

# Online Advertising, Retailer Platform Openness, and Long Tail Sellers

Jianqing Chen

Zhiling Guo

The University of Texas at Dallas

Singapore Management University

chenjq@utdallas.edu

zhilingguo@smu.edu.sg

## Abstract

It becomes increasingly popular that some large online retailers such as Amazon open their platforms to allow third-party retail competitors to sell on their own platforms. We develop an analytical model to examine this retailer marketplace model and its business impact. We assume that a leading retailer has both valuation advantage that may come from its reputation and information advantage that may come from its brand awareness. We find that the availability of relatively low-cost advertising through social media or search engine can effectively reduce the leading retailer's information advantage, and thus be an important driving force for its strategic decision to open its platform. Not only does the advertising option directly make small sellers more visible to consumers, but also incentivizes the online retailer to open its platform and dramatically increases small sellers' exposure, indirectly contributing to an even more prominent long tail phenomenon in e-commerce.

## 1 Introduction

With the global e-commerce sales reach over \$1 trillion and Amazon's mammoth growth in the retail industry over the last decade, nowadays thousands of small merchants depend on

Amazon to reach customers who otherwise would not know they exist. Smaller retailers are attracted to the Amazon marketplace by the promise of tapping into the Internet retailer's roughly 85 million unique monthly visitors and 270 million active customer accounts to expand reach and sales. Third-party sellers report an average of 50% increase in sales when they join Amazon's marketplace. In turn, Amazon takes a commission for every marketplace sale (e.g., 6% for personal computers, 15% for mobile phones). It appears that both Amazon and the third-party sellers benefit from the partnership, especially when smaller retailers do not have the resources to effectively and efficiently pursue e-commerce.

When Amazon itself does not carry the same products as small sellers for sale, Amazon acts as a sole platform owner to help the sellers reach potential buyers. There is no direct retail competition with the small sellers who join its platform, and any positive sales on the platform directly benefit both Amazon and the sellers. The incentives of partnership are well aligned. However, when Amazon sells the same products as small sellers, Amazon acts as both a platform owner and a competing seller. It is less obvious why Amazon should allow competing sellers to sell on its platform. One argument is that by opening its platform, the commission fee charged by Amazon directly contributes to the retailer's revenue, which provides Amazon an incentive to open its platform. However, excluding the small sellers makes Amazon a monopolist over the consumers who are aware of its products only. It may be beneficial for Amazon to sell by itself and enjoy the monopoly profit, instead of gaining only a small share of third-party sellers' sales. Therefore, a simple commission-fee argument may not explain retailer platform openness.

In this paper, we aim to explain the rationale for retailer platform openness. Based on the observation that together with retailer platform openness is the emergence of low-cost advertising through social media or search engine, we ask the following questions: how does low-cost online advertising affect leading retailers' incentive to open their platforms? Is the availability of low-cost advertising a driving force for leading firms and small firms to form a partnership? If so, how does low-cost advertising option affect sales distribution and

contribute to long tail phenomenon via the open platform?

We consider a leading online retailer competing with a small retailer. The leading retailer has both valuation advantage and information advantage over the small retailer. The valuation advantage comes from the leading retailer's reputation and the quality of customer services. So for the same product, everything (e.g., price) else being equal, consumers prefer to buy from the leading retailer rather than the small seller. The information advantages comes from the leading retailer's brand awareness. Therefore, the leading retailer can access a larger potential market than the small retailer. While the valuation advantage is the leading firm's intangible asset, the information advantage can be weakened with the relatively low cost Internet advertising technologies.

For example, traditional TV advertising incurs a setup cost of at least \$50,000, and the cost of media is as expensive as \$35,000 to \$2 million per 30 second spot. The cost of designing and put up a commercial can really be a barrier for small sellers with a low budget. The expenses for magazine and newspaper advertising are also high. More recently, search engines and social media have dramatically changed the advertising industry. First, search engines provide organic listing service, which is totally free. Second, with these new online advertising on search engines and social media, the setup cost for advertising can be very low to even negligible. Third, advertisers can easily control their online advertising campaigns and tailor the awareness levels that are best for them. For example, small sellers can easily set up advertising accounts with Google to advertise their products with Google search engine or YouTube (a subsidiary of Google). In addition, the sellers can specify their daily budget and their intended positions with search engines or YouTube pages, among others, and tailor the awareness level to be achieved depending on their budgets. Google also provides many tools for new advertisers to manage their marketing campaigns. The small seller can even create commercials on YouTube and Hulu for only a fraction of the cost of advertising on TV. Usually the cost of pay-per-click marketing is about several cents to a few dollars per qualified visitor. The cost effective advertising makes it possible that the

small seller gains exposure and increases its awareness level to compete more effectively with large retailers. The small seller's outside option of advertising reduces the leading retailer's relative information advantage and thus will affect the leading retailer's marketplace strategy.

An interesting question is how the cost of advertising affects the leading retailer's incentive to open its platform and the small seller's strategic choice of advertising. We develop a model of retail competition to formally analyze the strategic interactions between the two firms. Our model consists of a leading retailer engaging in price competition with a small seller on selling an identical product. The leading retailer strategically decides whether to open its platform to allow the small retailer to access its customer base by charging a commission per unit of product sale on the platform. The small retailer then decides whether to join the platform and compete with the leading retailer in the expanded market. We characterize the conditions under which both the leading retailer and the small seller are willing to form the partnership on the platform.

Our results indicate that the availability of low-cost advertising through social media or search engine can be an important driving force for platform openness. Low-cost advertising, on the one hand, increases the value of the small seller's outside option and thus gives the leading retailer incentive to open its platform. On the other hand, unless the cost of advertising is too low such that small sellers rather prefer pursuing advertising by itself, the small seller has incentive to join the leading retailer's platform due to the greater exposure it gains on the platform. Together, our study suggests that relatively low-cost advertising is one driving force that facilitates the partnership between leading online retailers and small sellers. Moreover, we find that in addition to the direct effect that advertising can be used by small sellers to increase their exposure and visibility, contributing to long tail phenomenon, the availability of low-cost advertising channels plays another important role in driving long tail phenomenon—indirectly, the advertising option may induce leading retailers to open their otherwise closed platforms. When small sellers join the platforms, their exposure is dramatically increased and they become more visible to consumers, which contributes to an

even more prominent long tail phenomenon in online retail industry.

The most relevant stream of literature to our research is dual-channel distribution. More specifically, several recent studies focus on analyzing the potential incentives for an online retailer to open its platform for direct competition with other retailers (e.g., Zhu and Liu, 2015; Jiang et al., 2011). For example, Jiang et al. (2011) consider a setting in which the retailer faces uncertain demand and can learn from small sellers who sell on their platforms about future demand information. Ryan et al. (2012) analyze the price competition and channel conflict between a marketplace seller and a third-party retailer. They focus on a revenue sharing contract with a fixed fee for participation as a coordination mechanism. They find that the third-party seller prefers to sell through her own channel or through the marketplace system, but not both. Mantin et al. (2014) provide a different insight into the marketplace model. They show that through opening its platform the retailer creates an “outside option” that improves its bargaining position in negotiations with the manufacturer. Different from this line of research, our work provides alternative explanation for the prevalence of the retailer marketplace model. We show that the small seller’s ability to increase its exposure by low-cost online advertising exerts external pressure for the leading retailer to open its platform.

## 2 Baseline Model

We consider Amazon (A) and a small seller (B) selling an identical product. As an established and reputable retailer, Amazon has two types of advantage over its competitor: *valuation advantage* and *information advantage*. The former refers to the fact that everything else being equal, consumers prefer to buy from Amazon rather than from the small seller. The latter refers to fact that some consumers are aware of Amazon but not the small firm.

There is a continuum of consumers with unit mass in the market. Each consumer has a unit demand of the product. All consumers prefer buying from A than from B, everything

else being equal. In particular, consumers derive value  $v$  from purchasing the product from A and derive a discounted utility  $\tilde{k}v$  from purchasing from B, where  $\tilde{k}$  is uniformly distributed over  $[0, 1]$  across all consumers. The valuation advantage of Amazon may come from its reputation and high-quality service such as handling and return. Without loss of generality, we normalize  $v$  to 1. We further normalize the marginal costs for the sellers to provide the product to zero.

All consumers are aware of A. If B joins A's platform, all consumers are also aware of B's product. B pays a commission rate  $\rho$  for each unit sale in this case. If B does not join A's platform, initially only a proportion  $\alpha$  of consumers are aware of B. B may advertise its product with search engines and its awareness can be increased to  $\psi$  at cost  $G(\psi)$ . Notice that the awareness level is  $\alpha$  without advertising, and therefore  $G(\alpha) = 0$ . We assume that  $G'(\psi) > 0$  and  $G''(\psi) \geq 0$  for  $\psi \in (\alpha, 1)$ . Further note that the purpose of advertising is to increase consumer awareness. If B chooses to join A's platform, B has no incentive to advertise any more because all consumers are aware of its product already. To exclude some trivial cases, we assume that  $\alpha < \frac{2}{3}$ ; that is, the small seller B's information disadvantage over A is not too small.

The time sequence of the game is as follows. In stage 1, A announces the commission rate  $\rho$ . In stage 2, B decides whether to join A's platform. If B does not join A's platform, B may choose its advertising level if the advertising option is available. In stage 3, both firms decide their retail prices  $p_A$  and  $p_B$ , and consumers make their purchase decisions.

Consumers will purchase a product only when they are aware of the product and the product generates a net utility no less than a certain reservation value, which is normalized to zero. For those consumers who derive positive net utility from both firms' products, they purchase the product with higher net utility. We consider two scenarios: the case without advertising option and the case with advertising option. We use the case without advertising option as a benchmark to examine the effect of advertising on A's platform openness.

### 3 Equilibrium Analysis on Competition

We use backward induction to solve the game. We start with the last stage price competition. Based on consumer preference, we conjecture and can verify that in equilibrium it must be  $p_A > p_B$ . We consider the price competition when B does not join A's platform and when B joins A's platform.

#### 3.1 When B does not Join A's Platform

When B does not join A's platform, a portion  $\psi$  of consumers are aware of both products, and  $(1 - \psi)$  portion of consumers are aware of A's product only. In the absence of advertising option,  $\psi = \alpha$  and in the presence of advertising option,  $\psi$  is the B's optimal choice of awareness level. Note that  $(1 - \psi)$  reflects the information advantage of firm A over firm B, which is also the exclusive demand for A. A consumer who is aware of both sellers will buy from A as long as  $1 - p_A \geq \tilde{k} - p_B$ . Therefore, among all consumers who are aware of both sellers, the ones with  $\tilde{k} \leq 1 - (p_A - p_B)$  buy from A. The rest buy from B. We can formulate the demand functions for both firms as follows.

$$\begin{aligned} D_A(p_A, p_B) &= (1 - \psi) + \psi [1 - (p_A - p_B)] \\ D_B(p_B, p_A) &= \psi (p_A - p_B) \end{aligned} \tag{1}$$

where firms' prices  $p_A, p_B \in [0, 1]$ . The first term in  $D_A(p_A, p_B)$  is A's exclusive demand and the second term is the competing demand. B only has the competing demand. Firms' profits can thus be written as

$$\pi_i(p_i, \bar{p}_i) = p_i D_i(p_i, \bar{p}_i), \{i, \bar{i}\} = \{A, B\} \tag{2}$$

Both firms maximize their profits by choosing optimal prices. Based on the best response functions, we can derive the equilibrium prices. Furthermore, by substituting the equilibrium prices into the profit functions in Equation (2), we can obtain the equilibrium profits. The

following lemma summarizes the equilibrium outcome.

**Lemma 1.** *When B does not join A's platform, the equilibrium prices are*

$$\begin{cases} p_A^* &= \min \left\{ \frac{2}{3\psi}, 1 \right\} \\ p_B^* &= \frac{p_A^*}{2} \end{cases} \quad (3)$$

and the equilibrium profits are

$$\begin{cases} \pi_A^* &= \begin{cases} \frac{4}{9\psi} & \text{if } \psi > \frac{2}{3} \\ \frac{2-\psi}{2} & \text{otherwise} \end{cases} \\ \pi_B^* &= \begin{cases} \frac{1}{9\psi} & \text{if } \psi > \frac{2}{3} \\ \frac{\psi}{4} & \text{otherwise} \end{cases} \end{cases}$$

*Proof.* All proofs are available upon request. □

Note that in equilibrium, as conjectured,  $p_A^* > p_B^*$ . When A has significant information advantage (i.e.,  $\psi \leq \frac{2}{3}$ ),  $p_A^* = 1$  according to Equation (3).  $D_A^* = 1 - \frac{\psi}{2}$  and  $D_B^* = \frac{\psi}{2} \leq \frac{1}{3}$ . As long as its information advantage is reasonably large, firm A simply charges the monopoly price to fully exploit its exclusive demand and the demand left by B. If  $\psi \geq \frac{2}{3}$ ,  $D_A^* = \frac{2}{3}$  and  $D_B^* = \frac{1}{3}$ . So A enjoys higher demand than B when A has significant information and valuation advantage.

In the absence of advertising, when B does not join A's platform, substituting  $\psi = \alpha$  into the results in Lemma 1 leads to the equilibrium outcome. When B has the option to advertising, B can choose its awareness level. Based on Lemma 1, we first notice that even if it is cost free, B never wants to advertise to  $\psi \geq \frac{2}{3}$ . Technically, we can see this result because  $\pi_B^*$  decreases in  $\psi$  for  $\psi > \frac{2}{3}$ . Intuitively, when B's awareness level is low, A forgoes the competition and simply charges a monopoly price. In contrast, when B's awareness level is large enough, A has incentive to lower price and directly compete with B for the



the consumers who are aware of both product. Increasing B's awareness can increase the competition, and the benefit from increased awareness for B cannot compensate the loss from the increased competition.

**Proposition 1.** *In the presence of the advertising option, when B does not join A's platform,*  
 (a) *B never advertises to the awareness level beyond  $\psi \geq \frac{2}{3}$  even if advertising is cost-free;*  
 (b) *the optimal advertising level is*

$$\psi^* = \begin{cases} \alpha & \text{if } G'(\alpha) > \frac{1}{4} \\ \frac{2}{3} & \text{if } G'(\frac{2}{3}) < \frac{1}{4} \\ \tilde{\psi} & \text{otherwise} \end{cases} \quad (4)$$

where  $\tilde{\psi}$  is characterized by  $G'(\tilde{\psi}) = \frac{1}{4}$ . B's optimal payoff is

$$\Pi_B^* = \frac{\psi^*}{4} - G(\psi^*)$$

### 3.2 When B Joins A's Platform

When B is on A's platform, B has to pay commission  $\rho$  of each sale to A, which is the cost for B. The direct benefit of joining A is the increased awareness: when B joins A's platform, all consumers are aware of B; that is,  $\psi = 1$  in Equation (1). The demands for A and B are  $[1 - (p_A - p_B)]$  and  $(p_A - p_B)$ , respectively. Therefore, the two sellers' profits can be formulated as

$$\pi_A(p_A, p_B) = p_A [1 - (p_A - p_B)] + \rho p_B (p_A - p_B)$$

$$\pi_B(p_B, p_A) = (1 - \rho)p_B (p_A - p_B)$$

Similar to the case where B does not join A's platform, both firms optimize their profits by determining the optimal prices. Based on the best response functions, we can derive the equilibrium prices. Furthermore, we can obtain the equilibrium profits by substituting the

equilibrium prices into the profit functions. The following lemma summarizes the equilibrium outcome.

**Lemma 2.** *When B joins A's platform, the equilibrium prices are*

$$\begin{cases} p_A^{**} &= \frac{2}{3-\rho} \\ p_B^{**} &= \frac{p_A^{**}}{2} \end{cases} \quad (5)$$

and the equilibrium profits are

$$\begin{cases} \pi_A^{**} &= \frac{4-\rho}{(3-\rho)^2} \\ \pi_B^{**} &= \frac{1-\rho}{(3-\rho)^2} \end{cases} \quad (6)$$

Accordingly, the equilibrium demand is  $D_A^{**} = \frac{2-\rho}{3-\rho}$  and  $D_B^{**} = \frac{1}{3-\rho} > \frac{1}{3}$ .

Two important observations are worth highlighting. First, the product prices increase in the commission rate  $\rho$ . When A charges a higher commission rate, a larger proportion of B's sales also go to A's revenue, and thus the competition between A and B is softened, which enables both sellers to charge a higher product price. Second, we can verify that A's profit increases in the commission rate  $\rho$  and B's profit decreases in the commission rate  $\rho$ . Intuitively, a higher commission rate directly benefits A because of the a larger proportion of B's revenue goes to A. In addition, a higher commission rate also softens the competition, which indirectly benefits A. As  $\rho$  increases, both B's unit price and demand increases. But a higher portion of the B's profit goes to A. As a result, B may not be better off compared with the case where B does not join A's platform if the commission is too high. We analyze the optimal commission rate and both sellers' incentive to partner on A's platform in the next section.

## 4 The Sellers' Incentives of Partnership

We next derive the condition under which A is willing to open its platform and B has incentive to join A's platform.

### 4.1 In the Absence of Advertising Option

In the absence of advertising option, A has both the information and valuation advantage over B. When A has big information advantage, A does not have incentive to have B on its platform. This is because although having B on its platform can harvest the commission fee, it is more effective for A to exploit its exclusive demand by charging high price. On the other hand, when A's information advantage is not large and consumers' awareness of B is high enough, B has no incentive to join A. This is because, similar to the intuition for Proposition 1(a), increasing B's awareness by joining A's platform increases the competition between the two sellers and thus hurts B's profit. As a result, we conclude the following equilibrium.

**Proposition 2.** *In the absence of the advertising option, A's and B's incentives cannot be aligned. In equilibrium, B does not appear on A's platform.*

Conventional wisdom may suggest that A is willing to open its platform and B has incentive to join because A can enjoy the commission fee and B can earn higher profit because of the increased awareness and sales. However, this explanation does not always hold, according to the above proposition. The main reason is that when B does not have any advantage over A, it is more effective for A to exploit the market itself rather than charging a low commission fee. But, charging a high commission fee may keep B from joining the platform. The commission fee itself is not sufficient to explain why A is willing to open its platform and meanwhile B has incentive to join. We find that the low-cost advertising is one of the driving forces that makes it happen.

## 4.2 In the Presence of Advertising Option

When advertising option is available, B may choose not to join A's platform but increase its awareness level from  $\alpha$  to  $\psi^*$  to its best interest. The advertising option essentially increases the value of B's outside option of not joining A's platform. Therefore, for given commission rate  $\rho$  offered by A, B has less incentive to join A with the advertising option than without it. In contrast, when B increases its awareness by advertising, A's information advantage over B is reduced if A does not have B on its platform. Therefore, in the presence of advertising option, A has greater incentive to partner with B on its platform.

**Proposition 3.** *Compared with the case without advertising option, in the presence of advertising option, (a) A has greater incentive to have B on its platform; that is, given any  $\rho$ ,  $\pi_A^{**}(\rho) - \pi_A^*(\alpha) \leq \pi_A^{**}(\rho) - \pi_A^*(\psi^*)$ . (b) B has less incentive to join A's platform; that is, given any  $\rho$ ,  $\pi_B^{**}(\rho) - \pi_B^*(\alpha) \geq \pi_B^{**}(\rho) - [\pi_B^*(\psi^*) - G(\psi^*)]$ .*

Intuitively, the advertising option has asymmetric effect on firms A and B. In general, the advertising option increases the value of B's outside option of not joining A's platform, but reduces A's competitive advantage of keeping its platform closed. Although the advertising option has the opposite effect on the two firms' incentives, we show that B's decision to partner with A may emerge as an equilibrium because of the advertising option.

We next examine the condition under which both A and B have incentive to form the partnership. By comparing the equilibrium outcome in Lemmas 1 and 2 and Proposition 1, we can conclude the following.

**Proposition 4.** *In the presence of the advertising option, if  $\frac{1-\rho}{(3-\rho)^2} \geq \frac{\psi^*}{4} - G(\psi^*)$  and  $\frac{4-\rho}{(3-\rho)^2} \geq (1 - \frac{1}{2}\psi^*)$ , B joins A's platform in equilibrium; Otherwise, B simply advertises by itself and does not join A's platform, where  $\psi^*$  is defined as in Equation (4).*

The first condition ensures that B has incentive to join the platform, and the second condition ensures that A has incentive to open its platform. We first illustrate that for some forms of advertising cost functions, the above conditions can be satisfied and thus the

partnership can arise as an equilibrium outcome. For instance,  $G(\phi) = (\psi - \alpha)/4$ . In this case, the benefit and the cost of advertising for B cancel out, and B is indifferent in choosing any  $\psi$ . We assume that B chooses  $\psi^* = \frac{2}{3}$ . Therefore, when the commission rate is not too high, or, more specifically, when  $\rho < \rho^{**}$ , B has incentive to join A's platform, where  $\rho^{**}$  is defined by

$$\frac{1 - \rho^{**}}{(3 - \rho^{**})^2} = \frac{\alpha}{4}$$

It is easy to see that when  $\alpha$  is small,  $\rho^{**}$  can be very high and close to 1 (because the left-hand side is decreasing in  $\rho^{**}$ ). Intuitively, when B's initial awareness level is low and the net benefit of advertising is negligible, B has incentive to join A's platform even if the commission rate offered by A is high. Meanwhile, in this case, if A can charge a commission rate greater than a certain level  $\rho^*$ , A has incentive to have B on its platform, where  $\rho^*$  is defined by

$$\frac{4 - \rho^*}{(3 - \rho^*)^2} = 1 - \frac{1}{2}\psi^*$$

This is because, different from the case without the advertising option, with advertising the awareness gap becomes small and A's information advantage also becomes small; that is, in the former  $\psi = \alpha$ , whereas in the latter  $\psi = \psi^*$ . Therefore, when  $\rho^* < \rho^{**}$ , A is willing to open its platform and B has incentive to join A's platform.

We next consider the class of linear advertising cost function:  $G(\phi) = k(\psi - \alpha)$ . When B does not join A's platform, according to Proposition 1, if  $k > \frac{1}{4}$ , the advertising cost is too high for B to advertise, and therefore the case is equivalent to the case without advertising option. If  $k < \frac{1}{4}$ , B advertises and chooses the optimal awareness level  $\psi^* = \frac{2}{3}$ .

**Corollary 1.** *In the presence of the advertising option with  $G(\phi) = k(\psi - \alpha)$ , (a) if  $k > \frac{1}{4}$ , B does not join A's platform in equilibrium and B does not advertise; (b) if  $\frac{3(6-\sqrt{33})}{4-6\alpha} < k < \frac{1}{4}$ , B joins A's platform in equilibrium; (c) otherwise, B simply advertises by itself and does not join A's platform.*

Corollary 1 shows the effect of the advertising cost on the equilibrium outcome. When

advertising cost is high, the benefit from increased awareness for B cannot compensate the cost and thus B has no incentive to advertise. Therefore, the advertising option does not increase the value of B's outside option if B does not join A's platform. As a result, as in the case without advertising option, the two firms' incentives cannot be aligned to form partnership, which explains Corollary 1(a).

On the other hand, if the advertising is cost-free or the advertising cost is very low, as shown in Corollary 1(c), B can increase its awareness to an appropriate level by advertising and thus gain competitive advantage over A. In contrast, by joining A's platform, B's awareness level cannot be tailored and B has to pay commission fee. As a result, when the advertising cost is very low, B has no incentive to join A's platform; instead, B is better off by advertising by itself without joining A's platform, even if A is willing to open its platform.

Finally, Corollary 1(b) indicates that when the cost of advertising is in the intermediate range, A is willing to open its platform and B has incentive to join A's platform. In this case, without joining A's platform, B can advertise to increase its awareness level, which in turn reduces A's information advantage and decrease A's incentive to keep its platform closed. Therefore, A is willing to open its platform. Meanwhile, although B can increase its awareness level, B has to take into account the non-negligible advertising cost. Comparing the benefit of advertising with that of joining A's platform, B has incentive to join A's platform.

Corollary 1 illustrates that if the advertising cost is not too high or too low, A has incentive to open its platform and B has incentive to join A's platform. When there is no advertising option or advertising cost is too high, A may rather keep its platform closed and exclude B. For instance, the high-cost advertising with traditional media cannot induce A to open its platform. On the other hand, when B can effectively take advantage of the very low-cost social media advertising or the free organic listing with search engines, B has no incentive to pay commission fee to join A's platform even if the platform is open.

We next examine the effect of low-cost advertising on sales diversity. As in Xu et al.

(2012), we use the *Gini coefficient* to measure the sales diversity of the two firms in equilibrium. The Gini coefficient measures the difference between the actual distribution and the perfect equality/diversification case. A lower coefficient means greater diversification. Based on the equilibrium sales amount  $D_A(p_A, p_B)$  and  $D_B(p_B, p_A)$ , we can calculate the Gini coefficient as follows:

$$G = \frac{1}{2} - \frac{D_B(p_B, p_A)}{D_B(p_B, p_A) + D_A(p_A, p_B)} \quad (7)$$

We denote the Gini coefficient for the benchmark case without advertising as  $G(\alpha)$ . In the presence of advertising option, we denote the Gini coefficient for the case that B does not join A's platform as  $G(\psi^*)$  and that B joins A's platform as  $G(1)$ .

**Proposition 5.** *The presence of advertising option increases sales diversity; that is,  $G(\psi^*) \leq G(\alpha)$  and  $G(1) \leq G(\alpha)$ . Moreover, the platform partnership increases sales diversity; that is,  $G(1) \leq G(\psi^*)$ .*

The advertising option increases sales diversity because either the small seller can use advertising to increase its awareness and attract more consumers, or the advertising option can induce the platform partnership, and thus B increases its exposure. This is in line with the observation of the long tail phenomenon in e-commerce (Brynjolfsson et al., 2011). The relatively low cost of sponsored advertising with search engines can increase the exposure of small sellers. Our study echoes such discussion that advertising can directly be used by small sellers to increase their exposure and visibility, which contributes to long tail phenomenon. More importantly, our result suggests that the availability of low-cost advertising channels such as search engine or social media advertising has another important effect on driving long tail phenomenon—indirectly, the advertising option may induce leading retailers to open their otherwise closed platforms. When small sellers join the platforms, they can increase the exposure and be more visible to consumers, contributing to an even more prominent long tail phenomenon in online retail industry. In addition, our result also shows that the

indirect effect revealed in this study may be even more significant than the direct effect of the advertising option.

## 5 Conclusion

It is increasingly popular that some online retailers open their own platforms for third-party sellers to access and compete for the same customers. We analyze the strategic rationale for a leading online retailer to open its platform for third-party sellers. We find that, when there is no advertising option or when the advertising is expensive, the small seller is seen as a weak competitor because of its low awareness level, and the pure competition equilibrium emerges. When the cost of advertising is low, the small seller prefers to increase its awareness through its own advertising effort, rather than joining the leading retailer's platform. Only when the advertising cost is moderate, both the leading retailer and the small seller have incentives to open/join the leading retailer's platform. Our results indicate that the decreasing cost of advertising in social media or search engine is an important driving force to motivate the retailer to open its platform and welcome small sellers, effectively contributing to the increasingly prominent long tail phenomenon.

There are several possible future extensions of our study. First, so far we have only focused on the business impact. We have not performed consumer and social welfare analysis. It would be interesting to see to what extent consumers benefit from the retailer platform openness and what the social impact is. Second, in this research, we assume that both the platform owner and the small seller set their respective retail prices simultaneously. Alternatively, the platform owner may act as the Stackelberg leader in setting price. Other plausible sequences of decisions can be considered in future research.



## References

- Brynjolfsson, Erik, Yu Jeffrey Hu, Duncan Simester. 2011. Goodbye pareto principle, hello long tail: The effect of search costs on the concentration of product sales. *Management Science* **57**(8) 1373–1386.
- Jiang, Baojun, Kinshuk Jerath, Kannan Srinivasan. 2011. Firm strategies in the “mid tail” of platform-based retailing. *Marketing Science* **30**(5) 757–775.
- Mantin, Benny, Harish Krishnan, Tirtha Dhar. 2014. The strategic role of third-party marketplace in retailing. *Production and Operations Management* **23**(11) 1937–1949.
- Ryan, Jennifer K., Daewon Sun, Xuying Zhao. 2012. Competition and coordination in online marketplaces. *Production and Operations Management* **21**(6) 997–1014.
- Xu, Lizhen, Jianqing Chen, Andrew B. Whinston. 2012. Effects of the presence of organic listing in search advertising. *Information Systems Research* **23**(4) 1284–1302.
- Zhu, Feng, Qihong Liu. 2015. Competing with complementors: An empirical look at amazon.com. *working paper* .