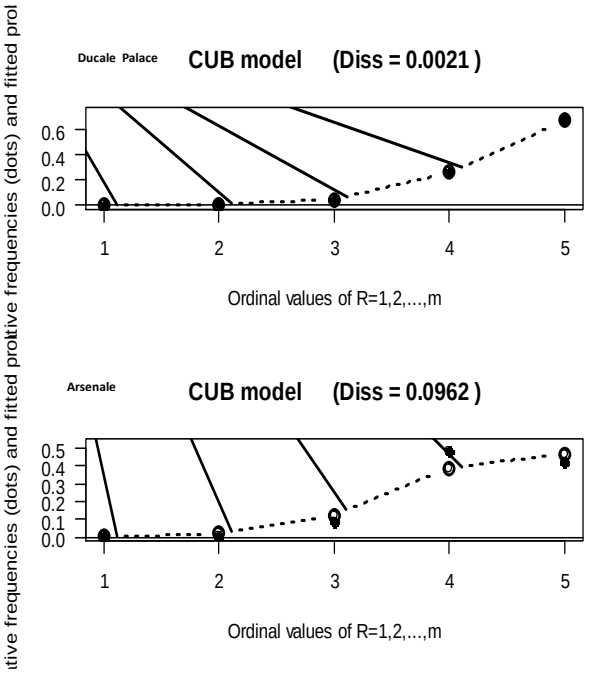
Ghetto (n=553)

Variables	**Mean**	**St. Dev.**	**Min**	**Pctl(25)**	**Pctl(75)**	**Max**
Review rate	4,286	0,721	1	4	5	5
Reviewer level	5,450	0,966	2	5	6	6
Number of reviews	309,031	570,414	6	67	327	10039
Reviewer vote	167,904	720,788	1	25	144	15123
Number of citeies visited by reviewer	202,165	296,162	1	44	235	3289

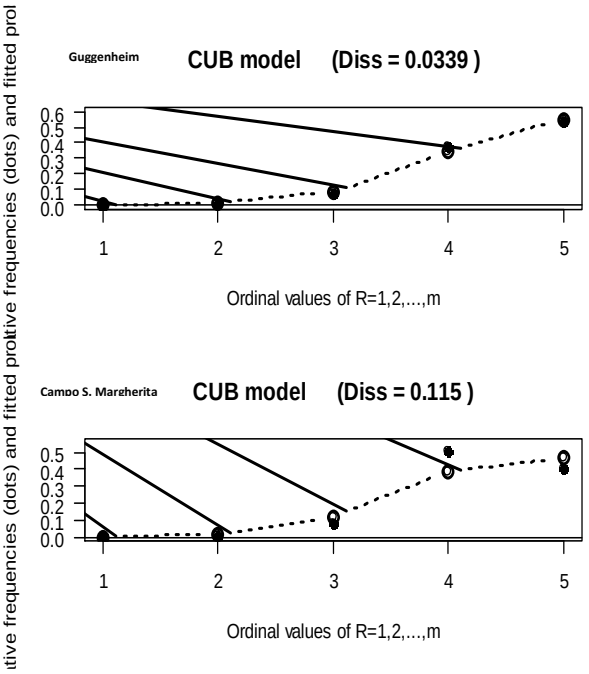
Variables	**%**
Age 18 24	2,0
Age 25 34	11,2
Age 35 49	25,1
Age 50 64	42,5
Age 65+	19,2
Female	56,4
Male	43,6

3. Results

The fitting of the CUB model to the empirical distributions of ratings for the considered sites was displayed in Figure 1 (the points represent the empirical distribution, the dotted line represents the estimated distribution). The empirical frequency distributions indicate that the modal score is prevalently equal to 5, that there is a substantial absence of symmetry and the variability is generally low.


Ducale Palace
CUB model (Diss = 0.0021)
tive frequencies (dots) and fitted prol
0.0
0.2
0.4
0.6
1
2
3
4
5
Ordinal values of R=1,2,...,m

Arsenale
CUB model (Diss = 0.0962)
tive frequencies (dots) and fitted prol
0.0
0.1
0.2
0.3
0.4
0.5
1
2
3
4
5
Ordinal values of R=1,2,...,m


Guggenheim
CUB model (Diss = 0.0339)
tive frequencies (dots) and fitted prol
0.0
0.1
0.2
0.3
0.4
0.5
0.6
1
2
3
4
5
Ordinal values of R=1,2,...,m

Campo S. Margherita
CUB model (Diss = 0.115)
tive frequencies (dots) and fitted prol
0.0
0.1
0.2
0.3
0.4
0.5
1
2
3
4
5
Ordinal values of R=1,2,...,m

Ca d'Oro

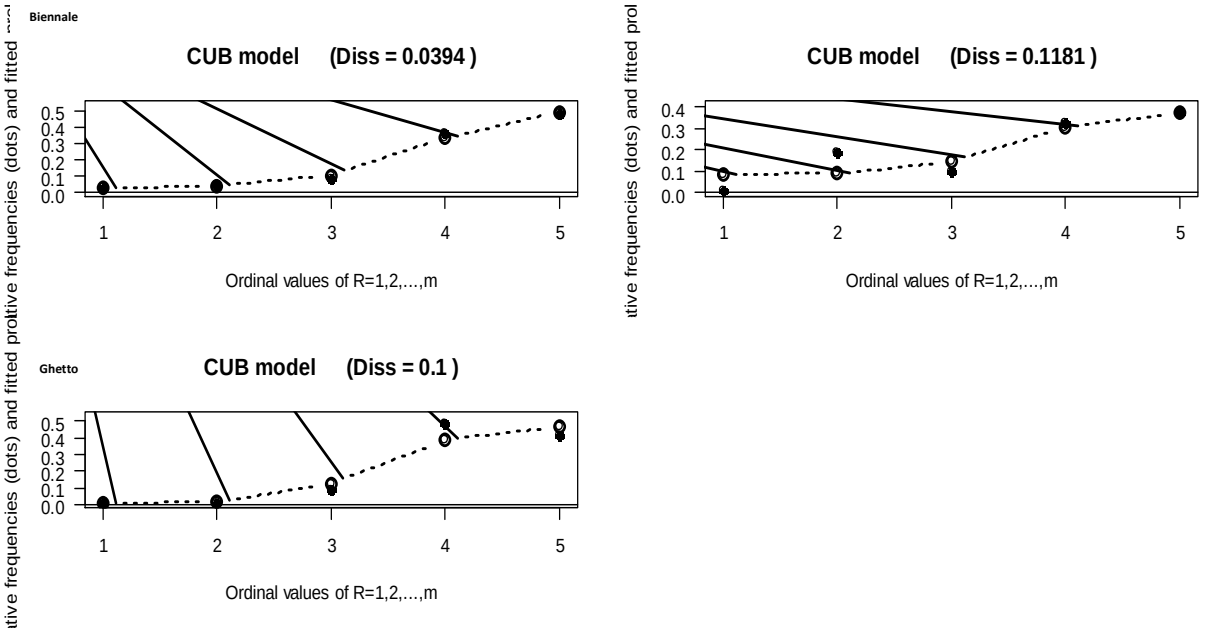


Figure 1. Observed (.) and CUB(0,0) fitted (.) distributions of ratings

For each model the normalized dissimilarity index (Diss) was reported. It indicates the proportion of units that would have to be moved among the categories in order to get a perfect fit. The highest values of the Diss index are associated to Arsenale Ca d'Oro e Ghetto: the values are approximately equal to 0.10.

Table 2 shows the results of the estimates obtained by adapting CUB (0,0) models to the assessments made in relation to 7 attractives. The values of feeling (1-ξ) are quite high, in the majority of cases higher than 0.8, while the level of uncertainty (1-π) expressed by the raters is low, reaching values at most of 0.4. The last column shows the average values of uncertainty, which are very close to zero.

Figure 2 displays the estimated coefficients of the CUB (0,0) models in the parameter space, where the degree of uncertainty (1-π) is shown on the horizontal axis and the degree of feeling (1-ξ) on the vertical one.

Table 2. Estimation results of CUB (0,0) models.

Attracction	**n**	**1-π**	**Wald test**	**1-ζ**	**Wald test**	**1-π /m**
Ducale Palace	14760	0,035	364,580	**0,914**	66,510	0,007
Peggy Guggenheim Collection	641	0,032	73,838	0,865	18,154	0,006
Arsenale	932	0,022	108,690	0,829	26,192	0,004
Campo S. Margherita	592	0,004	159,430	0,828	21,593	0,001
La Biennale	916	0,152	39,551	0,858	18,303	0,030
Ca' d'Oro	691	**0,409**	15,121	0,840	10,453	0,082

Ghetto	553	0,017	94,443	0,828	20,442	0,003

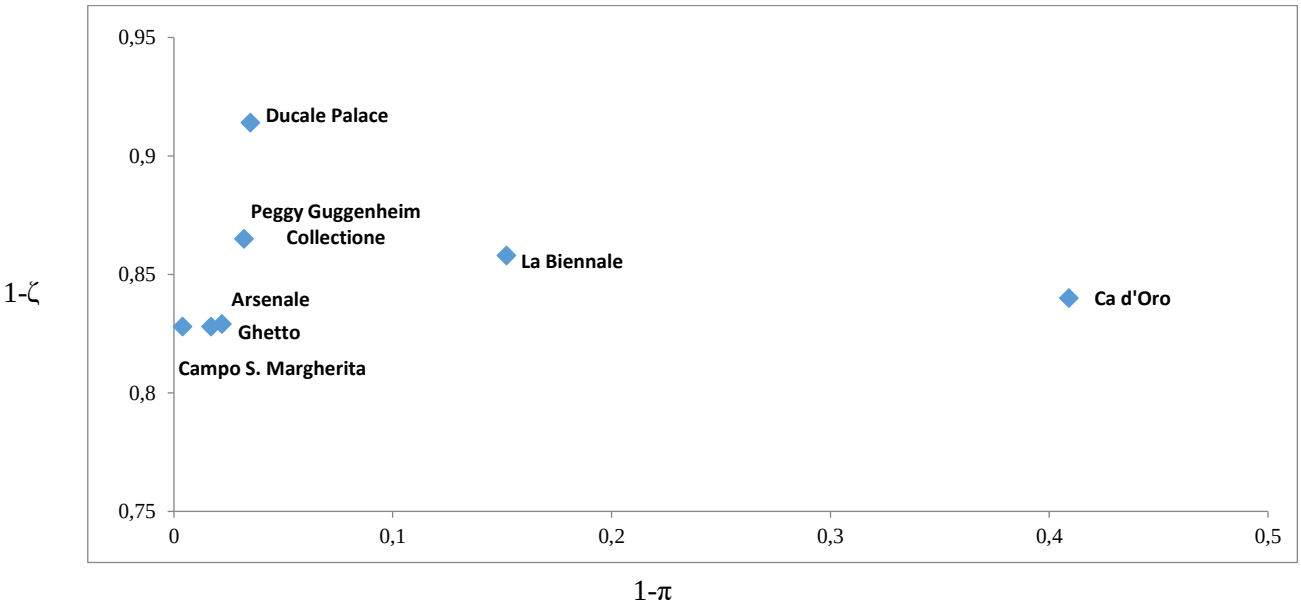


Figure 2: Estimated parameters for attractions.

3.1 CUB with covariates

The estimation of the CUB model with covariates makes it possible to investigate if the satisfaction expressed by the rater and the uncertainty accompanying the evaluation may be influenced by socio-demographic variables such as gender, age, number of cities visited, reviewer level, number of reviewes .
The introduction of covariates did not produce statistically significant results for Peggy Guggenheim Collection and Arsenale.

Table 3 summarizes the main results obtained from the estimation of the model after introducing covariates related to the reviewers. The Table 4 lists the variables statistically significant and therefore have an influence on the degree of uncertainty and/or feeling.
On the basis of the values of the adaptability indices, a general improvement can be seen in the fitting, compared to the basic CUB (0,0) model.

Table 3 Estimation results of CUB Model with Covariates

Attractions	Model	l_{p0}	l_{00}	AIC	AIC CUB(0,0)	ICOMP	ICOMP CUB(0,0)
Ducale Palace	CUB(1,2)	-12188,28	-12211,7	24390,56	24427,34	24387,6	24423,4
Peggy Guggenheim Collection	CUB(0,0)		-633,83		1271,652		1268,03
Arsenale	CUB(0,0)		-970,043		1944,087		1940,225
Campo Santa Margherita	CUB(0,1)	-578,15	-588,55	1162,29	1181,11	1168,72	1177,201
La Biennale	CUB(2,0)	-1071,48	-1079,67	2150,97	2163,33	2160,77	2160,368
Ca' d'Oro	CUB(2,0)	-885,657	-987,89	1779,32	1979,78	1787,55	1976,856

Ghetto	CUB(0,1)	-568,58	-570,55	1143,35	1145,11	1141,903	1141,185

Table 4. Variables influencing on the degree of uncertainty and/or feeling

Attractions	**Model**	**Uncertainty**	**Feeling/liking**
Ducale Palace	CUB(1,2)	Gender	Reviewer level and Age
Peggy Guggenheim Collection	CUB(0,0)		
Arsenale	CUB(0,0)		
Campo Santa Margherita	CUB(0,1)		Reviewer level
La Biennale	CUB(2,0)	Gender and Number of cities visited	
Ca' d'Oro	CUB(2,0)	Gender and Number of cities visited	
Ghetto	CUB(0,1)		Gender

It is interesting to observe that the Reviewer level variable exclusively influences the degree of satisfaction, while the variable Number of cities visited affects the level of uncertainty, in particular with regard to Biennale and Ca' d'Oro attractions.
Table 6 contains the mean uncertainty and feeling ($1-\pi$ and $1-\xi$) values estimated for the reporting unit groups identified by reviewers characteristics.

Table 5:

Attractions	Uncertainty	Feeling/liking	Wald test
Ducale Palace			
Gender (Reference attribute: Female)	-0,493		-3,13
Age (Reference class: Age>64)			
Age 18_34		0,14	2,29
Age 35_49		0,121	2,2
Age 50_64		0,113	2,07
Reviewer level		0,034	2,35
Campo Santa Margherita			
Reviewer level		0,292	4,27
La Biennale			
Gender (Female=0)	-1,087		-2,87
Number of cities visited	0,00315		2,41
Ca' d'Oro			
Gender ((Reference attribute: Female)	-5,107		-6,008
Number of cities visited	0,0441		4,034
Ghetto			
Gender (Female=0)		0,23	1,92

With reference to the attractions La Biennale and Ca' d'Oro the rating uncertainty was influenced by two covariates, i.e. gender and number of cities visited by the reviewer. Specifically, two subpopulations of raters emerge: one characterized by reviewers male another with reviewers female.

The first has a mean rating higher than second. The mean rating increases when the reviewer has visited a high number of cities.
Campo Santa Margherita and Ghetto ratings were influenced by only one covariate, reviewer level and gender, but only for the feeling/liking part. If the reviewer level increases, feeling/liking decreases for Campo Santo Margherita, while for Ghetto attractions feeling/liking is higher in the sub population of male than the one of female.
Ducale Palace score is influenced by gender (uncertainty) and by age and reviewer level (feeling/liking). The reviewer most satisfied belongs to the higher age (more than 64 years old) and to higher (reviewer) level.
With regard to reviewer gender, a difference emerges between female and male reviewers, with the degree of uncertainty higher among the latter.

Table 6:

Covariates	**1_pai**	**1_csi**	**Average (Reviewer rate)**
Female	0,027	0,909	**4,61**
Male	**0,043**	0,923	4,58
Age 1	0,033	0,912	4,596
Age2	0,035	0,913	4,599
Age 3	0,036	0,913	4,593
Age 4	0,037	0,921	**4,626**
Reviewer level			
1	0,0358	0,924	4,55
2	0,0329	0,921	4,58
3	0,033	0,919	4,62
4	0,034	0,916	4,6
5	0,035	0,914	4,6
6	0,037	0,912	4,58

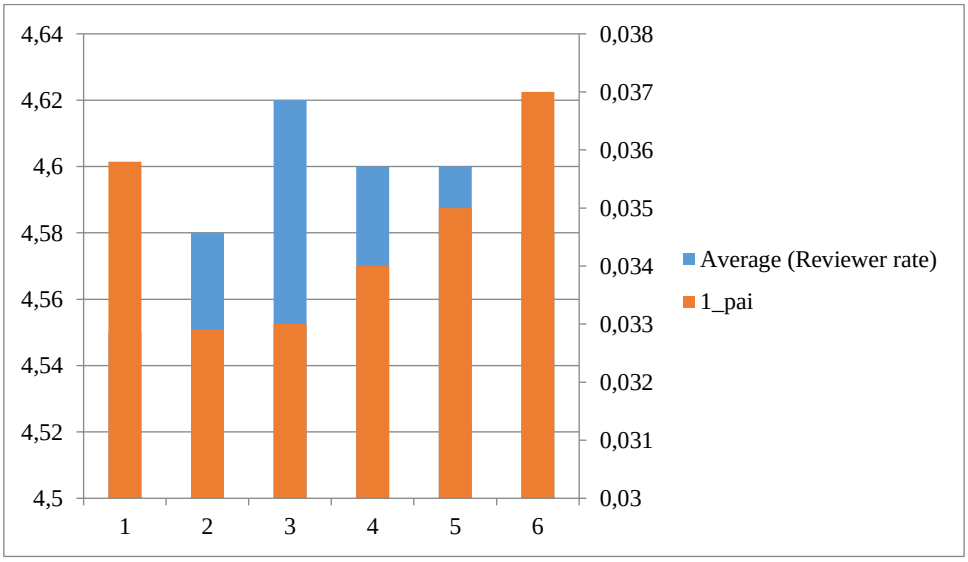


Figure 3:

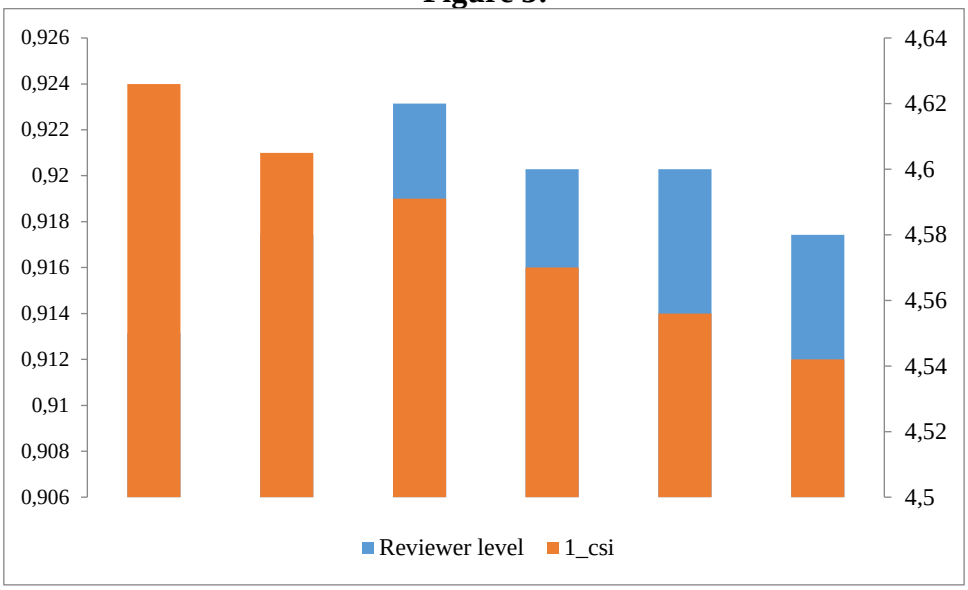


Figure 4:

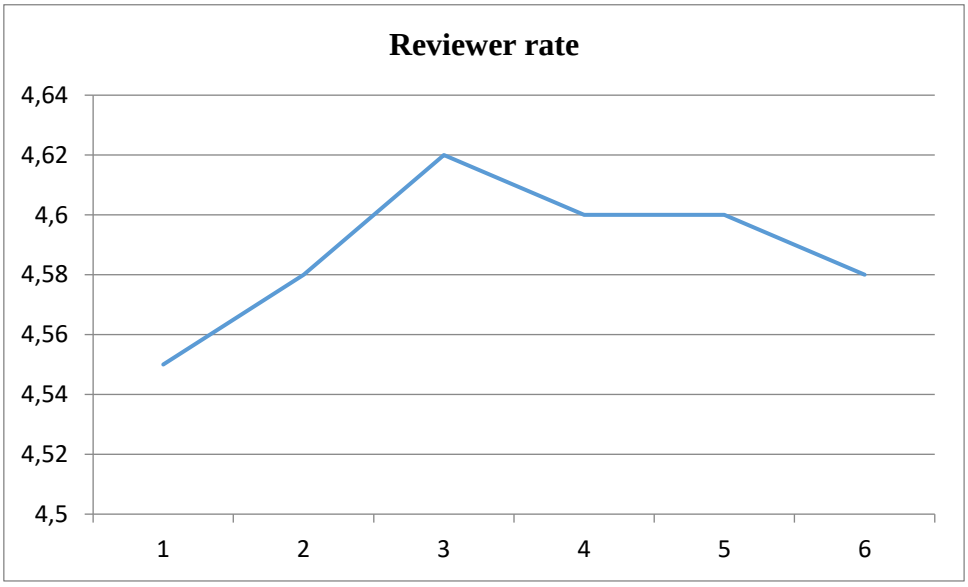


Figure 5:

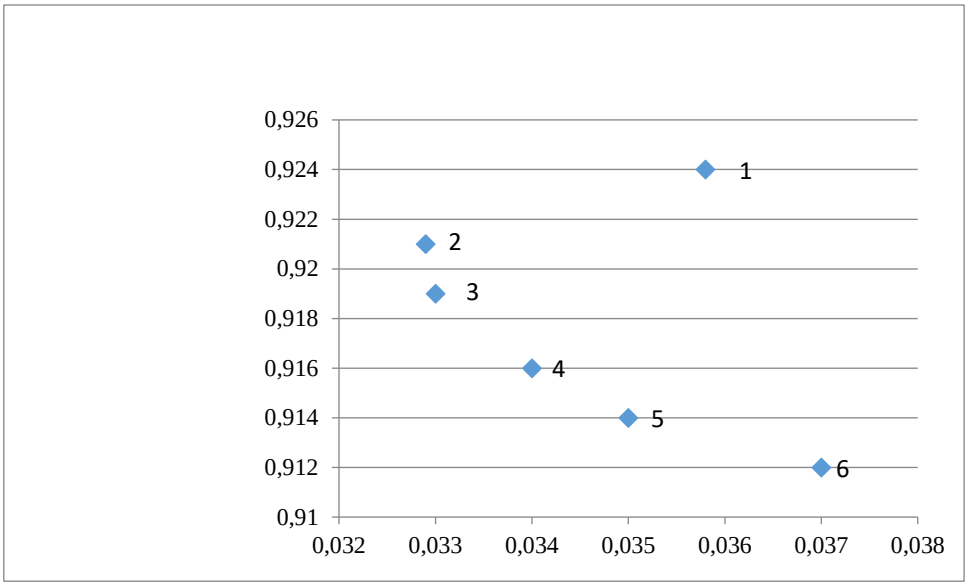


Figure 6:

Campo Santa Margherita

Reviewer Level	Average rate	1_csi
<=3	4,5	0,911
4	4,6	0,881
5	4,51	0,847
6	4,2	0,805

Ghetto

Gender	Average rate	1_csi
Female	4,331	0,846
Male	4,25	0,814

Biennale

Gender	Average rate	1_pai
Female	4,309	0,087
Male	4,134	0,199

Ca d'Oro

Gender	Average rate	1_pai
Female	4,317	0,049
Male	3,632	0,514

Conclusions

We find that uncertainty plays an important role in reviewer's judgements with different effects across time periods. According to our results uncertainty in reviewer's ratings affects significantly the distribution of ratings and should be accounted for in order to obtain more precise measures of reputation for touristic destinations.

References

B. Barber, The logic and limits of trust, New Rutgers University Press, Brunswick, NJ (1983)

Benckendorff, Pierre J., Pauline J. Sheldon, and Daniel R. Fesenmaier. "Social media and tourism." Tourism information technology Ed. 2 (2014): 120-147.

Hennig-Thurau, T., Gwinner, K. P., Walsh, G., & Gremler, D. D. (2004). Electronic word-of-mouth via consumer-opinion platforms: What motivates consumers to articulate themselves on the Internet? Journal of Interactive Marketing, 18(1), 38–52.

Hennig-Thurau, Thorsten, et al. "Electronic word-of-mouth via consumer-opinion platforms: what motivates consumers to articulate themselves on the internet?." Journal of interactive marketing 18.1 (2004): 38-52.

Henning-Thurau T.,2004 Electronic word-of-mouth via consumer-opinion platforms: What motivates consumers to articulate themselves on the Internet?, https://www.sciencedirect.com/science/article/pii/S1094996804700961

Kucukusta, Deniz, et al. "Re-examining perceived usefulness and ease of use in online booking: The case of Hong Kong online users." International Journal of Contemporary Hospitality Management 27.2 (2015): 185-198.

Kwok, Linchi, and Karen L. Xie. "Factors contributing to the helpfulness of online hotel reviews: does manager response play a role?." International Journal of Contemporary Hospitality Management 28.10 (2016): 2156-2177.

Kwok, Linchi, Karen L. Xie, and Tori Richards. "Thematic framework of online review research: A systematic analysis of contemporary literature on seven major hospitality and tourism journals." International Journal of Contemporary Hospitality Management 29.1 (2017): 307-354.

L.V. Casaló, C. Flavián, M. Guinalíu, Understanding the intention to follow the advice obtained in an online travel community, Computers in Human Behavior, 27 (2) (2011), pp. 622-633

L.-Y. Pan, J.-S. Chiou, How much can you trust online information? Cues for perceived trustworthiness of consumer-generated online information, Journal of Interactive Marketing, 25 (2) (2011), pp. 67-74

Leung, Xi Yu, Lan Xue, and Billy Bai. "Internet marketing research in hospitality and tourism: a review and journal preferences." International Journal of Contemporary Hospitality Management 27.7 (2015): 1556-1572.

Litvin, Stephen W., Ronald E. Goldsmith, and Bing Pan. "Electronic word-of-mouth in hospitality and tourism management." Tourism management 29.3 (2008): 458-468.

Q. Ye, R. Law, B. Gu. The impact of online user reviews on hotel room sales, International Journal of Hospitality Management, 28 (1) (2009), pp. 180-182

See-To, Eric WK, and Kevin KW Ho. "Value co-creation and purchase intention in social network sites: The role of electronic Word-of-Mouth and trust–A theoretical analysis." Computers in Human Behavior 31 (2014): 182-189.

Senecal, Sylvain, and Jacques Nantel. "The influence of online product recommendations on consumers' online choices." Journal of retailing 80.2 (2004): 159-169.

Sparks, Beverley A., and Victoria Browning. "The impact of online reviews on hotel booking intentions and perception of trust." Tourism management 32.6 (2011): 1310-1323.

T. Hennig-Thurau, K.P. Gwinner, G. Walsh, D.D.Gremler. Electronic word-of-mouth via consumer-opinion platforms: what motivates customers to articulate themselves on the Internet? Journal of Interactive Marketing, 18 (1) (2004), pp. 38-52

TripBarometer2016 & 2017, https://www.tripadvisor.it/TripAdvisorInsights/tripbarometer

Vermeulen, Ivar E., and Daphne Seegers. "Tried and tested: The impact of online hotel reviews on consumer consideration." Tourism management 30.1 (2009): 123-127.

Xia, Lan, and Nada Nasr Bechwati. "Word of mouse: the role of cognitive personalization in online consumer reviews." Journal of interactive Advertising 9.1 (2008): 3-13.

Y.Y.Y. Chan, E.W.T. Ngai, Conceptualising electronic word of mouth activity: An input-process-output perspective, Marketing Intelligence and Planning, 29 (5) (2011), pp. 488-516