The current issue and full text archive of this journal is available on Emerald Insight at:
https://www.emerald.com/insight/2815-5793.htm

Received 15 July 2024
Revised 16 December 2024
8 January 2025
Accepted 10 January 2025

Optimizing sales mode selection and marketing effort for a B2C marketplace under green product investment uncertainty

Dinh Anh Phan
Faculty of Banking, University of Economics – The University of Danang, Danang, Vietnam, and
Thi Le Hoa Vo
IGR-IAE Rennes, Univ Rennes, CNRS, CREM – UMR6211, Rennes, France

Abstract

Purpose – This study investigates the circumstances under which a business to customer (B2C) marketplace chooses to implement green marketing to promote green product investment (GPI). It further identifies the optimal sales model approach for implementing green marketing under uncertainty about the effects of GPI.

Design/methodology/approach – We examine an e-commerce (EC) supply chain involving a manufacturer who determines the product's greenness level and a B2C marketplace who can operate in either an agency or a reselling mode and engages in green marketing to promote sales of green products. Using the backward induction method, we develop an analytical model to drive the optimal decisions and profits under each sales model.

Findings – Our research demonstrates that high GPI uncertainty drives B2C marketplaces to adopt green marketing strategies. These initiatives not only prompt manufacturers to invest in eco-friendly products but also boost profits for all parties involved. Nevertheless, these benefits depend on the choice of a sales model between agency and reselling. Our findings offer a novel practical application into the relationship between GPI uncertainty and green marketing. When the GPI uncertainty is high, green marketing is profitable for the B2C marketplace regardless of which sales mode is adopted. However, when uncertainty is low, green marketing only benefits the B2C marketplace in the agency mode. Moreover, the interaction between GPI uncertainty and the referral fee exerts a moderating influence on the preferred sales mode for both the manufacturer and the B2C marketplace.

Practical implications – Our findings offer a novel practical application into the relationship between GPI uncertainty and green marketing. When the *GPI* uncertainty is high, green marketing is profitable for the B2C marketplace regardless of which sales mode is adopted. However, when uncertainty is low, green marketing only benefits the B2C marketplace in the agency mode. Moreover, the interaction between GPI uncertainty and the referral fee exerts a moderating influence on the preferred sales mode for both the manufacturer and the B2C marketplace.

Originality/value – Overall, our research contributes to a deeper understanding of the complex but beneficial interplay between GPI uncertainty, green marketing and sales mode selection in an EC supply chain.

Keywords Green product investment, Green marketing, B2C marketplace, e-commerce supply chain, Agency mode, Reselling mode

Paper type Research paper

1. Introduction

In light of the detrimental impact of human activities on the environment, a growing number of consumers have demonstrated a heightened interest in green products (Dangelico and Vocalelli, 2017). In response, an increasing number of manufacturers have developed green technologies, including the use of recyclable materials and the promotion of energy-saving products (Swami and Shah, 2013; Dong *et al.*, 2019). Green product investment (*GPI*) serves to enhance the environmental friendliness of the product, thereby meeting the growing

© Dinh Anh Phan and Thi Le Hoa Vo. Published in *Journal of Trade Science*. Published by Emerald Publishing Limited. This article is published under the Creative Commons Attribution (CC BY 4.0) licence. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this licence may be seen at http://creativecommons.org/licences/by/4.0/legalcode

This research is partly funded by the University of Danang, University of Economics, Vietnam.

Journal of Trade Science
Vol. 13 No. 1, 2025
pp. 44-64
Emerald Publishing Limited
e-ISSN: 2755-3957
p-ISSN: 2815-5793
DOI 10.1108/JTS-07-2024-0041

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026

demand from environmentally-concerned consumers, and ultimately increasing market demand for products. Prior research in sustainable consumer behavior has demonstrated that a significant proportion of customers hold positive attitudes towards green products (Hong and Guo, 2019; Ketelsen *et al.*, 2020) and are even willing to pay a premium for them compared to conventional products (Aguilar and Vlosky, 2007; Wei *et al.*, 2018). Nevertheless, a discrepancy exists between consumers' expressed intention to buy and their actual purchasing behavior concerning green products (Vermeir and Verbeke, 2006; Grunert, 2011; Sheeran and Webb, 2016). It is evident that a positive perception of a product does not necessarily result in a purchase decision. The decision to buy is complex and influenced by a multitude of factors (Grunert, 2011; Paul *et al.*, 2016). This is consistent with the fact that, while a significant proportion of consumers express interest in environmentally-friendly products, only a small fraction, less than 10%, are truly dedicated to buying them (Ketelsen *et al.*, 2020).

Furthermore, *GPI* presents challenges for manufacturers as such investments are not only costly, but are also not directly observable by consumers (Baksi and Bose, 2007). The asymmetric information about *GPI* between manufacturers and consumers can lead consumers to doubt the claims of *GPI*, potentially undervaluing products' green attributes or environmental features. Consequently, the effect of *GPI* on the market demand may be less positive than expected due to the high uncertainty regarding its effectiveness. This uncertainty can, in turn, act as a deterrent for manufacturers developing green products. Nevertheless, consumer purchasing decisions are frequently influenced by their awareness of a product's green attributes. Consequently, green marketing initiatives play a pivotal role in influencing this awareness (Rahbar and Wahid, 2011; Hong and Guo, 2019). Business to Customer (B2C) marketplaces, such as Amazon, eBay, and Alibaba, have employed green marketing initiatives to promote manufacturers' *GPI*. For example, Amazon, one of the largest B2C marketplaces in the world, launched the "Climate Pledge Friendly" project in 2020, in collaboration with reputable third-party certifications, with the objective of showcasing products that adhere to sustainability standards and contribute to environmental conservation. Another example is Alibaba, the fourth-largest B2C marketplace in the world, creating the "Green Channel" to promote eco-friendly products and service. This channel facilitates the connection between environmentally-conscious suppliers and manufacturers with consumers seeking for sustainable options. Furthermore, the specific nature of green marketing initiatives is contingent upon the sales model employed. Indeed, the advent of B2C marketplaces has led to the emergence of two dominant sales models: the reselling mode and the agency mode. In the reselling mode, the B2C marketplace acts as a reseller, purchasing products from suppliers and subsequently reselling them to consumers. In the agency mode, the B2C marketplace serves as a marketplace, allowing the manufacturer to sell products directly to consumers. The selection of a sales mode has a significant impact on operational decisions and the profitability of both the B2C marketplace and the manufacturer, as evidenced by academic research on operations management (Zennyo, 2020; Zhang *et al.*, 2021, 2023; Xu *et al.*, 2023). There is a shortage of research exploring the interaction between uncertainties associated with *GPI*, green marketing, and sales mode selection, and their influence on the green degree of products and individual profits in the e-commerce (EC) supply chain.

This study addresses this gap by investigating a green supply chain composing a single B2C marketplace and a single manufacturer. The manufacturer produces eco-friendly products and sells them through the B2C marketplace, which operates either as a marketplace or a reseller and engages in marketing efforts to promote the green products. In particular, the following questions are addressed:

(1) Under what circumstances should the B2C marketplace exert green marketing efforts?

and.

(2) Considering both the marketing effort and the uncertainties associated with *GPI*, which sales model would be the optimal choice for both the B2C marketplace and the manufacturer?

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026

In order to address these research questions, a game-theoretic framework is employed to determine the optimal values of the product greenness level, green marketing effort, product quantity, and the individual profits of the manufacturer and the B2C marketplace. The findings and practical applications can be summarized as follows:

First, our research demonstrates that high *GPI* uncertainty drives B2C marketplaces to adopt green marketing strategies. These initiatives not only prompt manufacturers to invest in eco-friendly products but also boost profits for all parties involved. Moreover, the impact of green marketing on the B2C marketplace is dependent on the specific sales mode and the degree of *GPI* uncertainty. In particular, green marketing efforts yield positive outcomes for the B2C marketplace in both agency and reselling modes when there is considerable ambiguity surrounding *GPI*. However, when *GPI* uncertainty is relatively low, green marketing is only beneficial for the B2C marketplace in the agency mode. These findings contribute valuable supplementary insights to the existing knowledge on green marketing in operations management (Du *et al.*, 2019; Li *et al.*, 2021; Shi *et al.*, 2022). Our findings offer a novel practical application into the relationship between *GPI* uncertainty and green marketing. When uncertainty of *GPI* is low, our research indicates that the B2C marketplace should prioritize green marketing for third-party seller products. Conversely, in the context of high *GPI* uncertainty, the B2C marketplace has the potential to engage in green marketing for both third-party and its own products.

Second, it can be observed that the interplay between the *GPI* uncertainty and the referral fee exerts a moderating influence on the preferred sales mode for both the manufacturer and the B2C marketplace. When *GPI* uncertainty exceeds a certain threshold and the referral fee is low, the agency mode results in a higher green level and greater profits for both parties, which leads to a preference for this mode. However, an increase in uncertainty reduces the likelihood of the agency mode being adopted, as heightened uncertainty prompts the B2C marketplace to favor the reselling mode. The aforementioned practical implications indicate that marketing efforts may facilitate the selection of the reselling mode, particularly in situations where there is a high degree of uncertainty regarding *GPI*. This emphasizes the importance of green marketing in EC supply chains where green investment involves a significant degree of risk. In conclusion, our research contributes to a deeper understanding of the complex but beneficial interplay between *GPI* uncertainty, marketing efforts, and sales mode selection in an EC supply chain.

The rest of the paper is structured as follows. The literature review is presented in Section 2. We provide the model setting with notations and assumptions in Section 3. Section 4 is dedicated to the analysis of a benchmark model of the EC supply chain under *GPI*, without the inclusion of green marketing efforts. Section 5 considers the performance of the *GPI* supply chain with a green marketing effort. In Section 6, we conclude with a summary of our findings and suggest avenues for future research. For the convenience of the reader, the mathematical proofs are provided in the Appendix.

2. Literature review

Our study aims to investigate the potential effects of green marketing efforts and sales mode selection on the performance of an EC supply chain. It is primarily related to two research streams: the first involves *GPI* and sales mode selection in B2C marketplaces, and the second focuses on green marketing efforts in EC supply chains.

2.1 B2C marketplace sales mode selection and green product investment

In recent years, the B2C marketplace has attracted the attention of researchers in supply chain management, with a particular focus on the optimal online channel modes of the supply chain. Most of the existing research in this field is based on the agency theory framework, which examines the interactions between entities with aligned yet distinct objectives (Bergen *et al.*, 1992).

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026

The objective of these studies was to determine the optimal sales mode for supply chain members. For instance, Hagiu and Wright (2015) suggested the decision between the reselling mode and the marketplace mode hinges on which entity, independent suppliers or the intermediary, possesses more information for crafting effective, product-specific marketing strategies. The study by Abhishek *et al.* (2016) suggested that agency selling may be more efficient than reselling and could potentially lead to lower retail prices. However, it is worth noting that e-tailers may find themselves in a position where they relinquish control over retail prices to the manufacturer. Chen *et al.* (2021) put forth an analytical framework to examine the optimal sales model for an e-seller offering return-freight insurance in an EC supply chain. Zhang *et al.* (2023) offered further insights into the optimal sales model, combined with optimal operational decisions for a platform supply chain in the presence of a secondary marketplace. However, it would be beneficial to consider the impact of *GPI* on the selection of the optimal sales mode, as considered in this research. As Sarkis *et al.* (2011) observed, green supply chain management has become an essential component of corporate strategies focused on sustainable practices. Consequently, firms are experiencing mounting pressure to enhance their environmental performance further compounded by heightened environmental awareness exhibited by stakeholders, which serves to incentivize firms to mitigate the adverse environmental impact of their operations (Tseng *et al.*, 2019). The extant literature documents numerous benefits of supply chain practices for corporate performance. For instance, Dyer and Singh (1998) indicated that a proactive environmental strategy can enhance a firm's competitiveness. Furthermore, Younis *et al.* (2016) found that green purchasing and environmental cooperation had a significant impact on operational performance, based on data collected through survey questionnaires from 117 firms in the manufacturing industry in the UAE. Li *et al.* (2024) demonstrated that environmental regulations, as exemplified by China's low-carbon city pilot policy, motivated firms to adopt green image management within the supply chain. Furthermore, firms' financial performance was shown to improve after implementing green image management in their supply chain.

It seems that, as a result of environmental issues and the green promotion of e-retailers, consumers are becoming increasingly interested in purchasing green products through the B2C marketplace. Wang *et al.* (2020) focused on the study of the green degree of products and the service level of EC platforms. The authors suggested that consumer preferences for green products and service quality could potentially benefit both the manufacturer and the EC platform. Wang *et al.* (2021) explored the potential for sustainable decisions in an EC platform marketing environment, with a focus on competition. Their findings suggested that the launch of a green product by an EC platform could benefit manufacturers if the discrepancy in evaluation for the green product is sufficiently small. However, the potential consequences of *GPI* uncertainty are not given sufficient consideration. Liu *et al.* (2020) confirmed that market uncertainty affects sustainability management, which is crucial for long-term survival and growth. Wu *et al.* (2020) analyzed the influence of uncertainty of green products on environmental investment decisions within supply chains. Their findings indicated that, as eco-friendly intermediate components become less uncertain and more feasible, suppliers will increase the greenness of these components and increase the investment in environment. Concurrently, manufacturers will reduce the proportion of the green costs.

Zhou and Duan (2022) examined the selection of online sales channels in the context of consumers' environmental awareness and the reference greenness effect. Their findings indicated that the choice of sales channels is contingent upon the cost-effectiveness of greenness improvement and that the optimal product greenness is influenced by the reference effect.

Nevertheless, it is notable that none of these addressed the role of the marketing effort in reducing the *GPI* uncertainty and optimizing the choice of selling formats and operational decisions.

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026

2.2 Green marketing effort in e-commerce supply chain

The role of marketing in supply chains is crucial for fostering customer loyalty and driving long-term profitability (Kumar and Shah, 2004). Furthermore, research by Mishra and Modi (2016) substantiated the complementary function of marketing capability. Their findings indicated that sustainable practices, such as CSR, are unlikely to directly impact firm shareholder wealth; rather, CSR is more likely to exert its influence in conjunction with marketing capability. Their study underscored the notion that the positive impact of CSR on shareholder value can be amplified through the enhancement of marketing capabilities. Additionally, it appeared that consumer awareness of green products is the primary factor influencing purchasing behavior (Hong and Guo, 2019) and therefore is evident that improving consumer awareness of green products through retailers' marketing efforts is a fundamental requirement for all online channels in the EC supply chain. Many existing works appear to confirm the important role of marketing effort (Giri and Sharma, 2014; Guo *et al.*, 2020; Li *et al.*, 2021). For example, in their work focusing on the effectiveness of different contracts in coordinating the sale efforts of brick-and-mortar retailers with those of free-riding online retailers, Xing and Liu (2012) suggested that a rebate contract combined with sales efforts could potentially lead to significant improvements in supply chain efficiency. Further, Taleizadeh *et al.* (2016) explored the potential impact of marketing effort on dual-channel closed-loop supply chain systems and their findings suggested that, depending on consumer preferences for the direct channel, the marketing effort could be allocated by the manufacturer or the retailer to enhance coordination and generate greater profit for the supply chain. In a similar vein, Li *et al.* (2019) examined the pricing and service effort strategy in a dual-channel supply chain with showrooming effect. Their findings suggest that service effort and retail profit are largely independent of the coefficient of the showrooming effect. Guo *et al.* (2020) suggested that by investigating the impact of green supply chain contracts with eco-labels issued by the sales platform on the profitability and environmental impact of the supply chain, it may be possible to demonstrate that marketing effort can lead to greater green awareness among consumers, which could contribute to improving the performance of the supply chain. In the view of Zhang *et al.* (2023a), consumers are inclined to purchase green products based on their understanding of such products, which is shaped by the marketing efforts of the B2C marketplace. Their study suggested that marketing efforts benefit consumers, leading to increased adoption of green products and greater profits for both the B2C marketplace and the manufacturer. This research aims to gain a deeper understanding of the impact of green marketing efforts in two sales modes of the EC supply chain. In our view, this represents a novel approach to investigating the optimal sales model for implementing green marketing in a B2C marketplace by considering the risk associated with *GPI*.

3. Model setting

3.1 Green product investment and market demand

Manufacturers often invest in green initiatives to add environmentally-friendly characteristics to their final product. The costs associated with green investment represent a fixed expenditure and depend on the greenness of the products, denoted by θ. Following the common assumption of diminishing returns on green investment in the relevant literature (Hong and Guo, 2019; Zhang *et al.*, 2020; Wu *et al.*, 2020; Shi *et al.*, 2022), this study models the relationship between green investment cost and greenness level using a quadratic function. Specifically, the investment cost to achieve the green level θ is given by $\kappa\theta^2/2$, where $\kappa > 0$ is the marginal cost coefficient of *GPI*. Since consumers are willing to pay a premium for green products over conventional ones (Aguilar and Vlosky, 2007; Wei *et al.*, 2018), *GPI* is modeled to increase the demand for green products (Hong and Guo, 2019; Shi *et al.*, 2022). Nevertheless, the scale of the green market segment cannot be predicted as it depends on the ability of green products to prove environmental quality and meet the broader expectations of consumers (Ottman *et al.*, 2006). To capture the uncertainty of a *GPI* while maintaining model complexity at a reasonable level, we adopt the demand for product with green level θ as

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026

$$D(\theta) = \begin{cases} a & \text{with probability } \rho \\ a + \eta\theta & \text{with probability } 1 - \rho \end{cases}$$

where, $a > 0$ is the base market size, and the parameter η referred to as the green elasticity of demand, quantifies the responsiveness of product demand to changes in its green attributes. This elasticity can vary significantly depending on the nature of the green technology adopted or the target consumers. The random market demand for the product (post-GPI) can alternatively be written as

$$D(\theta) = a + \eta\theta\xi$$

where ξ is a Bernoulli variable with probability $(\xi = 0) = \rho$ and probability $(\xi = 1) = 1 - \rho$. The probability ρ measures the likelihood of the scenario that the *GPI* fails to stimulate the market demand. This parameter ρ serves as an indicator of the uncertainty associated with *GPI*, with a high ρ showing a high degree of uncertainty regarding the effect of *GPI* on the market demand.

3.2 Green marketing efforts

In our setting, green marketing efforts, represented by marketing expenditures and denoted by e, can reduce the probability of the failure scenario, ultimately reducing the uncertainty of *GPI*. Specifically, we consider the function $\rho_e = \rho\exp(-\omega e)$ with $\omega > 0$ to quantify the impact of green marketing on *GPI* uncertainty. Here, a higher marketing effort e leads to lower *GPI* uncertainty. As the green marketing effort approaches infinity, the probability ρ_e approaches to zero. And the parameter ω controls the rate of convergence to a zero level of *GPI* uncertainty, reflecting the effectiveness of green marketing in mitigating the risk associated with *GPI*.

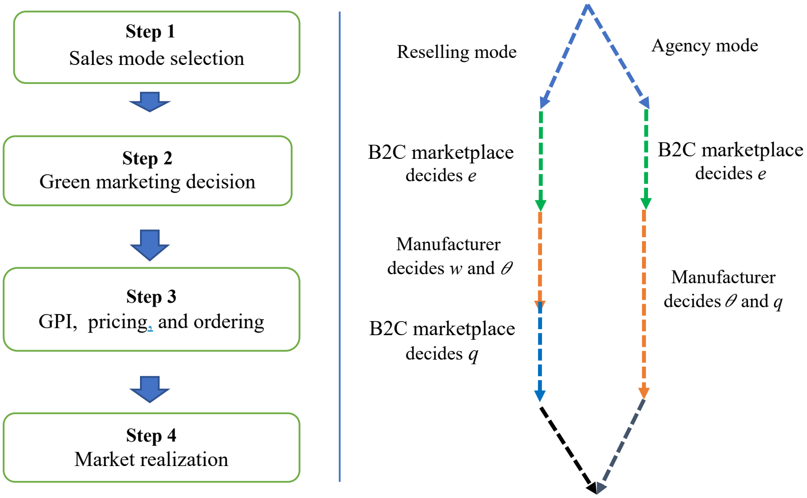
3.3 Supply chain structure

We consider a supply chain consisting of one manufacturer (referred to as "he") and one B2C marketplace (referred to as "she"). The manufacturer invests in *GPI* to create eco-friendly products sold directly to consumers via a B2C marketplace that promotes green marketing to inform the eco-friendly features of the products. Both green marketing and *GPI* are long-term decisions. However, given the increasing power of the B2C marketplace, it is assumed that the green marketing decision is made before investing in *GPI* and that the manufacturer is clearly informed of the B2C marketplace's planned green marketing strategy. Throughout our analysis, we normalize the production cost to zero and treat the selling price r as an exogenous parameter. The B2C marketplace offers two sales models for the manufacturer to sell products: (*1*) the reselling mode, where the B2C marketplace acquires products from the manufacturer and resells them to consumers, and (*2*) the agency mode, in which the manufacturer sells products directly to consumers, but the manufacturer has to pay a fraction $\gamma \in (0,1)$ of the total sales revenue to the B2C marketplace and keeps the remaining fraction $1 - \gamma$ of the sales at the end of the selling season. This proportion γ is referred to as the referral fee, is usually not easily altered by a single B2C marketplace due to the formidable external force of competition. This is evident in the similar referral fees charged by major B2C marketplaces such as Amazon and Walmart Marketplace, among others. Therefore, this research follows the work of Zhang *et al.* (2023) to assume that γ is an exogenous parameter.

3.4 The sequence of events

Figure 1 shows the four decision stages in the investigated supply chain. Stage 1: The B2C marketplace and the manufacturer select a sales mode (reselling or agency). Stage 2: The B2C marketplace decides on green marketing efforts. Stage 3: *GPI*, pricing, and ordering are decided. Stage 4: Market demand and profits are realized. Given the sequence of events, the

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026



Source(s): The authors

Figure 1. Sequence of the events in two sales modes

backward induction method (Heifetz, 2012) is used to model the decision-making processes in the investigated supply chain. For instance, if the B2C marketplace chooses its marketing effort, it maximizes its expected profit $\Pi_B(e, \theta^*(e))$ where $\theta^*(e)$ results from the optimization of the CSR effort undertaken by the manufacturer. All notations are listed in Table 1.

4. Benchmark: without green marketing effort

4.1 Reselling mode

In this mode, the behavior of the manufacturer and the B2C marketplace in the reselling mode can be modeled using backward induction approach are as follows

$$\text{Stage 1}: max_{\{\theta,w\}}\Pi_M^R = wq - \kappa\frac{\theta^2}{2} \tag{1}$$

$$\text{Stage 2}: \underset{q}{max}\Pi_B^R = rE[\min\{q, D(\theta)\}] - wq \tag{2}$$

Proposition 1. The optimal decisions $(w^{R*}, \theta^{R*}, q^{R*})$ and individual profits (Π_M^{R*}, Π_B^{R*}) in the reselling mode are as follows

(1) If $\rho < \widehat{\rho}$, then $w^{R*} = r(1-\rho)$, $\theta^{R*} = \frac{\eta}{\kappa}r(1-\rho)$, $q^{R*} = a + \frac{r\eta^2(1-\rho)}{\kappa}$, $\Pi_M^{R*} = r(1-\rho)\left(a + \frac{r\eta^2(1-\rho)}{2\kappa}\right)$, *and* $\Pi_B^{R*} = ar\rho$.

(2) If $\rho > \widehat{\rho}$, then $w^{R*} = r$, $\theta^{R*} = 0$, $q^{R*} = a$, $\Pi_M^{R*} = ra$, *and* $\Pi_B^{R*} = 0$.

Where $\widehat{\rho} = 1 + \frac{a\kappa}{r\eta^2} - \sqrt{\left(1 + \frac{a\kappa}{r\eta^2}\right)^2 - 1}$.

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026

Table 1. List of notations

Notation	Description
Superscript/subscript	
M, B	Subscripts to identify the parties: $M =$ manufacturer and $B =$ B2C marketplace
$j \in \{R, A, RG, AG\}$	The superscript $j = R, A, RG, AG$ corresponds to reselling mode, agency mode, green marketing in the reselling mode, and green marketing in the agency mode, respectively
*	Superscript for optimality
Objective function	
Π	The expected profit
Decision variables	
θ	Green level set by the manufacturer
e	Green marketing effort level decided by the B2C marketplace
w	The wholesale price decided by the manufacturer
q	The product quantity decided by either the manufacturer or the B2C marketplace depending on the sales mode adopted
Exogenous parameters	
γ	The referral fee
ρ	The level of *GPI* uncertainty
c	Unit cost of production (normalized to zero)
r	Retail price
η	Green elasticity of demand
ω	The marketing effect on *GPI* uncertainty reduction
κ	The marginal cost coefficient of *GPI*.
a	The base market size

Source(s): The authors

Proposition 1 analyzes the equilibrium outcomes in the reselling mode in terms of the *GPI* uncertainty. Specifically, when *GPI* uncertainty is sufficiently high to satisfy $\rho > \widehat{\rho}$, the manufacturer does not invest in green initiatives and increases the wholesale price to match the selling price. In this case, the manufacturer extracts all the supply chain profits while the B2C marketplace obtains zero profit. Conversely, when *GPI* uncertainty is relatively low ($\rho < \widehat{\rho}$), the manufacturer invests in *GPI* and incentivizes the B2C marketplace to order more by lowering the wholesale price. This strategy allows both the manufacturer and the B2C marketplace to achieve positive profits.

4.2 Agency mode

In this mode, the manufacturer simultaneously decides a product quantity q directly selling to the consumers and a level of greenness θ to maximize his profit. The profit functions of the manufacturer and the B2C marketplace can be can be formulated as follows, respectively

$$\Pi_M^A = (1-\gamma)rE[\min\{q, D(\theta)\}] - \kappa\frac{\theta^2}{2}. \tag{3}$$

$$\Pi_B^A = \gamma rE[\min\{q, D(\theta)\}] \tag{4}$$

Proposition 2. In the agency mode, the optimal GPI level, product quantity, and profits of the manufacturer and B2C marketplace are as follows

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026

$$\theta^{A*} = \frac{r\eta}{\kappa}(1-\rho)(1-\gamma), q^{A*} = a + \frac{r\eta^2}{\kappa}(1-\rho)(1-\gamma), \Pi_M^{A*} = (1-\gamma)r\left(a + \frac{r\eta^2}{2\kappa}(1-\rho)^2(1-\gamma)\right), \text{and } \Pi_B^{A*} = \gamma\, r\left(a + \frac{r\eta^2}{\kappa}(1-\rho)^2(1-\gamma)\right).$$

According to Proposition 2 the manufacturer always benefits from investing in *GPI* with the agency mode. This contrasts with the reselling mode, where the manufacturer invests in *GPI* only when uncertainty is low.

4.3 Green product investment and sales mode selection

In this subsection, the equilibrium results between the reselling mode and the agency mode are compared. To further illustrate the comparative results, figures are occasionally provided with the following hypothetical parameters $a = 10, \gamma = 0.2, r = 10, \kappa = 0.1, \eta = 0.6, \rho = 0.5$, and $\omega = 0.05$, unless otherwise mentioned.

Proposition 3. The comparative results of green levels between two sales modes, reselling and agency, are provided as follows

(1) If $0 < \rho < \widehat{\rho}$, then $0 < \theta^{A*} < \theta^{R*}$.

(2) If $\widehat{\rho} < \rho < 1$, then $\theta^{A*} > \theta^{R*} = 0$.

Proposition 3 highlights the impact of the choice of a sales mode on the manufacturer's optimal green level. When the *GPI* uncertainty is lower than a certain threshold (i.e. $\rho < \widehat{\rho}$), the reselling mode offers a stronger incentive for the manufacturer to increase his investment in green initiatives. Conversely, when the *GPI* uncertainty is high (i.e. $\rho > \widehat{\rho}$), the agency mode becomes more effective in driving *GPI*. This finding suggests that the agency mode is better at promoting green manufacturing within supply chains when the risk associated with *GPI* is high.

The next proposition illustrates the comparative results on profits. For ease of exposition, we introduce the following thresholds for the referral fee parameter as follows

$$\widehat{\gamma}_1 = 1 + \frac{a\kappa}{r\eta^2(1-\rho)^2} - \sqrt{\left(1 + \frac{a\kappa}{r\eta^2(1-\rho)^2}\right)^2 - \frac{2a\kappa\rho}{r\eta^2(1-\rho)^2}},$$

$$\widehat{\gamma}_2 = 1 + \frac{a\kappa}{r\eta^2(1-\rho)^2} - \sqrt{\left(1 + \frac{a\kappa}{r\eta^2(1-\rho)^2}\right)^2 - 1}, \text{ and}$$

$$\widehat{\gamma}_3 = \frac{1}{2}\left(1 + \frac{a\kappa}{r\eta^2(1-\rho)^2} - \sqrt{\left(1 + \frac{a\kappa}{r\eta^2(1-\rho)^2}\right)^2 - \frac{4a\kappa\rho}{r\eta^2(1-\rho)^2}}\right).$$

Proposition 4. The comparative results for the profits of the manufacturer and the B2C marketplace between two sales modes, reselling and agency, are given as follows

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026

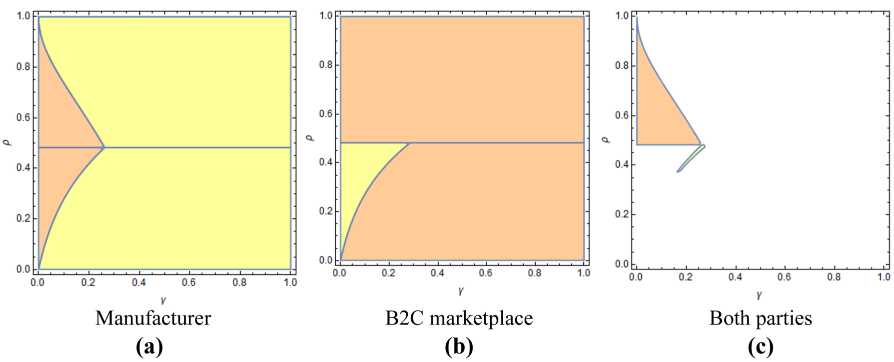
(1) *If* $\{0 < \rho < \widehat{\rho}\, and\, 0 < \gamma < \widehat{\gamma}_1\}$ *or* $\{\widehat{\rho} < \rho < 1\, and\, 0 < \gamma < \widehat{\gamma}_2\}$, *then* $\Pi_M^{A*} > \Pi_M^{R*}$; *otherwise, that is* $\{0 < \rho < \widehat{\rho}\, and\, \widehat{\gamma}_1 < \gamma < 1\}$ *or* $\{\widehat{\rho} < \rho < 1\, and\, \widehat{\gamma}_2 < \gamma < 1\}$, $\Pi_M^{A*} < \Pi_M^{R*}$.

(2) If $0 < \rho < \widehat{\rho}\, and\, 0 < \gamma < \widehat{\gamma}_3$, then $\Pi_B^{A*} < \Pi_B^{R*}$, otherwise, that is $\widehat{\rho} < \rho < 1$ or $\{0 < \rho < \widehat{\rho}\, and\, \widehat{\gamma}_3 < \gamma < 1\}$, $\Pi_B^{A*} > \Pi_B^{R*}$.

(3) If $0 < \rho < \widehat{\rho}\, and\, \widehat{\gamma}_3 < \gamma < \widehat{\gamma}_1$, then $\Pi_M^{R*} > \Pi_M^{A*}$ and $\Pi_B^{R*} > \Pi_B^{A*}$.

(4) If $\widehat{\rho} < \rho < 1\, and\, 0 < \gamma < \widehat{\gamma}_2$, then $\Pi_M^{A*} > \Pi_M^{R*}$ and $\Pi_B^{A*} > \Pi_B^{R*}$.

Proposition 4 indicates that the profitability comparisons of the manufacturer and the B2C marketplace are affected by the referral fee and the level of uncertainty associated with *GPI*. Proposition 4 is graphically illustrated in Figure 2, showing the joint impact of γ and ρ on the preferred sales mode of each supply chain member. According to part (1) of Proposition 4, the manufacturer prefers the agency mode (reselling mode) when the referral fee is low (high). This result is consistent with Zennyo (2020) who claimed that the suppliers will choose the wholesale (agency) contract when the referral fee (i.e. royalty rate) is high (low). Proposition 4 (2) shows that B2C marketplace favors the reselling mode when both the *GPI* uncertainty and the referral fee are sufficiently low. In other scenarios, the agency mode, which brings higher profits to the B2C marketplace, is preferred. This result is quite intuitive: a low referral fee harms the B2C marketplace's revenue, while a high referral fee reduces market demand and ultimately lowers the B2C marketplace's profits. Interestingly, the B2C marketplace's preferred sales mode shifts from agency to reselling mode as *GPI* uncertainty increases and remains lower than the threshold $\widehat{\rho}$, as illustrated in Figure 2 (b). The reason can be that increasing *GPI* uncertainty lowers expected demand, negatively affecting the B2C marketplace's sales revenue in the agency mode. Figure 2(c) reveals that the sales mode preference of both parties depends on the interaction between the referral fee and the *GPI* uncertainty. There are some combinations of γ and ρ (i.e. the "yellow" region in Figure 2(c)) where both parties favor the reselling mode, and others (i.e. the "orange" region in Figure 2(c))



Note(s): The orange (yellow) area points to situations where decision-makers favor the agency (reselling) mode
Source(s): The authors

Figure 2. Preferred sales mode without marketing effort

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026

where both parties favor the agency mode. By observing that the "orange" region in Figure 2(c) shrinks as the *GPI* uncertainty increases, it can be concluded that increasing *GPI* uncertainty weakens agreement between the manufacturer and B2C marketplace on selection of agency mode. This provides an important insight that reducing uncertainty in green investments, especially when the level of uncertainty is high, can facilitate an agreement on selecting a sales mode between the two parties.

5. Supply chain performance with green marketing

5.1 Green marketing in the reselling mode

This strategy involves the following stages: *Stage 1*: the B2C marketplace decides a level of green marketing effort e. *Stage 2*: the manufacturer simultaneously determines a green level θ and a wholesale price w. *Stage 3:* the B2C marketplace decides an order quantity q.

The profit functions of both parties are formulated as follows

$$\Pi_M^{AG} = wq - \kappa\frac{\theta^2}{2} \tag{5}$$

$$\Pi_B^{AG} = rE[\min\{q, D(\theta)\}] - wq - e. \tag{6}$$

Proposition 5. In the reselling mode, the B2C marketplace's optimal marketing effort and the associated outcomes are characterized as follows

(1) When $\rho < \widehat{\rho}$ or when $\rho > \widehat{\rho}\, and\, \omega < \widehat{\omega}$, the B2C marketplace's optimal marketing effort is $e^{RG*} = 0$, and the associated outcomes are given by: $w^{RG*} = r(1-\rho)$, $\theta^{RG*} = \frac{\eta}{\kappa}r(1-\rho)$,
$q^{RG*} = a + \frac{r\eta^2(1-\rho)}{\kappa}$, $\Pi_M^{RG*} = r(1-\rho)\left(a + \frac{r\eta^2(1-\rho)}{2\kappa}\right)$, $and\, \Pi_B^{RG*} = ar\rho.$

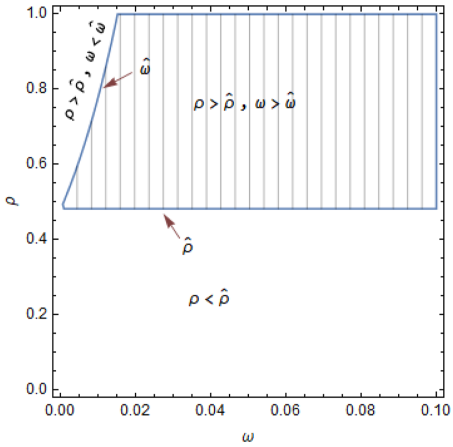
(2) When $\rho > \widehat{\rho}\, and\, \omega > \widehat{\omega}$, the B2C marketplace's optimal marketing effort is $e^{RG*} = \frac{1}{\omega}Ln\left[\frac{\rho}{\widehat{\rho}}\right]$, and the associated outcomes are given by: $w^{RG*} = r(1-\widehat{\rho})$, $\theta^{RG*} = \frac{\eta}{\kappa}r(1-\widehat{\rho})$, $q^{RG*} = a + \frac{r\eta^2(1-\widehat{\rho})}{\kappa}$, $\Pi_M^{RG*} = r(1-\widehat{\rho})\left(a + \frac{r\eta^2(1-\widehat{\rho})}{2\kappa}\right)$, $and\, \Pi_B^{RG*} = ar\widehat{\rho}.$

Where $\widehat{\rho}$ is defined in Proposition 1, and $\widehat{\omega} = \frac{1}{ar\widehat{\rho}}Ln\left[\frac{\rho}{\widehat{\rho}}\right]$.

Proposition 5 clarifies the conditions under which the B2C marketplace will choose to implement green marketing in the reselling mode. This proposition is graphically illustrated in Figure 3. Part (1) of Proposition 5 indicates that the B2C marketplace does not exert green marketing when the *GPI* uncertainty is low or when the *GPI* uncertainty is high and the marketing effect on *GPI* uncertainty reduction is low. In contrast, it is optimal for the B2C marketplace to implement green marketing when the *GPI* uncertainty and the marketing effect on *GPI* uncertainty reduction are high as shown by Part (2) of Proposition 5.

From Part (2) of Proposition 5, we know that the B2C marketplace is more willing to implement green marketing when the threshold $\widehat{\rho}$ decreases. Note that the threshold $\widehat{\rho}$ is determined by the parameters $a, \kappa,$ and η. Having observed that the derivatives $\frac{\partial\widehat{\rho}}{\partial a}$ and $\frac{\partial\widehat{\rho}}{\partial \kappa}$ are both

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026



Note(s): The vertical lines indicate situations where it is optimal for the B2C marketplace to implement marketing effort in the reselling mode, namely $e^{RG*} > 0$

Source(s): The authors

Figure 3. The joint impact of ρ and ω on the green marketing adoption in the reselling mode

negative, the derivative $\frac{\partial \widehat{\rho}}{\partial \eta}$ is positive, and illustrates that when the cost of *GPI* is expensive, the B2C marketplaces are less willing to undertake green marketing. In contrast, when consumers' preference for green products is stronger or when the base market size is larger, B2C marketplaces are more likely to undertake green marketing.

5.2 Green marketing in the agency mode

The profits of the manufacturer and the B2C marketplace are formulated as follows

$$\Pi_M^{AG} = (1-\gamma)rE[\min\{q, D(\theta)\}] - \kappa\frac{\theta^2}{2} \tag{7}$$

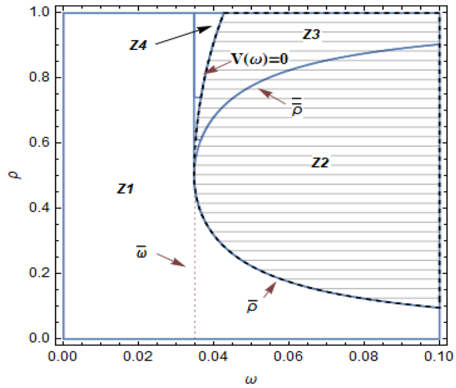
$$\Pi_B^{AG} = \gamma rE[\min\{q, D(\theta)\}] - e. \tag{8}$$

The following proposition highlights the circumstances under which the B2C marketplace chooses to exert (or not) green marketing in the agency mode. We introduce the following thresholds for the *GPI* uncertainty and marketing effect on *GPI* uncertainty reduction parameter: $\overline{\omega} = \frac{2\kappa}{r^2\eta^2(1-\gamma)\gamma}$, $\overline{\rho} = \frac{1}{2}\left(1 - \sqrt{\frac{1}{\omega}(\omega - \overline{\omega})}\right)$, *and* $\overline{\overline{\rho}} = \frac{1}{2}\left(1 + \sqrt{\frac{1}{\omega}(\omega - \overline{\omega})}\right)$.

Proposition 6. In the agency mode, the impact of green marketing effort on B2C marketplace's profit and the optimal level of green marketing effort e^{AG*} that maximizes the B2C marketplace's profit are as follows

(1) When $\{\omega \le \overline{\omega}\}$ *or* $\{0 < \rho < \overline{\rho}$ *and* $\omega > \overline{\omega}\}$ (i.e. region Z1 occurs in Figure 4), Π_B^{AG*} is decreasing in e, and $e^{AG*} = 0$,

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026



Note(s): This figure plots some zones labelled Z1, Z2, Z3, and Z4 identified by Proposition 6. The horizontal lines (including regions Z2 and Z3) indicate situations where it is optimal for the B2C marketplace to exert marketing effort in the agency mode, namely $e^{AG*} > 0$
Source(s): The authors

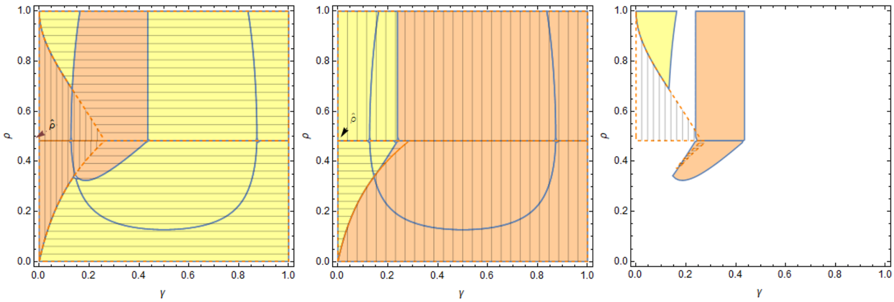
Figure 4. The joint impact of ρ and ω on the green marketing adoption in the agency mode

(2) When $\{\omega > \overline{\omega}\, and\, \overline{\rho} < \rho < \overline{\overline{\rho}}\}$ (i.e. region Z2 occurs in Figure 4), Π_B^{AG*} is strictly unimodal with respect to e, and $e^{AG*} = \frac{1}{\omega} Ln\left[\frac{2\rho}{1-\sqrt{\frac{1}{\omega}(\omega-\overline{\omega})}}\right]$.

(3) *When* $\{\omega > \overline{\omega}\, and\, \overline{\overline{\rho}} < \rho < 1\}$, Π_B^{AG*} *is non-unimodal with respect to e. Furthermore, if the function* $V(\omega,) = \gamma\left(\frac{r\eta^2(1-\rho \mathrm{Exp}[-e^*\omega])^2(1-\gamma)}{\kappa}\right) - e^* - \gamma\left(\frac{r\eta^2(1-\rho)^2(1-\gamma)}{\kappa}\right)$ *is positive, where* $e^* = \frac{1}{\omega} Ln\left[\frac{2\rho}{1-\sqrt{\frac{1}{\omega}(\omega-\overline{\omega})}}\right]$ *(i.e. region Z3 occurs in Figure 5),* $e^{AG*} = e^*$*, otherwise (i.e. region Z4 occurs in Figure 4),* $e^{AG*} = 0$.

Proposition 6 highlights the circumstances under which the B2C marketplace chooses to implement green marketing in the agency mode. This decision requires an investigation of four regions, denoted as Z1, Z2, Z3, and Z4, as graphically shown in Figure 4. In region Z1 where parameters satisfy $\{\omega < \overline{\omega}\}\, or\, \{0 < \rho < \overline{\rho}\, and\, \omega > \overline{\omega}\}$, the marketing effort effect is lower than a certain threshold $\overline{\omega}$ or when the *GPI* uncertainty is low and the marketing effort effect is high. Under these conditions, the B2C marketplace does not exert green marketing. In region Z2 where parameters satisfy $\{\omega > \overline{\omega}\, and\, \overline{\rho} < \rho < \overline{\overline{\rho}}\}$, the effect of green marketing is high and the *GPI* uncertainty is moderate. In this region, green marketing always benefits the B2C marketplace. In regions Z3 and Z4 where the marketing effort effect and the *GPI* uncertainty are both high, i.e. $\{\omega > \overline{\omega}\, and\, \overline{\overline{\rho}} < \rho < 1\}$, the B2C marketplace's profit obtained with marketing efforts may be either lower or higher than its profit without it. To make a final decision, the B2C marketplace must investigate the sign of the function $V(\omega)$, which measures the difference between the maximum profit with marketing efforts and the profit without it. If $V(\omega) > 0$, the B2C marketplace chooses to exert green marketing. Otherwise, in region Z4, where the parameters satisfy $\{\omega > \overline{\omega}\, and\, \overline{\overline{\rho}} < \rho < 1\, and\, V(\omega) < 0\}$, it is better for the B2C marketplace to choose not to undertake green marketing efforts.

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026



Note(s): The horizontal (vertical) lines highlight situations where decision-makers favor the agency mode (reselling mode) without green marketing efforts. The orange (yellow) area indicates situations where decision-makers prefer the agency mode (reselling mode) with green marketing efforts

Source(s): The authors

Figure 5. Preferences for sales mode with green marketing in $(\rho, \gamma) -$ space

5.3 Green marketing and sales mode selection

Figure 5 numerically illustrates the effects of green marketing effort on the comparison of individual profits between the two sales modes. In contrast to Figure 2, Figure 5 reveals an intriguing finding that both the referral fee and *GPI* uncertainty affect the profit comparison between the two sales models. Comparing Figure 2(a) and 5(a), the expanded "orange" region in Figure 5(a) when the uncertainty is high, and the referral fee is relatively high (i.e. the orange region with horizontal lines), indicates a shift in the manufacturer's preferred mode choice from the reselling mode to the agency mode due to marketing efforts. The rationale for this result can be explained as follows: an increase in the referral fee will increase the selling cost for the manufacturer using the agency mode, incentivizing them to switch to the reselling mode to sell their products. However, when *GPI* is highly uncertain, green marketing is more effective in enhancing market demand. Consequently, the manufacturer's profits from increased demand due to green marketing can offset the costs of selling on the B2C marketplace. This implies that when the B2C marketplace implements green marketing, the agency mode can yield higher profits for the manufacturer than the reselling mode, even if the referral fee is relatively high. This finding also suggests that the manufacturer should consider both the referral fee and *GPI* uncertainty when choosing an optimal sales mode, and B2C marketplaces can influence this decision by providing green marketing efforts. Comparing Figure 2(b) and 5(b), the larger "yellow" region in Figure 5(b) suggests that when the *GPI* uncertainty is high and the referral fee is low, the B2C marketplace's preferred sales mode shifts from agency to reselling. The reason can be that a low referral fee can be offset by the B2C marketplace's profit gains from increased demand due to green marketing effort. As a result, the "yellow" region in Figure 5(c) expands compared to Figure 2(c), signifying increased agreement within the reselling mode. In addition, the "orange" region in Figure 5(c) expands compared to Figure 2(c) when the *GPI* uncertainty is low, indicating that marketing efforts can increase agreement within agency mode with a low *GPI* uncertainty.

6. Conclusions and managerial implications

6.1 Results discussions

B2C marketplaces, as pivotal and impactful entities within the context of supply chains, serve to bridge the gap between manufacturers and consumers. Moreover, they are acutely aware of the

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026

necessity to align their supply chain operations with environmentally-conscious practices. Consequently, the B2C marketplace is confronted with the crucial decision of selecting a sales mode (reselling or agency) that can effectively reconcile the dual objectives of environmental sustainability and financial profitability. This study analyzed a green EC supply chain wherein a manufacturer implements green practices to create eco-friendly products, while a B2C marketplace uses green marketing to promote these products. A game-theoretic framework is employed to model the decision-making regarding the green level, marketing effort, and product quantity, given uncertainty about the effect of green product investment on increasing the market demand.

This study first focused on the impact of uncertainty surrounding green product investment on the greenness of supply chains and profits. The results showed that an increase in the uncertainty surrounding green product investment has a detrimental effect on the optimal green level and the profit of the manufacturer. Nevertheless, this uncertainty increases the optimal green marketing level, which not only incentivizes manufacturers to improve the green performance of their products, but also benefits all members of the supply chain. More importantly, our findings suggest that the adoption of green marketing by the B2C marketplace is contingent upon the choice between an agency mode and a reselling mode, particularly when the impact of green marketing on mitigating green product investment uncertainty is low. In particular, in both the agency and reselling modes, green marketing is profitable for the B2C marketplace when there is a high degree of uncertainty. However, when *GPI* uncertainty is low, green marketing confers benefits solely on the B2C marketplace in the agency mode.

Next, a comparison was conducted between the two sales modes with the objective of analyzing the preferences of both parties regarding their preferred sales mode. The results indicated that the optimal sales mode selection for both the B2C marketplace and the manufacturer depends on the interplay between the referral fee and the uncertainty associated with green product investment. In particular, when the referral fee is low and the *GPI* uncertainty is high, both the manufacturer and the B2C marketplace opt for the agency mode, as this results in a higher green level and profits. Nevertheless, an increase in green product investment uncertainty leads to a divergence of opinion, with manufacturer's preferred mode of operation changing from the agency mode to reselling mode as the *GPI* uncertainty increases. This highlights the potential conflict in sales mode selection that green product investment uncertainty creates for manufacturers and B2C marketplaces. Fortunately, our findings indicated that green marketing efforts can facilitate consensus on both the agency mode and the reselling mode, which is more flexible for all members of the supply chain. This underscores the vital importance of proactive green marketing strategies in not only enhancing overall supply chain profitability but also promoting positive environmental outcomes.

6.2 Managerial implications

This study investigated the interplay between green marketing efforts and sales mode selection in the context of varying levels of *GPI* uncertainty in decision-making within green supply chains. Its results provide valuable insights for manufacturers and B2C marketplaces implementing sustainable strategies.

Firstly, with the increase in *GPI* uncertainty, manufacturers tend to reduce their investments in green initiatives. However, B2C marketplaces can mitigate the uncertainty of *GPI* and encourage manufacturers to increase green investments by adopting green marketing efforts. Moreover, B2C marketplaces are well-positioned to provide flexible green marketing support for green products, whether sold directly or through third-party sellers, because green efforts benefit the B2C marketplace in both sales models. Nevertheless, it is essential the B2C marketplace considers its capacity to determine the referral fee to guarantee mutual benefits for all supply chain members. In circumstances where the referral fee is low and cannot be readily modified by the B2C marketplace due to significant external forces, it is recommended that the marketplace prioritize green marketing for products sold directly (reselling mode). Conversely, when the referral fee is relatively high, the optimal choice is to prioritize green

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026

marketing for products sold by third-party sellers (agency mode). This implication is derived from Figure 5, specifically the (yellow) area in the figure that demonstrates the reselling mode, whereby products are sold directly by the marketplace, results in higher profits for both the manufacturer and the B2C marketplace when the *GPI* is high and the referral fee is low. Conversely, the (orange) area illustrates the agency mode, where products are sold by third-party sellers, yields higher profits for both the manufacturer and the B2C marketplace when the *GPI* is high, and the referral fee is relatively high.

Secondly, when the uncertainty of *GPI* is low, manufacturers are more willing to invest in greening their products. To maximize the benefits of green marketing in such circumstances, B2C marketplaces should concentrate their green marketing efforts on manufacturers who sell their products via the agency mode. Moreover, B2C marketplaces have the potential to reduce the referral fee in order to ensure the profitability of manufacturers, thereby fostering ongoing investments in green innovations. In conclusion, aligning green marketing efforts and referral fee strategies with varying levels of *GPI* uncertainty allows B2C marketplaces to optimize benefits across the supply chain while advancing sustainable practices.

The findings of this study may also prompt further research in this area. The model can be extended by incorporating diverse environmental consumer preferences, which give rise to different degrees of uncertainty regarding the potential impact on demand and renders investment decision-making more complex. It would be beneficial in the future to investigate the possibility of the B2C marketplace offering or sharing the logistics costs with the supplier in the agency mode. This could be done with the aim of encouraging the supplier to invest further in green products and utilize this mode to a greater extent. Another promising avenue for further exploration would be to consider the case of different types of green product investments, such as low-carbon products, recycled materials, or second-hand products. In order to improve consumers' knowledge and purchase decisions, these require more personalized and adaptive marketing efforts.

References

Abhishek, V., Jerath, K. and Zhang, Z.J. (2016), "Agency selling or reselling? Channel structures in electronic retailing", *Management Science*, Vol. 62 No. 8, pp. 2259-2280, p. 8, doi: 10.1287/mnsc.2015.2230.

Aguilar, F.X. and Vlosky, R.P. (2007), "Consumer willingness to pay price premiums for environmentally certified wood products in the US", *Forest Policy and Economics*, Vol. 9 No. 8, pp. 1100-1112, doi: 10.1016/j.forpol.2006.12.001.

Baksi, S. and Bose, P. (2007), "Credence goods, efficient labelling policies, and regulatory enforcement", *Environmental and Resource Economics*, Vol. 37 No. 2, pp. 411-430, doi: 10.1007/s10640-006-9032-0.

Bergen, M., Dutta, S. and Walker, O.C. Jr, (1992), "Agency relationships in marketing: a review of the implications and applications of agency and related theories", *Journal of Marketing*, Vol. 56 No. 3, pp. 1-24, doi: 10.2307/1252293.

Chen, Z., Fan, Z.P. and Zhao, X. (2021), "Offering return-freight insurance or not: strategic analysis of an e-seller's decisions", *Omega*, Vol. 103, 102447, doi: 10.1016/j.omega.2021.102447.

Dangelico, R.M. and Vocalelli, D. (2017), "'Green Marketing': an analysis of definitions, strategy steps, and tools through a systematic review of the literature", *Journal of Cleaner Production*, Vol. 165, pp. 1263-1279, doi: 10.1016/j.jclepro.2017.07.184.

Dong, C., Liu, Q. and Shen, B. (2019), "To be or not to be green? Strategic investment for green product development in a supply chain", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 131, pp. 193-227, doi: 10.1016/j.tre.2019.09.010.

Du, S., Wang, L., Hu, L. and Zhu, Y. (2019), "Platform-led green advertising: promote the best or promote by performance", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 128, pp. 115-131, doi: 10.1016/j.tre.2019.05.019.

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026

Dyer, J.H. and Singh, H. (1998), "The relational view: cooperative strategy and sources of interorganizational competitive advantage", *Academy of Management Review*, Vol. 23 No. 4, pp. 660-679, doi: 10.5465/amr.1998.1255632.

Giri, B.C. and Sharma, S. (2014), "Manufacturer's pricing strategy in a two-level supply chain with competing retailers and advertising cost dependent demand", *Economic Modelling*, Vol. 38, pp. 102-111, doi: 10.1016/j.econmod.2013.11.005.

Grunert, K.G. (2011), "Sustainability in the food sector: a consumer behaviour perspective", *International Journal on Food System Dynamics*, Vol. 2 No. 3, pp. 207-218.

Guo, X., Cheng, L. and Liu, J. (2020), "Green supply chain contracts with eco-labels issued by the sales platform: profitability and environmental implications", *International Journal of Production Research*, Vol. 58 No. 5, pp. 1485-1504, doi: 10.1080/00207543.2019.1658911.

Hagiu, A. and Wright, J. (2015), "Marketplace or reseller?", *Management Science*, Vol. 61 No. 1, pp. 184-203, doi: 10.1287/mnsc.2014.2042.

Heifetz, A. (2012), *Game Theory: Interactive Strategies in Economics and Management*, Cambridge University Press, Cambridge.

Hong, Z. and Guo, X. (2019), "Green product supply chain contracts considering environmental responsibilities", *Omega*, Vol. 83, pp. 155-166, doi: 10.1016/j.omega.2018.02.010.

Ketelsen, M., Janssen, M. and Hamm, U. (2020), "Consumers' response to environmentally-friendly food packaging-A systematic review", *Journal of Cleaner Production*, Vol. 254, 120123, doi: 10.1016/j.jclepro.2020.120123.

Kumar, V. and Shah, D. (2004), "Building and sustaining profitable customer loyalty for the 21st century", *Journal of Retailing*, Vol. 80 No. 4, pp. 317-330, doi: 10.1016/j.jretai.2004.10.007.

Li, G., Li, L. and Sun, J. (2019), "Pricing and service effort strategy in a dual-channel supply chain with showrooming effect", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 126, pp. 32-48, doi: 10.1016/j.tre.2019.03.019.

Li, G., Wu, H., Sethi, S.P. and Zhang, X. (2021), "Contracting green product supply chains considering marketing efforts in the circular economy era", *International Journal of Production Economics*, Vol. 234, 108041, doi: 10.1016/j.ijpe.2021.108041.

Li, D., Zhang, Z. and Xu, R. (2024), "The impact of environmental regulation on green image management of supply chain: evidence from China", *Finance Research Letters*, Vol. 74, 106723, doi: 10.1016/j.frl.2024.106723.

Liu, H., Kim, S.J., Wang, H. and Kim, K.H. (2020), "Corporate sustainability management under market uncertainty", *Asia Pacific Journal of Marketing and Logistics*, Vol. 32 No. 5, pp. 1023-1037, doi: 10.1108/apjml-03-2019-0131.

Mishra, S. and Modi, S.B. (2016), "Corporate social responsibility and shareholder wealth: the role of marketing capability", *Journal of Marketing*, Vol. 80 No. 1, pp. 26-46, doi: 10.1509/jm.15.0013.

Ottman, J.A., Stafford, E.R. and Hartman, C.L. (2006), "Avoiding green marketing myopia: ways to improve consumer appeal for environmentally preferable products", *Environment: Science and Policy for Sustainable Development*, Vol. 48 No. 5, pp. 22-36, doi: 10.3200/envt.48.5.22-36.

Paul, J., Modi, A. and Patel, J. (2016), "Predicting green product consumption using theory of planned behavior and reasoned action", *Journal of Retailing and Consumer Services*, Vol. 29, pp. 123-134, doi: 10.1016/j.jretconser.2015.11.006.

Rahbar, E. and Wahid, N.A. (2011), "Investigation of green marketing tools' effect on consumers' purchase behavior", *Business Strategy Series*, Vol. 12 No. 2, pp. 73-83, doi: 10.1108/17515631111114877.

Sarkis, J., Zhu, Q. and Lai, K.H. (2011), "An organizational theoretic review of green supply chain management literature", *International Journal of Production Economics*, Vol. 130 No. 1, pp. 1-15, doi: 10.1016/j.ijpe.2010.11.010.

Sheeran, P. and Webb, T.L. (2016), "The intention–behavior gap", *Social and Personality Psychology Compass*, Vol. 10 No. 9, pp. 503-518, doi: 10.1111/spc3.12265.

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026

Shi, J., Yang, D., Zheng, Z. and Zhu, Y. (2022), "Strategic investment for green product development and green marketing in a supply chain", *Journal of Cleaner Production*, Vol. 366, 132868, doi: 10.1016/j.jclepro.2022.132868.

Swami, S. and Shah, J. (2013), "Channel coordination in green supply chain management", *Journal of the Operational Research Society*, Vol. 64 No. 3, pp. 336-351, doi: 10.1057/jors.2012.44.

Taleizadeh, A.A., Sane-Zerang, E. and Choi, T.M. (2016), "The effect of marketing effort on dual-channel closed-loop supply chain systems", *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, Vol. 48 No. 2, pp. 265-276, doi: 10.1109/tsmc.2016.2594808.

Tseng, M.L., Islam, M.S., Karia, N., Fauzi, F.A. and Afrin, S. (2019), "A literature review on green supply chain management: trends and future challenges", *Resources, Conservation and Recycling*, Vol. 141, pp. 145-162, doi: 10.1016/j.resconrec.2018.10.009.

Vermeir, I. and Verbeke, W. (2006), "Impact of values, involvement and perceptions on consumer attitudes and intentions towards sustainable consumption", *Journal of Agricultural and Environmental Ethics*, Vol. 19 No. 2, pp. 169-194, doi: 10.1007/s10806-005-5485-3.

Wang, J., Yan, Y., Du, H. and Zhao, R. (2020), "The optimal sales format for green products considering downstream investment", *International Journal of Production Research*, Vol. 58 No. 4, pp. 1107-1126, doi: 10.1080/00207543.2019.1612963.

Wang, J., Gao, X. and Wang, Z. (2021), "Sustainable supply chain decisions under E-Commerce Platform Marketplace with competition", *Sustainability*, Vol. 13 No. 8, p. 4162, doi: 10.3390/su13084162.

Wei, S., Ang, T. and Jancenelle, V.E. (2018), "Willingness to pay more for green products: the interplay of consumer characteristics and customer participation", *Journal of Retailing and Consumer Services*, Vol. 45, pp. 230-238, doi: 10.1016/j.jretconser.2018.08.015.

Wu, S., Yao, X. and Wu, G. (2020), "Environmental investment decision of green supply chain considering the green uncertainty", *Complexity*, Vol. 2020 No. 1, pp. 8871901-8871913, doi: 10.1155/2020/8871901.

Xing, D. and Liu, T. (2012), "Sales effort free riding and coordination with price match and channel rebate", *European Journal of Operational Research*, Vol. 219 No. 2, pp. 264-271, doi: 10.1016/j.ejor.2011.11.029.

Xu, X., Guo, S., Cheng, T.C.E. and Du, P. (2023), "The choice between the agency and reselling modes considering green technology with the cap-and-trade scheme", *International Journal of Production Economics*, Vol. 260, 108839, doi: 10.1016/j.ijpe.2023.108839.

Younis, H., Sundarakani, B. and Vel, P. (2016), "The impact of implementing green supply chain management practices on corporate performance", *Competitiveness Review*, Vol. 26 No. 3, pp. 216-245, doi: 10.1108/cr-04-2015-0024.

Zennyo, Y. (2020), "Strategic contracting and hybrid use of agency and wholesale contracts in B2C marketplaces", *European Journal of Operational Research*, Vol. 281 No. 1, pp. 231-239, doi: 10.1016/j.ejor.2019.08.026.

Zhang, X., Jin, Y. and Shen, C. (2020), "Manufacturers' green investment in a competitive market with a common retailer", *Journal of Cleaner Production*, Vol. 276, 123164, doi: 10.1016/j.jclepro.2020.123164.

Zhang, C., Li, Y. and Ma, Y. (2021), "Direct selling, agent selling, or dual-format selling: electronic channel configuration considering channel competition and platform service", *Computers and Industrial Engineering*, Vol. 157, 107368, doi: 10.1016/j.cie.2021.107368.

Zhang, Z., Xu, H., Chen, K., Zhao, Y. and Liu, Z. (2023), "Channel mode selection for an e-platform supply chain in the presence of a secondary marketplace", *European Journal of Operational Research*, Vol. 305 No. 3, pp. 1215-1235, doi: 10.1016/j.ejor.2022.06.064.

Zhou, H. and Duan, Y. (2022), "Online channel structures for green products with reference greenness effect and consumer environmental awareness (CEA)", *Computers and Industrial Engineering*, Vol. 170, 108350, doi: 10.1016/j.cie.2022.108350.

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026

Appendix

Proof of Proposition 1

In the reselling mode without *GPI*, $\Pi_B^R(q) = ra - wq$. The optimal decision and profits are $w^* = r, q^* = a$, $\Pi_M^{R*} = ra$ and $\Pi_B^{R*} = 0$. With *GPI*, given w and θ, the B2C marketplace chooses a quantity q to maximize $\Pi_B^R(q) = rE[\min\{q, D\}] - wq = r(a\rho + (1-\rho)q) - wq$. The first-order derivative of $\Pi_B^R(q)$ with respect to q is $\frac{\partial \Pi_B^R(q)}{\partial q} = r(1-\rho) - w$. Therefore, the manufacturer is better to set a wholesale price satisfying $w \le r(1-\rho)$. If this condition is met, $\Pi_B^R(q)$ is increasing in q. The B2C marketplace places an order $q^*(\theta) = a(1+\eta\theta)$. Substituting $q^*(\theta)$ into the manufacturer's profit leads to $\Pi_M^R(w,\theta) = wq - \kappa\frac{\theta^2}{2} = wa(1+\eta\theta) - \frac{\kappa}{2}\theta^2$. For a given w, $\frac{\partial \Pi_M^R(\theta)}{\partial \theta} = w\eta - \theta\kappa$, and $\frac{\partial \Pi_M^R(\theta)}{\partial \theta^2} = -\kappa < 0$. The first order condition (FOC) yields $\theta^* = \frac{\eta}{\kappa}w$. Now, substituting $\theta^* = \frac{\eta}{\kappa}w$ into the manufacturer's profit, and taking the first-order derivative of manufacturer's profit with respect to the wholesale price, we have $\frac{\partial \Pi_M^R(w)}{\partial w} = a + \frac{w\eta^2}{\kappa}$. The manufacturer's profit is increasing in w and the optimal wholesale price is $w^* = r(1-\rho)$. It follows that $\theta^* = \frac{\eta}{\kappa}r(1-\rho)$, $\Pi_M^{R*} = r(1-\rho)\left(a + \frac{r\eta^2(1-\rho)}{2\kappa}\right)$ and $\Pi_B^{R*}(0) = ar\rho$. We next compare the optimal profit with *GPI* and that without *GPI*.

If $0 < \rho < 1 + \frac{a\kappa}{r\eta^2} - \sqrt{\left(1 + \frac{a\kappa}{r\eta^2}\right)^2 - 1} \equiv \widehat{\rho}$, then $r(1-\rho)\left(a + \frac{r\eta^2(1-\rho)}{2\kappa}\right) > ra$. Therefore, it is better for the manufacturer to make *GPI*, $\theta^* = \frac{\eta}{\kappa}r(1-\rho)$ and set a wholesale price $w^* = r(1-\rho)$. The resulting profits are $\Pi_M^{R*} = r(1-\rho)\left(a + \frac{r\eta^2(1-\rho)}{2\kappa}\right)$ and $\Pi_B^{R*} = ar\rho$. Otherwise, the manufacturer does not make *GPI*.

Proof of Proposition 2

In the agency mode without *GPI*, $\Pi_M^A(q) = (1-\gamma)rq$. This profit increases in q. The optimal decision and profits are $q^* = a$, $\Pi_M^{R*} = (1-\gamma)ra$ and $\Pi_B^{R*} = \gamma ra$. With *GPI*, $\Pi_M^A(q,\theta) = (1-\gamma)\ rE[\min\{q, D(\theta)\}] - \kappa\frac{\theta^2}{2} = (1-\gamma)r(a\rho + (1-\rho)q) - \kappa\frac{\theta^2}{2}$. Taking the first-order derivative of $\Pi_M^A(q,\theta)$ with respect to q, it yields $\frac{\partial \Pi_M^A(q,\theta)}{\partial q} = r(1-\rho)(1-\gamma) > 0$. Because $\Pi_M^A(q,\theta)$ increases in q, we obtain $q^* = a + \eta\theta$. Substituting q^* into $\Pi_M^A(q,\theta)$ leads to $\Pi_M^A(q^*,\theta) = (1-\gamma)r(a + (1-\rho)\eta\theta) - \kappa\frac{\theta^2}{2}$. Taking the first-order and second-order derivatives of $\Pi_M^A(q^*,\theta)$ with respect to θ, it yields $\frac{\partial \Pi_M^A(q^*,\theta)}{\partial \theta} = -\theta\kappa + r\eta(1-\rho)(1-\gamma)$, and $\frac{\partial^2 \Pi_M^A(q^*,\theta)}{\partial \theta^2} = -\kappa < 0$. Solving the FOC yields $\theta^* = \frac{r\eta(1-\rho)(1-\gamma)}{\kappa}$. It follows that $q^* = a + \eta\theta = a + \frac{r\eta^2}{\kappa}(1-\rho)(1-\gamma)$. By plugging q^* and θ^* into the profits of the manufacturer and the B2C marketplace, we obtain their respective optimal profits.

Proof of Proposition 3

Comparing the green levels between reselling mode and agency mode, we have:

If $0 < \rho < \widehat{\rho}$, $\theta^{R*} - \theta^{A*} = \frac{r\eta(1-\rho)}{\kappa} - \frac{r\eta(1-\rho)(1-\gamma)}{\kappa} = \gamma\frac{r\eta(1-\rho)}{\kappa} > 0$.

If $\widehat{\rho} < \rho < 1$, then $\theta^{R*} - \theta^{A*} = 0 - \frac{r\eta(1-\widehat{\rho})(1-\gamma)}{\kappa} < 0$

Proof of Proposition 4

Proposition 4 is obtained by solving the inequalities $\Pi_M^{R*} - \Pi_M^{A*} > 0$, and $\Pi_B^{R*} - \Pi_B^{A*} > 0$. The details have been omitted for brevity.

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026

Proof of Proposition 5

It is worth noting that the marketing effort does not change the form of the manufacturer's objective function. Thus, the manufacturer's optimal decisions are the same as presented in Proposition 1 except that the value ρ would change to $\rho_e = \rho\exp(-\omega e)$. Given a marketing effort e, the optimal decisions $\{w^*, \theta^*\}$ of the manufacturer are

$$\left\{w^*, \theta^*\right\} = \begin{cases} \left\{r(1-\rho_e), \dfrac{\eta}{\kappa} r(1-\rho_e)\right\} & if\ \rho_e < \widehat{\rho} \\ \{r, 0\} & if\ \rho_e \geq \widehat{\rho} \end{cases}$$

And the B2C marketplace's profit can be expanded as

$$\Pi_B^R(e) = \begin{cases} ar\rho_e - e & if\ \rho_e < \widehat{\rho} \Leftrightarrow if\ \rho < \widehat{\rho}\ or\ \rho > \widehat{\rho}\ and\ e > \dfrac{1}{\omega}\text{Log}\left[\dfrac{\rho}{\widehat{\rho}}\right] \\ -e & if\ \rho_e \geq \widehat{\rho} \Leftrightarrow if\ \rho > \widehat{\rho}\ and\ e \leq \dfrac{1}{\omega}\text{Log}\left[\dfrac{\rho}{\widehat{\rho}}\right] \end{cases}$$

By analyzing the impact of e on $\Pi_B^R(e)$, we obtain the results presented in the core text.

Proof of Proposition 6

By replacing $\rho_e = \rho exp(-e\omega)$ into the profit of the B2C marketplace obtained from Proposition 2, it yields $\Pi_B^{AG*} = \gamma r\left(a + \frac{r\eta^2(1-\rho exp(-e\omega))^2(1-\gamma)}{\kappa}\right) - e$. The FOC is $\frac{\partial \Pi_B^{AG*}}{\partial e} = \frac{2exp(-e\omega)r^2\eta^2\rho(1-exp(-e\omega)\rho)(1-\gamma)\gamma\omega}{\kappa} - 1$. Let $Y = exp(-e\omega)$ with $0 < Y \leq 1$. Then, there will be a one-to-one mapping and a negative relationship between Y and e. The FOC can be rewritten as $\frac{\partial \Pi_B^{AG*}}{\partial e} = -\left(\frac{2r^2\eta^2\rho^2(1-\gamma)\gamma\omega}{\kappa}\right)Y^2 + \left(\frac{2r^2\eta^2\rho(1-\gamma)\gamma\omega}{\kappa}\right)Y - 1$. This is a quadratic equation in Y with the *discriminant* equal to $\frac{4p^4\eta^4\rho^2(1-\gamma)^2\gamma^2\omega}{\kappa^2}\left(\omega - \frac{2\kappa}{r^2\eta^2(1-\gamma)\gamma}\right)$. Considering finding the zeros of the FOC, we have the following situations:

(1) If $\left\{\omega < \frac{2\kappa}{r^2\eta^2(1-\gamma)\gamma} = \overline{\omega}\right\}$, the discriminant is negative. Hence, the FOC has no real roots. In addition, the coefficient of the quadratic term is negative. It follows that $\frac{\partial \Pi_B^{AG*}}{\partial e} < 0$ and Π_B^{AG*} *is decreasing in e.*

(2) If $\{\omega = \overline{\omega}\}$, the discriminant is zero, and the FOC has only one root, $Y = \frac{1}{2\rho}$. In this case the FOC is non-positive. It indicates that Π_B^{AG*} *is non-increasing in e.*

(3) If $\{\omega > \overline{\omega}\}$, the discriminant is positive, and the FOC has two roots: $Y_1 = \frac{1}{2\rho} - \frac{1}{2}\sqrt{1-\frac{\widetilde{\omega}}{\omega}}$; $Y_2 = \frac{1}{2\rho} + \frac{1}{2}\sqrt{1-\frac{\widetilde{\omega}}{\omega}}$.

+ When $1 < Y_1 < Y_2 \Leftrightarrow \{0 < \rho < \overline{\rho}\ and\ \omega > \overline{\omega}\}$, then the FOC has no real roots in the range (0,1), and Π_B^{AG*} *is decreasing in e.*

+ When $0 < Y_1 < 1 < Y_2 \Leftrightarrow \{\omega > \overline{\omega}\ and\ \overline{\rho} < \rho < \overline{\overline{\rho}}\}$, then the FOC has only one root in the range of (0,1). It indicates a change of sign for the FOC from negative to positive with an increase in Y (coresponding indicates a change of sign for the FOC from positive to negative with an increase in e). Therefore, Π_B^{AG*} *is non-unimodal with respect to e.* And, Π_B^{AG*} reaches its maximum at Y_1, that is $e^{AG*} = \frac{1}{\omega}Ln\left[\frac{2\rho}{1-\sqrt{\frac{1}{\omega}(\omega-\overline{\omega})}}\right]$.

+ When $0 < Y_1 < Y_2 < 1 \Leftrightarrow \{\omega > \overline{\omega}\ and\ \overline{\overline{\rho}} < \rho < 1\}$, the FOC has two roots in the range of (0,1). It indicates a change of sign for the FOC from negative to positive and then negative with an increase in Y (coresponding indicates a change of sign for the FOC is the same direction with an increase in e). This means that the larger of the two (Y_2) represents the minimum and the smaller (Y_1) represents the maximum

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026

of Π_B^{AG*}. Thus, Π_B^{AG*} *is non-unimodal with respect to e.* Solving for $Y_1 = exp(-e\omega)$, we get $e^{AG*} = \frac{1}{\omega}Ln\left[\frac{2\rho}{1-\sqrt{\frac{1}{\omega}(\omega-\overline{\omega})}}\right]$. The final decision of the B2C marketplace requires the investigation of the sign of function $V(\omega) = \Pi_B^{AG*}(e^{AG*}) - \Pi_B^{AG*}(0)$ which measures the difference between the maximum profit with green marketing $\Pi_B^{RG*}(e^{AG*})$ and profit without it $\Pi_B^{AG*}(0)$. Therefore, when parameters satisfy $\{\omega > \overline{\omega}\, and\, \overline{\overline{\rho}} < \rho < 1\, and\, V(\omega) > 0\}$, the B2C marketplace chooses to exert green marketing; otherwise, it will not undertake green marketing effort.

Corresponding author
Thi Le Hoa Vo can be contacted at: thi-le-hoa.vo@univ-rennes.fr

For instructions on how to order reprints of this article, please visit our website:
www.emeraldgrouppublishing.com/licensing/reprints.htm
Or contact us for further details: **permissions@emeraldinsight.com**

Downloaded from http://www.emerald.com/jts/article-pdf/13/1/44/9670693/jts-07-2024-0041.pdf by guest on 23 July 2026