How to Resist Imitation Competition in Product Crowdfunding? Mechanisms of Information Disclosure

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Abstract

Internet crowdfunding provides a lower cost and more open access to financing for startups by leveraging the advantages of pre-sales and mass investment. However, the internet has exacerbated the degree of information asymmetry, and while entrepreneurs disclose information about their projects to mitigate moral risks such as quality exaggeration and fraud to win investors' trust, it also brings about other problems such as trade secret leakage and imitation by potential competitors. By constructing a game theoretic model, this project attempts to reveal the information disclosure mechanism under the crowdfunding model and provide guidance suggestions for entrepreneurs to deal with the problems of moral hazard and imitators plagiarizing business information, and for the government to optimize the regulatory strategy. First, a dynamic game model is built to capture the decision-making interactions (optimal pricing, financing objectives, information disclosure levels, investment strategies, etc.) among entrepreneurs, investors, and imitators. Second, the game equilibrium is solved by inverse induction method, combined with sensitivity analysis and other methods, to determine the optimal operation strategy and reveal the information disclosure mechanism. Finally, government regulatory decisions are introduced into the model to analyze how the government can enhance social welfare through control.

Keywords

Crowdfunding, imitation competition, information disclosure strategy.

1. Introduction

Both crowdfunding and traditional financing (bank financing, etc.) can provide funding for startups. Traditional financing requires companies to bear additional financing costs because of the risk of demand. In contrast, crowdfunding can be used to survey the market in advance through pre-sales, i.e., the crowdfunding results are a public signal of how promising the product will be (if the crowdfunding results indicate low market demand, then development can be stopped before costs are incurred). However, it cannot be ignored that there may be a relatively strong potential imitator that, after receiving public project information and market demand signals from the crowdfunding platform, goes into production before the financially constrained startup and takes over the market at a lower price. Star products in the crowdfunding market undoubtedly attract potential imitators, and opportunistic imitators take advantage of the public information about successful crowdfunding projects to imitate these products. The potential entry of imitators increases price competition, raises consumer surplus, and poses a significant threat to market operations.

The emergence of potential imitators undoubtedly undermines the healthy development of crowdfunding market. On the one hand, this topic will establish the game between startups and potential imitators at different stages of product crowdfunding and analyze the impact of different information disclosure strategies on the interests and decisions of each party, which has strong theoretical value. On the other hand, the laws and regulations related to the regulation of crowdfunding information disclosure in China are not yet perfect. This topic will discuss how companies can adjust their product disclosure strategies to compete with potential imitators with or without third-party regulation, protect the creativity of startups, maintain a good order of crowdfunding market, and improve social welfare.

2. Literature Review

Next, we will sort out the status of related research from three parts: crowdfunding, imitators, and information disclosure.

Crowdfunding: A considerable number of scholars at home and abroad have focused on crowdfunding activities. Major studies include optimal campaign design, product line and pricing strategies (Hu et al., 2015), fixed or flexible funding mechanisms (Chang, 2016), mechanisms for organizational misconduct (Belavina et al., 2020), and revenue management (Zhang et al., 2022). All these studies suggest that appropriate crowdfunding mechanisms are a key factor for success. One category of papers focuses on the informational value of crowdfunding (Roma et al., 2018; Chemla and Tinn, 2020) and suggests that crowdfunding campaigns provide signals about future demand, i.e., public crowdfunding results reflect the size of demand for the product in future markets. In addition, Xu and Zhang (2018) and Chakraborty and Swinney (2021) summarize how firms manage information under crowdfunding. Other analyses on crowdfunding examine its financial value from an operational management perspective. For example, Roma et al. (2018) show that the amount of information in crowdfunding may harm subsequent venture capital opportunities. Xu et al. (2018) compare crowdfunding and bank financing in the presence of market uncertainty and word-of-mouth communication. Babich et al. (2021) show that launching a crowdfunding campaign can help overcome agency problems but may harm firms and venture capital investors. Clearly, the threat of potential imitation is underappreciated in these studies.

Imitator competition strategies: Imitators are common in every lucrative market and are involved in various areas such as product upgrading strategies (Purohit, 1994), brand management (Qian, 2014), global supply chains (Cho et al., 2015) and luxury management (Gao et al., 2017). The current main tools for stopping imitators from entering and reducing losses from imitation competition include by studying the feasibility and optimal design of contracts (Ji et al., 2022), exploring optimal pricing strategies for products (Xue et al., 2017), setting up barrier strategies and market capture strategies (Sun et al., 2010). We note that information disclosure is a double-edged sword: releasing more information, such as disclosing more features or functions of a product, can induce more contributor commitment; while more public information also lowers the barriers to entry for imitators (Cowden and Young, 2020). Specifically, in the face of potential imitation threats, startups can use disclosure as a weapon to compete with imitators in the crowdfunding market. Therefore, it has become increasingly important to understand how imitation affects startups' disclosures when operating campaigns on public crowdfunding platforms. However, there is a lack of research that addresses these key issues. It is unclear how firms make pricing and information distribution decisions in the context of imitation in crowdfunding campaigns; what economic impact strategic disclosure will have on the operation of crowdfunding platforms; and how these outcomes depend on market conditions such as imitation efficiency and crowdfunding market share.

Information disclosure strategies: A growing number of studies analyze demand information leakage among horizontal downstream competitors in supply chains due to vertical information sharing (Li, 2002, Li and Zhang, 2008). Kong et al. (2013) and Chen and Özer (2019) discuss the performance of different supply chain contracts in managing information flows. Guo and Zhao (2009) demonstrate in their study that quality information asymmetry puts pressure on competing firms to disclose less information than monopolistic firms. In addition to demand information leakage from information sharing, firms' disclosure of product information in competitive markets may also lead to quality information leakage. In a crowdfunding campaign, the quality of replicas depends on the information disclosed by the startup in the crowdfunding platform. Startups can use appropriate restrictions on product quality to deter potential entrants (Donnenfeld and Weber, 1995).

In contrast to the existing literature, this study focuses on the importance of disclosure strategies in crowdfunding in the presence of potential imitation threats. That is, it considers how information about crowdfunding can be strategically concealed to deter potential entry, protect the interests of startups and consumers, and how government can regulate to achieve higher social welfare.

3. Methodology

The main objective of this topic is to explore the following questions: (i) What is the optimal information strategy for competing with imitators and does it deter potential entrants? (ii) How do market conditions such as crowdfunding market share and imitation efficiency affect the optimal information strategy? What is the profitability impact? (ii) To effectively compete with imitators, when should startups exit crowdfunding and turn to traditional bank financing? How does this financing choice affect consumer surplus and social welfare?

To answer these questions, we divide the study into two parts, as follows:

3.1. Crowdfunding Strategies without Considering Government Regulation.

This section develops a dynamic game model to capture the decision interactions between entrepreneurs, investors, and imitators (optimal pricing, financing objectives, level of disclosure, investment strategy, etc.). In the absence of demand information, startups can choose either a bank financing strategy and start their entrepreneurial activities or a crowdfunding strategy where potential imitations exist. The results of different levels of information disclosure strategies can also lead the firm to choose the financing method that is most optimal for its own profit.

3.1.1. Modeling of Startups and Imitators.

First, assume that a startup has an innovative product idea whose product quality q is exogenously determined by it. To complete the innovation process, the startup needs external financing to cover the fixed setup costs C_s. There are two common financing strategies used by startups, namely traditional bank financing and crowdfunding. Therefore, startups need to decide whether to raise funds through crowdfunding campaigns or to borrow money from banks. In this topic, we assume a situation where the startup uses only one funding strategy, because combining two funding strategies may in practice create additional management and operational complexity for the startup; and the startup can only receive the funds raised if it successfully achieves its funding goal. Otherwise, the campaign will fail, and all funds received will be returned to the investors.

Also, a potential copycat is introduced during the retail phase. This imitator does not enter the market until it receives a signal of success. When it observes an innovative product of quality λq on the crowdfunding platform, the imitator with imitation efficiency $\delta \le 1$ can only copy

parts of the original product, i.e., the quality of the copied product is $\delta\lambda q$. In the retail stage, the imitator decides whether to enter the retail market and, if so, competes with the startup by announcing its own retail price while competing on price. Similarly, the imitator enters the market when and only when its retail profit can cover the fixed entry cost C_c.

We assume that the efficiency of imitators δ is exogenously given and restrict the range of values δ, i.e., we exclude the case where imitators with higher imitation efficiency harm themselves. Also, both the startup and the imitator continue their business activities only when their profits are positive, i.e., $\Pi_s^* > 0$ and $\Pi_c^* > 0$ respectively.

3.1.2. Modeling of Consumers.

Next, the entire market is divided into two parts: $\alpha/(\alpha+1)$ of the crowdfunding market and $1/(\alpha+1)$ of the retail market. The former is the loyal group of crowdfunding platforms that may participate in crowdfunding campaigns as backers; the latter is the potential future market of consumers who will only consider buying the product after it is fully developed. All consumers share the same utility function $u = \theta q - p$, where θ represents the consumer's willingness to pay for quality, and are assumed to be uniformly distributed over $[0,1]$. q and p represent their observed product quality and price, respectively. In the model we build, the perceived quality depends not only on the game stage but also on the startup's disclosure. Consumers in the crowdfunding market make their purchase decisions based on what the startups present on the platform, and the perceived quality in this stage is λq; if the cottage companies enter the retail market, consumers can also directly observe their product quality $\delta\lambda q$.

Since the product is innovative, the startup is unsure of the market response. To capture the demand risk, the entire market is assumed to consist of an infinitely small group of consumers with a total quality of $(\alpha+1)X$, where X follows the Bernoulli distribution:

$$X = \begin{cases} X_H, \text{with the demand probability } \beta, \\ X_L, \text{with the demand probability } 1-\beta. \end{cases} \tag{1}$$

3.1.3. Modeling of Crowdfunding Strategy Optimization.

Since the cost of crowdfunding is lower compared to traditional financing, it is assumed that companies prefer crowdfunding. When crowdfunding is used, startups need to first seek financial support in the crowdfunding market and then promote their successful products to the retail market, rather than selling directly to the entire market through bank financing. Therefore, this key feature of the crowdfunding strategy can be captured by describing a two-stage game. We use the concept of subgame perfect Nash equilibrium, which is derived by backward induction. Specifically, we will solve the subgame in the retail stage first and then fold back to the crowdfunding stage to analyse the optimal pricing and disclosure strategy of the product under crowdfunding.

(1) Retail Stage

In the retail phase, we focus only on the case of high demand status, i.e., $X = X_H$. Because the crowdfunding mechanism helps the startup to end a product with no prospects at the market size of $X_L = 0$. There are two possible equilibrium cases in this phase (denoted by the superscripts CM and CD to indicate the equilibrium outcomes in the case of monopoly and duopoly under crowdfunding, respectively):

(i) No entry and the startup monopolize the retail market with the following goal setting.

$$\max_{P_{sr}} \prod_{sr}^{CM} = X_H P_{sr}(1 - \frac{P_{sr}}{q}). \tag{2}$$

(ii) An imitator enters the retail market, and the two firms compete for their own market shares, with their respective objectives set as follows.

$$
\begin{cases}
\max_{P_{sr}} \prod_{sr}^{CD} = P_{sr}(1-\theta_{sc})X_H, \\
\max_{P_c} \prod_c = P_c(\theta_{sc} - \dfrac{P_c}{\lambda\delta q})X_H - C_c, \text{ s.t. } P_c(\theta_{sc} - \dfrac{P_c}{\lambda\delta q})X_H \geq C_c.
\end{cases} \tag{3}
$$

(2) Crowdfunding Stage

In the crowdfunding stage, the startup needs to determine the crowdfunding price P_{sc} and the level of disclosure λ, only the latter of which affects the equilibrium outcome of the retail market. The problem for startups at this stage is:

$$
\begin{cases}
\max_{\lambda, P_{sc}} \mathbb{E}\left[\prod_s^C\right] = \alpha\beta P_{sc}(1-\dfrac{Pc}{\lambda q})X_H - \beta C_s + \beta\prod_{sr}^*, \\
\text{s.t. } \alpha P_{sc}(1-\dfrac{P_{sc}}{\lambda q})X_H \geq C_s.
\end{cases} \tag{4}
$$

Obviously P_{sc} plays no role in retail profits $\prod_{sr}^*$ and obviously $P_{sc}^* = (q\lambda)/2$, which reduces the original problem to a constrained optimization with only one decision λ. The above problem can then be solved by determining the conditions under which the crowdfunding strategy is a viable option for startups to raise capital and by inscribing the associated optimal pricing and disclosure levels.

(3) Information Disclosure Strategy

If the threat of imitation is serious, startups may choose to undermine or expel imitators by hiding crowdfunding information. However, when the threat is not significant, startups may continue to partially disclose information. The level of disclosure can provide a clear indication of the trade-off between current crowdfunding profits and future retail profits. Specifically, disclosing more information at the crowdfunding stage can help startups raise capital, but may also attract more competitive copycats. In contrast, hiding crowdfunding information can reduce the risk of imitation, but startups may not reach their funding goals. Taken together, the level of information disclosure and the nature of retail competition reflect this trade-off.

In this section, a sensitivity analysis is conducted by analysing the optimal disclosure strategy and the associated profits separately in each equilibrium case to reveal the key driving forces; the impact of market conditions on the optimal level of disclosure in each equilibrium case; and the overall perspective of the overall sensitivity analysis on the optimal level of disclosure. An attempt is made to explore the role of crowdfunding market proportions and imitation efficiency in the duopoly game. For example, startups may use crowdfunding disclosure to influence the quality of a cottage firm's product and thus the retail profits of the cottage firm. Crowdfunding and retail prices, although also important for profits, can be formulated according to the level of disclosure. The above equations are derived to determine the optimal operating strategy and reveal the disclosure mechanism.

3.2.   Considering Crowdfunding Strategies under Government Regulation.

In this section, we extend the model to the case with third-party regulation. The government regulation decision is introduced into the model to analyse how the government can enhance social welfare through control. For example, by comparing the impact of product disclosure strategies and potential imitation on consumer surplus and social welfare for different Internet crowdfunding. Considering social factors, the extent to which the government would require crowdfunding platforms to make disclosure in favour of market development and how the interests of all parties are balanced to achieve the optimal social welfare goal.

When either crowdfunding or bank financing is feasible, the one that is feasible will result in positive consumer surplus. In contrast, when both strategies are feasible, crowdfunding always generates more or equal surplus to consumers than bank financing. Thus, with the dominance of crowdfunding, crowdfunding achieves a weak "win-win" situation for startups and consumers. On the other hand, the entry of copycat products provides an alternative for consumers who cannot afford to buy original products. As a result, these consumers enjoy a positive surplus when purchasing replicas. In addition, retail price competition enables consumers to purchase both originals and replicas at a lower price than in the monopoly situation. However, excessive disclosure gives imitators the opportunity to enter the competition to bring benefits to consumers while forcing startups to turn to banks for financing; too little disclosure poses moral risks such as fraud. Therefore, how the government can reach this trade-off through regulation is the focus of this section.

Finally, based on the results of the derivation of the dynamic game model, we explain the relationships that exist, and then suggest how startups can use product disclosure strategies to deal with the problems of moral hazard and plagiarism of business information by potential imitators, as well as provide guidance suggestions on how the government can optimize its regulatory strategies.

4. Results and Conclusion

4.1. Disregarding Government Regulation.

In the absence of government regulation, different levels of information disclosure in product crowdfunding have different impacts on the interests and decisions of the three parties: startups, crowdfunding platforms, and consumers.

For startups, appropriate information disclosure can help them obtain more capital and resources, increase product awareness, and market share, and thus promote business growth. If startups provide detailed information in product crowdfunding, including product features, technology, business plan, and financial status, this will help enhance investors' trust and support, and increase the success rate of product crowdfunding. In addition, detailed information disclosure can help companies avoid legal disputes and investor complaints, thus reducing unnecessary costs and risks. However, if startups are not transparent and complete enough in terms of information disclosure, it may reduce investors' trust and support and lead to product crowdfunding failure. In addition, if startups provide false or misleading information, it may harm investors' interests and cause legal problems.

For crowdfunding platforms, proper disclosure can help them build trust and reputation and attract more investors and startups to join the platform. In addition, platforms can use disclosure to monitor and manage the behavior of startups, ensure that they comply with the platform's rules and standards, and reduce the risk to investors. However, if crowdfunding platforms are not transparent and open enough in terms of information disclosure, it may reduce investors' trust and support for the platform and affect the platform's reputation and business. In addition, if platforms fail to adequately monitor the behavior of startups, they may harm investors' interests, leading to investor churn and legal problems.

For consumers, proper disclosure can help them better understand the quality, features, price and returns of a product and make informed investment decisions. If startups provide detailed information in product crowdfunding, consumers can better assess the value and risks of the product and avoid poor decisions due to insufficient information. However, if a startup provides inaccurate or false information, consumers may be misled, resulting in a loss of investment or a product that does not meet expectations. In addition, if product crowdfunding platforms do not adequately disclose information about startups, consumers may not have access to

comprehensive product evaluations and comparisons, which may influence their purchasing decisions.

4.2. Considering Government Regulation.

When considering government regulation, government regulation can motivate startups to provide more accurate and comprehensive information to meet the requirements of regulators and the needs of investors. The government can establish laws and regulations and require product crowdfunding platforms and startups to disclose key information, including the product development process, technical solutions, business plans, financial status, etc. Such disclosure requirements can increase the transparency of startups and improve investors' trust and support. However, excessive government regulation and disclosure requirements may increase the burden and cost of startups. If the disclosure requirements are too burdensome and complex, startups may need to invest significant time and resources to meet these requirements, which may affect the day-to-day operations and growth of the business. Therefore, the government needs to weigh the purpose of regulation and the actual situation of startups when setting disclosure requirements to avoid unnecessary burden of over-regulation on businesses.

In addition, government regulation can regulate the operation and behavior of crowdfunding platforms and protect the rights and interests of investors. The government can require crowdfunding platforms to disclose information such as fees, protection mechanisms for investors' rights and interests, and vetting standards for investment projects to ensure that the platform's operations are following the regulations and that the legitimate rights and interests of investors are protected. However, government regulation may also increase the operating costs and legal risks of the platform. If the regulatory requirements are too strict or the information disclosure requirements are too burdensome, the platform may need to invest more time and resources to meet the regulatory requirements, thus increasing the platform's operating costs. In addition, if a platform fails to meet the regulatory requirements or violates the relevant regulations, the platform may face legal risks such as fines or revocation of its business license. Therefore, the government needs to consider balancing the purpose of regulation and the actual situation of the platform when setting regulatory requirements and information disclosure requirements to ensure the reasonableness and effectiveness of regulation and to avoid unnecessary burden and adverse impact of excessive regulation on the platform.

Government regulation and information disclosure requirements can also enhance consumers' rights to information and protection and promote the protection of consumers' rights and interests. If the government requires platforms and startups to disclose more information, consumers can get a more comprehensive understanding of important information such as the product development process, technical solutions, business plans and financial status, so that they can better assess the risks and benefits of the products and make more informed investment decisions. However, government regulation and information disclosure requirements may also increase the cost of choice and information processing for consumers. If regulatory requirements and information disclosure requirements are too burdensome or complex, consumers may need to spend more time and effort to screen information and assess risks, thus increasing the cost of choice and information processing. Therefore, the government needs to consider balancing the purpose of regulation and the actual situation of consumers when formulating regulatory requirements and information disclosure requirements, to ensure the reasonableness and effectiveness of regulation, and to avoid unnecessary burdens and adverse effects of over-regulation on consumers.

Acknowledgements

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