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Reselling, consignment or In-Marketplace selling Mode? Competitive strategy for E-tailers to counteract online third-party marketplaces

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ABSTRACT

The increasing prevalence of online marketplaces has induced many suppliers to sell directly on them, which causes potential threats to small- and medium-sized e-tailers. Considering e-tailers' broader question of how best to counteract these marketplaces, we consider three of online sales modes, namely, the traditional, consignment, and in-marketplace selling modes. In particular, we investigate the interaction between a supplier's strategy for introducing a marketplace channel and an e-tailer's choice of selling mode. Our analysis reveals that the e-tailer's selling mode choice depends not only on the performance of both the supplier and the marketplace but also channel competition. In general, the e-tailer prefers the in-marketplace selling mode with a higher marketplace service level and the consignment mode with higher supplier selling efficiency. If a marketplace channel exists, traditional reselling is a better choice when both the marketplace service level and the supplier selling efficiency are restricted to the middle range. The underlying mechanism is that traditional reselling is less negatively affected by the competition effect. Finally, we find that the supplier wants to eschew the marketplace channel and strategically induce the e-tailer to sell through it even though the marketplace service level is relatively high. This research provides guidance not only for the supplier's channel choice but also for the small- and medium-sized e-tailers' choice of selling mode when encountering the online marketplace.

1. Introduction

Online retailing has grown rapidly in recent decades, and online marketplaces (marketplaces, hereafter) play a critical role. As of June 2022, Amazon accounted for 37.8 percent of the U.S. e-commerce market, making it by far the leading online retailer in the country¹. A survey in China shows that in the second quarter of 2022, Tmall and JD.com, two online marketplaces in China, accounted

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¹ <https://www.statista.com/statistics/274255/market-share-of-the-leading-retailers-in-us-e-commerce/>.

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for 94.1% of total online retail sales. However, the market shares of other small- and medium-sized e-tailers amount to only 5.9%². The increasing prevalence of marketplaces benefits in-marketplace shops in two ways. First, due to the large market share of marketplaces, shops in these marketplaces can take advantage of their consumer base. For example, GOME, a home appliance e-tailer in China, has greatly expanded its potential online consumer base since entering Amazon³ and Tmall, which we refer to as the *market expansion effect*. In addition, with the rapid development of marketplaces, more high-quality services are being provided for in-marketplace shops. These services include but are not limited to promotion (Yang et al., 2006), return services (Yan et al., 2018), and logistics (Qin et al., 2021). For example, the safe return policies and fast delivery of Amazon have helped it effectively attract consumers and charge higher sales prices. JD.com has built its own logistics system and offers high-quality logistics services, such as “211-limited-time delivery”, which makes it possible for the shops to demand a price premium on the goods sold via its system. In this paper, we refer to the price premium due to the marketplace’s superior service as the *service premium effect*.

The advantages of the market expansion and service premium effects have led many suppliers to enthusiastically embrace the marketplace channel. In 2022, some suppliers of international high-end brands, such as Porsche, LVMH and Gucci, launched flagship shops on Tmall to directly reach their consumers. However, some suppliers, such as book and record suppliers, have not introduced the marketplace channel. A survey shows that 100% of the surveyed manufacturing firms expressed a willingness to embrace the marketplace, but only 37.05% of them had introduced a marketplace channel⁴. The reason for this can be attributed to suppliers’ distance from the end market and lack of experience in collecting market information, marketing planning, and aftersales management. Even so, many consumers prefer to purchase from suppliers’ online stores over e-tailers. The reason can be attributed to their concerns about product freshness and genuine security, which can be guaranteed in factory-direct sales if the supplier is expert in direct selling. As a result, sales efficiency has become a key factor for suppliers to consider when entering online marketplaces.

The emergence of the marketplace has also posed a potential threat to small- and medium-sized e-tailers, such as BestBuy, Sephora, DangDang.com, and Suning.com, which specialize in certain kinds of products and are known only to some consumers. A manager of Suning.com said, “To get more customers, we even have to join in Tmall as a reseller. However, there is another problem. Some suppliers, such as Apple, not only sell to Suning but also sell directly on Tmall by themselves. Fierce competition may be induced since we sell the same product.” Some small- and medium-sized e-tailers have shuttered their flagship stores in online marketplaces. For example, ZOZOTOWN, the largest clothing e-tailer in Japan, abandoned its online business on Tmall due to fierce competition. ZOZOTOWN opened its Tmall flagship in 2020 and closed it only one year and three months later. As a result, a question naturally arises regarding what strategies small- and medium-sized e-tailers should adopt to compete with online marketplaces. To counteract the encroachment of online marketplaces, small- and medium-sized e-tailers have attempted to find an appropriate selling mode. For example, DangDang.com offers a platform through which home appliance suppliers can sell products to the consumers directly and charges the suppliers a referral fee. We refer to this as the *consignment selling mode*. Incidentally, traditional reselling prevails as the main selling format for e-tailers (Jeffers and Nault, 2011). Sephora, a French beauty brand, launched a website through which it resells goods purchased from suppliers and has maintained the top spot in terms of beauty sales among e-tailers. However, Sephora joined Kohl’s in 2021, which we refer to as the *in-marketplace selling mode*. Indeed, by joining Kohl’s, Sephora can enjoy more platform services and obtain a larger consumer base, but such advantages come at the cost of intensified competition with suppliers that directly sell to consumers⁵.

Although scholars have begun to address the issue of e-tailers’ choice of selling mode, research in this area has mainly focused on the tradeoff between reselling and consignment (Abhishek et al., 2016; Hagi and Wright, 2015). Given the varied channel strategies recently employed by e-tailers, there is a notable gap in terms of understanding the relative effectiveness and limitations of these strategies. These observations motivate this research, the aim of which is to respond to the following general questions:

- 1) What is the supplier’s channel strategy concerning whether to introduce the marketplace channel?
- 2) Which selling mode—reselling, consignment, or in-marketplace—should small- and medium-sized e-tailers adopt to counteract the leading marketplace?
- 3) What is the interaction between the supplier’s channel strategy and the e-tailer’s selling mode choice?

We address the above questions by analyzing a Stackelberg game model in which consumer utility depends on not only the supplier’s selling efficiency (Yan et al., 2018) but also the service level of the marketplace. This study focuses on the various factors that affect the e-tailer’s choice of selling mode considering online competition. We analyze the impacts of sales efficiency and service level on the profitability of both the supplier and the e-tailer across three modes: (a) the traditional reselling mode, in which the e-tailer purchases the product from the supplier at a wholesale price and in turn sells it to consumers at a retail price; (b) the consignment selling mode, in which the supplier determines the retail price and delivery quantity, while the e-tailer charges a referral fee to the supplier; and (c) the in-marketplace selling mode, where the e-tailer, which acts as a reseller, sells goods through the marketplace and pays the marketplace owner a referral fee. If the supplier introduces the marketplace channel, then there exist two types of competition in both the traditional reselling and in-marketplace selling modes, namely, vertical and horizontal competition (Zhen and Xu, 2021).

² <https://www.analysys.cn/article/detail/20020654>.

³ <https://www.reuters.com/article/us-gome-amazon-com-marketplace-idUSKCN0XJ174>.

⁴ <https://i.dell.com/sites/doccontent/corporate/secure/zh/Documents/eCommerce-data-sheet.pdf>.

⁵ <https://investors.kohls.com/news-releases/news-details/2022/Kohls-and-Sephora-Announce-Planned-Expansion-of-Sephora-Presence-to-All-Kohls-Stores/default.aspx>.

Vertical competition refers to the game between the supplier and the e-tailer at the wholesale level regarding the wholesale price, which always intensifies the double-marginalization problem. Horizontal competition refers to the competition between the supplier's marketplace channel and the e-tailer's sales channel at the retail level, which has a direct impact on the demands in different channels. Clearly, there is no vertical competition in the consignment selling mode because the supplier directly determines the retail price. Moreover, if the supplier chooses not to introduce the marketplace channel, then it sells only through the e-tailer's channel, and horizontal competition is thus avoided.

Our study yields several important findings. First, the e-tailer should identify channel members' performance and consider the competition effect when deciding on selling modes. In general, the e-tailer prefers the consignment selling mode when the value-added service in the marketplace is poor or when the supplier is a retailing expert, through which the e-tailer can exploit the supplier's sales efficiency and vertical competition can be avoided. This explains why Apple directly sells its products on BestBuy, where BestBuy exploits Apple's sales efficiency. This result stems from the e-tailer's tradeoff between a higher service premium and more intense vertical competition. With a high marketplace service level, the e-tailer's profit is higher in the marketplace channel than in the reseller channel, which explains why Sephora joined Kohl's in 2021, although the former had launched its own website and app. Second, the e-tailer's preference for the traditional reselling mode closely depends on the supplier's channel strategy. If the supplier introduces the direct channel, then the e-tailer has to balance the horizontal and vertical competition with the supplier. Interestingly, we show that there exists a *waterbed effect* such that the supplier always balances the competition with the e-tailer by manipulating the wholesale price in case *IR*. As a result, the e-tailer sells in the traditional way when the performance levels of both the supplier and the marketplace are in moderate ranges, where it can induce the least competition with the supplier. For example, some small and unpopular appliance suppliers cooperate with Guomei.com to sell their products. Third, whether the supplier introduces the marketplace channel is related to the e-tailer's market share. When the e-tailer has a small market share, the supplier always has the incentive to introduce the marketplace channel. In contrast, if the e-tailer covers a large part of the end market, then horizontal channel competition may take place in a wider range. Specifically, when both the marketplace service level and the supplier sales efficiency are low, the supplier should not introduce the marketplace channel and counteract the traditional channel. This finding also offers a theoretical explanation for why some small- and medium-sized suppliers, such as book and record suppliers, do not introduce the marketplace channel. Interestingly, if the marketplace service level is relatively high, then the supplier also eschews the marketplace channel and strategically induces the e-tailer to sell through it (case *NM*).

This paper makes several novel contributions to the extant literature on supply chain channel strategy. First, although some studies have focused on the e-tailer's selling mode choice ([Abhishek et al., 2016](#); [Hagiu and Wright, 2015](#); [Zhang and Zhang, 2020](#); [Zhang and Hou, 2021](#)), they focus on studying the e-tailer's preference for consignment selling or reselling considering different influencing factors. We proceed one step further and examine a third selling mode, i.e., the in-marketplace selling mode, in which the e-tailer and the supplier both settle on the e-marketplace and increase sales with the help of marketplace services. Therefore, we analyze the mode where the e-tailer and supplier compete within the same channel. Second, in contrast to a number of papers on the supplier's strategy for introducing its own direct e-channel ([Cui, 2019](#); [Guan et al., 2019](#); [Ha et al., 2015](#); [Huang et al., 2018](#)), the issue of introducing the marketplace channel has received only scant attention ([Chen et al., 2020a](#); [Yan et al., 2019](#); [Zhen and Xu, 2021](#)). Building on [Zhen and Xu \(2021\)](#), our work contributes directly to the discourse on the interaction between the supplier's marketplace channel introduction strategy and the e-tailer's selling mode choice. Third, we add to the emerging stream of research on the consignment contract ([Cachon and Lariviere, 2005](#); [Giannoccaro and Pontrandolfo, 2004](#); [Linh and Hong, 2009](#); [Zhang et al., 2019](#)) by showing that the e-tailer can always maximize its profit while coordinating the system by using the consignment contract in the new competitive market structure, in which the supplier has the option of selling directly to consumers through the marketplace, a consignment e-tailer, or both.

2. Literature review

The following three streams of research can be found in relation to our work: the supplier's channel selection, e-tailer's selling mode choice, and consignment contract design in the multichannel supply chain.

During the last three decades, distribution channel selection has been widely investigated and viewed as a key marketing strategy for suppliers. Most early studies focused on the supplier's (manufacturer's) strategy regarding the introduction of its own direct e-channel in different research contexts, such as quality control ([Cui, 2019](#); [Guan et al., 2019](#); [Ha et al., 2015](#)), advertisement ([Zhang et al., 2020](#)), externality ([Pun, 2013](#)), information asymmetry ([Huang et al., 2018](#); [Li et al., 2015](#); [Li et al., 2014](#)), and green supply chains ([Li et al., 2021a](#); [Li et al., 2021b](#)). With the emergence of the virtual marketplace, a few studies have begun to investigate the supplier's strategy for introducing the marketplace channel. A key problem is whether and under what conditions should the supplier introduce the marketplace channel and the impact if it does. [Yan et al. \(2018\)](#) investigated how the effect of online spillover, platform fees, and the manufacturer's sales inefficiency influence the manufacturer's attitudes toward the introduction of the marketplace channel. They found that with a higher level of online spillover, a lower platform fee, and lower retailing inefficiency, the manufacturer has more motivation to introduce the marketplace channel, which may reduce the e-tailer's profit when the spillover factor is sufficiently high. Further studying the situation under information asymmetry, [Yan et al. \(2019\)](#) suggested that the manufacturer introduces the marketplace channel when sales inefficiency is low or high, which can benefit not only the manufacturer but also the e-tailer. Moreover, they found that the introduction of the marketplace channel results in increased output, lower wholesale prices, and lower retail prices, all of which benefit the supply chain system. Motivated by [Yan et al. \(2018\)](#), [Zhang et al. \(2021\)](#) also take the cross-channel effect into consideration. They show that when the channel competition is either large or small, the manufacturer prefers to add a reselling channel to the marketplace channel; otherwise, it prefers to sell exclusively through the marketplace channel. [Xu et al. \(2021\)](#) extend the work of [Yan et al. \(2018\)](#) to explore the manufacturer's channel introduction strategy under regional carbon cap-

and-trade regulation. They show that the manufacturer can always be better off by adding a reselling channel to the marketplace channel. However, it is not beneficial for the manufacturer if it additionally introduces a marketplace channel to the reselling channel if the commission rate is low and the order-fulfillment cost is high. Motivated by the results of Yan et al. (2018), Chen et al. (2020a) focused on finding the conditions under which channel members can reach agreement on introducing the marketplace channel. They found that the manufacturer prefers to introduce the marketplace when acting as a leader, which also benefits the e-tailer if it moves later or simultaneously with the manufacturer. However, when the chain members become more risk averse, they are reluctant to introduce the marketplace. Based on Yan et al. (2018) and Chen et al. (2020a), Zhen and Xu (2021) investigated who (the manufacturer or e-tailer) should introduce the marketplace channel under two scenarios where the manufacturer could choose to match the e-tailer's price in the marketplace channel (the UP strategy) or charge a different price (the DP strategy). They showed that when the channel competition and platform fee are low, introducing the marketplace channel is optimal for both chain members under the UP strategy. However, under this strategy, the introduction of the marketplace channel by the manufacturer negatively affects the e-tailer. The results demonstrate the interplay between the manufacturer's pricing strategy and the channel members' marketplace channel introduction strategies. Different from Zhen and Xu (2021), we investigate the interaction between the supplier's marketplace channel introduction strategy and the e-tailer's selling mode choice, where the e-tailer can choose to sell in either the consignment selling mode or the reselling mode.

This research is also pertinent to a vast literature about the e-tailer's choice between the consignment selling and reselling modes. Abhishek et al. (2016) developed a theoretical model to respond to a critical question concerning the cross-channel effect and what selling mode the e-tailer should adopt. They found that when there is negative spillover between the online and offline channels, the e-tailer prefers agency selling; otherwise, it prefers reselling. Addressing a similar issue, Hagi and Wright (2015) found that the preference between the marketplace and reseller modes depends on whether the independent supplier or e-tailer has more relevant knowledge on the best marketing activities for each given product. Motivated by the above two studies, research on selling mode choice has gradually emerged. To date, a number of papers have studied the e-tailer's preference for consignment selling or reselling considering different influencing factors. One stream of the literature focuses on the e-tailer's internal factors, such as private information (Zhang and Zhang, 2020), private brand advantage (Zhang and Hou, 2021), and sales efficiency (Wang et al., 2021). Another stream examines how external factors, such as online product reviews (Kwark et al., 2017), suppliers' product quality (Luo et al., 2022; Zhang et al., 2019), brand advantage (Zhang and Hou, 2021), customer loyalty (Chen et al., 2018), and external competition, influence the e-tailer's selling mode choice. External competition, including vertical competition from the upstream firm (Chen et al., 2018; Zhen and Xu, 2021) and horizontal competition from other channels (Abhishek et al., 2016; Chen et al., 2020b; Liu et al., 2022), has been widely studied and viewed as the main factor influencing the e-tailer's selling mode choice. The above studies find that with a higher referral fee (Zhen and Xu, 2021) or consumer loyalty (Chen et al., 2018), a higher wholesale price from the manufacturer is possible, which leads to fiercer vertical competition. Under such circumstances, the e-tailer prefers the consignment selling mode. However, scholars are inconsistent in their views about how horizontal competition influences the e-tailer's selling mode choice. While Abhishek et al. (2016) showed that increased horizontal competition induces the e-tailer to forgo its pricing power and adopt the consignment selling mode, Chen et al. (2020b) obtained the opposite result.

In the consignment selling mode, the e-tailer should further design the consignment contract, which is also related to our paper. While previous studies (Cachon and Lariviere, 2005; Giannoccaro and Pontrandolfo, 2004; Linh and Hong, 2009; Zhang et al., 2019) have demonstrated that revenue sharing contracts can coordinate a wholesale channel, Zhang et al. (2010) found that this may not be true for a consignment channel. To achieve full coordination, they proposed revenue sharing with a fixed fee (side payment) contract, which can also be customized to meet the needs of small, medium and large suppliers for additional retailer services. Based on the results of Zhang et al. (2010), many studies adopt this contract to coordinate different channel structures. Ryan et al. (2012) applied this consignment contract to coordinate a supply chain consisting of a marketplace firm and an e-tailer. The marketplace firm operates an online marketplace through which the e-tailer can choose to sell directly to consumers. Adida and Ratisoontorn (2011) extended the consignment contract to a supply chain with one supplier and two competitive retailers. Zhang et al. (2019) further examined two consignment contracts (the revenue sharing contract and the fixed fee contract) in a distribution channel consisting of a manufacturer and a marketplace firm. Different from the above literature, we study a supply chain consisting of one supplier, one e-tailer and one marketplace firm, where the supplier can choose to sell directly to consumers through the marketplace, the consignment e-tailer, or both. We find that by using the consignment contract, the e-tailer can always maximize its profit while coordinating the system.

If the small- and medium-sized e-tailer acts as a reseller, it can further choose to sell through its web store (traditional reselling) or through the marketplace (in-marketplace selling), which exhibit differences in terms of channel selection. While the traditional reselling mode has been widely investigated (Wu et al., 2022), the condition for the in-marketplace selling mode remains a topic of research. Ryan et al. (2012) analyzed the channel competition between a marketplace seller and a small- and medium- retailer. They found that small and medium sellers prefer to sell through their own channel or through the marketplace, but not both. Similar to Ryan et al. (2012), Hsiao and Chen (2014) also considered horizontal channel competition and showed that symmetric small and medium retailers may adopt different channel strategies as a stable market equilibrium. Mantin et al. (2014) provided a different insight into the marketplace role. They showed that by introducing the marketplace channel, small and medium-sized e-tailers create an "outside option" that improves their bargaining position when negotiating with the manufacturer.

Our work is most closely related to Shi et al. (2022). Both works study the e-tailer's selling mode choice and the supplier's channel strategy concerning whether to introduce the marketplace channel. However, our study differs from Shi et al. (2022) in the following three aspects. First, unlike their work, which focuses on large-sized e-tailers' operation issues, we shed light on small and medium-sized e-tailers' strategies. In particular, we examine how small and medium-sized e-tailers choose an appropriate selling mode to counteract the large-sized e-tailer (online marketplace). Second, while Shi et al. (2022) focused on the e-tailer's selling mode choice between the

reselling and consignment modes, we are motivated by practice and investigate small and medium-sized e-tailers' third option, i.e., the in-marketplace selling mode, whereby they can establish a flagship store in the marketplace in addition to their online stores. Third, in the consignment mode, Shi et al. (2022) assumed that the referral fee charged by the e-tailer is exogenously given. In this paper, we endogenize the referral fee to provide guidance on consignment contract design for small and medium-sized e-tailers. To the best of our knowledge, our work is the first to investigate three selling modes (i.e., the reselling mode, consignment selling mode and in-marketplace selling mode) in the context of horizontal competition between small and medium-sized e-tailers and a marketplace. Accordingly, we propose the optimal selling mode choice for the e-tailer when encountering competition from a marketplace.

3. Model description

3.1. Firms' strategies and market segments

Consider a supply chain comprising two decision makers, i.e., a supplier and a small or medium-sized e-tailer, both of which are risk neutral and profit maximizing. The supplier (she, denoted by the subscript s), acting as a leader, is currently selling her product to the end market through the e-tailer (he, denoted by the subscript r) at wholesale price w . Moreover, the supplier can also choose to pay the online marketplace and sell directly to consumers through her marketplace channel P . In exchange, the supplier needs to pay the marketplace a fixed fee k_p for participation and a referral fee, α_p , for every unit sold in this channel. We use the superscript $i \in \{I, N\}$ to denote the supplier's decision of whether to introduce the marketplace channel. Specifically, "I" represents the case where the supplier introduces the marketplace channel, and "N" represents the case where she does not.

The small or medium-sized e-tailer, as the follower, then decides the selling price in his reseller channel. As shown in Fig. 1, in addition to adopting traditional reselling and reselling through his own website (mode R), i.e., reseller channel r , the e-tailer has two other options: (1) he can offer the consignment contract by specifying a referral fee α'_c , as well as a fixed fee k'_c , and let the supplier directly sell through his consignment channel (channel c), which we refer to as the consignment selling mode, denoted as mode C . In line with Ryan et al. (2012), we assume that the supplier accepts the contract as long as her profit is nonnegative. (2) The e-tailer can join the marketplace and act as an intermediary by reselling the product purchased through the supplier to consumers, which we refer to as the in-marketplace selling mode, denoted as mode M . We denote this selling channel as the e-tailer's marketplace channel (channel m). For ease of exposition, we use the superscript $j \in \{R, C, M\}$ to capture the e-tailer's different sales mode choices and refer to the three kinds of channels mentioned above (i.e., channels r , c , and m) collectively as the e-tailer channel.

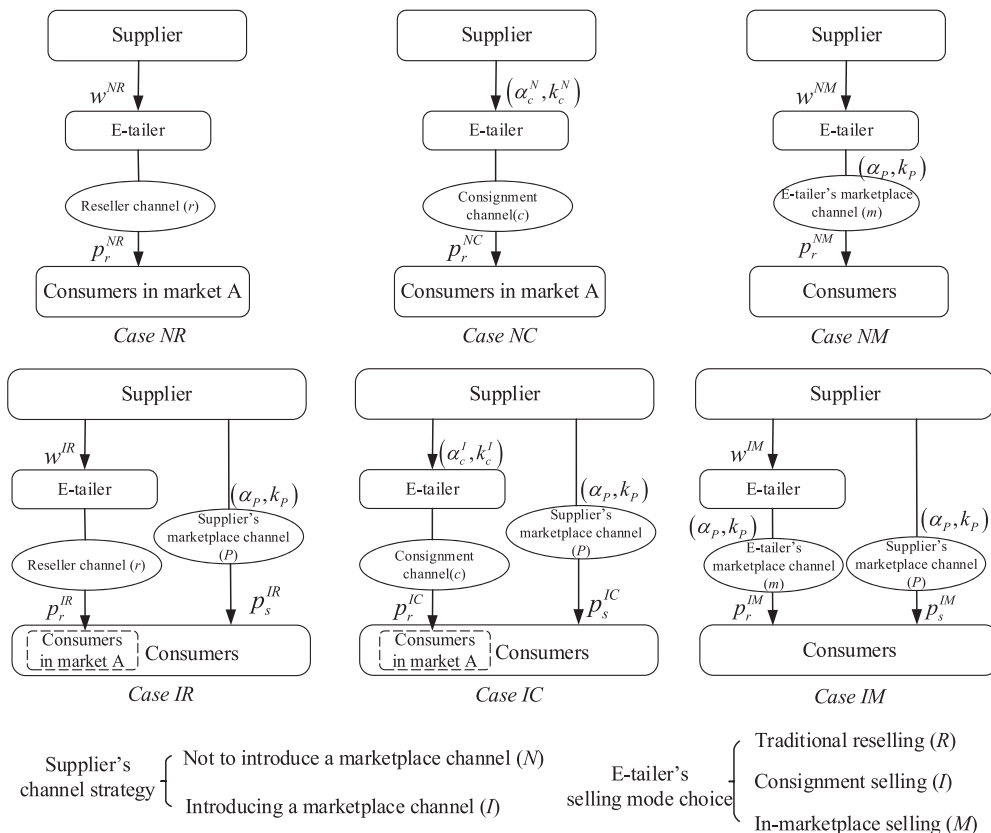


Fig. 1. Channel structures.

According to the above discussion, there are six possible outcomes arising from the different combinations of the supplier’s decision on the introduction of the marketplace channel (I, N) and the e-tailer’s sales mode choice (R, C , and M). We use a superscript combination to denote these cases. Specifically, cases NR, NC , and NM imply that the e-tailer adopts the traditional reselling, in-marketplace selling, and consignment modes, respectively, while the supplier does not introduce the marketplace channel. Cases IR, IC , and IM mean that the supplier chooses to introduce the marketplace channel. Under such circumstances, she offers products not only through the e-tailer channel (i.e., the reseller channel, the consignment channel, or the e-tailer’s marketplace channel) but also through her marketplace channel.

Due to name recognition and high visibility, we assume that all consumers are aware of the online marketplace. However, not all consumers are familiar with the e-tailer. Instead, ϕ denotes the proportion of consumers aware of both the e-tailer and the marketplace, and $1 - \phi$ represents the proportion aware only of the marketplace. For ease of exposition, the market mutually owned by the e-tailer and the marketplace is named market A, and the market exclusively owned by the marketplace is called market B (see Fig. 2). If, however, the e-tailer chooses to sell in the marketplace, then his visibility increases, and as a result, all consumers are familiar with the e-tailer (Ryan et al., 2012). Based on the above discussion, all customers are aware of the marketplace channel (specifically, the e-tailer’s or the supplier’s marketplace channel), while only a proportion, ϕ , of all customers know about the reseller channel and the consignment channel.

3.2. Consumer utility

Consumers are strategic and make purchasing decisions based on utility maximization. We express the consumer’s net utility as $U = V - p$ (Bernstein et al., 2009; Chiang et al., 2003), where p is the product’s selling price and V represents the consumer’s valuation of the product. Consumers choose only one product if their utility is nonnegative and do not choose the product if their utility is negative.

As a benchmark, we assume that the consumer’s valuation is $V = v$ for every unit purchased from the reseller channel. Let the variable V represent the consumption value (alternatively called the “willingness to pay”), which is heterogeneous and assumed to be uniformly distributed in the interval $[0,1]$ for analytic simplicity (Chiang et al., 2003). If consumers purchase the product directly sold by the supplier, then their valuation of the product is accompanied by a coefficient ρ , where $\rho > 0$. The value of the coefficient can be influenced by two effects. On the one hand, compared with the e-tailer, the supplier is more distant from the end consumers and lacks retailing experience (Yan et al., 2018). In this sense, the consumer purchasing from the supplier may suffer from a utility discount if the supplier is inefficient in direct selling. On the other hand, consumers can expect to obtain fresher and better guaranteed products from the producer. In particular, when the supplier is expert in direct selling, the consumer may obtain a valuation premium. Considering the above two effects, we use the coefficient ρ to capture the supplier’s efficiency (performance) in direct selling. The consumer’s valuation changes to $V = \rho v$ if purchasing from the consignment channel operated by the supplier. When $\rho \in [0, 1]$, the consumer will gain a lower reserved valuation from the consignment channel than that in the reseller channel (Yan et al., 2018).

If consumers purchase from the marketplace channel, they can expect to incur a valuation premium due to the value-added services provided by the marketplace, such as comprehensive logistics services, availability of transparent product information, and a convenient way to return the merchandise. Here, we use the premium factor to capture the marketplace service level. Consumers’ valuation increases to $V = \beta v$ if they purchase from the e-tailer’s flagship store in the marketplace (i.e., the e-tailer’s marketplace channel). Finally, the valuation gained from the product sold in the supplier’s marketplace channel is $V = \beta\rho v$ under the mutual effect of the marketplace and the supplier’s performance. In the following content, we assume that $\beta\rho > 1$, i.e., the consumer’s WTP for a unit in the supplier’s marketplace channel is higher than that in the reseller channel. This assumption indicates that the advantage of the marketplace service premium can compensate for the supplier’s sales inefficiency (if $0 < \rho < 1$). Otherwise, there is no need for the supplier to introduce the marketplace channel. According to the above discussion, we summarize the factors that affect the consumer’s valuation in different channels as follows:

- v = the consumer’s valuation of the supplier’s product sold in the reseller channel;
- ρv = the consumer’s valuation of the product sold in the consignment channel, $\rho > 0$;
- βv = the consumer’s valuation of the product sold in the e-tailer’s marketplace channel, $\beta > 1$; and.
- $\beta\rho v$ = the consumer’s valuation of the product sold in the supplier’s marketplace channel, $\beta\rho > 1$.

3.3. Sequence of events and decisions

In this section, we state the sequence of decisions in our model and depict it in Fig. 3. The first decision, i.e., whether to introduce the marketplace channel, is made by the supplier, and then the e-tailer chooses the selling mode. Note that compared to the e-tailer’s selling mode choice, it is a longer-term decision for the supplier to introduce the marketplace channel, which involves significant investment in inventory and logistics services. Hence, we set the supplier’s channel decision ahead of the e-tailer’s selling mode choice. Then, the sequence of subsequent events depends on the e-tailer’s selling mode choice. Specifically,

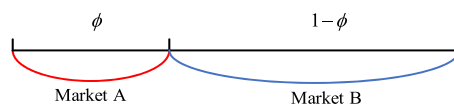


Fig. 2. Market segments.

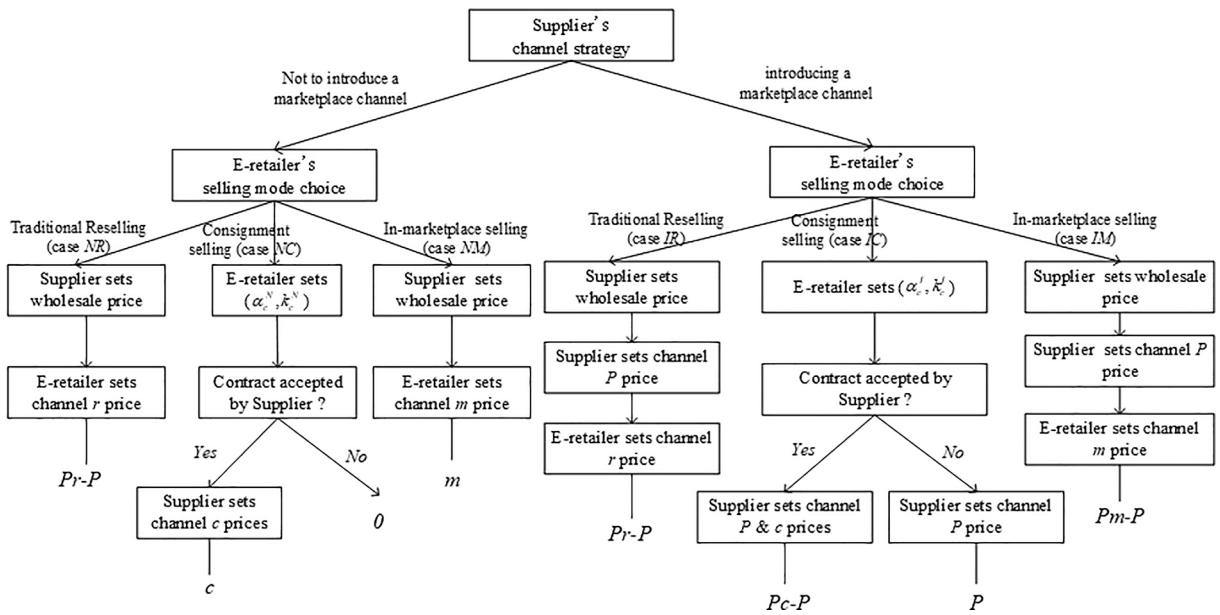


Fig. 3. Sequence of events.

- If the e-tailer serves as a reseller and sells through his own web store, then the supplier first sets wholesale price w^{IR} in channel r and then determines selling price p_s^{IR} in channel P (if introduced). Given the wholesale price, the e-tailer then sets selling price p_r^{IR} in channel r .
- If the e-tailer determines to operate the online channel in the consignment way, then he forgoes his pricing power and only needs to determine the contract parameters α_c^i and k_c^i . Next, given the contract, the supplier decides whether to accept it and sell in the consignment channel. Finally, the supplier decides selling price p_s^{IC} in channel P (if introduced), and if he has accepted the contract, then he simultaneously sets selling price p_r^{IC} in channel c .
- If, in turn, the e-tailer chooses to join the marketplace, then the supplier first sets wholesale price w^{IM} in channel m and then determines selling price p_s^{IM} in channel P (if introduced). Next, the e-tailer sets the selling price in channel m .

We summarize the key notation in Table 1.

As shown in Fig. 3, the labels at the end of the branches represent the resulting system configurations. For case IR , we use Pr to represent the configuration in which sales may occur in both channels P and r in market A. In market B, however, sales may occur only in channel P due to a lack of visibility of channel r , which is denoted by M . By the same token, for case IM , we use Pm to denote the configuration in which sales may occur in both channels P and m in the whole market, while the notation PO indicates that sales occur only in channel P . Finally, we use notation $Pc-P$ for case IC to indicate that the supplier has accepted the contract provided by the e-tailer and may sell through channel c . In contrast, if the supplier declines the contract, then she can only sell through channel P .

Table 1
Summary of the key notation.

Notation	Explanation
$i \in \{I, N\}$	Indicator for the supplier introducing the marketplace channel (mode I) and not introducing the marketplace channel (mode N)
$j \in \{R, C, M\}$	Indicator for traditional reselling (mode R), consignment selling (mode C), and in-marketplace selling (mode M)
V	Consumer's valuation from purchasing in the reseller channel
β	Premium coefficient of consumer's valuation due to purchasing in the marketplace
ρ	Coefficient of consumer's valuation due to purchasing directly from the supplier
ϕ	Proportion of all consumers aware of both the e-tailer and the marketplace channel
α_P	Referral fee percentage in the marketplace channel
k_P	Fixed fee in the marketplace channel
α_c^i	Referral fee percentage in the e-tailer's consignment channel, $i \in \{I, N\}$
k_c^i	Fixed fee in the e-tailer's consignment channel, $i \in \{I, N\}$
w^{ij}	Equilibrium wholesale price charged by the supplier in case ij
p_s^{ij}	Equilibrium selling price in the supplier's marketplace channel in case ij
p_r^{ij}	Equilibrium selling price charged by the e-tailer (or in the e-tailer's consignment channel) in case ij
$\prod_{1s}^{ij}(\pi_s^{ij})$	Supplier's (e-tailer's) payoff in case ij

4. Supplier does not introduce the marketplace channel

In this section, we focus on the case where the supplier does not introduce the marketplace channel (N). We denote the e-tailer's choices of traditional reselling, consignment selling, and in-marketplace selling as NR , NC , and NM , respectively.

For case NR , the e-tailer sells in the traditional way, in which he purchases goods from the supplier and sells them to the end consumers at retail price p_r . In this case, only the consumer whose consumption value satisfies $v \geq p_r$ will purchase in the reseller channel. Hence, we can derive the demand for the reseller channel as $D_r^{NR} = 1 - p_r$. The profits of the supplier and e-tailer are $\pi_s^{NR} = \phi w(1 - p_r)$ and $\pi_r^{NR} = \phi(p_r - w)(1 - p_r)$, respectively.

For case NC , the e-tailer provides the consignment contract and consigns the sales business to the supplier. The supplier accepts the contract if her profit is nonnegative. Under such a circumstance, the consumer purchases the product only if $\rho v - p_r \geq 0$, i.e., $v \geq p_r/\rho$. The demand for the consignment channel is $D_r^{NC} = 1 - p_r/\rho$. The profits of the supplier and e-tailer are $\pi_s^{NC} = (1 - \alpha_c^N)\phi p_r(1 - p_r/\rho) - k_c^N$ and $\pi_r^{NC} = \alpha_c^N p_r \phi(1 - p_r/\rho) + k_c^N$, respectively.

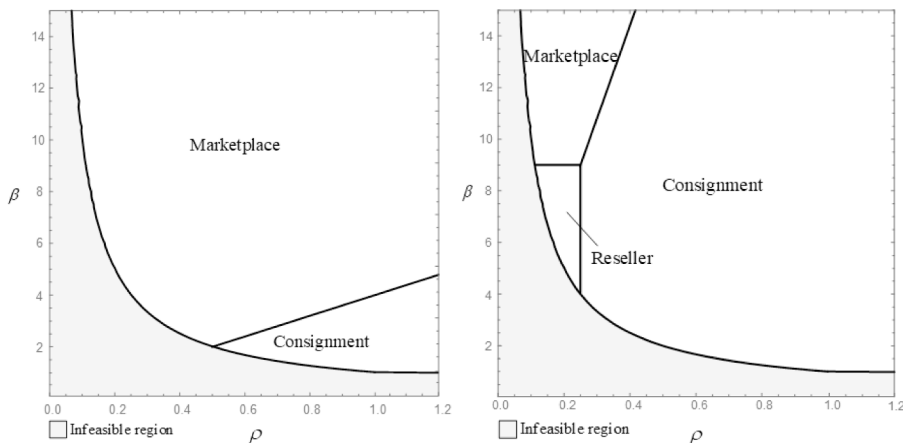
For case NM , the e-tailer joins the marketplace and resells the product purchased from the supplier. Different from case NR , in this case, selling in the marketplace can not only allow the e-tailer to gain a valuation premium but also help him expand his potential market. Hence, the valuation of the consumer purchasing from the e-tailer's marketplace channel is βv . Hence, only the consumer whose valuation satisfies $v \geq p_r/\beta$ will purchase in the marketplace channel. Hence, we derive the demand for the marketplace channel as $D_r^{NM} = 1 - p_r/\beta$. The profits of the supplier and e-tailer are $\pi_s^{NM} = w(1 - p_r/\beta)$ and $\pi_r^{NM} = (1 - \alpha_p)p_r(1 - p_r/\beta) - w(1 - p_r/\beta)$, respectively.

Applying backward induction, we derive the following equilibrium conclusion.

- Proposition 1.** a. For case NR , channel members' equilibrium prices are $w^{NR} = \frac{1}{2}$ and $p_r^{NR} = \frac{3}{4}$ and their equilibrium profits are $\pi_s^{NR} = \frac{\phi}{8}$ and $\pi_r^{NR} = \frac{\phi}{16}$.
- b. For case NC , the e-tailer's optimal contract design is $(\alpha_c^N, k_c^N) = (0, \frac{1}{4}\rho\phi)$, whereby the system can be coordinated, and the supplier can accept the contract by setting $p_r^{NC} = \frac{\rho}{2}$. Their equilibrium profits are $\pi_s^{NC} = 0$ and $\pi_r^{NC} = \frac{1}{4}\rho\phi$.
- c. For case NM , channel members' equilibrium prices are $w^{NM} = \frac{1}{2}\beta(1 - \alpha_p)$ and $p_r^{NM} = \frac{3\beta}{4}$, and their equilibrium profits are $\pi_s^{NM} = \frac{1}{8}\beta(1 - \alpha_p)$ and $\pi_r^{NM} = \frac{1}{16}\beta(1 - \alpha_p) - k_p$.

It is easy to demonstrate that for case NC , the e-tailer's profit is increasing in the supplier's sales efficiency. The reason can be interpreted simply as the e-tailer generating more profits from a supplier that is an expert in retailing. Conversely, due to the service premium effect, the e-tailer joining the marketplace channel gains a higher profit as the marketplace service level increases. In the traditional reselling mode, the e-tailer's profit is independent of the performance of both the marketplace and the supplier. This finding implies that compared with other selling modes, the profit of the e-tailer that adopts the traditional reselling mode is less affected by other supply chain parties than when he adopts other selling modes.

Furthermore, Proposition 1(b) illustrates that for case NC , the e-tailer generates profits from both the supplier and the consumer by adopting a two-part tariff, while the supplier receives nothing. In this sense, it may not be in the supplier's best interest to sell only through the e-tailer's consignment channel. From the e-tailer's perspective, charging only a flat monthly fee can coordinate the supply chain and maximize his profit. The above results are in line with Ryan et al. (2012).



i) $k_p = 0.01, \phi = 0.5, \alpha_p = 0.5$ ii) $k_p = 0.01, \phi = 0.9, \alpha_p = 0.9$

Fig. 4. The e-tailer's optimal selling mode choice without horizontal competition.

For case *NM*, interestingly, the e-tailer’s selling price is independent of the referral fee percentage α_p , while the wholesale price is decreasing in this case. The reason is that the supplier voluntarily shares the referral fee to keep the retail price stable so that the demand does not vary with the referral fee. The marketplace firm charges the referral fee only to channel members and need not worry about negatively affecting consumers.

Comparing the e-tailer’s profits in different cases, we summarize his preference with respect to selling mode in the following.

- Proposition 2.**
- a. If $0 < \phi \leq \min\{4(1 - \alpha_p) - 16k_p, 1\}$, then
 - b. when $\beta < \frac{4\rho\phi + 16k_p}{1 - \alpha_p}$, the e-tailer prefers selling in the consignment mode (case *NC*), and
 - c. when $\beta \geq \frac{4\rho\phi + 16k_p}{1 - \alpha_p}$, the e-tailer prefers selling in the marketplace channel (case *NM*).
 - d. If $\max\{4(1 - \alpha_p) - 16k_p, 0\} < \phi \leq 1$, then
 - e. when $\rho < \frac{1}{4}$ and $\beta < \frac{\phi + 16k_p}{1 - \alpha_p}$, the e-tailer prefers traditional reselling (case *NR*);
 - f. when $\rho > \frac{1}{4}$ and $\beta < \frac{\phi + 16k_p}{1 - \alpha_p}$, the e-tailer prefers selling in consignment mode (case *NC*); and
 - g. when $\beta > \max\{\beta < \frac{\phi + 16k_p}{1 - \alpha_p}, \frac{4\rho\phi + 16k_p}{1 - \alpha_p}\}$, the e-tailer prefers selling in the marketplace channel (case *NM*).

Given that the supplier makes the decision not to introduce the marketplace channel, Fig. 4 illustrates the optimal sales mode choice for the e-tailer having different market shares. As explicitly shown in Fig. 4, the e-tailer may eschew the traditional reselling mode when having a low market share ($0 < \phi \leq \min\{4(1 - \alpha_p) - 16k_p, 1\}$). This finding is in line with the real practice that small enterprises prefer to sell in the marketplace rather than use their traditional reselling channels. Moreover, it is intuitive that a high marketplace service level attracts e-tailors to join the marketplace.

Proposition 2(b) characterizes the condition for the e-tailer to resell in the traditional way, i.e., if and only if the e-tailer has a large market share and the performance of both the supplier and the marketplace is poor. The reason is that the e-tailer has more advantages in the other two channels, and the performance of the supplier and the marketplace is high. Specifically, a higher marketplace service level leads to a higher retail price, as Proposition 1(c) shows, so the e-tailer earns more profit in case *NM*. Moreover, the e-tailer has more advantage in the *NC* channel when the supplier’s sales efficiency is high, which leads to high consumer valuation.

5. Supplier introduces the marketplace channel

In this section, we extend the model to investigate the case where the supplier introduces the marketplace channel. Under such circumstances, there exists not only vertical competition but also horizontal competition in the supply chain system. Here, we consider three main cases based on the e-tailer’s endogenous mode choice, that is, cases *IR*, *IC* and *IM*. We derive the equilibrium outcomes of these three strategies, investigate the supplier’s channel selection behavior and examine how these channel structures influence channel members’ performance. Then, in Section 5.4, we compare these equilibrium outcomes to obtain managerial insights into the channel members’ pricing behavior with different strategies. Finally, in Section 6, we derive the ideal mode option for the e-tailer by comparing his profits in cases *IR*, *IC* and *IM*.

5.1. Traditional reselling

We first investigate a benchmark scenario where the e-tailer plays the reseller role in the traditional channel. We use the superscript *R* to represent the equilibrium outcome in this situation. Specifically, the consumer that is not aware of channel *r* purchases only through channel *P* if $v \geq p_s/\beta\rho$. The consumer that is aware of both channels compares U_p and U_r and purchases through the channel with higher utility. Hence, on the one hand, if $\beta\rho v - p_s \geq v - p_r$ and $\beta\rho v - p_s \geq 0$, then the consumer chooses to purchase through channel *P*. On the other hand, if $v - p_r \geq \beta\rho v - p_s$ and $v - p_r \geq 0$, then the consumer chooses to purchase through channel *r*. Finally, if $\beta\rho v - p_s \leq 0$ and $v - p_r \leq 0$, then the consumer chooses not to purchase.

It follows that we derive the demands in the supplier’s marketplace channel and reseller channel and D_r , respectively, as follows:

$$(D_s, D_r) = \begin{cases} \left(1 - \frac{p_s}{\beta\rho}, 0\right), & \text{if } \frac{p_s - p_r}{\beta\rho - 1} \leq \frac{p_s}{\beta\rho} \\ \left(\phi\left(1 - \frac{p_s - p_r}{\beta\rho - 1}\right) + (1 - \phi)\left(1 - \frac{p_s}{\beta\rho}\right), \phi\left(\frac{p_s - p_r}{\beta\rho - 1} - p_r\right)\right), & \text{if } 0 < p_r \leq \frac{p_s - p_r}{\beta\rho - 1} \leq 1 \\ \left((1 - \phi)\left(1 - \frac{p_s}{\beta\rho}\right), \phi(1 - p_r)\right), & \text{if } 0 < p_r \leq 1 \leq \frac{p_s - p_r}{\beta\rho - 1} \end{cases}$$

Therefore, the profit functions of the supplier and the e-tailer are $\pi_s^{IR} = (1 - \alpha_p)p_s D_s + wD_r - k_p$ and $\pi_r^{IR} = (p_r - w)D_r$, respectively.

Proposition 3. In market *A*, there exists a threshold

$$\hat{\beta}^{IR} = \frac{4 - 3\alpha_p - (1 - \phi)\alpha_p^2}{4\rho(1 - \alpha_p)}$$

such that when $\beta < \hat{\beta}^{IR}$, sales occur only in the reseller channel (system Or-P); when $\beta > \hat{\beta}^{IR}$, sales occur in both channels (system Pr-P). The equilibrium prices and profits of channel members are shown in Table 2. Proposition 3 indicates how the sales of the supplier's marketplace channel in market A vary with the marketplace service level. We show that when the marketplace service level is high, sales occur in both channels; otherwise, sales occur only in the reseller channel. This result implies that when the marketplace service level is low, no sales occur in the marketplace of market A. This phenomenon is common in practice. Taking the marketplace's marketing service as an example, the presentation order of a good on the search page substantially affects the consumer's valuation of it. For low-ranking products, consumers have doubts about their quality. As a result, there may even be no sales of goods that rank too low. The above example indicates how the marketplace service level influences the supplier's sales performance.

Furthermore, we obtain an expression for the threshold $\hat{\beta}^{IR}$ in Proposition 3. It is easy to verify that when the supplier's sales efficiency improves, the threshold increases. This implies that the supplier's retailing efficiency can compensate for the poor service of the marketplace. Moreover, threshold $\hat{\beta}^{IR}$ is increasing in the e-tailer's market occupancy, which indicates that when the e-tailer has a large market occupancy, the supplier is more inclined to sell exclusively through the reseller channel in market A. This is because the larger the market the e-tailer occupies, the more consumers experience horizontal competition between the e-tailer and the marketplace. To avoid this competition, the supplier may forgo selling in the marketplace channel.

Corollary 1. For case IR, we have.

- a. the wholesale price is decreasing in β and ρ , i.e., $\partial w^{IR} / \partial \beta < 0$ and $\partial w^{IR} / \partial \rho < 0$.
- b. the e-tailer's profit is concave in β and ρ , i.e., when $\beta < \hat{\beta}^{IR}$, $\partial \pi_r^{IR} / \partial \beta > 0$ and $\partial \pi_r^{IR} / \partial \rho > 0$; when $\beta \geq \hat{\beta}^{IR}$, $\partial \pi_r^{IR} / \partial \beta < 0$ and $\partial \pi_r^{IR} / \partial \rho < 0$.

Corollary 1(a) indicates that with a higher marketplace service level (or higher supplier sales efficiency), the supplier charges a lower wholesale price, and the double-marginalization effect is alleviated. Note that with better marketplace or supplier performance, the consumer's reservation utility in the marketplace channel increases, leading to more intensified horizontal competition for the e-tailer. To encourage the reselling business, the supplier mitigates vertical competition with the e-tailer by strategically reducing the wholesale price. In contrast, when the marketplace service level (or supplier sales efficiency) is low, the marketplace channel incurs more shortcomings in terms of competition. Under such circumstances, the supplier strategically increases the wholesale price and intensifies vertical competition with the e-tailer so that the marketplace channel can gain an edge in terms of horizontal competition. As a result, the horizontal and vertical competition between the supplier and e-tailer vary in terms of their directions. We refer to this intriguing phenomenon as the *waterbed effect*.

In Corollary 1(b), we observe the intriguing result that the e-tailer's payoff exhibits an inverted U-shaped relationship with the marketplace service level and supplier sales efficiency. As mentioned above, the performance enhancements of the supplier and the marketplace influence the e-tailer's profit in two ways. On the one hand, horizontal competition for the reseller channel is expected to intensify, which is an obvious hindrance to the e-tailer. On the other hand, vertical competition is alleviated due to the decreasing wholesale price, which provides a higher profit margin to the e-tailer. Weighing these two opposite impacts, when the marketplace service level is low ($\beta < \hat{\beta}^{IR}$), the threat of horizontal competition is nonsignificant for the e-tailer. Under such a circumstance, the positive force induced by the decreasing wholesale price overcomes the negative effect caused by horizontal competition. Hence, with a decreasing trend in the wholesale price, the e-tailer's profit tends to increase in the marketplace service level (or the supplier sales efficiency). However, when the marketplace service level is in a high range ($\beta \geq \hat{\beta}^{IR}$), the benefit of mitigated vertical competition cannot exceed the loss caused by intensive horizontal channel competition. Under such circumstances, the e-tailer's profit is mainly influenced by the horizontal competition effect. Note that the e-tailer will encounter stronger horizontal competition with an increasing marketplace service level (or supplier sales efficiency), resulting in decreasing profit.

Table 2
Equilibrium prices and profits for case IR.

	Or-P ($\beta < \hat{\beta}^{IR}$)	Pr-P ($\beta \geq \hat{\beta}^{IR}$)
p_s^{IR}	$\frac{\beta\rho(1 + 4(\beta\rho - 1)\phi - (1 - \phi)\alpha_P)}{2 + 4(\beta\rho - 1)\phi - 2(1 - \phi)\alpha_P}$	$\frac{4\beta\rho(\beta\rho - 1)(1 - \alpha_P)}{8(\beta\rho - 1) + 8(\beta\rho - 1)\alpha_P - \phi\alpha_P^2}$
w^{IR}	$\frac{3 - 4\phi - 2\beta\rho(1 - 2\phi) + (2\beta\rho - 3)(1 - \phi)\alpha_P}{2 + 4(\beta\rho - 1)\phi - 2(1 - \phi)\alpha_P}$	$\frac{2(\beta\rho - 1)(2 - \alpha_P)(1 - \alpha_P)}{8 - 8\beta\rho + 8(\beta\rho - 1)\alpha_P + \phi\alpha_P^2}$
p_r^{IR}	$\frac{2 - 4\phi - \beta\rho(1 - 4\phi) - (\beta\rho - 2)(1 - \phi)\alpha_P}{2 + 4(\beta\rho - 1)\phi - 2(1 - \phi)\alpha_P}$	$\frac{(\beta\rho - 1)(4 - 5\alpha_P + \alpha_P^2)}{8(\beta\rho - 1) - 8(\beta\rho - 1)\alpha_P - \phi\alpha_P^2}$
π_s^{IR}	$\frac{\beta\rho(1 - (1 - \phi)\alpha_P)^2}{4 + 8(\beta\rho - 1)\phi - 4(1 - \phi)\alpha_P} - k_P$	$\frac{2\beta\rho(\beta\rho - 1)(1 - \alpha_P)^2}{8(\beta\rho - 1)(1 - \alpha_P) - \phi\alpha_P^2} - k_P$
π_r^{IR}	$\frac{\beta\rho(\beta\rho - 1)\phi(1 - (1 - \phi)\alpha_P)^2}{4(1 + 2(\beta\rho - 1)\phi - (1 - \phi)\alpha_P)^2}$	$\frac{\beta\rho(\beta\rho - 1)\phi(1 - \alpha_P)^2\alpha_P^2}{(8(\beta\rho - 1)(1 - \alpha_P) - \phi\alpha_P^2)^2}$

5.2. Consignment selling

We now consider the scenario where the e-tailer provides a platform to the supplier and charges her a referral fee α_c^I . Note that the consumer holds a higher reserved valuation when buying through the supplier’s marketplace channel. Thus, it is intuitive to assume that $\alpha_c^I \leq \alpha_p$, which will be verified in the sequel. For ease of exposition, we use the superscript *C* to represent the equilibrium outcome in this case. Specifically, the consumer that is not aware of channel *c* purchases only through channel *P* if $v \geq p_s/\beta\rho$. The consumer that is aware of both channels compares U_p and U_c and purchases through the channel that provides the highest utility. Hence, on the one hand, if $\beta\rho v - p_s \geq \rho v - p_r$ and $\beta\rho v - p_s \geq 0$, then the consumer chooses to purchase through channel *P*. On the other hand, if $\rho v - p_r \geq \beta\rho v - p_s$ and $\rho v - p_r \geq 0$, then the consumer chooses to purchase from channel *c*. Finally, if $\beta\rho v - p_s \leq 0$ and $\rho v - p_r \leq 0$, then the consumer chooses not to purchase.

It follows that we derive the demands in the supplier’s marketplace channel and consignment channel and D_r , respectively, as follows:

$$(D_s, D_r) = \begin{cases} \left(1 - \frac{p_s}{\beta\rho}, 0\right) & \text{if } \frac{p_s - p_r}{(\beta - 1)\rho} \leq \frac{p_s}{\beta\rho} \leq 1 \\ \left(\phi\left(1 - \frac{p_s - p_r}{(\beta - 1)\rho}\right) + (1 - \phi)\left(1 - \frac{p_s}{\beta\rho}\right), \phi\left(\frac{p_s - p_r}{(\beta - 1)\rho} - \frac{p_r}{\rho}\right)\right) & \text{if } 0 \leq \frac{p_r}{\rho} \leq \frac{p_s - p_r}{(\beta - 1)\rho} \leq 1 \\ \left((1 - \phi)\left(1 - \frac{p_s}{\beta\rho}\right), \phi(1 - \frac{p_r}{\rho})\right) & \text{if } 0 \leq \frac{p_r}{\rho} \leq 1 < \frac{p_s - p_r}{(\beta - 1)\rho} \end{cases}$$

Therefore, the profit functions of the supplier and e-tailer are $\pi_s^{IC} = (1 - \alpha_p)p_s D_s + (1 - \alpha_c^I)p_r D_r - k_p$ and $\pi_r^C = \alpha_c^I p_r D_r$, respectively.

Proposition 4. In market A, there exists a threshold $\hat{\beta}^{IC} = \frac{2 - \alpha_p - (1 - \phi)\alpha_p^2}{2(1 - \alpha_p)}$ such that.

- a. when $\beta < \hat{\beta}^{IC}$, sales occur only in the consignment channel (system *Oc-P*), where the consignment channel profit is $\frac{(\beta - 1)\rho\phi(2 - \alpha_p)(1 - \alpha_p)(2(\beta - 1) - (2\beta - 1)\alpha_p + (1 - \phi)\alpha_p^2)}{(\phi\alpha_p^2 - 4(\beta - 1)(1 - \alpha_p))^2}$. The optimal contract parameters are $\alpha_c^{I(Oc-P)} = 0$ and $k_c^{I(Oc-P)} = \frac{\beta\rho\phi(1 - \beta + \beta\alpha_p - (1 - \phi)\alpha_p^2)}{4(1 + (\beta - 1)\phi - (1 - \phi)\alpha_p)}$,
- b. when $\beta \geq \hat{\beta}^{IC}$, sales occur in both the consignment and marketplace channels (system *Pc-P*), where the consignment channel profit is $\frac{\rho\phi(2 - \beta + 2(\beta - 1)\phi - (2 - \beta)(1 - \phi)\alpha_p)(\beta - \beta(1 - \phi)\alpha_p)}{4(1 + (\beta - 1)\phi - (1 - \phi)\alpha_p)^2}$. The optimal contract parameters are $\alpha_c^{I(Pc-P)} = 0$ and $k_c^{I(Pc-P)} = \frac{\beta\rho\phi(1 - \alpha_p)\alpha_p^2}{4(4(\beta - 1) - 4(\beta - 1)\alpha_p - \phi\alpha_p^2)}$.

The supplier always has the incentive to accept the (α_c^I, k_c^I) contract and follows the optimal solution, as shown in Table 3. In addition, the (α_c^I, k_c^I) contract maximizes the total system profit $\pi_r^{IC} + \pi_s^{IC}$.

Proposition 4 provides the e-tailer with a consignment contract for case *IC* to coordinate different systems. Recalling the contract proposed for case *NC* in Proposition 1, for case *IC*, there is a similar result that remains beneficial for the e-tailer in terms of coordinating the system by charging only a fixed fee. However, what is quite different from case *NC* is that in this case, the supplier obtains more profit when a marketplace exists as a competitor to the e-tailer, in which the supplier is allowed to participate because the e-tailer has to surrender part of the channel profit to guarantee the supplier’s participation. This part of the profit equals the supplier’s opportunity cost if she transfers her selling from the marketplace to the consignment channel.

Similar to Proposition 3, we show that when the marketplace service level is low ($\beta < \hat{\beta}^{IC}$), the supplier may sell only in the e-tailer’s consignment channel; otherwise, she chooses to also sell in the marketplace channel. This result is because the lower service level of the marketplace leads to a lower profit gained by the supplier from the marketplace channel, which implies that the e-tailer can encourage the supplier to join his consignment channel with a lower compensation fee. With an increasing service level in the marketplace, the e-tailer has less incentive to fully compensate for the supplier’s opportunity cost of selling exclusively through the consignment channel. We further obtain the expression for the marketplace service level threshold, which is verified to be increasing with the e-tailer’s market share and the referral fee percentage charged by the marketplace. This result implies that the supplier is more likely to eschew the sales business in the marketplace channel with a powerful e-tailer consignment channel or a high referral fee.

Table 3
Equilibrium prices and profits for case *IC*.

	<i>Oc-P</i>	<i>Pc-P</i>
p_s^{IC}	$\frac{\beta\rho(1 + 2(\beta - 1)\phi - (1 - \phi)\alpha_p)}{2(1 + (\beta - 1)\phi - (1 - \phi)\alpha_p)}$	$\frac{2(\beta - 1)\beta\rho(1 - \alpha_p)}{4(\beta - 1)(1 - \alpha_p) - \phi\alpha_p^2}$
p_r^{IC}	$\frac{\rho(2 - \beta - 2\phi + 2\beta\phi + (\beta - 2)(1 - \phi)\alpha_p)}{2(1 + (\beta - 1)\phi - (1 - \phi)\alpha_p)}$	$\frac{(\beta - 1)\rho(2 - \alpha_p)(1 - \alpha_p)}{4(1 - \beta)(1 - \alpha_p) - \phi\alpha_p^2}$
π_s^{IC}	$\frac{1}{4}\beta\rho(1 - \alpha_p) - k_p$	$\frac{1}{4}\beta\rho(1 - \alpha_p) - k_p$
π_r^{IC}	$\frac{\beta\rho\phi(\beta - 1 - \beta\alpha_p + (1 - \phi)\alpha_p^2)}{4((1 - \phi)\alpha_p - 1 - (\beta - 1)\phi)}$	$\frac{\beta\rho\phi(1 - \alpha_p)\alpha_p^2}{4(4(\beta - 1)(1 - \alpha_p) - \phi\alpha_p^2)}$

Corollary 2. For case IC, the e-tailer’s profit is decreasing in the marketplace service level β and increasing in the supplier sale efficiency ρ , i.e., $\frac{\partial \pi_r^{IC}}{\partial \beta} < 0$ and $\frac{\partial \pi_r^{IC}}{\partial \rho} > 0$.

Note that for case IC, the supplier sells directly to the end consumers in the e-tailer’s consignment channel, which eliminates vertical competition. As a result, there exists only horizontal competition between the e-tailer and the marketplace. With an increasing service level, the consumer is more likely to purchase from the marketplace. As a result, the e-tailer suffers fierce horizontal competition, thereby losing more profit. Therefore, it is clear that the e-tailer becomes worse off as the marketplace service level increases.

One might follow the same reasoning as that for case IR to infer that for case IC, the e-tailer’s profit is decreasing in supplier sales efficiency because of more intensified horizontal competition. However, Corollary 2 suggests the opposite. The reason is that the impact of supplier sales efficiency on the e-tailer’s profit is driven by two conflicting effects. One is the aforementioned downside caused by the competition effect, and the other is that increasing supplier sales efficiency leads to higher consumer valuation when purchasing in the consignment channel. Since the positive effect of higher supplier sales efficiency overcomes the downside of more intensive horizontal competition, the e-tailer can charge the supplier a higher fixed fee because of a higher channel profit.

5.3. In-marketplace selling

We explore a scenario where the e-tailer operates as the reseller in the marketplace and the supplier has the option of selling directly to customers in the marketplace. Note that in this scenario, all consumers are familiar with the e-tailer’s marketplace channel. Therefore, horizontal competition between the supplier and e-tailer’s marketplace channels occurs in the whole market. When choosing a channel to purchase from, the consumer compares U_p and U_m and chooses the channel that yields the highest utility. If $\beta\rho v - p_s \geq \beta v - p_r$ and $\beta\rho v - p_s \geq 0$, then the consumer chooses to purchase through channel P. Otherwise, if $\beta v - p_r \geq \beta\rho v - p_s$ and $\beta v - p_r \geq 0$, then the consumer chooses to purchase from channel c. Finally, if $\beta\rho v - p_s \leq 0$ and $\beta v - p_r \leq 0$, then the consumer chooses not to purchase. According to the above analysis, we derive the demand functions (please see Appendix A). The profit functions of the supplier and e-tailer are $\pi_r^{IM} = (1 - \alpha_p)p_r D_r - wD_r - k_p$ and $\pi_s^{IM} = (1 - \alpha_p)p_s D_s + wD_r - k_p$, respectively.

Proposition 5. For case IM, when $0 < \rho \leq 1$, the supplier sells in both channels; when $\rho > 1$, she exclusively sells through the marketplace channel. The equilibrium prices and profits of channel members are shown in Table 4.

For case IM, both the supplier and the e-tailer join the marketplace. Hence, the e-tailer can not only increase his visibility and expand his market share (referred to as the market expansion effect) but also enhance the consumer’s reservation utility for his product (referred to as the service premium effect). The supplier prefers to provide the product in both channels in case IM when her sales efficiency is not particularly high, i.e., $0 < \rho \leq 1$. Otherwise, she prefers to exclusively sell her product through her marketplace channels.

Proposition 5 also illustrates how the performance of the supplier and the marketplace affects the sales prices in different channels. First, similar to the results for case NM, we see that sales prices p_s^{IM} and p_r^{IM} are independent of the referral fee percentage, while the wholesale price is decreasing with it. This result implies that the supplier (Stackelberg leader) voluntarily shares the referral fee to keep the sales price stable. Second, it can be seen that the sales price of e-tailer p_r^{IM} is decreasing in ρ when $0 < \rho < 1$, while that of supplier p_s^{IM} is increasing in ρ . The intuition here is that increasing supplier sales efficiency leads to a higher consumer valuation of the product if purchased through the supplier’s marketplace channel, which renders the supplier more profitable from raising the sales price. From the e-tailer’s viewpoint, when sales occur in the supplier’s marketplace channel, he may encounter higher horizontal competition with increasing ρ , so he must reduce the sales price to counteract the marketplace. Finally, due to the service premium effect, the consumer’s valuation increases if purchasing from the marketplace channel. Therefore, increasing the sales price in case IM is profitable for both the e-tailer and the supplier.

Corollary 3. For case IM, we have,

- a. the supplier’s wholesale price is increasing in β , i.e., $\frac{\partial w^{IM}}{\partial \beta} > 0$;
- b. in system Pm, the e-tailer’s profit is always increasing in β and decreasing in ρ , i.e., $\frac{\partial \pi_r^{IC}}{\partial \beta} > 0$ and $\frac{\partial \pi_r^{IC}}{\partial \rho} < 0$.

Table 4
Equilibrium prices and profits for case IM.

	$Pm(0 < \rho \leq 1)$	$PO(\rho > 1)$
p_s^{IM}	$\frac{\beta\rho}{2}$	$\frac{\beta\rho}{2}$
w^{IM}	$\frac{1}{2}\beta(1 - \alpha_p)$	$\frac{1}{2}\beta(1 - \alpha_p)$
p_r^{IM}	$\frac{1}{4}\beta(3 - \rho)$	$\frac{\beta}{2}$
π_s^{IM}	$\frac{1}{8}\beta(1 + \rho)(1 - \alpha_p) - k_p$	$\frac{1}{4}\beta\rho(1 - \alpha_p) - k_p$
π_r^{IM}	$\frac{1}{16}\beta(1 - \rho)(1 - \alpha_p) - k_p$	$-k_p$

Recall, for case *IR*, that the marketplace service level increases, where the supplier voluntarily reduces the wholesale price to alleviate vertical competition with the e-tailer. For case *IM*, however, we show the opposite result. The reason for this difference is attributable to the service premium effect, where the sales price in the e-tailer’s marketplace channel increases with the marketplace service level. Accordingly, the supplier charges a higher wholesale price contingent on the e-tailer’s increased sales price.

Corollary 3(b) shows that when sales occur in the e-tailer’s marketplace channel, the e-tailer’s profit increases with the marketplace service level. The intuition here stems from two conflicting effects. First, the enhancement of marketplace service enhances the consumer’s reserved utility obtained by purchasing through the e-tailer and indirectly gives him higher profitability (the service premium effect). In addition, the service premium in the supplier’s marketplace channel results in intensified horizontal competition with the e-tailer. Since the benefit of the service premium effect overcomes the downside of the horizontal competition effect, the e-tailer obtains more profit. Moreover, it is intuitive that increasing supplier sales efficiency intensifies horizontal competition, so the e-tailer must reduce the sales price, leading to less profit.

5.4. E-tailer’s selling mode choice

To provide managerial insights into the e-tailer’s selling mode choice, we compare the sales prices and wholesale prices among different selling modes in the retail channel and obtain the following result.

Proposition 6. *There exists a threshold $\hat{\beta}$ such that when $\beta < \hat{\beta}$, the supplier charges a higher wholesale price in case *IR* than in case *IM*, i.e., $w^{IR} > w^{IM}$; otherwise, $w^{IR} < w^{IM}$.*

Proposition 6 compares the wholesale prices between the traditional reselling mode and the in-marketplace selling mode. One might intuitively infer that the supplier charges the e-tailer a higher wholesale price in case *IM* than in case *IR*. The reason is attributable to a higher sales price charged by the e-tailer in case *IM*, as illustrated above. However, this is only part of the story. We show that with a low service premium in the marketplace, the supplier prefers to set a higher wholesale price in case *IR* due to the waterbed effect. As a result, in case *IR*, the lower the service premium in the marketplace is, the higher the wholesale price the supplier would charge the e-tailer. When the service level is sufficiently low, the wholesale price in case *IR* exceeds that in case *IM*.

We further compare the e-tailer’s profits pairwise among cases *IR*, *IM*, and *IC* and summarize the results in Lemma 1.

Lemma 1. *Comparing the e-tailer’s profits between cases *IR* and *IM*, we have.*

- a. when $0 < \rho < \hat{\rho}^{RM}$, selling in the marketplace is the dominant strategy;
- b. when $\hat{\rho}^{RM} \leq \rho \leq 1$, the e-tailer prefers traditional reselling if $\hat{\beta}_1^{RM} < \beta < \hat{\beta}_2^{RM}$ or $\phi > \hat{\phi}_1^{RM}$; otherwise, he prefers in-marketplace selling; and
- c. when $\rho > 1$, the e-tailer always prefers traditional reselling.

Lemma 1(a) shows that traditional reselling is dominated by in-marketplace selling when supplier sales efficiency is sufficiently low. However, as is shown in Fig. 5, the above results may not always hold when supplier sales efficiency is relatively high, and the e-tailer’s selling mode choice exhibits three distinct patterns with respect to the marketplace service level. When the marketplace service level is lower than a certain threshold ($\beta \leq \hat{\beta}_1^{RM}$), the e-tailer in case *IR* encounters more intensified vertical competition than that in

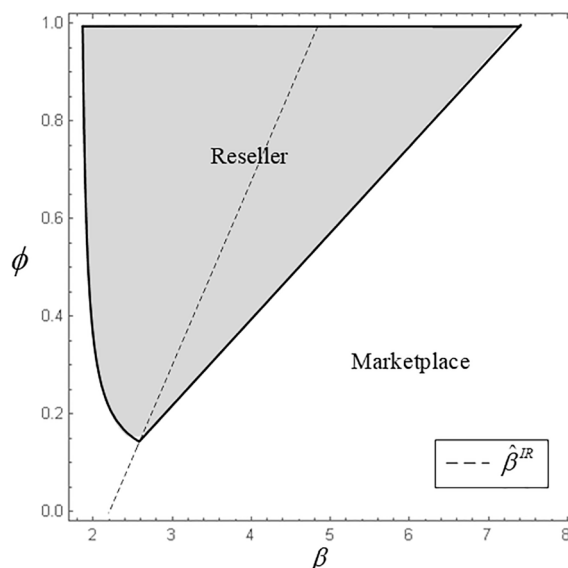


Fig. 5. The e-tailer’s optimal selling mode choices for cases *IR* and *IM*.

case *IM*, as stated in Proposition 6. As a result, selling in the marketplace is the best choice for the e-tailer. In contrast, if the marketplace service level is sufficiently high ($\beta \geq \hat{\beta}_2^{RM}$), then the benefits from a higher service premium in the marketplace cancel out the shortcomings due to the high wholesale price. Hence, it is reasonable for the e-tailer to adopt the in-marketplace selling mode. If, in turn, the marketplace service level falls within an intermediate range ($\hat{\beta}_1^{RM} < \beta < \hat{\beta}_2^{RM}$), then the e-tailer's optimal selling mode is changed. Recall that in Corollary 1, the e-tailer's profit reaches the highest level in case *IR* at a moderate service premium, in which both vertical and horizontal competition are moderate. Under such circumstances, the e-tailer prefers to sell in the traditional manner to mitigate the competition effect.

Moreover, it is not difficult to infer that when the supplier is sufficiently efficient in direct reselling (i.e., $\rho > 1$), the e-tailer would prefer traditional reselling. Otherwise, the e-tailer would end up with no sales in his channel under the in-marketplace selling mode.

Lemma 2. Comparing the e-tailer's profits between cases *IM* and *IC*, we have.

- a. when $0 < \rho < \hat{\rho}^{MC}$, selling in the marketplace is the dominant strategy;
- b. when $\hat{\rho}^{MC} \leq \rho \leq 1$, the e-tailer prefers in-marketplace selling if $\beta > \hat{\beta}_1^{MC}$ or $\phi < \hat{\phi}_1^{MC}$; otherwise, he prefers consignment selling; and
- c. when $\rho > 1$, the e-tailer always prefers consignment selling.

Lemma 2(a) states that the supplier always chooses to sell in the marketplace when her sales efficiency is low. Recall that in Table 3, the sales price in the consignment channel decreases when the consumer obtains lower reservation utility from the supplier, which reflects that the e-tailer's profit is negatively affected in the consignment channel. Therefore, the result reveals that to gain more profit, the e-tailer needs to control sales.

In contrast, when supplier sales efficiency is relatively high ($\hat{\rho}^{MC} \leq \rho < 1$), the e-tailer's selling mode choice is further influenced by the marketplace service level (and proportion ϕ). Lemma 2(b) shows that a higher marketplace service level will make it more likely for the e-tailer to choose the marketplace channel. This result is attributable to the service premium effect elaborated in Corollary 3. Otherwise, the e-tailer adopts the consignment selling mode because of weaker horizontal competition. In addition, we see that the supplier chooses to sell in the marketplace channel if the proportion ϕ is low. This result is attributable to the marketplace expansion effect, i.e., by joining the marketplace, the e-tailer can gain a larger potential market, which is helpful, especially for small and medium-sized enterprises, to increase his market occupancy.

If the supplier is expert in direct selling ($\rho > 1$), it is reasonable that the e-tailer will choose the consignment selling mode. Under such circumstances, the e-tailer can share the supplier's revenue via referral fees and exploit the supplier's sales efficiency. The e-tailer's choice for cases *IM* and *IC* can be depicted by Fig. 6.

Lemma 3. Comparing the e-tailer's profits in cases *IR* and *IC*, we have that.

- a. when $\rho \geq \hat{\rho}^{RC}$, consignment selling is the dominant strategy;
- b. when $\frac{1}{4} \leq \rho < \hat{\rho}^{RC}$, the e-tailer prefers traditional reselling if $\hat{\beta}_1^{RC} < \beta < \hat{\beta}_2^{RC}$ and prefers consignment selling if $\beta \leq \hat{\beta}_1^{RC}$ or $\beta \geq \hat{\beta}_2^{RC}$; and

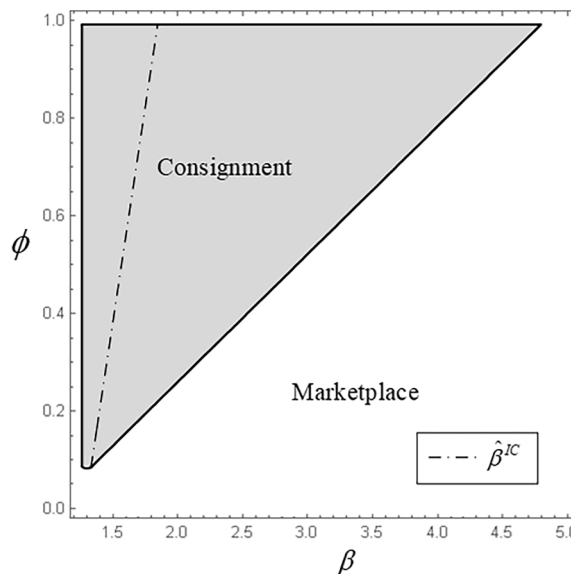


Fig. 6. The e-tailer's choice of optimal selling mode between cases *IM* and *IC*.

c. when $0 \leq \rho < \frac{1}{4}$, the e-tailer prefers consignment selling if $\beta \leq \hat{\beta}_1^{RC}$ and prefers traditional reselling if $\beta > \hat{\beta}_1^{RC}$, where $\hat{\rho}^{RC} = \frac{4 - (7 - 4\phi)\alpha_p + 2(1 - \phi)\alpha_p^2 + (1 - \phi)^2\alpha_p^3}{4 - 4(1 - \phi)\alpha_p - (4 - \phi)\alpha_p^2 + (2\phi^2 - 5\phi + 4)\alpha_p^3}$.

Intuitively, when supplier sales efficiency is high ($\hat{\rho}^{RC} \leq \rho$), the e-tailer always sells via consignment. In this way, he can exploit consumers' high valuation and avoid horizontal competition.

When supplier sales efficiency belongs to a middle range, the e-tailer's choice of selling mode is also dependent on the marketplace service level. Specifically, consignment selling is dominated by traditional reselling if and only if the marketplace service level is moderate. This finding is in line with the result in Corollary 1: the e-tailer in the traditional reselling mode gains the highest profit only when both horizontal and vertical competition are at a moderate level, which can be achieved with a moderate marketplace service level. Otherwise, when the marketplace service level is sufficiently high or low, the e-tailer is worse off in case IR. Under such a circumstance, it is in his best interest to sell via consignment.

When supplier sales efficiency is low ($0 \leq \rho < 1/4$), the e-tailer chooses the consignment selling mode if and only if the marketplace service level is sufficiently low. Recall that in Corollary 2, the result reveals that the e-tailer's profit is increasing with the supplier sales efficiency but decreasing with the marketplace service level. It follows that, given low supplier sales efficiency, the e-tailer in case IC can expect to earn a higher profit than that in case IC only if horizontal competition is sufficiently low ($\beta \leq \hat{\beta}_1^{RC}$). The e-tailer's choice for cases IR and IC can be depicted by Fig. 7.

Proposition 7. The e-tailer prefers reselling (case IR) if $\max\{\hat{\beta}_1^{RC}, \hat{\beta}_1^{RM}\} \leq \beta \leq \min\{\hat{\beta}_2^{RC}, \hat{\beta}_2^{RM}\}$. Otherwise, the e-tailer prefers consignment (case IC) if $\beta \leq \hat{\beta}_1^{MC}$ and prefers selling in the marketplace (case IM) if $\beta > \hat{\beta}_1^{MC}$.

Fig. 8 explicitly depicts the e-tailer's optimal selling mode choice when encountering horizontal competition in the marketplace channel. Compared with the case of no competitive marketplace channel (see Proposition 1), interestingly, the e-tailer still prefers in-marketplace selling, even though horizontal competition is fierce, i.e., $\beta > \hat{\beta}_1^{MC}$. This result indicates that when the marketplace service level is sufficiently high, the positive effect of the service premium overcomes the downside of more intensified horizontal competition. Conversely, when the marketplace is inefficient in terms of enhancing the consumer's reservation utility, i.e., $\beta \leq \hat{\beta}_1^{MC}$, the e-tailer is more competitive in the consignment selling mode. Hence, it is intuitive that the consignment selling mode occurs with a low marketplace service level. The above results are similar to those for the case of no marketplace channel.

Different from the case without horizontal competition, we show that traditional reselling is always the dominant strategy when the marketplace service level is in an intermediate range. While vertical competition intensifies with a decreasing wholesale price, horizontal competition also increases. This result reveals that when encountering supplier encroachment via the marketplace channel, the traditional selling mode is superior for the e-tailer under moderate competition.

6. Analysis of overall system equilibrium

We now come to the very first stage, which involves whether the supplier should introduce the marketplace channel and how this decision influences the e-tailer's selling mode choice. We derive the answer directly by comparing the supplier's profits in two cases where she introduces (does not introduce) the marketplace channel when the e-tailer can (cannot) gain a higher payoff if she joins in the marketplace. The following result provides the equilibrium strategies of the two channel members.

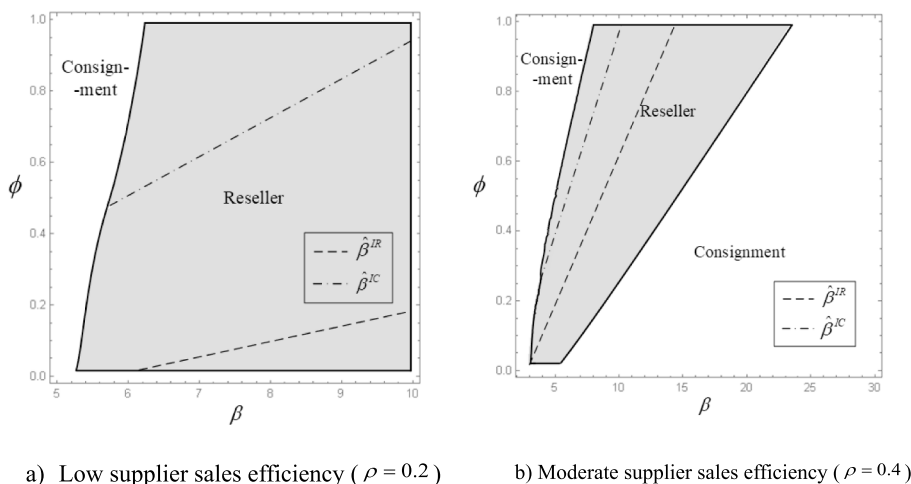


Fig. 7. The e-tailer's optimal selling mode choices for cases IR and IC.

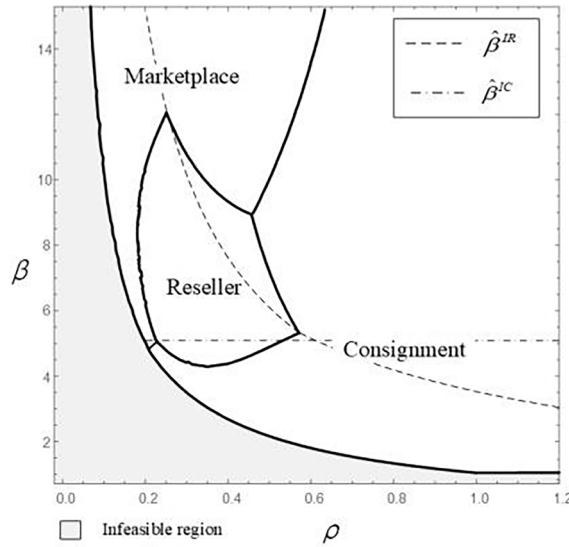
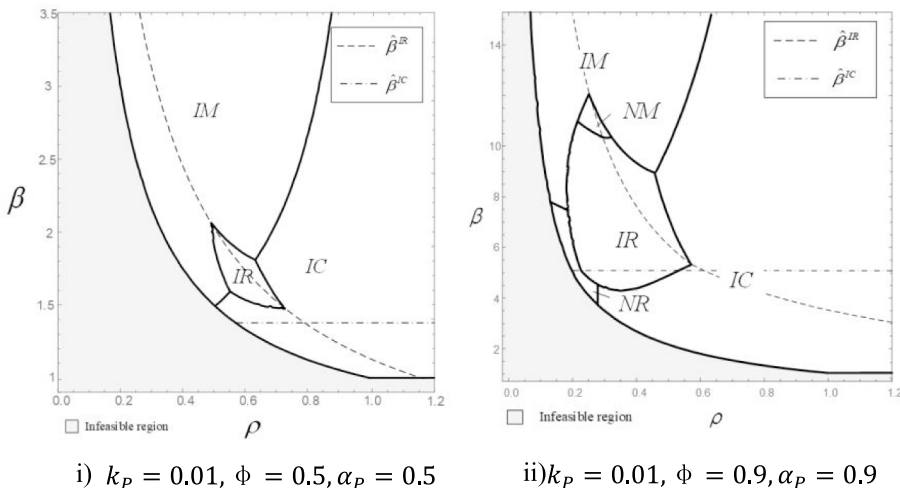


Fig. 8. The e-tailer’s optimal selling mode choice with horizontal competition ($k_p = 0.01, \phi = 0.9, \alpha_p = 0.9$).

- Proposition 8.**
- a. If $0 < \phi \leq \min\{4(1 - \alpha_p) - 16k_p, 1\}$, then the supplier always introduces the marketplace channel, and the e-tailer’s selling mode choice follows Proposition 7.
 - b. If $4(1 - \alpha_p) - 16k_p < \phi \leq 1$, then
 - c. case NR is in equilibrium when $\beta < \min\{\frac{\phi + 8k_p}{(1 + \rho)(1 - \alpha_p)}, \max\{\hat{\beta}_1^{RC}, \hat{\beta}_1^{RM}\}\}$, and $0 < \rho < \frac{1}{4}$;
 - d. case NM is in equilibrium when $\max\{\hat{\beta}_1^{RM}, \tilde{\beta}, \frac{4\rho\phi + 16k_p}{1 - \alpha_p}\} < \beta < \hat{\beta}_2^{RM}$;
 - e. otherwise, the supplier prefers to introduce the marketplace channel, and the e-tailer’s selling mode follows Proposition 7.

Proposition 8 characterizes the conditions under which the supplier introduces or does not introduce the marketplace direct selling channel. The first condition relates to the e-tailer’s market share, which should not exceed a certain threshold. When the fraction of consumers aware of the e-tailer is not too large, then the supplier is better off selling directly through the marketplace, which is why an increasing number of suppliers attempt to introduce direct channels to raise their market share, e.g., Tmall, as the marketplace enables them to achieve sharp growth.

However, as is shown in Fig. 9, when the fraction of consumers aware of the e-tailer is relatively large and the performance of both the supplier and the marketplace are poor, the reseller channel has the edge of acquiring a larger number of customers, so the supplier prefers selling exclusively through the e-tailer to avoid direct channel risk. Moreover, interestingly, the supplier may sell exclusively through the e-tailer when the marketplace service level is within a certain region. Note that under such circumstances, the e-tailer



i) $k_p = 0.01, \phi = 0.5, \alpha_p = 0.5$ ii) $k_p = 0.01, \phi = 0.9, \alpha_p = 0.9$

Fig. 9. Equilibrium strategies of channel members.

adopts the traditional selling mode if the supplier introduces the marketplace channel, which causes horizontal competition with the marketplace channel. To this end, the supplier chooses not to encroach and strategically induces the e-tailer to adopt the in-marketplace selling mode, where she can make a higher profit because of the service premium effect and reduced horizontal competition.

7. Discussion and conclusion

With marketplaces becoming an increasingly ubiquitous business model, many suppliers have entered marketplaces to build their direct channels. We study the supplier's channel structure selection regarding whether to introduce the marketplace channel and the e-tailer's selling mode choice among traditional, consignment, and in-marketplace selling. We analyze the advantages and disadvantages of their choices in detail and summarize the findings and examples in Table 5. We not only examine the impacts of supplier sales efficiency, the marketplace service level, and the e-tailer's market occupancy on the supplier's channel selection and e-tailer's selling mode choice but also explore the interactions among their decisions.

When making the decision on the selling mode, the e-tailer should identify channel members' performance and take the competition effect into account. We show that, in general, the e-tailer would like to use the consignment selling mode when the supplier is a retailing expert or when the value-added service of the marketplace is poor, so that the e-tailer can exploit the supplier's sales efficiency and avoid vertical competition. In contrast, the e-tailer prefers the in-marketplace selling mode if he can obtain a high service premium from the marketplace or if the supplier is uncompetitive in terms of retailing. This results from the e-tailer's tradeoff between the service premium and the intensity of vertical competition. Moreover, the e-tailer's preference for the traditional reselling mode closely depends on the supplier's channel strategy. The e-tailer must balance horizontal and vertical competition with the supplier if the supplier introduces the direct channel. In addition, we find that there exists a *waterbed effect* such that the supplier always manipulates the wholesale price to balance the competition with the e-tailer in case *IR*. Therefore, when the performance levels of both the supplier and the marketplace are within moderate ranges, the e-tailer sells in the traditional way, in which case he can compete the least with the supplier. Conversely, without the influence of horizontal channel competition, traditional reselling is a stable method that is not influenced by channel members' performance. As a result, it is easy to determine that the e-tailer sells in this way when the performance levels of both the supplier and the marketplace are poor.

In addition, we investigate the channel strategy of the supplier regarding whether to introduce the marketplace channel. We show that when the e-tailer has a small market share, the supplier always has the incentive to introduce the marketplace channel, where she can not only increase her market occupancy but also benefit from the service premium. In contrast, if the e-tailer covers a large part of the end market, then horizontal channel competition may take place in a wider range. Under such circumstances, the supplier strategically introduces the marketplace channel by trading off among the market expansion effect, the service premium effect, and the competition effect. Specifically, when both the marketplace service level and the supplier sales efficiency are low, the supplier should not introduce the marketplace channel and counteract the traditional channel. One plausible reason is the poor sales performance of these small companies. Moreover, the service level for small articles of daily use is relatively low because the elasticity of demand is so weak that there is no need to provide advanced services for such articles. Interestingly, if the marketplace service level is relatively high, then the supplier also eschews the marketplace channel and strategically induces the e-tailer to sell through it (case *NM*), where she can make a higher profit because of the service premium effect and reduced horizontal competition. It is not surprising that the supplier never chooses case *NC*, where the downstream market is completely monopolized by the e-tailer, so the supplier would end up with zero surplus in equilibrium.

Our findings provide several important managerial implications for practitioners. First, the e-tailer's selling mode choice is heavily influenced by supplier sales efficiency. For example, [DangDang.com](https://www.dangdang.com) divides its suppliers into two types according to their sales efficiency and service levels. For suppliers such as book suppliers that do not provide many aftersales services, [DangDang.com](https://www.dangdang.com) adopts the reselling mode. However, for suppliers such as Haier, which has its own logistics and aftersales services, [DangDang.com](https://www.dangdang.com) adopts the consignment selling mode. Second, the e-tailer needs to carefully evaluate the marketplace service level. With an increasing marketplace service level, the e-tailer's profit in the marketplace channel outperforms the reseller channel, which explains why [Suning.com](https://www.suning.com) joined [Tmall.com](https://www.tmall.com) in 2015, although the former had launched its own website and app in 2010. Another example is that Sephora, which owned a website and app, joined Kohl's in 2021. Finally, the direct selling channel is not always beneficial to the supplier, so she should take into account factors such as her own sales efficiency relative to the e-tailer's market share and the marketplace service level.

Several limitations of our model provide opportunities for further research. In practice, the e-tailer adopts different pricing strategies for different selling channels. It is thus necessary to consider pricing design when considering the selling mode. [Zhen and Xu \(2021\)](#) presented some useful information, but more research is needed. In addition, it would be interesting to investigate the case where the e-tailer chooses the selling mode before the supplier's channel selection. In this way, we can examine how the supplier's channel strategy is affected by the e-tailer's selling mode choice. Finally, we analyze the situation where both the supplier and the e-tailer possess the same perfect information about market demand. Future research should explicitly study asymmetric information case where the e-tailer is more knowledgeable about the true market size than the supplier. It would be interesting to determine how information asymmetry affects the strategies of both channel members.

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Table 5
Advantages and disadvantages of firms' different choices.

Strategy	Analysis		Examples
	Advantage	Disadvantage	
Supplier's channel strategy	Introducing a marketplace channel (I)	<ul style="list-style-type: none"> Introduce a larger sales market (market expansion effect) Prevent the e-tailer from monopolizing the downstream market. Take advantage of the marketplace service level (valuation premium effect) 	<ul style="list-style-type: none"> Horizontal channel competition occurs (competition effect) <p>Most suppliers of electrical and electronic products such as Haier, Huawei</p>
	Not introducing a marketplace channel (N)	<ul style="list-style-type: none"> Horizontal channel competition is avoided. The e-tailer monopolizes the downstream market and squeezes the supplier's profit (especially in case NC) 	<ul style="list-style-type: none"> The e-tailer monopolizes the downstream market and squeezes the supplier's profit (especially in case NC) <p>Book and record suppliers</p>
E-tailer's selling mode choice	Traditional reselling mode (R)	<ul style="list-style-type: none"> It is a stable strategy without being influenced by channel members' performance (in case N). The supplier can balance horizontal and vertical competition by manipulating the wholesale price (in case I) 	<ul style="list-style-type: none"> There exists a double-marginalization effect (vertical competition) in the e-tailer's channel <p>Guomei.com</p>
	In-marketplace selling mode (M)	<ul style="list-style-type: none"> Expand the market (market expansion effect). Take advantage of the marketplace service level (service premium effect) 	<ul style="list-style-type: none"> There exists a double-marginalization effect (vertical competition) in the e-tailer's channel <p>Suning Flagship Store in Tmall.com</p>
	Consignment selling mode (C)	<ul style="list-style-type: none"> The absence of double marginalization (vertical competition). Coordinate the supply chain with the consignment contract 	<ul style="list-style-type: none"> The supplier's selling inefficiency will cut into the e-tailer's profit <p>DangDang.com</p>

CRedit authorship contribution statement

Huaqing Hu: Formal analysis, Conceptualization, Methodology, Writing – original draft. **Gaoyan Lyu:** Formal analysis, Conceptualization, Methodology, Writing – review & editing, Supervision, Funding acquisition. **T.C.E. Cheng:** Conceptualization, Supervision. **Yunhuan Zhang:** Conceptualization, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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