

The Power and Pitfalls of Scarcity Messaging in Online Travel Booking

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Abstract

This study investigates the effects of scarcity messages and social proof communication on consumer decision-making in online travel agencies. Using a mixed methods approach, the study included a content analysis of Booking.com listings and a questionnaire survey (N = 247) to investigate users' perceptions. Results show that time- and demand-based scarcity messages significantly influence booking intentions, especially among younger, impulsive users. Social proof elements further reinforce the decision, although overly aggressive tactics can undermine trust. The findings emphasise the need for ethical, data-driven messaging, with transparent communication and careful UX design to drive both conversion and consumer trust.

Keywords

Scarcity messages, Social proof, Consumer decisions, Online travel agencies, Digital marketing communication

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1 Introduction

Technological progress has drastically changed consumer behaviour and sales processes. This trend is particularly evident in the tourism sector, where online transactions now account for an increasingly large proportion of total bookings. According to a market analysis conducted by Future Market Insights [1] in 2018, the global digital travel market was estimated at USD 400 billion in 2022 and is expected to reach USD 1,618 billion by 2032, representing an annual growth rate of 15%. These figures underline the dynamic expansion of the sector and growing consumer confidence in digital platforms for travel planning and booking.

This study examines online sales strategies in tourism that use psychological insights from behavioural economics to stimulate consumer purchasing behaviour. It examines the application and effectiveness of scarcity messages and social proof. It is found that these techniques increase perceived value, create a sense of

urgency and increase purchase intent. In the face of loss aversion, such strategies lead to faster decision making and contribute significantly to higher conversion rates and increased revenue for online platforms.

It is increasingly recognised in the academic literature that human decision-making diverges from the rational actor model traditionally assumed in economic theory. Instead, decisions are often guided by emotional and unconscious cognitive biases. Consequently, advertising messages that target these psychological mechanisms can effectively influence consumer behaviour and increase purchase propensity.

Prospect theory [2] assumes that consumers rely on heuristics and favour decisions to avoid losses. Scarcity messages and social proof exploit this innate behavioural tendency. Similarly, reactance theory [3, 4] and commodity theory [5] suggest that people place a higher value on scarce resources, which increases both their willingness to buy and the price they are willing to pay. The phenomenon of fear of missing out (FOMO) can also lead to impulsive decisions. This is explained by the Regret Theory [6], which emphasises the role of anticipated regret in the purchase decision.

Online travel agencies (OTAs) such as Booking.com and Szallas.hu routinely use these psychological tools to promote faster and more favourable purchasing decisions. However, such practises can provide consumers with subjective or misleading information, which raises ethical concerns. These manipulative design strategies are known as dark patterns. According to a study by the European Commission [7] in 2022, 97% of the most commonly used apps and websites in Europe contain some form of dark pattern in their user interface.

In Hungary, the tightening of the legal framework can be seen in the heavy fine imposed on Booking.com in 2020, followed by proceedings against Szallas.hu. These legal actions resulted in changes to the platform's user interface and restricted the excessive use of persuasion techniques. This study examines the role and effectiveness of scarcity notifications in the practise of OTAs using a mixed methods approach that integrates qualitative and quantitative data. Its aim is to provide a comprehensive understanding of the impact of the 2020 competition authority intervention, the use of scarcity techniques and consumer perceptions of these practises.

2 Theoretical framework and literature review

In the field of behavioural marketing and sales incentives, the use of scarcity messages and social proof on digital platforms is particularly prominent. A fundamental insight of behavioural economics is that consumer decision-making is not a rational process, but an emotional and psychological one that is influenced by cognitive



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biases, heuristics and anxiety, among other things [8–10]. Lynn [5] have also shown that scarcity increases the perceived value of a product and the willingness to buy.

Scarcity as a heuristic mechanism for decision support is a means of “fast and economical” information processing. People rely on these shortcuts especially when they have little time, have a large amount of information or are emotionally saturated [11]. In this sense, marketing messages based on scarcity can also exploit decision fatigue.

The social proof emphasised by Cialdini [12] suggests that people are more likely to decide if others have made it too. This is particularly true in the digital environment, where real-time statistics (e.g. “18 people have viewed this accommodation today”) can reinforce perceived demand [13, 14]. According to Cialdini [12], people make decisions based on the example of others when they are unsure of themselves or are forced to make a quick decision.

The phenomenon of fear of missing out (FOMO) can significantly accelerate decision-making. This phenomenon has become one of the defining psychological factors of the digital age [15]. FOMO is also related to regret theory [6], which states that consumers are more likely to make immediate decisions to avoid later regrets.

In the digital environment, the toolkit of dark patterns has expanded considerably. They are defined in the literature as elements of the user experience that aim to unconsciously influence the user to take a predetermined action, often against their interests [16, 17].

There are three main types of digital scarcity messages: (1) limited-time scarcity: the offer is only available for a limited time; (2) limited quantity scarcity: there is only a small amount of the product or service in question; (3) social proof scarcity: a high number of other buyers indicates strong demand [18].

Various studies attribute different levels of effectiveness to these factors. According to Herhausen et al. [13], the effect of social proof is stronger when the information is communicated in real time. In experiments [19], inventory-based scarcity proved to be more effective in increasing conversions, while social proof strengthened brand loyalty.

More and more research also shows that the effectiveness of scarcity messages can differ significantly depending on demographic factors (gender, age), cultural background or emotional state [20]. This draws attention to the need for personalisation and maintaining user trust, which is key to long-term business success.

In the domestic literature [21] examined behavioural patterns along cluster-based target group approaches, while [22] pointed to the specific marketing environment of services, where trust and perceived risk play a prominent role. The advancement of digital technologies has reinterpreted traditional marketing strategies and offers the possibility to dynamically address individual target groups with customised messages.

3 Methodology

The aim of the study is to analyse the role and effectiveness of scarcity messages in the sales practise of online travel agencies. The research methodology is based on a combination of qualitative and quantitative instruments to obtain a comprehensive picture of service providers’ practises and consumers’ perceptions. The focus of the study is on how scarcity messages influence booking

intentions. To investigate this, the following research questions were formulated:

- Q1: What changes have occurred in the sales practises of online travel agencies since the 2020 sanction measure?
- Q2: What types of scarcity-based messages are currently used by OTAs?
- Q3: Why are scarcity messages effective in the context of OTA sales?
- H1: The risk-averse attitude of people contributes significantly to the intention to book.
- H2: The perceived urgency felt in response to scarcity messages contributes significantly to the intention to book.
- H3: Customers perceive a higher value with the respective service in response to scarcity messages, which contributes to the intention to book.
- H4: The perceived scarcity in response to scarcity messages contributes significantly to the intention to book.
- H5: The gender of the customer contributes significantly to an increase in the intention to book in response to scarcity messages.
- Q4: Which scarcity messages are perceived to be most effective?
- H6: Different scarcity messages will lead to significantly different booking intentions.
- Q5: How do consumers perceive the use of scarcity messages in OTA interfaces?

A mixed methods approach was used to analyse the practises of service providers and consumers perceptions of scarcity marketing. As part of the qualitative phase (Q1), an interview was conducted with two members of Szallas.hu’s sales team. Their answers reflect the differences in the industry: some OTAs still use scarcity techniques in a toned-down form (e.g. Booking.com), while Szallas.hu has removed FOMO messages completely. Instead, they now emphasise unique selling points such as a free breakfast or a panoramic view. The retreat may have reduced conversion rates somewhat, but loyalty programmes and app-based offers now play an important role in driving bookings.

To assess industry practises (Q2), a content analysis of Booking.com’s user interface was conducted using the Wayback Machine, comparing current and archived versions after the 2020 GVH penalty. Earlier versions included messages such as “This is the last room!” or “Others are now interested too”, while newer versions are more subtle [23]. The manipulation of experiences remains, but is less intrusive.

The quantitative research focused on Q3, Q4 and Q5. The model by Teubner & Graul [24] and the scales for risk aversion and trustworthiness by Song et al. [25] were used. The online experiment simulated a booking scenario for Easter in which respondents (N=247) were randomly assigned to one of four scarcity message types: “Only 1 room left” (supply-based), “90% of similar accommodations are already booked” (restriction of choice), “26 people are looking for accommodation now” (demand-based), Combined message (supply & demand).

The balance across groups (n=61, 62, 60, 64; N=247) were insured. Validated psychological scales measured urgency, FOMO, value, bias and booking intention (5-point Likert scale). Booking intention

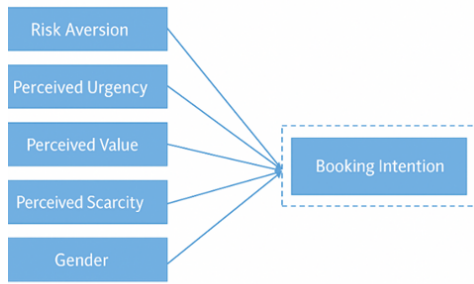


Figure 1: Modified research model [24]

was the key dependent variable. The reliability of the scales ensures valid interpretation. Figure 1 shows the modified research model.

4 Results

4.1 In-depth expert interview with representative of Szallas.hu

Following the proceedings of the Hungarian Competition Authority (GVH), Szallas.hu has removed all FOMO (fear of missing out) messages related to scarcity. In-depth interviews revealed four key areas: the authority’s actions, strategic changes, market trends and target group characteristics. The typical user is a 30-40 year old woman who plans her holidays and books impulsively. Scarcity messages had previously increased urgency and conversion rates.

Although the messages were based on real data, Szallas.hu removed them and launched consumer research, a redesign of the user interface, internal training and an awareness campaign [10]. Conversions decreased slightly, showing that FOMO plays only a limited role in booking decisions. The focus shifted to unique value propositions (e.g. panoramic views, free breakfast) and the introduction of the Hű! loyalty programme, which improved conversions via the mobile app.

The app now offers personalised offers and push notifications with AI to improve recommendations and service. Scarcity can be effective but should be used ethically. Long-term trust is better built through meaningful offers and experience-orientated tools.

4.2 Content analysis of the Booking.com user interface

Following the interviews, the next step was to analyse the current use of scarcity reports by Booking.com. The aim was to evaluate the changes since 2020, based on Frontira’s customer journey table from 2021. Using the same method, we searched for accommodation for two people and recorded scarcity reports from search to booking.

Unlike Szallas.hu, Booking.com still uses scarcity messages, albeit in a different form. The study found that the wording, design and visual elements of the messages have changed: red colours and strong wording have been replaced by green, black or grey tones. Misleading or unverifiable statements such as “1 person has searched in the last 10 minutes” are no longer used. Today, more objective notifications appear, such as stock-based limits or expiry dates. However, vague messages such as “Lucky! Almost

always fully booked” still aim to create urgency without clear evidence. Overall, the tone is more restrained and more in line with GVH guidelines. Scarcity messages have not disappeared, but have evolved into more ethical, data-driven communication. Further refinement is advisable to promote transparency and consumer trust.

4.3 Quantitative research

The questionnaire was completed by 247 people between March and April 2025 using a non-random sampling method. 61.5% of respondents are women. Most responses came from people between the ages of 20 and 29, so their perception of the issue is most pronounced in the sample. 56.3% of respondents stated that they had an average income. In terms of place of residence, 7% of respondents live in Budapest, 35% in a county, 42% in a city and 16% in a village or municipality. During the period analysed, 85% of respondents have booked accommodation at least once, so they have experience and knowledge of the processes involved in booking.

Before carrying out the measurements, we checked the internal scale consistency of the scales used. To do this, we used Chronbach’s alpha index, as a high value increases the stability of the model and can minimise measurement errors. Its value can be between 0 and 1. The scale is good if this value is between 0.707 and 0.95 (Table 1). All values obtained are acceptable, as they lie between the two limits. This means that the scales have measured the individual questions correctly, and the results obtained reflect the opinions and perceptions of the respondents well.

The first scale was the risk aversion scale by Song et al [25], which was used to measure general attitudes at the beginning of the questionnaire, before the booking situation. On the scale, which contains 6 statements. We reversed item 5 due to its negative tendency, so that a higher score indicates risk aversion and a lower score indicates risk tolerance. The results show that respondents tend to be risk averse, especially for statements that refer to predictable outcomes. The average of the scale is 3.58 on a 5-point scale, indicating moderate risk aversion.

After describing the booking situation, respondents saw the following scales in which we asked about perceived scarcity, perceived value, perceived urgency and finally intention to book. The second scale measures perceived scarcity. The average score for all respondents was 3.13. Under the influence of the various scarcity messages, the sample perceived a shortage of supply or an increase in demand, but despite the messages, they did not perceive a significant scarcity. This scale resulted in the most neutral value.

According to the literature, people who are confronted with scarcity tend to associate added value with the scarce good, so we measured this with the third scale (Lynn, [5]). Under the influence of the four messages, we obtained an average score of 3.39, which is more positive than neutral, but does not indicate a particularly positive value judgement by respondents.

Under the influence of scarcity messages, people may feel a sense of urgency that leads them to act more quickly. Therefore, we measured this phenomenon in the sample using the fourth scale according to Aggarwal et al. [18]. Considering the total number of respondents, we obtained an average score of 3.43, which means

Table 1: Chronbach’s alpha values of the scales used

SCALES IN THE QUESTIONNAIRE	CRONBACH’S ALPHA
Risk aversion – 6 elements (Song et al. [25])	0.767
Perceived urgency – 4 elements (Park et al. [26])	0.919
Perceived value – 4 elements (Lynn [5])	0.860
Perceived scarcity – 3 elements (Aggarwal et al. [18])	0.826
Booking intention – 3 elements (Teubner et al. [24])	0.900

Table 2: Results of scales

Statement	Avg.	Std dev
1.Risk aversion scale – To what extent do the following statements apply to you?		
I am a risk averse person.	3.43	1.134
I prefer situations where the outcome is predictable.	4.27	0.817
Before I make a decision, I want to be absolutely sure how things will turn out.	4.12	0.856
I avoid situations with an uncertain outcome.	3.79	1.064
I like to improvise in new situations.	2.65*	1.200
I get nervous when I have to make decisions in uncertain situations.	3.23	1.198
Scale mean and standard deviation	3.5803	0.71833
2.Perceived scarcity – To what extent do the following statements apply to you?		
I have the feeling that there are only a few rooms available in the city at the moment.	2.97	1.251
I have the feeling that many rooms in the city are already booked.	3.32	1.222
I have the feeling that there are only a few rooms left to book in the city.	3.15	1.272
I have the feeling that there are only a few rooms left in the city.	3.06	1.225
Scale mean and standard deviation	3.1265	1.11391
3.Perceived value – To what extent do the following statements apply to you?		
I find the ad very attractive.	3.48	1.100
I find the ad very appealing.	3.48	1.031
I find the ad very persuasive.	3.41	1.115
I find the ad very interesting.	3.19	1.073
Scale mean and standard deviation	3.3887	0.90659
4.Perceived urgency – To what extent do the following statements apply to you?		
If I don’t book now, I might lose the chance to book this room.	3.40	1.252
There is a lot of competition with other people who want to book this room.	3.26	1.196
I have the feeling that I need to book soon so that the room is ours.	3.62	1.141
Scale mean and standard deviation	3.4291	1.03082
5.Booking intention – To what extent do the following statements apply to you?		
I would be willing to book this room.	3.48	1.136
I would probably book this room.	3.32	1.1215
I would be willing to book this room for us.	3.12	1.271
Scale mean and standard deviation	3.3036	1.10391

that they perceive an increased demand or limited supply but do not feel an immediate urge to act.

Finally, in relation to the situation, we asked the target variable, intention to book, using the Teubner & Graul’s [24] scale. The four groups showed a combined readiness score of 3.3 in response to the messages, meaning they have the feeling but not the firm intention to book the accommodation in the situation (Table 2).

The last part of the questionnaire investigated the perception of scarcity messages on online travel agency user interfaces using Song et al.’s [25] five-point scale containing pairs of opposites. According to the results, respondents tended to rate these messages

as neutral (mean: 3.19) and were unsure of their truthfulness. This is consistent with the dark patterns and deceptive practises discussed in the literature that cause consumer distrust, as well as the phenomenon of blindness to scarcity messages [27].

We analysed the effectiveness of the different messages using one-way independent ANOVA tests. The conditions – normal distribution (based on the central limit theorem), independence (one respondent completed only one questionnaire), and variance homogeneity (based on the Levene test) – were met. According to the results of the Levene test, the significance level for all variables

Table 3: Prerequisite for the ANOVA analysis - Levene's test

Tests of Homogeneity of Variances					
	Based on Mean	Levene Statistic	df1	df2	Sig.
Risk aversion		0.390	3	243	0.761
Percieved scarcity		1.691	3	243	0.170
Percieved value		0.442	3	243	0.723
Percieved urgency		0.673	3	243	0.569
Booking intention		1.313	3	243	0.271

Table 4: ANOVA analysis of various stimuli with scarcity messages

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Risk aversion	Between	0.641	3	0.214	0.411	0.745
Percieved scarcity	Groups	20.562	3	6.854	5.851	0.001
Percieved value		1.989	3	0.663	0.805	0.492
Percieved urgency		2.340	3	0.780	0.732	0.534
Booking intention		6.449	3	2.150	1.781	0.151

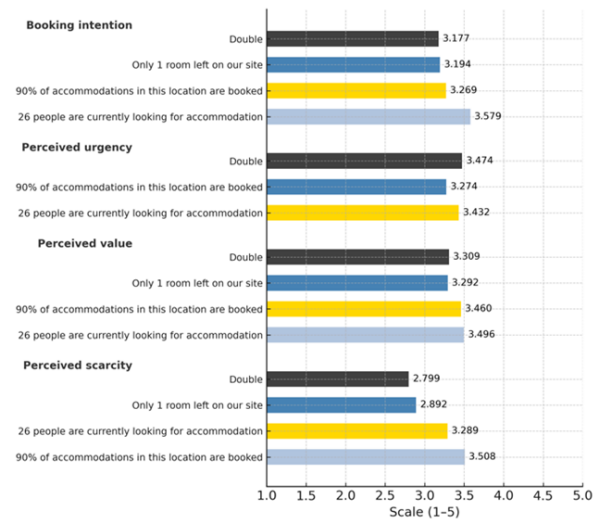
was above 0.05, so that the performance of an ANOVA analysis was justified (Table 3).

Based on the results of the ANOVA test, a significant difference between the groups was only found for perceived scarcity ($F = 5.851$; $p = 0.001$), so that we can only speak of a different effectiveness of the various stimuli for this variable. This indicates that the scarcity messages only had a different effect with regard to perceived scarcity. No significant difference was found for the other variables analysed (risk aversion, perceived value, perceived urgency, booking intention), which means that a similar effect mechanism can be observed for these (Table 4).

Overall, the various scarcity messages – with the exception of perceived scarcity – had a similar effect on respondents and only moderately increased their intention to book. The study is not representative; the results can only be interpreted at the level of the sample analysed and are not suitable for drawing general conclusions.

The two most effective messages in the sample were the demand-based scarcity message “26 people are still looking for accommodation in Lillafüred on your date” and the supply-based, quantitative, choice-based scarcity message “90% of the accommodation in the estate is booked”. These two messages also had the best effect on the target variable, the intention to book, where the demand-based scarcity message achieved the best result. However, when looking at the four expected effects as a whole (sense of scarcity, sense of urgency, added value, intention to book), these two messages still performed best when analysed in the correct order.

However, in terms of the average standard deviation achieved, the double message performed most reliably, “There are only two rooms left on our website” and “26 people are still looking for accommodation in Lillafüred on your dates”. The standard deviation of the individual scales was lowest here. However, in terms of perceived urgency, the sentence “There is only 1 room left on our website”, which is also used by Booking, was possibly the most

**Figure 2: Effectiveness of scarcity messages among respondents**

appropriate, among the many scarcity messages, which is why they still use this exact sentence.

Interestingly, in Teubner and Graul's [24] study, supply scarcity was the most effective, while in my sample both supply and demand scarcity were effective, as both performed almost equally well on the various dimensions. However, their finding that the combined use of supply and demand scarcity messages does not produce a significant difference in effectiveness and that the demand message itself can also produce such results also applies to my sample. Figure 2 summarises the effectiveness of the individual messages based on various aspects.

The main objective was to test the following hypotheses in relation to booking intention (dependent variable). Prior to model estimation, all assumptions of the linear regression were checked in accordance with Simon et al. [28]. The absence of perfect multicollinearity was confirmed using a correlation matrix; none of the pairwise correlations between independent variables exceeded $r = 0.7$. To assess homoscedasticity, the standardised residuals were plotted against the predicted values, showing no pattern of heteroscedasticity. The assumption of normally distributed residuals was also fulfilled, which was supported by a histogram centred around the mean and justified by the central limit theorem ($n > 100$).

The regression analysis showed that the model was statistically significant (F-test, $p < 0.001$). Among the independent variables, perceived urgency had the strongest positive effect on booking intention ($\beta = 0.333$, $p < 0.001$), followed by perceived value ($\beta = 0.260$, $p < 0.001$), and perceived scarcity ($\beta = 0.176$, $p = 0.003$). These results confirm hypotheses H2, H3, and H4. Gender was not a significant predictor ($\beta = -0.054$, $p = 0.300$), therefore H5 was rejected. Risk aversion showed a moderate but significant effect ($\beta = 0.128$, $p = 0.030$), confirming H1.

To assess H6, a one-way ANOVA was conducted to compare booking intention across the four scarcity message conditions. The analysis revealed a statistically significant difference between the groups ($F = 3.212$, $p = 0.024$). Post-hoc comparisons revealed that the combined message had the highest average booking intention, while the supply-based message had the lowest. This supports the assumption that the design and composition of the message significantly influences consumer response.

In summary, the quantitative analysis supports the central claim that scarcity messages influence booking behaviour through cognitive and emotional mechanisms. Urgency and perceived value are particularly strong drivers, and their ethical application in OTA interfaces can increase conversion rates without compromising consumer trust.

5 Conclusions and recommendations

This research explored the types, effectiveness, and consumer perceptions of scarcity messages used by online travel agencies (OTAs), using Booking.com as a case study. A mixed-method approach revealed the following:

- Q1: Since the 2020 GVH sanction, OTAs have shown more restraint in using dark patterns. Booking.com reduced intrusive red warnings and now applies scarcity cues in a more transparent manner [29, 30].
- Q2: Three main scarcity types were identified: (1) limited-time (“offer ends today”), (2) limited quantity (“only 1 room left”), and (3) demand base scarcity (“12 people viewed this”). Most platforms combine these for real-time persuasion.
- Q3: Scarcity is effective due to psychological triggers like loss aversion, FOMO, and decision fatigue. These messages create urgency and promote quick decisions [2, 15].
- Q4: Stock-based messages had the strongest effect on purchase intent. Social proof enhanced trust, while time-based cues worked best with short, realistic deadlines [13].

- Q5: While 60% of respondents recognised and 45% were influenced by scarcity cues, excessive or manipulative use reduced trust. Perceptions were therefore ambivalent.

The findings confirm that scarcity and social proof significantly impact OTA conversions, especially among younger, impulsive users. However, overly aggressive tactics risk alienating more conscious consumers. Recommendations:

1. Data-driven personalisation: Tailor scarcity messages by age and behaviour (e.g. urgency for young users, reviews for older ones).
2. Transparent communication: Use real data to maintain credibility.
3. Ethical UX: Avoid manipulative visuals and forced decisions.
4. Continuous testing: A/B testing helps optimise message impact.

When applied ethically and transparently, scarcity messaging can enhance competitiveness while preserving long-term consumer trust.

The survey sample consisted mainly of young, internet-active participants, limiting representation of older age groups. The content analysis was time-bound to spring 2025, making long-term generalisability uncertain. The study focused exclusively on Booking.com, excluding comparative insights from other OTA platforms. Self-reported questionnaire data may be subject to bias due to social desirability or post-rationalisation. While mixed methods were used, deeper methodological integration was constrained by time and resources. The sample is non-representative and heavily skewed towards younger respondents, which restricts the transferability of the findings to broader traveller populations. Future research should therefore include more diverse age groups and user segments, incorporate additional online travel platforms beyond Booking.com and conduct international comparisons to enhance external validity and generalisability.

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