How signal portfolios affect success in equity-based crowdfunding: Evidence from the Chinese hotel industry

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ABSTRACT

While most crowdfunding studies predominantly explore the success factors of reward-based crowdfunding, this research studies the efficacy of composite signal portfolios. Specifically, we investigate how bundles of substantive signals—comprising product- and firm-relevant information—and rhetorical signals—grounded in language-based information—affect the performance of equity-based hotel crowdfunding. By analyzing objective data from 512 equity crowdfunding projects within the Chinese hotel industry, our findings indicate that the combination of product- and firm-related substantive signals, such as price and team size, enhances both the amount and percentage of equity-based crowdfunding. Furthermore, our results unveil that the combination of product-related substantive (price) and rhetorical (emotional appeal) signals significantly contributes to equity-based crowdfunding success. These findings not only contribute to the existing literature on hotel crowdfunding but also offer strategic implications for equity-based crowdfunding managers in the hotel industry.

1. Introduction

Crowdfunding has emerged as a new financing mechanism, complementing traditional financing channels, by harnessing the collective power of decentralized individual investors who contribute small investment amounts (Block et al., 2018). The United States currently stands as the world's largest crowdfunding market, boasting a transaction value of $450 million. In contrast, China's share accounts for only 3 % of the global total, approximately $34.68 million. Examining the penetration rate of crowdfunding activities in China, an emerging market, reveals a decline from 4.880 in 2017 to 1.540 in 2023, significantly lower than the U.S. (63.740) and the global market (151.100) when measured by the number of activities per thousand users. However, it is noteworthy that the average funds per crowdfunding activity in the Chinese market reached $22.20 million in 2023, surpassing the global market average of $7.75 million. The distinction between the Chinese crowdfunding market and the global market may be attributed to the prevalent crowdfunding types. While platforms like Kickstarter and Indiegogo predominantly focus on reward-based crowdfunding in global markets, China features a more balanced market share between reward-based (36 %) and equity-based crowdfunding (37 %) (Daxue Consulting, 2021).

As reward-based crowdfunding platforms are the fastest-growing platform type (Kuppuswamy and Bayus, 2018), hospitality scholars have focused more on the determinants of reward-based crowdfunding success compared to equity-based crowdfunding success (e.g., Kedas and Sarkar, 2023; Koh et al., 2023; Lelo de Larrea et al., 2019; Yang and Koh, 2022). Entrepreneurs can raise funds by offering rewards such as products or services (reward-based) or by offering their stakes in their business (equity-based) in exchange for investment. While reward-based crowdfunding campaigns often raise a small amount of capital quickly and easily, equity-based campaigns raise larger amounts of capital but require giving up some control over the business. This underscores the growing importance of equity crowdfunding for hotel startups, which typically struggle to secure traditional institutional financing (Bianco et al., 2022). For instance, the Hard Rock Hotel Palm Springs in California became the first hotel to be crowdfunded on the Realty Mogul platform, successfully raising over $1.5 million via equity crowdfunding within two months. Despite the increasing popularity of equity crowdfunding in the hotel industry, no research has yet focused on examining the determinants of equity-based hotel crowdfunding success. Equity crowdfunders often face challenges in designing effective campaigns that attract backers and encourage participation, especially within the constraints of a limited timeframe (Wei et al., 2022).

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When modeling the success of crowdfunding, scholars often rely on signaling theory to identify determining factors (e.g., Cappa et al., 2021; Lelo de Larrea et al., 2019). Traditional signaling theory is valuable for understanding the role of isolated signals in attracting financial resources in low-noise environments (Spence, 1973), which have fewer competing campaigns, leading to less competition for attention (e.g., one-on-one venture capital negotiations). Crowdfunding, however, represents a high-noise environment with many campaigns vying for attention simultaneously, sending numerous complex signals to potential backers (Moradi et al., 2024). In such settings, recipients are less likely to notice and respond to each signal equally and sequentially. Drawing insights from cognitive processing, relevant conceptual work has revised traditional signaling theory, suggesting that in high-noise environments, recipients shift to a holistic processing pattern, evaluating a bundle of signals as a mental representation rather than discrete information chunks (Drover et al., 2018; Evans, 2006). However, there is limited knowledge on how various signals combine and interact to influence crowdfunding performance (Moradi et al., 2024; Steigenberger and Wilhelm, 2018).

Extant research on equity-based crowdfunding success mechanisms remains focused on the role of signals in isolation. Scholars have examined the independent effect of substantive signals, such as project quality (e.g., funding targets and product demos) and firm capability (e.g., founders' educational levels and entrepreneurial experiences), or rhetorical signals embedded in language (e.g., Block et al., 2018; Reichenbach, 2021; Troise et al., 2024). To the best of our knowledge, no study has revealed the joint effects of rhetorical and substantive signals on equity-based crowdfunding campaign performance. Empirical evidence of joint effects from reward-based technology product-related crowdfunding projects (e.g., Moradi et al., 2024; Steigenberger and Wilhelm, 2018) cannot be generalized to equity-based hotel crowdfunding projects. As investors rely on different bundles of signals across various industries (Johan and Zhang, 2022), there is a lack of empirical research on the combined effectiveness of equity crowdfunding campaign signals in the hotel sector.

To bridge these gaps, this study aims to investigate how multiple signals interactively influence the success of hotel equity crowdfunding campaigns. Consistent with previous applications of signaling theory in crowdfunding context (Steigenberger and Wilhelm, 2018), we identify hotel price as a *product-related substantive* signal because it can imply a quality differential between high-priced and low-priced hotels (Bergh et al., 2014; Spence, 1973). Additionally, we regard team size as a *firm-related substantive* signal, reflecting a hotel's capability to execute the project based on human resources of the founding team (Lagazio and Querci, 2018). Furthermore, message appeal (informational, emotional, or mixed) is identified as a *rhetorical* signal because it captures how hotel entrepreneurs appeal to potential backers through persuasive techniques (Steigenberger and Wilhelm, 2018). Furthermore, we hypothesize three interaction terms regarding equity-based crowdfunding performance: (1) product-related substantive x firm-related substantive, (2) product-related substantive x rhetorical, and (3) firm-related substantive x rhetorical. Using objective data from equity-based hotel crowdfunding campaigns in China, our findings reveal that equity-based crowdfunding performance is enhanced by alignments of (i) product- and firm-related substantive signals and (ii) product-related substantive and rhetorical signals.

This study contributes significantly to crowdfunding theory and practice in several ways. First, we enrich the hotel crowdfunding literature by uncovering the interplay among substantive signals (product-related and firm-related) and rhetorical signals (informational and emotional appeals) as determinants of equity-based crowdfunding in the hotel sector. Our findings demonstrate that in equity-based hotel crowdfunding environments, investors respond holistically to sets of signal portfolios rather than evaluating specific information blocks in isolation (Drover et al., 2018). Second, we contribute to the literature by going beyond explaining consumer reactions to marketing communication messages (Halkias, 2015; Rodríguez-Molina et al., 2019). Our findings demonstrate the significance of emotional-related rhetorical appeals and their interaction with product-level substantive signals in enhancing potential crowdfunding investors' decisions. Finally, our study extends valuable insights to emerging crowdfunding markets, such as China, moving beyond the previous focus on Western economies and reward-based crowdfunding (Kedas and Sarkar, 2023; Lagazio and Querci, 2018; Yang et al., 2020). By investigating the emerging equity-based crowdfunding market, particularly in China, our findings offer strategic guidance for hotel entrepreneurs seeking financial resources via equity crowdfunding.

2. Literature review

2.1. Hotel crowdfunding

Crowdfunding, a new financing phenomenon developed through online social platforms, facilitates investment transactions among three players (Ordanini et al., 2011): (1) entrepreneurs offering new projects and applying for financial resources, (2) crowdfunders providing financial resources either in the form of donations or in exchange for some form of reward and/or voting rights, and (3) online platforms enabling entrepreneurs and funders to exchange values and money. Among the four models of crowdfunding—donation-based, debt-based, reward-based, and equity-based—reward- and equity-based crowdfunding are most popular. Reward-based crowdfunders receive products or services in exchange for their investment, whereas equity-based crowdfunders receive a stake in the company. Reward-based crowdfunders are motivated by various factors, with altruism playing a key role in charitable and social campaigns, while equity investors primarily participate to seek financial returns.

Hospitality and tourism projects can raise reward-based funds from general platforms like Indiegogo and Kickstarter or from specialized platforms such as TravelStarter and InKind. TravelStarter enables tourist businesses to raise funds in exchange for travel rewards for individual investors, while InKind helps restaurants receive funds in exchange for gift cards (Chaboud and Caseau, 2017). Equity-based models are commonly used to raise substantial, long-term funding for hotel development and expansion, typically through real estate crowdfunding platforms like CrowdStreet and RealtyMogul in the U.S. In China, platforms such as Duocaitou and Kaishiba, dominated by equity-based models, have raised significant funds for well-known hotel brands like Sheraton Hotel and independent hotel startups.

Despite the growing relevance of crowdfunding in hospitality financing, most related studies have focused on reward-based crowdfunding with research primarily conducted in the U.S. (Camilleri, 2018), Germany (Honisch et al., 2019), Spain (San Martín et al., 2020), South Korea (Kim, Petrick, 2020), and the Middle East and North Africa (Bagheri et al., 2020). These studies often rely on subjective data such as surveys. Meanwhile, equity-based crowdfunding research has explored backers' intentions and the success of campaigns across various industries. For instance, Ahlers et al. (2015) studied industries like technology startups, real estate, and consumer products to understand how signals like financial forecasts, risk factors, and team experience influence investments. Lukkarinen et al. (2016) analyzed campaign data from renewable energy, real estate, and technology sectors, while Block et al. (2018) focused on technology startups to study the impact of campaign updates on investor participation. However, these studies provide limited insight into how hotel project initiators can design effective crowdfunding campaigns. To our knowledge, this study is one of the first to empirically investigate the success factors of equity crowdfunding campaigns within the hotel industry.

2.2. Signaling in equity-based crowdfunding

Signaling theory serves as a fundamental framework for addressing

information asymmetry in crowdfunding. Signalers aim to generate signals aligning with their intentions to effectively reduce information asymmetry and prompt appropriate responses from receivers (Gulati and Higgins, 2003). Information asymmetry poses a significant challenge in online crowdfunding markets, characterized by spatial and temporal separation between fund seekers and investors. A party with information advantages sends signals to counterparts with information disadvantages to overcome unfavorable choices and biases in value evaluation (Connelly et al., 2011). Crowdfunding investors evaluate venture quality and financial return solely through signals available on online crowdfunding platforms. Traditional signaling theory thus provides a robust framework for understanding how crowdfunding entrepreneurs can effectively use signals to reduce information asymmetry and attract investments (Block et al., 2018; Cappa et al., 2021).

Researchers have categorized crowdfunding campaign signals into two types: substantive and rhetorical (Moradi et al., 2024; Steigenberger and Wilhelm, 2018). Substantive signals can effectively reduce information asymmetry by providing cognitive information or factual cues about the quality of economic activities and a firm's capability to execute them (Connelly et al., 2011; Steigenberger and Wilhelm, 2018). In contrast, rhetorical signals refer to linguistic elements embedded in project pitches. Rhetorical signals are reflected in project narrative descriptions, generally at lower costs compared to substantive signals (Drover et al., 2018; Steigenberger and Wilhelm, 2018). For instance, message appeals adopted by entrepreneurs significantly affect their financing performance (Xiang et al., 2019). An evolving stream of literature has highlighted the significant role of diverse rhetorical signals in crowdfunding, such as message appeals (Xiang et al., 2019), cognitive and affective tones (Peng et al., 2022), low psychological distance of the linguistic style (Koh et al., 2020), and communal

language style (Moradi et al., 2024).

Table 1 illustrates how signaling portfolios affect equity-based crowdfunding success. Most studies focus on either substantive signals or the independent effects of these signals, with only a few studies exploring the interactive effects of different signals (Di Pietro and Tenca, 2024; Kleinert et al., 2020; Sendra-Pons et al., 2024). The effect of rhetorical signals on equity-based crowdfunding performance has not been examined sufficiently (Block et al., 2018). Notably, some reward-based crowdfunding studies show that rhetorical signals operate in conjunction with substantive signals to influence potential backers' decisions (Drover et al., 2018; Steigenberger and Wilhelm, 2018). In equity crowdfunding campaigns, firms could send many signals simultaneously, including multiple substantive signals or both substantive and rhetorical signals, which inevitably have joint effects on receivers' responses. To date, researchers have not demonstrated the interactive effects of substantive and rhetorical signals on the performance of equity-based crowdfunding campaigns in the hotel industry.

2.3. Holistic processing of signal portfolios

The dual-process theory of human cognition provides a valuable lens for understanding the joint effects of signal portfolios by elaborating on how receivers process multiple signals in high-noise environments (Drover et al., 2018). This theory posits that human information processing is governed by two systems: System 1, characterized by fast, automatic, and subconscious processing, and System 2, involving slower, conscious, and deliberative thinking (Evans, 2008). System 1 becomes more prominent in high-noise environments, where decision-relevant information is dense (Dane and Pratt, 2007; Steigenberger and Wilhelm, 2018). Crowdfunding campaigns are typically

Table 1
Exemplary literature on signaling determinants of equity crowdfunding success.

Literature	Country	Industry	Signal portfolios	Portfolio effect	Outcome variable	Main findings
Bapnaa (2019)	—	Technology ventures	Substantive	Combined	Interest in investing (Binary variable)	Product certification and signals from well-known customers, as well as product certification and social proof are complementary.
Block et al. (2018)	Germany	Overall	Substantive Rhetorical	Isolated	Funding amount Number of investors	The easier language used in updates positively affects the number of investors; the updates about new developments of the start-up have positive effects on crowd participation.
Di Pietro et al. (2023)	UK	Overall	Substantive	Isolated	Funding amount	Costly signals (statements about past achievements and results) are positively associated with crowdfunding performance; costless signals (statements about future plans and goals) are negatively associated.
Di Pietro and Tenca (2024)	UK	Overall	Substantive (F)	Combined	Funding success (Binary variable)	Entrepreneurial experience reinforces the impact of entrepreneurial passion on crowdfunding success.
Kleinert et al. (2020)	UK	Overall	Substantive	Combined	Funding success Number of investors	Firms with lower human and social capital benefit more from venture capital linkages.
Lukkarinen et al. (2016)	Northern Europe	Overall	Substantive	Isolated	Funding amount Number of investors	The criteria used by angel or VC investors are not relevant for equity crowdfunding. The significant factors of equity crowdfunding success include early funding collected from private networks, social media networks, and minimum investment.
Nose and Hosomi (2023)	Japan	Overall	Substantive	Isolated	Funding success (Binary variable)	Signals including the number of directors, intellectual property, product releases and tax incentives significantly influence equity crowdfunding success.
Piva and Rossi-Lamastra (2018)	Italy	Overall	Substantive (F)	Isolated	Funding percentage Number of investors	Social capital, entrepreneurial experience, business education, patent holdings, and fundraising goals significantly affect equity crowdfunding outcomes.
Reichenbach and Walther (2021)	Germany	Overall	Substantive	Isolated	Funding failure (Binary variable)	The entrepreneur's education level, share of equity offered, updates, external certifications significantly affect the success of equity crowdfunding.
Sendra-Pons et al. (2024)	Spain	Overall	Substantive	Combined	Funding success (Binary variable)	To some extent, traditional visual cues (images, videos) and social networks (Instagram, Facebook, Twitter) are interchangeable with each other.
Troise et al. (2024)	Italy	Overall	Substantive (F)	Isolated		The founding teams play different roles in the three stages of equity crowdfunding (before, during and after the campaign).
This study	China	Hotels	Substantive (P, F) Rhetorical	Combined	Funding amount Funding percentage	The importance of signal portfolios is identified. There exist significant interaction effects between hotel prices and team size/ emotional appeal in influencing crowdfunding performance.

Notes: P denotes product-related, and F denotes firm-related.

high-noise environments, with numerous competing firms (i.e., signalers) sending complex substantive and rhetorical signals to influence potential investors (i.e., receivers). In such contexts, receivers tend to process a multitude of competing signals holistically, forming mental representations rather than evaluating each signal equally.

Schema theory further explains this by suggesting that individuals rely on schemas—organized cognitive structures of knowledge about an object or concept, formed through long-term experience—to process new information (Bobrow and Norman, 1975; Fiske and Taylor, 1991). Reactions to new information depend on its alignment with existing schemas (Halkias, 2015; Rodríguez-Molina et al., 2019). Information that fits prior beliefs or expectations is processed effortlessly and positively evaluated, while information deviating from existing schemas triggers deliberated processing and counter-argumentation, often leading to negative responses. For instance, the schema that "better hotels have better management teams" means potential investors associate luxury hotels with attributes like diverse skills, extensive social networks, and managerial expertise.

Building on this understanding of holistic signal processing, scholars have identified the interactive effects of substantive and rhetorical signals on the performance of reward-based crowdfunding campaigns. Steigenberger and Wilhelm (2018) indicated that rhetorical signals interact with substantive signals (product- and firm-related) through attribute- and attention-based complementary and signal redundancy. Additionally, Tajvarpour and Pujari (2022) found significant interactive effects between geographical distance and rhetorical signals. Recently, Moradi et al. (2024) concluded that the number of backers reinforced the effect of rhetorical signals (i.e., emotional and cognitive tone, linguistic style match, and communal language) on crowdfunding performance. Notably, existing research explores a limited set of signals and primarily focuses on reward-based crowdfunding. This raises an important question: How does the interplay among product- and firm-related substantive signals and rhetorical signals affect equity-based crowdfunding performance in the hotel context?

3. Hypotheses development

In our study, we identify hotel price, team size, and message appeal as product-related substantive, firm-related substantive, and rhetorical signals, respectively, in the hotel crowdfunding context. First, pricing strategy is widely acknowledged as a crucial factor influencing hotels' revenue (Abrate and Viglia, 2016; Noone and Mattila, 2009). Consequently, a transparent and reliable pricing strategy helps potential investors understand the quality and potential returns of the hotel project. This is supported by Bolandifar et al. (2023), who observed that high-quality entrepreneurs use more competitive pricing designs to showcase the quality of their projects to backers. Peng et al. (2020) also found that the match between product price and funding goal contributes to the success rate of crowdfunding campaigns. Therefore, the price signal aligns with the goal of this study, which focuses on the interactive effects of signal portfolios.

Furthermore, team size serves as a key firm-related substantive signal because a larger team tends to represent more diverse knowledge, skills, and social capital embodied by the founding team (Chandler et al., 2005; Lagazio and Querci, 2018). Notably, Coakley et al. (2022) found that solo founders with exceptional quality are more likely to achieve success in initial equity crowdfunding endeavors. This suggests that the interpretation of team size may vary when considered independently versus in conjunction with other factors, such as product characteristics.

Regarding rhetorical signals, we concentrate on message appeals, which are classified into informational (containing cognitive information like product features), emotional (containing expressions of values and entrepreneurial stories), or mixed (combining both informational and emotional elements) (Akpinar and Berger, 2017; Allison et al., 2017; Wang et al., 2009). Research indicates that these appeals trigger different consumer outcomes by engaging cognitive, affective, or both

types of responses (Burman et al., 2017; Cervellon and Galipienzo, 2015). In the crowdfunding context, Xiang et al. (2019) found that emotional appeals are more compelling for equity-based crowdfunding supporters, whereas informational appeals are more compelling for reward-based crowdfunding supporters. Following this stream, we deem it necessary to explore the boundary conditions of message appeals by examining their interaction effects with substantive signals.

Based on these three signals, we hypothesize three interaction terms regarding equity-based crowdfunding performance: (1) product-related substantive x firm-related substantive, (2) product-related substantive x rhetorical (emotional vs. informational), and (3) firm-related substantive x rhetorical (emotional vs. informational). Our theoretical foundation about the effectiveness of multiple signals is that hospitality firms attempt to attain optimal distinctiveness to become as differentiated as possible while still being perceived as legitimate (Deephouse, 1999) when conducting crowdfunding campaigns. Such optimal distinctiveness ensures that firms attract investor attention in the crowdfunding market. In the subsections, we hypothesize the relationship between each bundle of multiple signals and crowdfunding performance.

3.1. The interaction effect between product- and firm-related substantive signals

Faced with multiple signals from crowdfunding campaigns, investors typically evaluate the hidden attributes of both the product and the firm simultaneously. Research suggests that firm- and product-level signals should be processed together, as firm-related substantive signals may influence audience perception of specific products, and vice versa (Barlow et al., 2018; Brown and Dacin, 1997). According to the holistic processing mechanism of signals, investors allocate attention to both product and firm levels simultaneously rather than treating them as mutually exclusive (Drover et al., 2018; Miller, 1982). When signals related to a product and a firm are sent concurrently, receivers tend to allocate additional cognitive resources and attention to determine whether the firm has the capability to produce the given product. In cases of mismatch between product and firm information, investors' value evaluation and funding intentions may decrease.

Schema theory provides a valuable lens for understanding how congruous signals among product- and firm-related characteristics influence crowdfunding investors' decisions. Marketing scholars have used schema theory to demonstrate how products, brands, and attributes are cognitively structured in consumers' minds (Halkias, 2015) and how congruity between advertisement and brand schema affects consumer responses to advertising messages (Halkias and Kokkinaki, 2014). In crowdfunding campaigns, a large team size is likely to function as a congruent signal for a high-end hotel, facilitating investors' positive evaluations because the signal portfolio aligns with receivers' preexisting expectations. Conversely, a large team size might be perceived as incongruous for low-priced hotels. Faced with the signal portfolio of a large team size and a low-priced hotel, investors probably devote more cognitive effort to assessing whether the team size is justified for this hotel. This deliberated processing potentially leads investors to perceive the project as risky (e.g., overstaffing) and react negatively. Therefore, we argue that the alignment of product- and firm-related substantive signals contributes to the performance of hotel equity-based crowdfunding campaigns. Based on this premise, we hypothesize:

H1: Product- and firm-related substantive signals have a positive interaction effect on equity-based crowdfunding performance such that price positively moderates the relationship between team size and funding performance.

3.2. The interaction effect between substantive and rhetorical signals

We posit that bundling substantive and rhetorical signals is effective because potential investors are likely to process a set of multiple signals holistically (Drover et al., 2018; Evans, 2008; Söllner et al., 2013).

Existing research suggests that emotional appeal enhances consumers' purchasing intentions for hedonic products and services, while informational appeal is more effective for utilitarian consumption (Burman et al., 2017). In crowdfunding environments, emotional appeals have been shown positively impact funding intentions through peripheral cues compared to informational appeals (Allison et al., 2017; Wang et al., 2009). Xiang et al. (2019) also found that informational (emotional) appeals exert more positive persuasive effects on reward-based (equity-based) backers. However, few studies explore how message appeals (i.e., rhetorical signals) interact with different substantive (product- and firm-related) signals in hotel crowdfunding projects.

In crowdfunding environments, emotional-related rhetorical signals can enhance the visibility of substantive signals, thus enhancing crowdfunding performance (Steigenberger and Wilhelm, 2018). Marketing research indicates that high-priced products are associated with hedonic benefits and promotion goals, whereas low-priced products emphasize utilitarian benefits and the fulfillment of prevention goals (Babin et al., 1994; Chitturi et al., 2008). For hotel equity investors, emotional appeals are expected to resonate with high-priced hotels by emphasizing entertainment, aesthetics, and hedonic experience, while informational appeals may be more effective for low-priced hotels by highlighting value for money. Thus, emotional (informational) appeals combined with high-priced (low-priced) hotels create a matching signal portfolio that aligns with investors' expectations, facilitating positive responses and funding intentions. Therefore, we hypothesize:

H2a. Rhetorical and product-related substantive signals have a positive interaction effect on equity-based crowdfunding performance, such that emotional appeals positively moderate the effect of product price on funding performance compared to informational appeals.

Furthermore, emotional-based rhetorical signals interact with firm-related substantive signals (i.e., team size) in influencing crowdfunding decisions. Prior research suggests that rhetorical signals help firms convey capabilities and activities effectively to stakeholders (Monin et al., 2013; Taylor and Robichaud, 2004). These signals can synergize with firm-related substantive signals to enhance investors' funding intentions, as language provides nuanced information and context-based understanding of the firm's hidden attributes (Steigenberger and Wilhelm, 2018).

Research shows that reward-based funders are typically motivated to assess the desirability of purchasing a product or service (Xiang et al., 2019). Therefore, informational-based rhetorical signals can effectively convey details about the focal product and service, thereby reducing information asymmetry (Monin et al., 2013). In contrast, equity-based funders often prefer emotional-based rhetorical signals that convey entrepreneurship-related meanings (Li et al., 2017; Xiang et al., 2019). Such emotionally rich project pitches can serve as potent tools to compensate by showcasing the focal hotel's capabilities in various relevant aspects, including the founder's beliefs, passions, values, and experiences. Therefore, we hypothesize:

H2b. Rhetorical and firm-related substantive signals have a positive interaction effect on equity-based crowdfunding performance, such that emotional appeals positively moderate the effect of team size on funding performance compared to informational appeals.

4. Methodology

4.1. Data collection

We collected data on hotel crowdfunding campaigns and outcomes from Duocaitou (www.duocaitou.com), a prominent real estate crowdfunding platform in China established in 2014. This platform offers crowdfunding opportunities for a diverse array of venues, including hotels, restaurants, theaters, amusement parks, bars, and art galleries.

Duocaitou operates on an "all or nothing" basis: if the funding goal is not met, all pledged funds are refunded to supporters, and the initiator receives no funds; if the goal is met or exceeded, the initiator receives all the funds. On Duocaitou, hotel projects constitute over 40 % of all ventures, predominantly utilizing an equity-based crowdfunding model. Their primary objective is to raise capital from a broad pool of investors, while also pursuing additional goals such as increasing brand visibility, testing market demand, and building a customer base (Lukkarinen et al., 2016). A minority of projects (27 out of 572 projects, as of April 2024) have employed a reward-based model. While many of these hotels are situated in China, there are also international projects located in countries such as Thailand and Japan. Unlike global platforms such as Kickstarter, Duocaitou does not support real-time project updates or display comments from backers, necessitating thorough pre-launch project design for successful crowdfunding campaigns.

To gather data, we utilized a Python-based web crawler program to compile information on all completed hotel equity crowdfunding projects since the platform's inception, totaling 545 projects by April 2024. Due to the platform's policy of not disclosing exact launch dates for completed projects, specific timing details are unavailable. Our dataset includes several modules: (1) fundraising details such as funding goal, amount pledged, funding percentage, and minimum investment amount, (2) project pitches comprising images and text descriptions, (3) hotel particulars like name, location, and pricing, (4) initiator information encompassing names, positions, and brief introductions. In cases where price data was absent, we supplemented it by referencing major accommodation booking sites in China, primarily Ctrip.com, to identify successfully operated hotels. Following data screening that excluded 4 duplicate cases and 29 instances with incomplete information (e.g., missing initiator details, project pitch, or pricing), our final analytical sample comprised 512 equity-based crowdfunding projects.

4.2. Variables

As dependent variables, we measured two dimensions of crowdfunding performance: (1) funding amount—the total funds pledged, measured in RMB 10,000—and (2) funding percentage—the pledged amount as a percentage of the funding target. In successful campaigns, the funding amount reflects the actual funds transferred to the fundraiser. In unsuccessful campaigns, the funding amount represents the total amount investors intended to invest, but under the all-or-nothing model, the fundraiser does not receive any money. Prior studies have employed both metrics to assess crowdfunding performance or project attractiveness to external contributors (Block et al., 2018; Du et al., 2019; Lelo de Larrea et al., 2019; Lukkarinen et al., 2016; Steigenberger and Wilhelm, 2018).

For our independent variables, we used price as the product-related substantive signal and team size as the firm-related substantive signal. The price was calculated as the midpoint between the lowest and highest room prices, determined through three scenarios. First, for hotel projects that disclosed an estimated price range, regardless of peak or off-peak seasons, we averaged the highest and lowest values to determine the price indicator. Second, for hotel projects that provided separate price ranges for off-peak and peak seasons, we used the off-peak price range and calculated the mean value. Finally, for hotel projects that did not disclose price information but were listed on accommodation booking websites, we acquired the off-peak season price range according to procedures recommended by Schamel (2012). During data collection, there were no observed disruptions in market prices due to abnormal demand. Furthermore, team size was operationalized by counting the number of project initiators (Coakley et al., 2022), with a larger team implying a broader range of knowledge, skills, and social capital, serving as a proxy for the firm's capabilities (Chandler et al., 2005; Lagazio and Querci, 2018).

Regarding rhetorical signals, we categorized the project pitch texts into informational, emotional, or mixed appeals using generative

artificial intelligence (GenAI), specifically chatGPT-4.0. Cutting-edge AI systems like ChatGPT, which are based on large language models (LLMs), are trained on extensive text data and use deep learning algorithms to form a comprehensive understanding of their training data (Huang and Rust, 2024). GenAI can accurately label emotions from large amounts of unmarked and unstructured textual data, making it suitable for tasks like tagging prompts (Tak and Gratch, 2023). ChatGPT, in particular, can classify marketing prompts into categories such as informative, emotional, and mixed appeals (Tafesse and Wood, 2024). Following Tafesse and Wood's (2024) approach, we used the prompt: "Categorize the appeal of the following crowdfunding project pitch as either informational, emotional, or mixed. Please include a succinct justification for your categorization." With this approach, GPT-4 can provide specific reasoning for its predictions, accurately identifying words associated with informational or emotional appeals and logically determining the type of appeal. However, GPT-4 has limitations, particularly in grasping subtle human nuances. To minimize potential bias, two researchers independently conducted the analysis and manually reviewed the reasonableness and accuracy of GPT-4's responses. The results were then compared, and any discrepancies were resolved through discussion.

We controlled for several variables potentially impacting crowdfunding performance. First, we accounted for the funding target amount, as it has been shown to influence crowdfunding outcomes (Lagazio and Querci, 2018; Lukkarinen et al., 2016; Yang and Koh, 2022). Second, recognizing that a high minimum investment may deter some supporters (Lukkarinen et al., 2016), we controlled for minimum funding investment. Third, word count and picture number were controlled, considering their significance in demonstrating project quality and facilitating supporter evaluation of content and feasibility (e.g., De Crescenzo et al., 2023; Lagazio and Querci, 2018; Lelo de Larrea et al., 2019). Finally, we controlled for social orientation (Xiang et al., 2019), indicating whether the project description involved benefits for people other than enterprises and customers (e.g., villagers, disadvantaged groups), with 1 representing social orientation and 0 representing no social orientation. We also utilized GPT-4 to identify the presence of social orientation in the project pitches. The prompt we employ was: "Analyze the following project pitch and determine if it has a social orientation. Social orientation refers to the project pitch involving benefits for people other than enterprises and customers (e.g., villagers and disadvantaged groups). Please include a succinct justification for your categorization." We used the same analytical process used for identifying appeal types to enhance the reliability of the data. Variable details are provided in Table 2.

Table 2
The variable description.

Variables	Description
Dependent variable	
Funding percentage	The percentage of funding raised compared to the funding target (%)
Funding amount	The amount of money raised by the campaign (unit: RMB 10,000)
Independent variables	
Product-related substantive signal: Price	The middle price between highest price and lowest price
Firm-related substantive signal: Team size	The number of project initiators
Rhetorical signal: Appeal	1 = informational appeal; 2 = emotional appeal; 3 = mixed appeal
Control variables	
Funding target	The funding target amount (RMB 10,000)
Minimum investment	The minimum investment amount (RMB 10,000)
Word count	The number of words in project description
Picture number	The number of pictures in project description
Social orientation	0 = no social orientation; 1= social orientation

4.3. Data analysis

For the analysis, we performed a linear regression analysis (Koh et al., 2020; Lelo de Larrea et al., 2019; Yang and Koh, 2022). To facilitate the interpretation of interaction coefficients, we standardized all continuous variables. To ensure the main assumptions of linear regression were met, we first utilized graphical methods, supplemented by statistical tests. The linear relationship between continuous independent and dependent variables was evaluated graphically using the "lintrend" command in Stata. The normality of residuals was assessed visually through a histogram of residuals and a Q-Q plot. Furthermore, we tested for heteroscedasticity by conducting a Breusch–Pagan test and plotting standardized residuals against predicted values. This indicated the presence of heteroscedasticity. To address this issue, we reran the OLS regression models using robust standard errors.

5. Results

Table 3 shows the descriptive statistics and correlation coefficients of all variables used in the analysis. The equity crowdfunding percentage spanned from 10 % to 2277 %, with an average of 200.7 %, while the funding amount varied between RMB 30,000 and RMB 61,730,000, with an average of RMB 6462,000. The funding targets ranged from RMB 300,000 to RMB 25,000,000, with an average of RMB 3323,800. These figures illustrate the significant role of equity-based crowdfunding in financing hotel start-ups and expansions in China. In terms of project pitches, the average word count per project was 2139.3, and the average number of pictures was 20.6. The average room price was RMB 593.4, ranging from RMB 98 to RMB 11,100, indicating that crowdfunding hotels vary from budget brands to luxury brands. The average team size is 3.8 members, with a range from 1 to 12, showing diversity in team composition. Additionally, 30.7 % (157 projects) used informational appeals, 40.4 % (207 projects) utilized emotional appeals, and 28.9 % (148 projects) employed mixed appeals. Only 7.6 % (39 projects) exhibited social orientation in their pitches. These statistics highlight the variations in funding performance, pricing, team sizes, and message appeals among the hotels in the sample, showcasing the diverse strategies and outcomes within the hotel crowdfunding landscape in China.

Table 4 presents the results of OLS model estimations. Models 1 and 4 include only the control variables. Models 2 and 5 incorporate the independent variables of the three signal portfolios (i.e., product-related substantive, firm-related substantive, and rhetorical). Models 3 and 6 are full models that introduce all interaction terms. Variance inflation factor (VIF) values for all variables are below 10, with the maximum value of 6.04 for the full models (Models 3 and 6), indicating that multicollinearity is not a significant concern (James et al., 2013). The adjusted R-squared and Akaike Information Criterion (AIC) values suggest that the full models provide a better fit compared to other models.

H1 proposes a significant interaction effect between substantive product- and firm-level signals. We found that the interaction term of price and team size has a positive effect on both funding amount (Model 3: b = 0.092, p <.1) and funding percentage (Model 6: b = 0.051, p <.1). Fig 1a and b illustrate significant interactive effects when the dependent variable is either the funding percentage or the funding amount, indicating that team size negatively moderates the relationship between price and crowdfunding performance. These results support H1.

H2 proposes significant interaction effects between rhetorical (emotional appeal) and product-related substantive signals. Results of Models 3 and 6 show that emotional appeal positively moderates the relationship between price and performance compared to informational appeal (funding percentage: b = 0.168, p <.05; funding amount: b = 0.069, p <.1). Although mixed appeal has no significant moderating effect, it shows a marginal direct effect on funding percentage (b = 0.063, p <.1), suggesting that mixed appeals are effective regardless of product- or firm-related substantive signals. Fig 1c and d present the interaction plots of price and message appeal, demonstrating that the

Table 3
Descriptive statistics and correlation matrix.

Variable	Mean	SD	Min	Max	1	2	3	4	5	6	7	8	9	10	11
1 *Funding percentage*	200.70	0.86	10	2277											
2 *Funding amount*	646.20	572.44	3	6173	0.301***										
3 *Price*	593.38	384.80	98	11100	0.205***	0.083*									
4 *Team size*	3.80	1.60	1	12	0.141***	-0.092**	0.039								
5 *Informational*	0.31	—	0	1	-0.169***	0.016	-0.190***	-0.151***							
6 *Emotional*	0.40	—	0	1	0.165***	-0.089**	0.145***	0.136***	-0.548***						
7 *Mixed*	0.29	—	0	1	-0.007	0.081*	0.036	0.006	-0.424***	-0.525***					
8 *Funding target*	332.38	274.95	30	2500	-0.088**	0.891***	0.009	-0.168***	0.093**	-0.172***	0.091**				
9 *Minimum investment*	2.09	1.68	0	10	0.082*	0.606***	0.164***	-0.078*	0.057	-0.153***	0.108***	0.538***			
10 *Word count*	2139.26	703.58	360	5609	0.193***	0.181***	0.235***	0.134***	-0.246***	0.137***	0.102**	0.126***	0.048		
11 *Picture number*	20.57	7.72	4	63	0.210***	0.145***	0.311***	0.149***	-0.254***	0.229***	0.010	0.065	0.042	0.570**	
12 *Social orientation*	0.08	—	0	1	0.025	-0.081*	0.111**	0.031	-0.127***	0.109*	0.012	-0.102**	-0.031	0.076*	0.029

Note:
* p <.05,
** p <.01,
*** p <.001

slope of price on crowdfunding performance increases under the condition of emotional appeal. Therefore, our results support H2a.

Finally, results reveal no combined effect of rhetorical (emotional appeal) and firm-related substantive (team size) signals on funding amount and funding percentage, respectively, not supporting H2b. The lack of significant effect of firm-level substantive and rhetorical signals on crowdfunding performance may suggest that equity crowdfunding investors are primarily driven by economic motives. Therefore, the direct impact of team size and its joint impact with emotional signals are not significant. These findings imply that, in high-noise environments where entrepreneurs send multiple signals simultaneously, some of bundled signals become invisible, and their impact on investor decision-making is limited.

6. Conclusion and implications

6.1. General discussion

Equity-based crowdfunding allows entrepreneurs to raise significant, long-term capital from a wide range of individuals via the internet. This method has proven effective for financing hospitality ventures, including the launch of small independent hotels and the expansion of hotel chains. However, research on the success of equity-based crowdfunding, specifically within the hotel industry, is extremely limited. To our knowledge, this is the first study to empirically examine the success of hotel equity crowdfunding campaigns. By analyzing objective data from 512 equity crowdfunding projects in the Chinese hotel industry, we provide valuable insights on how hotel entrepreneurs can effectively use various signals to achieve their financing goals. Unlike previous studies that examine signals in isolation, our research explores the combined impact of substantive and rhetorical signal portfolios on crowdfunding performance and provides three key findings.

First, we present empirical evidence on the interactive effect between product- and firm-related substantive signals (i.e., price and team size). Our findings show that team size positively moderates the relationship between price and crowdfunding performance. Specifically, for high-priced hotels, a larger team size contributes to better fundraising outcomes, whereas for low-priced hotels, a smaller team size is more conducive. This finding aligns with schema theory, which emphasizes the importance of congruity between external stimuli (i.e., signals) and established mental schemas in shaping receivers' cognitive processing and evaluations (Bobrow and Norman, 1975; Halkias, 2015; Rodríguez-Molina et al., 2019). In the hotel crowdfunding context, our study demonstrates that potential investors tend to evaluate hotel price and team size jointly rather than in isolation. When investors receive a combination of signals that conflict with their pre-existing schema (e.g., high-end hotels with a small team size or low-end hotels with a large team size), they likely engage in deliberative and systematic processing, leading to increased risk identification (e.g., concerns about under-staffing or overstaffing) and negative evaluations of the project's feasibility.

Second, we find that emotional appeals positively moderate the relationship between price and crowdfunding performance compared to informational appeals. This finding extends previous studies highlighting the positive role of emotional-based rhetorical signals in shaping crowdfunding success (Allison et al., 2017; Wang et al., 2009; Xiang et al., 2019). Our study identifies a boundary condition for the effectiveness of emotional appeals, showing that they are more conductive to fundraising outcomes for high-priced products than low-priced products. This finding confirms schema theory (Bobrow and Norman, 1975) and aligns with previous research (Xiang et al., 2019). Potential investors have higher expectations for hedonic experiences and entrepreneurial vision from high-end hotels, and narratives employing emotional appeals significantly improve investors' funding intentions by attracting attention and creating emotional connections. Moreover, while the moderating effect of mixed appeals is not

Table 4
Model estimation results.

Variable	DV: Funding percentage						DV: Funding amount						VIF
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		
	Estimate	Robust SE	Estimate	Robust SE	Estimate	Robust SE	Estimate	Robust SE	Estimate	Robust SE	Estimate	Robust SE	
Constant	−0.228***	0.015	−0.260***	0.024	−0.298***	0.029	−0.173***	0.011	−0.198***	0.016	−0.214***	0.017	
Controls													
Funding target	−0.108***	0.022	−0.086***	0.020	−0.089***	0.020	0.532***	0.021	0.544***	0.021	0.543***	0.020	1.65
Minimum investment	0.095***	0.024	0.085***	0.020	0.088***	0.020	0.087***	0.018	0.084***	0.018	0.085***	0.018	1.63
Word count	0.050**	0.020	0.041**	0.020	0.042**	0.019	0.019	0.012	0.013	0.012	0.014	0.012	1.57
Picture number	0.050**	0.023	0.028	0.022	0.027	0.022	0.035***	0.013	0.023	0.014	0.022	0.014	1.63
Social orientation	−0.009	0.059	−0.034	0.064	−0.029	0.063	0.000	0.037	−0.013	0.04	−0.010	0.039	1.06
Product-related substantive													
Price			0.060	0.039	−0.031	0.057			0.021	0.02	−0.013	0.035	6.04
Firm-related substantive													
Team size			0.028	0.018	0.025	0.030			0.020*	0.011	0.018	0.017	4.46
Rhetorical													
Emotional			0.084***	0.032	0.125***	0.037			0.059***	0.021	0.076***	0.023	2.00
Mixed			0.029	0.031	0.063*	0.037			0.021	0.023	0.034	0.024	1.87
Product-related substantive x Firm-related substantive													
Price × Team size					0.092*	0.050					0.051*	0.027	1.31
Product-related substantive x Rhetorical													
Price × Emotional					0.168**	0.070					0.069*	0.038	4.08
Price × Mixed					0.045	0.068					0.013	0.046	2.58
Firm-related substantive x Rhetorical													
Team size × Emotional					0.020	0.039					0.012	0.022	2.85
Team size × Mixed					0.038	0.039					0.018	0.027	2.13
Adjusted R^2	0.084		0.106		0.129		0.811		0.815		0.816		
F	7.344***		5.775***		4.695***		269.342***		153.158***		110.154***		
AIC	264.915		256.260		248.090		−164.305		−169.728		−169.453		

Note:
* p <.1,
** p <.05,
*** p <.01.

a. Price x team size (DV = Funding percentage)

b. Price x team size (DV = Funding amount)

c. Price x message appeal (DV = Funding percentage)
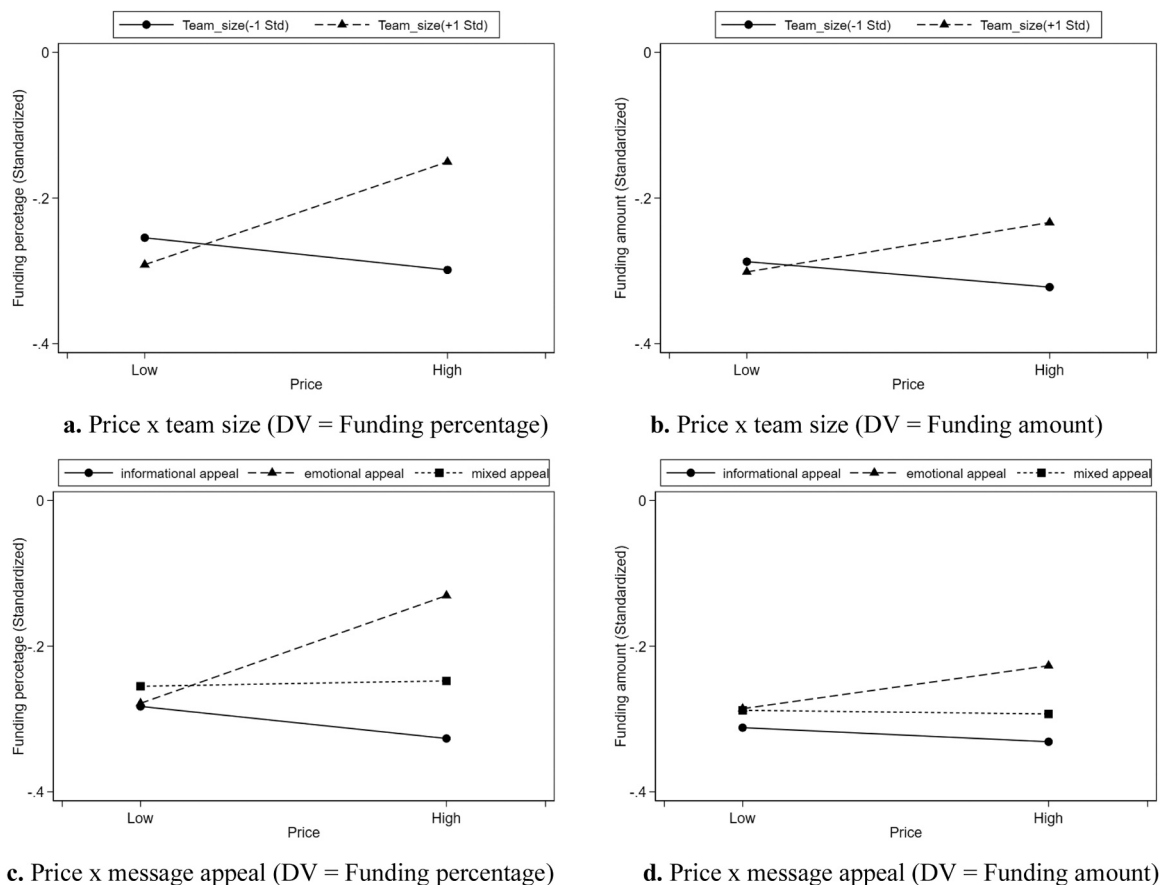
d. Price x message appeal (DV = Funding amount)

Fig. 1. The interaction effect among multiple signals. Note: High = Mean + SD; Low = Mean - SD.

significant, our results indicate that mixed appeals lead to a higher fundraising percentage than informational appeals, regardless of team size and product price (Model 3 in Table 4). This finding confirms the effectiveness of mixed appeals—both informational and emotional—by utilizing cognitive and affective persuasion routes (Ruiz and Sicilia, 2004).

Finally, our results do not support the interaction effect between rhetorical signals and firm-related substantive signals (i.e., message appeal and team size). In other words, emotional-related rhetorical signals do not synergize with team size in investors' holistic processing patterns. Well-crafted, emotionally charged project pitches inspire support from potential investors regardless of team size. This finding is inconsistent with Steigenberger and Wilhelm (2018), who found that emotional appeals weaken the relationship between press coverage (a firm-related substantive signal) and crowdfunding performance due to information redundancy. This suggests that the impact of emotional-based rhetorical signals varies across different substantive signals that indicate hidden attributes of firm capabilities. Overall, our study provides a nuanced understanding of how different combinations of signals influence crowdfunding success, highlighting the importance of considering both substantive and rhetorical signals in tandem.

6.2. Theoretical implications

This study makes several contributions to crowdfunding literature. First, we contribute to schema theory by identifying its significance in explaining investor responses to multiple signal portfolios in the equity-based crowdfunding context. Our study complements the evolving literature by identifying schema theory as another cognitive processing mechanism that influences crowdfunding backers' decisions. Specifically, signal portfolios that align with recipients' existing schemas yield positive effects in terms of processing fluency and positive evaluations. In contrast, signal portfolios that conflict with mental schemas prompt more systematic and deliberated processing, which may lead to higher risk perception and negative evaluations. While existing research has primarily employed schema theory to explain consumer attitudes and reactions to marketing communications (Halkias and Kokkinaki, 2014; Rodríguez-Molina et al., 2019), our study expands the scope of schema theory by offering new insights into investors' decisions in equity-based crowdfunding contexts.

Second, our study contributes to the literature on rhetorical signals in crowdfunding by examining interactive effects between message appeals and substantive signals. The importance of rhetorical signals in project pitches has received increasing attention (e.g., Moradi et al., 2024; Tajvarpour and Pujari, 2022), which highlights the positive role of emotional appeals (e.g., Steigenberger and Wilhelm, 2018; Xiang et al., 2019). Our findings advance this understanding by identifying product price as a critical boundary condition for the effectiveness of emotional appeals. This research also demonstrates the effectiveness of informational-emotional mixed appeals regardless of other substantive signals, confirming that mixed appeals are more effective than purely informational appeals by engaging both affective and cognitive persuasion functions.

Finally, to our knowledge, this research is pioneering in empirically demonstrating the success determinants of equity-based hotel crowdfunding campaigns. It is also among the first to provide insights based on real-world objective data, thereby contributing to the emerging body of research on crowdfunding in the hospitality industry. Hospitality scholars have been focusing on how signal portfolios, in isolation, influence the performance of reward-based crowdfunding projects using subjective data such as surveys (e.g., Kim, Petrick, 2020; San Martín et al., 2020). Although several studies have investigated the effect of

combined signals on equity-based crowdfunding performance, they focus mainly on firm-related substantive signals in general industries (Di Pietro and Tenca, 2024; Kleinert et al., 2020; Sendra-Pons et al., 2024). Previous studies provide limited understanding of the mechanisms influencing equity-based hotel crowdfunding performance, as investors refer to different signals depending on the industry (Johan and Zhang, 2022). Our empirical study, using objective data, extends this evolving body of equity-based crowdfunding research by examining not only the interactive effects between rhetorical and substantive signals, but also the interaction between product- and firm-related substantive signals.

6.3. Managerial implications

This study offers strategic insights for hotel entrepreneurs engaging with investors through tailored signal bundles when crafting and executing equity crowdfunding campaigns for hotels. First, hotel entrepreneurs should understand the significant interactive effect between team size and hotel price on crowdfunding performance. As investors hold higher expectations and requirements for the managerial qualifications of high-end hotels, we recommend that high-end hotel project initiators assemble larger and more diverse teams to appeal to potential investors. In contrast, low-priced hotel project initiators should avoid excessive partnering but form smaller teams. In our empirical context of the Chinese Duocaitou platform, founding teams of high-end hotels should consist of more than four members (the average team size is 3.8), while the founding teams of budget hotels should have no more than four members to avoid staff redundancy. Systematic differences in team size exist across various platforms, so project initiators should fully understand the dynamics of the crowdfunding platforms they are targeting and adjust the composition of their teams accordingly.

Moreover, the study advises hotel entrepreneurs to strategically deploy different types of rhetorical signals based on their product price. Emotional appeals prove more persuasive for high-priced hotels, encouraging them to incorporate such appeals in their campaign messages, highlighting hedonic benefits and entrepreneurial stories. Our investigation into the pitches of successful hotel projects shows that experienced initiators utilize emotional appeals in several key aspects. These include delineating a close connection between the hotel brand concept and the culture and lifestyle of the site, highlighting the design philosophy and artistic value of the hotel's architectural details beyond the technical aspects, and prioritizing hedonic experience over basic amenities. On the other hand, budget hotels should use mixed appeals rather than purely informational appeals to enhance their attractiveness through the dual mechanisms of affective and cognitive persuasion. Mixed appeals can effectively engage potential investors by combining emotional elements with practical information, thereby broadening the appeal and improving the chances of successful fundraising.

6.4. Limitations and future research direction

Our study acknowledges certain limitations that open avenues for future research. First, while we utilize objective data from a crowdfunding platform to assess the impact of signal portfolios on equity-based crowdfunding performance, the underlying psychological mechanisms in investor decision-making remain unexplored. Future research could employ qualitative and experimental methods to investigate the potential psychological mechanisms of various signal portfolios on investors' attitudes. For instance, exploring mediators such as emotional arousal (Chitturi et al., 2007) and processing fluency (Winkielman et al., 2003) could enhance our understanding of the relationship between favorable signal portfolios and investors' funding intentions.

Second, since our findings are based on hotel equity crowdfunding campaigns in China, they may not be fully generalizable to other countries or crowdfunding platforms with different regulatory environments, cultural backgrounds, or investor behavior. Future research could apply our theoretical framework using objective data from

Western countries and different platforms, as well as from other hospitality contexts, such as restaurants, to examine the generalizability of signal portfolios in determining equity-based hotel crowdfunding success.

Finally, we used a GenAI tool (i.e., GPT-4) to classify message appeals in the text data. While GenAI tools have demonstrated strong capabilities in processing and interpreting various types of data (e.g., texts, images, videos), they are still developing and have limitations, particularly in capturing subtle emotional nuances and context-specific intricacies. As GenAI continues to advance, researchers and practitioners could leverage these improvements to analyze unstructured big data more effectively. Given the increasing use of multimedia content in crowdfunding campaigns, future research could use GenAI tools to explore how multimodal communication—combining videos, images, and text—affects investor trust and decision-making.

CRediT authorship contribution statement

Liqing La: Writing – original draft, Visualization, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Seongsoo (Simon) Jang:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Conceptualization.

Declaration of Competing Interest

Authors have no conflict of interest to declare.

Data availability

The authors do not have permission to share data.

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