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# Product Differentiation, Exclusivity, and Multi-purchasing

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This paper investigates the competition between two horizontally differentiated firms whose products have partially overlapping functionalities. If the firms make their products exclusive with each other, consumers can purchase only one product. Otherwise, consumers can buy both products and derive utility from the non-overlapping functionalities. We show that the firm with a quality advantage is more likely to provide nonexclusive products. Moreover, the equilibrium exclusivity level is overprovided from the socially optimal point of view. The lower the differentiation between products, the more likely the firms and the social welfare maximizer are to allow purchasing both products.

*Key Words*: Product differentiation; Exclusivity; Overlap; Multi-purchasing.
*JEL Classification Numbers*: D21, D43, D60, L13, L20, L50.

## 1. INTRODUCTION

In many markets, particularly in markets for information goods, some consumers purchase only one of the available products that are offered, while others purchase two or many of them. For example, quite a few scholars prefer heterogenous typesetting software, such as Microsoft Office and TEX, while some scholars use only Microsoft Office or TEX. One consumer may install two operating systems, Microsoft Windows and Linux, but one operating system is enough for most people. Some people may install Tencent QQ[1], Skype, and MSN on the same computer in order to chat with different friends, but others may use only one of those programs. Game lovers may play multiple game systems (WII, PS3, XBOX), but other users

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[1]Tencent QQ is one of the world's most-used chat service, with more than 1 billion registered users, mainly in China.



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prefer only a specific one. Even if the functions of these programs overlap, purchasing an extra product can increase the utility of consumers when the overlap is not perfect. However, the larger the overlap, the smaller the extra gain that can be obtained from installing both programs.

People are sometimes restricted to purchasing only one available product at a time. For example, in 2008, Sen Medicine Company signed an exclusive distribution agreement with Marionnaud to carry its 34 premium health and beauty products. People cannot find these products in other cosmetics stores, such as Sephora or Douglas. Both Marionnaud and Sephora also have their private labels and exclusivities in order to boost sales. Another case of exclusive products is due to the technological barriers set by firms, such as the barriers between two antivirus software programs, 360 and Tencent: when users install one of them, they will be required to uninstall the other.[2]

Similar competition took place between two online TV platforms: PPStream and PPTV. These are the two major software programs that provide online TV or movies based on P2P technology in China. Each of them has more than 200 million subscribers, with an average of 0.5 million users online simultaneously. PPStream broadcasts 17 types of programs allocated among 250 channels with more than 10 thousand programs, and PPTV broadcasts 11 types of programs allocated among 457 channels but has fewer programs than PPStream. Many shows are broadcast by both entities, but each of them has some specific programs. For example, PPStream has more movies, especially recent movies, and live broadcasts than PPTV, but PPTV has more sports channels and local TV channels in mainland China. These broadcast platforms are both horizontally and vertically differentiated. Their "quality" essentially depends not only on the number of TV series and films that they offer but also on the content of the programs. Consuming a second service enlarges the number of TV series and films that a consumer can watch on his or her computer, therefore, the specific value of consuming a second TV broadcast software comes from the number of TV series and films that are specific to that software. In

[2]Tencent provides many services, with chat service QQ and antivirus program included. Even without technological barriers, the coexistence of two antivirus software programs does not work well because of the working principle for this kind of programs. It was announced by certain experts that installing two antivirus programmes had a negative influence on computer functionality, or even made some functionality not work. For example, the time to start computer with 360 antivirus installed is 33 seconds, and it is 38 seconds with Kaspersky installed, whereas 51 seconds with both programs installed. Under the test of mass files copying, it takes 59 seconds for the computer with Kaspersky antivirus, 53 seconds with Rising antivirus, but it takes 278 seconds for the computer with both antivirus programmes installed to finish the copying process.

2010, PPStream set technological barriers to prevent people from consuming both services using the same computer.[3]

Certain interesting questions arise. How do two products compete when their contents partially overlap? Is "nonexclusivity", defined as consumers can "multi-purchase" and use both products, in the interest of firms? Do the firms' strategies on exclusivity enhance or harm social welfare, and even consumers?

The existing literature on product differentiation and multi-purchase traces to Gabszewicz and Wauthy (2003), which explores price competition between two vertically differentiated firms when consumers can purchase both products (it is called the "joint purchase option" in their paper). Gabszewicz and Wauthy (2003) do not characterize the difference between the multi-purchase equilibrium and the standard single-purchase equilibrium in which each consumer purchases only one variant. In this paper, we consider an industry composed of two firms that sell products that are both horizontally and vertically differentiated. A similar Hotelling approach to analyze product differentiation and multi-purchasing can be found in Anderson *et al.* (2017), which explores the characteristics of single-purchasing and multi-purchasing equilibrium. This paper also follows this line and assumes that each product has its own specific part while there also exists a common overlapping part that belongs to both products. Each firm can make its product exclusive with its opponent's, and hence the customers can consume only one of the products (single-purchase) rather than both (multi-purchase). Without product overlap, allowing multi-purchasing should be better for the firms because they have larger demand and less fierce competition. With overlap, each firm cannot charge on the common part, as they compete as Bertrand competitors. Therefore, allowing multi-purchasing could make the firms worseoff because of overlap and horizontal differentiation.

The larger the degree of overlap, the more similar the two products are and less willing the consumers are to purchase both products. Hence, the profits of each firm can be lower when the users have the option to multi-purchase. Similarly, the smaller the horizontal differentiation, the less the consumers are willing to consume both, therefore the lower the profit that each firm obtains. One important property of equilibrium with multi-purchasing users is that each firm acts as a special type of monopoly. The overlap and each firm's own quality, but not the rival's quality and

[3]The lawsuit between PPStream and PPTV began in April of 2010. First PPTV copied some programs from PPStream, then PPStream set a technological barrier so that the individual who consumed PPStream would uninstall PPTV automatically. The consumers cannot consume PPStream and PPTV at the same time (cannot install both on the same computer). One week later, they made a joint announcement to stop the dispute, under pressure by the Chinese Ministry of Industry and Information Technology.

price, determine demand, and the prices are strategically independent. The characteristics of single-purchasing and multi-purchasing equilibrium are similar to those in Anderson *et al.* (2017). A number of papers in the existing literature analyze equilibrium with multi-purchasing, such as Gabszewicz *et al.* (2001, 2004), Gabszewicz and Wauthy (2004), Anderson and Coate (2005), Kim and Serfes (2006), and Ambrus *et al.* (2016).

Intuitively, we would expect that allowing multi-purchasing between nonexclusive products induces higher social welfare. For example, Aghion and Bolton (1987), Segal and Whinston (2000), and other literature have demonstrated that exclusive contracts between upstream and downstream firms lead to higher prices and therefore have anticompetitive effects. In this paper, we show that exclusive products for consumers may induce higher social welfare, which is new in the literature. Doganoglu and Wright (2006) use a Hotelling approach to study two firms' competing strategies on compatibility and the efficiency when consumers can (or cannot) multi-purchase by purchasing both horizontally differentiated products. In their paper, the fundamental values of products fully overlap. Consumers can obtain the same utility from the fundamental value regardless of whether they buy both products or just one. Consumers can enjoy the network externality of both products, no matter which product they purchase, if firms choose compatibility for their products. This paper uses the Hotelling approach to analyze the firm's exclusivity strategy to force single-purchase with product differentiation. In the symmetric case, allowing consumers to multi-purchase yields a higher social welfare as the consumption increases. However, compared with the exclusive products case, the price changes of two firms are different because of product differentiation, which induces an inefficient allocation of consumers. With the asymmetric adjustment of prices, some consumers purchase a product from the "further away" firm, which induces a social welfare loss because they have to pay a higher transportation cost.

If we analyze the exclusivity level from a competition policy perspective, where we only care about the additional benefit and additional cost to consumers when they have the option to consume another variant, we have a different optimal exclusivity level. Nonexclusive products have two effects on the consumers: more consumption but incurring the "transportation cost" and paying different prices. When the customers can consume both products, they should evaluate the additional value from consuming a second product. We show that the social welfare maximizer has the same preference for exclusivity as a competition authority if and only if the horizontal differentiation parameter is large and the overlap is not large. If either the horizontal differentiation or the overlap parameters are small, or if both the horizontal differentiation and the degree of overlap are large,

the social welfare maximizer has the same preference for exclusivity as the firms.

The rest of the paper is organized as follows: section 2 describes the model and characterizes equilibrium results with exclusive and nonexclusive products; section 3.1 analyzes exclusivity strategies from the firms' point of view; sections 3.2 and 3.3 provide the optimal exclusivity level from the social welfare maximizer and competition policy perspectives, respectively; then section 3.4 compares the different exclusivity levels from the firms', social welfare maximizer's, and competition policy perspectives. Section 4 concludes.

## 2. THE MODEL

Consider a model with two firms, $i = A, B$, that sell two horizontally differentiated products. The firms are located at the two end points of the Hotelling segmentation of length 1. Firm $A$ is located at the far left (point 0), and firm $B$ is located at the far right (point 1). Each firm provides a product with quality $i = A, B$, respectively. Therefore, the products are vertically differentiated if $A \neq B$. These two products partially overlap, and they have some common parts. The customers can choose only one of the products if either one of the firms makes its product exclusive with its opponent's. Otherwise, if the products are nonexclusive, the customers can consume both products and derive additional utility from the non-overlapping functionalities. To ease our exploration, we assume that both the fixed cost and the marginal production cost are zero.

There is a unit mass of individuals, uniformly distributed on the Hotelling line. For each product, each consumer buys either one unit of the product or none. When firms set the prices $P_A$ and $P_B$ for the two products, the utility of the consumer located at $x \in [0, 1]$ is

$$u = \begin{cases} A - tx - P_A & \text{if he only consumes product } A, \\ B - t(1-x) - P_B & \text{if he only consumes product } B, \\ A + B - C - t - P_A - P_B & \text{if he consumes both products,} \\ 0 & \text{if he consumes neither product.} \end{cases} \tag{1}$$

Here $C$ denotes the common part or the degree of overlap between these two products.[4] If the consumer buys one additional product when he has already bought the product from the other firm, he can obtain more util-

[4]For simplicity, we use this linear formula to denote the fixed amount $C$ of overlap. Here we can say that $A$ and $B$ are bundles of products, each bundle contains some different programs, so the overlap $C$ refers not only to the number of the common programs but also to the contents of programs contained in both bundles of products, for example: product $A$ might contain programs $a$, $b$, $c$, $d$, $e$ and product $B$ might

ity from the specific part of the product ($A - C$ or $B - C$). The parameter $t$ characterizes the horizontal differentiation between these two products. Following the convention in the previous literature, we use the terminology "transportation cost".[5] Before progressing with our analysis, we make the following two assumptions.

ASSUMPTION 1. $0 \leq C \leq B \leq A \leq 2B + 3C$.

Assumption 1 expresses the facts that (a) firm $A$ has a quality advantage and (b) consuming another product will always bring a nonnegative marginal benefit. The last inequality $A \leq 2B+3C$ ensures that the quality advantage of product $A$ is not too large; hence, there exists an equilibrium under which each firm faces a demand less than 1, either the products are exclusive or nonexclusive. This inequality, together with assumption 2 ensures that all consumers are served and there is effective competition between the two firms.

ASSUMPTION 2. $t \leq \dfrac{A+B}{3}$.

In the following, we first derive the market outcome at which the products are exclusive, such that each consumer can buy at most a single product (single-purchase); then we consider the nonexclusive products case in which customers can consume both products (multi-purchase).

### 2.1. Exclusive Products

If the products are exclusive, the customers are restricted to only consume one product. There exist two types of equilibria according to different values of the transportation cost $t$. For an intermediate value of $t$, the market is fully covered and shared by two firms; for a small value of $t$, firm $A$ with a product that has a quality advantage becomes a monopolist and firm $B$ has no sale. We have the following equilibrium result with price competition:

LEMMA 1. *The equilibrium outcome when users can only single-purchase is:*

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contain programs $d$, $e$, $f$. In this case, we have $A = 5$, $B = 3$, and their common program $C = 2$.

[5]We use this horizontal differentiation as the consumers' preferences are heterogeneous; for example, for TV channels, some consumers prefer sports while others prefer movies. Here we can also explain $t$ as the unit cost for consuming one product, such as spending time to purchase or consume the product. The linearity of transportation cost gives the result that everyone obtains the same utility when they consume both products.

*1.If* $\frac{A-B}{3} < t \leq \frac{A+B}{3}$, *then*

$$P_A^s = t + \frac{A-B}{3}, \qquad D_A^s = \frac{1}{2} + \frac{A-B}{6t}, \qquad \pi_A^s = \frac{t}{2} + \frac{A-B}{3} + \frac{(A-B)^2}{18t};$$

$$P_B^s = t - \frac{A-B}{3}, \qquad D_B^s = \frac{1}{2} - \frac{A-B}{6t}, \qquad \pi_B^s = \frac{t}{2} - \frac{A-B}{3} + \frac{(A-B)^2}{18t}.$$

*2.If* $t \leq \frac{A-B}{3}$, *firm A covers the whole market, and*

$$P_A^s = A - B - t, \qquad D_A^s = 1, \qquad \pi_A^s = A - B - t.$$

Here we use $P_i^s$ and $\pi_i^s$ to denote the equilibria price and profit where the consumers are forced to single-purchase. In the equilibrium with market sharing, each firm's price and profit increases with the horizontal differentiation $t$ ($dP_i^s/dt > 0$, $d\pi_i^s/dt > 0$). The intuition is that higher horizontal difference induces stronger preference, which entails more inelastic demand, more market power, and higher profit. When the quality difference $A - B$ increases, firm $A$'s price and profit increases while firm $B$'s decreases. The larger $A-B$, the more the inelastic consumers are willing to pay; therefore, firm $A$ can charge a higher price to obtain a higher profit. Similarly, for firm $B$, the larger the quality disadvantage, the less the inelastic consumers are willing to pay, hence firm $B$ has to charge a lower price. Two firms share the market equally in the symmetric case ($A = B$), and each of them sets a price equalling to the "transportation cost".

### 2.2. Nonexclusive Products

If products are nonexclusive, customers can consume both products and derive additional utility from the non-overlapping functionalities. They have to evaluate the additional value of buying a second product when making the purchasing decision. Each consumer prefers the product closer to his own location; therefore, he buys that product first. The additional value obtained from buying the other product depends on the degree of overlap. Two firms do not compete for the marginal consumer who is indifferent between consuming either product. Each firm's pricing strategy only affects its own demand. There exist pure strategy equilibria where there exist positive buyers for both products if and only if $t \leq (A + B - 2C)/2$. If $(A + B - 2C)/2 < t \leq (A + B)/3$, there is no pure strategy equilibrium under which multi-purchasing users exist.[6] For a large value of

[6]The detailed proof for nonexistence of a pure strategy equilibrium can be found in the Appendix in Gabszewicz and Wauthy (2003).

$t$, some consumers multi-purchase these two products and each firm faces a demand less than 1. For an intermediate value of $t$, all the consumers buy product $A$ and some of them also purchase product $B$. For a small value of $t$, every consumer purchases both products. We have the following result:

LEMMA 2. *If the consumers can multi-purchase, we have the following equilibria:*

*1.If $t$ is large, that is, $\frac{A-C}{2} < t \leq \frac{A+B-2C}{2}$, then a strictly positive mass $\frac{A-C}{2t} + \frac{B-C}{2t} - 1$ of consumers purchases both products.*

$$P_A^m = \frac{A-C}{2}, \qquad D_A^m = \frac{A-C}{2t} < 1, \qquad \pi_A^m = \frac{(A-C)^2}{4t};$$
$$P_B^m = \frac{B-C}{2}, \qquad D_B^m = \frac{B-C}{2t} < 1, \qquad \pi_B^m = \frac{(B-C)^2}{4t}.$$

*2.If $t$ is of intermediate size, that is, $\frac{B-C}{2} < t \leq \frac{A-C}{2}$, then a mass $\frac{B-C}{2t}$ of consumers purchases both products. No consumer purchases only product $B$.*

$$P_A^m = A - C - t, \qquad D_A^m = 1, \qquad \pi_A^m = A - C - t;$$
$$P_B^m = \frac{B-C}{2}, \qquad D_B^m = \frac{B-C}{2t}, \qquad \pi_B^m = \frac{(B-C)^2}{4t}.$$

*3.If $t$ is small, that is, $t \leq \frac{B-C}{2}$, all consumers purchase both products, and*

$$P_A^m = A - C - t, \qquad D_A^m = 1, \qquad \pi_A^m = A - C - t;$$
$$P_B^m = B - C - t, \qquad D_B^m = 1, \qquad \pi_B^m = B - C - t.$$

Here we use $P_i^m$ and $\pi_i^m$ to denote the equilibria price and profit when multi-purchasing users exist. In the equilibrium where each firm faces a demand less than 1, each firm's price and profit depends on its own product quality and the degree of overlap but not the opponent's quality. Indeed, there is no direct competition between two firms if the users are not restricted to buying only one variant, and the firms behave as Bertrand competitors on the common part $C$. Therefore, each firm can only charge consumers for its own contribution to their utility: $A - C$ or $B - C$. Furthermore, each firm has monopoly power on its own specific part and earns monopoly profit, which is increasing with its own product quality and decreasing with $t$ ($d\pi_i^m/dt < 0$.). The larger the overlap $C$, the less the

additional value obtained from purchasing a second variant. Therefore, each firm earns a lower profit ($d\pi_i^m/dC < 0$).

### 2.3. Exclusive vs. Nonexclusive Products

With exclusive products, the consumers become more heterogenous with the increase of horizontal differentiation $t$. Then each firm's market power on its own inelastic consumers increases, inducing higher prices and higher profits. With nonexclusive products, when the users become more heterogenous, each firm covers a smaller market segment and earns a lower profit. The intuition is that each firm has monopoly power on its own specific part but cannot charge on the common part $C$; therefore, each firm charges a monopoly price on its own specific part, $A - C$ or $B - C$, which is independent on the horizontal differentiation $t$. The population that is willing to buy both products decreases with the degree of heterogeneity. Hence, each firm faces a lower demand and earns a lower profit.

In the cases where each firm faces a demand less than 1, that is, case 1. in both lemmas, both firms charge a higher price under exclusivity ($P_A^s > P_A^m$, $P_B^s > P_B^m$ since $t > \frac{A-C}{2}$). With nonexclusive products, in order to attract users to consume its product in addition to its opponent's, each firm has to charge a lower price (the price charged for only the special part of each product). If $C > \frac{A+2B-3t}{3}$, firm $A$ faces a larger demand when the consumers can multi-purchase, but firm $B$ has a smaller demand. The intuition is that a larger $C$ makes purchasing both products less attractive to consumers, inducing the more inelastic consumers to purchase product $A$ due to its quality advantage. Some consumers that locate closer to firm $B$ switch to buy from a "further away" firm $A$. Furthermore, compared with the case of exclusive products, with nonexclusive products, both the price decrement and the demand increment of firm $A$ are larger than that of firm $B$.[7] Firm $A$ competes fiercely on price in order to induce a larger amount of increment of demand and hence a higher profit due to high quality.

For an intermediate value of $t$, all consumers purchase product $A$, some of them purchase product $B$ with nonexclusive products, and the two firms share the market with exclusive products. Both firms charge a higher price with exclusive products if and only if $t \geq \frac{2A+B-3C}{6}$. The smaller the value of $t$, the more fierce the competition between two exclusive firms, hence each firm charges a lower price. For a small value of $t$, firms $A$ covers the whole market with exclusive products and each firm faces a demand of 1 with nonexclusive products. Firm $A$ charges a lower price with exclusive products than that with nonexclusive products in order to

[7] We have $t+\frac{A-B}{3}-\frac{A-C}{2} > t-\frac{A-B}{3}-\frac{B-C}{2}$ and $\frac{A-C}{2t}-[\frac{1}{2}+\frac{A-B}{6t}] > \frac{B-C}{2t}-[\frac{1}{2}-\frac{A-B}{6t}]$ from lemma 1 and 2.

drive the opponent out of the market ($P_A^s < P_A^m$). Firm $A$ has to set a low price for the sake of market share under fierce competition with exclusive products.

In summary, if we compare the pricing strategy of each firm with exclusive and nonexclusive products, we have the following result due to the fact that a lower value of $t$ induces fierce competition with exclusive products.

LEMMA 3. *Each firm charges a higher price under exclusive products if and only if the horizontal differentiation t is large. Otherwise, if t is small, each firm charges a lower price under exclusive products.*

## 3. EXCLUSIVITY LEVEL

### 3.1. Equilibrium Level

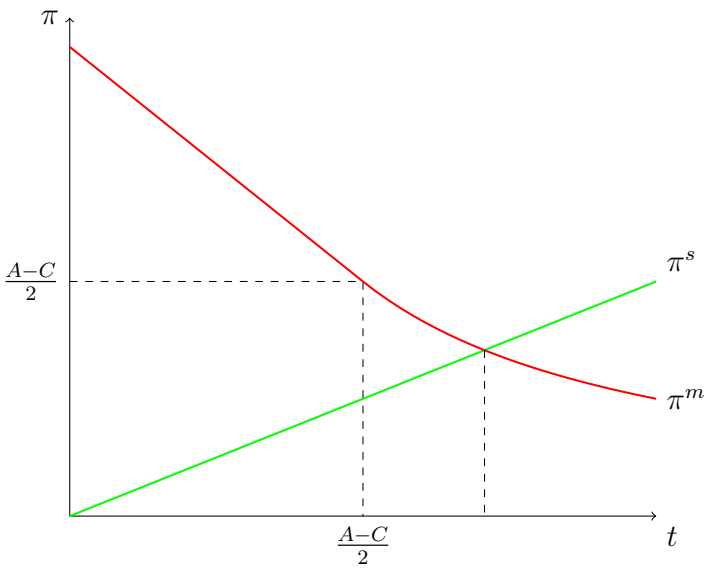
A firm will prohibit multi-purchase if and only if its profit is higher under single-purchase, and consumers will be allowed to multi-purchase if both firms earn greater profits under nonexclusivity. For simplicity, we only consider the case where $t \leq (A + B - 2C)/2$, which ensures that there exists a pure strategy equilibrium. From comparing the profits in lemmas 1 and 2, we have the following result:

PROPOSITION 1. *In equilibrium, both firms provide nonexclusive products to allow multi-purchasing if and only if* $t \leq \dfrac{A-B}{3} + \dfrac{B-C}{\sqrt{2}}$.

For a given degree of overlap $C$, nonexclusivity is the equilibrium strategy chosen by both firms if the degree of product differentiation $t$ is small. The intuition is that the smaller $t$ is, the more similar these two products are, and the more fierce Hotelling competition induces a lower price each firm can charge, and therefore the lower the profit that can be obtained. In the limit case when $t = 0$, Hotelling competition is equivalent to Bertrand competition, which induces a zero profit for firm $B$ and very low profit for firm $A$. Figure 1 gives the equilibrium profit with exclusive and nonexclusive products, respectively, in the symmetric case when $A = B$.

The threshold of preference for allowing multi-purchasing decreases with the product overlap $C$. Indeed, allowing multi-purchasing has two effects on the firms: on the one hand, the market expansion effect leads to an increment of demand for each firm; on the other hand, the strategic effect induces each firm to charge a lower price. The larger the overlap $C$, the less willing the consumers are to purchase both products, the smaller the market expansion effect, and the larger the strategic effect. Hence, the lower the profit each firm obtains; as a result, each firm has a lower incentive to allowing multi-purchase.

**FIG. 1.** Equilibrium profits when $A = B$.




We can prove that when $t > \frac{A-B}{3}$, for all circumstances under which firm $B$ permits multi-purchasing, so does firm $A$, so firm $A$ is more likely to set nonexclusive products to allow multi-purchasing than firm B. Both firms choose nonexclusive products when $t \leq \frac{A-B}{3}$. Therefore, the equilibrium nonexclusivity level is determined by firm $B$'s strategy. In addition, from the comparative statics on $t$, we find that a decrease in the transportation cost $t$ will lead both firms to value nonexclusive products more.

PROPOSITION 2. *Whenever firm $B$ accepts multi-purchasing, so does firm $A$. An increase in product qualities $A$ and $B$ will never lead to more prohibition of multi-purchasing. A decrease in the transportation cost $t$ makes both firms value multi-purchasing more.*

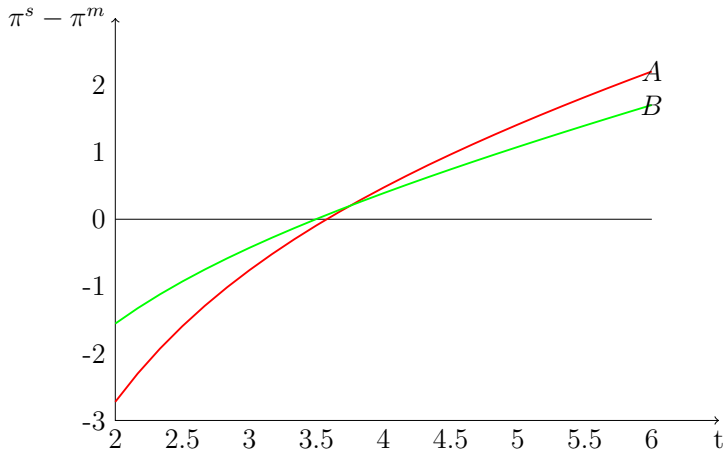
The prices charged by both firms and the demands are increasing with the product quality when consumers can multi-purchase. Firm $A$ has a quality advantage, so it charges a higher price and attracts more consumers than firm $B$. As a result, for all the parameter values under which firm $B$ allows multi-purchasing, so does firm $A$. The smaller $t$ is, the less difference in the consumers' evaluation of the two products. As a result, the less the inelastic consumers are willing to pay, the more fierce the competition between these

two firms becomes. Therefore, each firm earns a smaller profit when they compete under single-purchasing.

Figure 2 describes each firm's strategy for allowing multi-purchase. For a given degree of overlap $C$, both firms prefer the users to single-purchasing if the differentiation $t$ is large. When $t$ is medium, for all circumstances when firm $B$ prefers multi-purchasing, so does firm $A$; therefore, firm $A$ is more likely to allow multi-purchasing; both firms prefer single-purchasing if $t$ is small.

Figure 3 describes the comparative statics with the product quality $A$, $B$, and the transportation cost $t$. With the increase of product quality $A$ or $B$, both firms are more likely to allow multi-purchasing.[8] The intuition is that, with the increase of $A$, the more severe firm $B$'s quality disadvantage is, and lower the profit it obtains if the consumers can purchase only one product; therefore, firm $B$ has stronger preference for multi-purchasing. For firm $A$, the larger the quality it provides, the higher the price it can charge and the higher demand it faces when the consumers can multi-purchase; therefore, the higher profit it obtains.

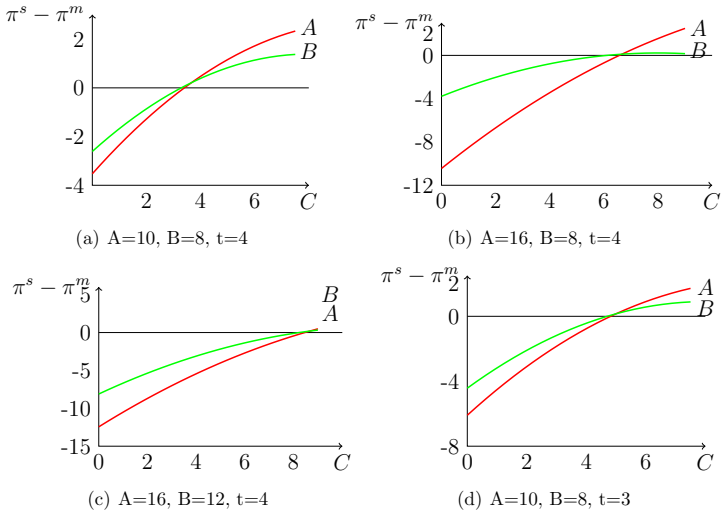
**FIG. 2.** Profit difference and transportation cost t for a given $C$.




### 3.2. Socially Optimal Level

[8]Another description for this stronger preference for multi-purchasing is that there exists an increasing function of $A$, $C_A(A)$, such that firm $A$ prefers allowing multi-purchasing if and only if $C < C_A(A)$. Similarly, there exists a function $C_B(A)$, such that firm $B$ prefers allowing multi-purchasing if and only if $C < C_B(A)$, where $C_B$ is increasing with $A$. Therefore, the threshold $C$ to allow multi-purchasing is increasing with $A$. The same condition holds for the product quality $B$.

**FIG. 3.** Profit difference and the degree of overlap.




In this section, we compare the single-purchasing and multi-purchasing outcomes from the perspective of the social planner who aims to maximize social welfare. From a comparison of social welfare, which is defined as the unweighted sum of consumer surplus and firms' profits, we have the following result:[9]

PROPOSITION 3. *Nonexclusive products is socially optimal if transportation cost $t$ is not large or if transportation cost $t$ is large and overlap $C$ is not large.*

Allowing multi-purchasing has two effects from the social welfare maximizer's perspective: more consumption by consumers and higher transportation cost. If the transportation cost is not large, the social welfare maximizer prefers nonexclusive products because prohibition of multi-purchasing induces a social welfare loss due to underconsumption. For a large value of $t$, the large value of $C$ renders multi-purchasing less attractive to consumers; hence, the strategic effect induces each firm to charge a lower price under nonexclusive products. In addition, the market expansion effect for the two firms are not symmetric because of product differentia-

[9]We can prove that nonexclusive products is socially optimal if either $t \leq \max\left\{\sqrt{\frac{7}{12}}(A-B), \frac{A-C}{2}\right\}$ or $t \geq \max\left\{\sqrt{\frac{7}{12}}(A-B), \frac{A-C}{2}\right\}$ and $C \leq \frac{3(A+B)-4t-4t\sqrt{\frac{1}{4}-\frac{7(A-B)^2}{48t^2}}}{6}$.

tion. The amount of increment of firm $A$'s demand is larger than that of firm $B$. Moreover, if $C > \frac{A+2B-3t}{3}$, firm $A$ faces a larger demand when the consumers can multi-purchase, but firm $B$ has a smaller demand. The asymmetric change of demand induces some consumers that are located close to firm $B$ to switch from purchasing firm $B$ to firm $A$ which is further away from them, creating an inefficient allocation, and this induces a social welfare loss because of the inefficient allocation in which consumers have to pay a larger transportation cost.

### 3.3. Consumer Surplus Maximization

The consumer surplus is equal to the difference between social welfare and the firms' profits. If we consider from the competition policy perspective that there exists a regulator who aims to maximize consumer surplus, we obtain different results:[10]

PROPOSITION 4. *Nonexclusive products is optimal from the competition policy perspective if $t$ is large.*

If the transportation cost $t$ is large (i.e, $\frac{A-C}{2} < t \leq \frac{A+B-2C}{2}$), the consumer surplus is larger under multi-purchasing than under single-purchasing. There are two effects when the consumers can multi-purchase: more consumption and paying different prices and transportation cost. If $t$ is large, the strategic effect induces each firm to charge a lower price under nonexclusive products than under exclusive products. Therefore, allowing multi-purchasing is beneficial to the consumers because of the increment of consumption and the decrement of prices. If $t$ is small (i.e, $t \leq \frac{A-C}{2}$), allowing multi-purchasing is harmful to consumers. The smaller the value of $t$, the more fierce the competition the two firms face with exclusive products and therefore the lower the price each firm charges. With nonexclusive products, the multi-purchasing users have to pay a high price to both firms and incur a higher transportation cost, both of which decrease consumer surplus.

### 3.4. Comparison

If we compare the exclusivity strategy for the socially optimal outcome and firms, we get: (1) for the parameter values when both firms choose nonexclusive products on the consumers' side, nonexclusive is socially optimal; (2) there exist some circumstances in which exclusive products is offered in the product market, while nonexclusive products is socially optimal.

[10]It is easy to show that multi-purchasing is optimal from the competition policy perspective if $\frac{A-C}{2} < t \leq \frac{A+B-2C}{2}$.

PROPOSITION 5. *Whenever nonexclusive products is offered by the firms, nonexclusive products is socially optimal.*

**FIG. 4.** Profit (welfare) difference and the degree of overlap $C$.

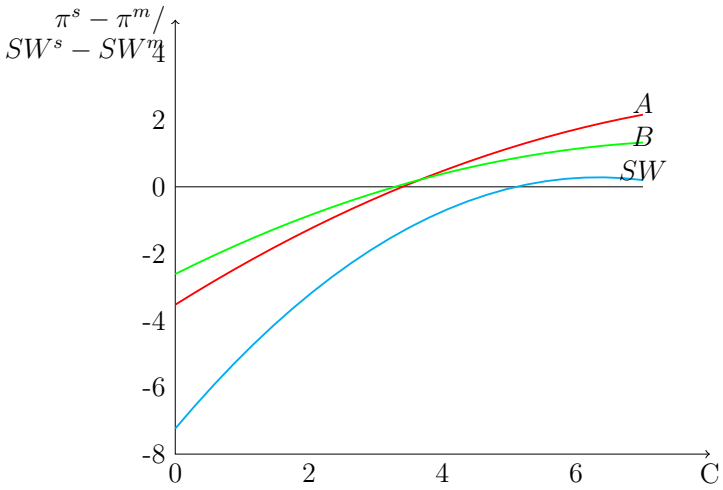
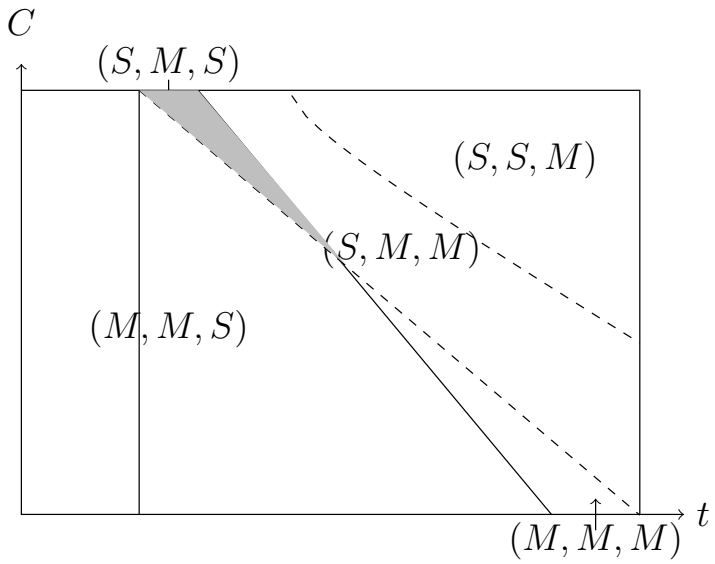



Figure 4 could be helpful to figure the intuition for proposition 5. For given values of $A$, $B$, and $t$, the social welfare difference between single-purchasing and multi-purchasing is always smaller than each firm's profit difference. The social welfare loss due to preventing multi-purchasing is always larger than the profit loss, because the social welfare maximizer cares about the consumer surplus in addition to the firms' profits. The loss in consumer surplus due to preventing multi-purchasing is larger than the increase of profits, which induces a welfare loss. Therefore, the equilibrium nonexclusivity strategy chosen by firms is less than socially optimal.

We use figure 5 to describe the firms' equilibrium behavior as well as the social welfare maximizer's and the consumer surplus maximizer's preference on allowing multi-purchase. From figure 5, enforcing single-purchasing is socially optimal if and only if both the degree of overlap $C$ and the transportation cost $t$ are large. The social welfare maximizer has the same preference as the consumer surplus maximizer if and only if $t$ is large and $C$ is not large. If $C$ is small, or if both $t$ and $C$ are large, the social welfare maximizer has the same preference as the firms. Allowing multi-purchasing is optimal for the firms, the social welfare and the consumer surplus if and only if $t$ is large and $C$ is small. Note that in the gray area, both the firms' equilibrium behavior and consumer surplus maximizer's

**FIG. 5.** We summarize the firms' exclusivity strategy, the social welfare maximizer and the consumer surplus maximizer's preference for multi-purchasing. We use $M$ to denote multi-purchasing and $S$ to denote single-purchasing. In each block, the first capital letter denotes the firms' equilibrium strategy; the second one denotes the social welfare maximizer's strategy, and the third one denotes the consumer surplus maximizer's strategy.




preference are single-purchasing, while the social welfare maximizer prefers nonexclusive products to allow multi-purchasing. This is because the firms' equilibrium behavior is determined by firm $B$'s strategy, while allowing multi-purchasing is profitable for firm $A$ for these parameter values, in addition, allowing multi-purchasing induces a profit increase for firm $A$, which is greater than the decrement of firm $B$'s profit and the consumer surplus.

PROPOSITION 6. *The social welfare maximizer has the same preference as the consumer surplus maximizer if and only if $t$ is large and $C$ is not large. If $C$ is small, or if both $t$ and $C$ are large, the social welfare maximizer has the same preference as the firms. The social welfare maximizer has the same preference as both the firms and the consumer surplus maximizer if and only if $t$ is large and $C$ is small.*

The intuition behind proposition 6 is that allowing multi-purchasing has an opposite effects on the firms' profits and consumer surplus. The social welfare maximizer's preference depends on which one dominates.

We can use proposition 6 to explain the exclusivity preference of the online TV broadcasters in China. Many online TV broadcasters have bought the exclusive broadcast rights for a sports program or reality show by spending a huge amount of money. For example, SINA has exclusive broadcast rights to the FA premier league, and Tencent video has exclusive broadcast rights to the NBA tournament. The Amazing Race is exclusively broadcasted on Sohu, and Running Man is broadcasted only in iQIYI. Consumers cannot watch both programs from only one of the broadcasters. A series of programs are similar, so the degree of overlap is large for these programs. On the consumers' side, different consumers have different preferences about TV programs, so the horizontal differentiation is large. Clearly allowing one online TV platform to broadcast different programs is beneficial to consumers. The government allows each broadcaster to protect its own program because the social welfare maximizer has the same preference as the firms when both the overlap and the horizontal differentiation are large.

## 4. CONCLUSION

This paper analyzes Hotelling competition between two horizontally differentiated firms with partially overlapping product lines. Each firm can make its product exclusive from its opponent's product to prevent consumers from using both products. If the products are nonexclusive with each other, consumers can multi-purchase and obtain more utility from the non-overlapping functionalities. If the consumers only have the option to single-purchase, the prices and profits depend on the quality difference of the two products. Higher heterogeneity of consumers induces larger market power for each firm, higher prices, and higher profits. With multi-purchasing users, in contrast, prices and profits depend on the specific part of each product. If the degree of overlap is sufficiently large, the additional benefit of buying a second product might vanish. More heterogenous consumers will reduce the number of consumers that are willing to consume both products but will not affect the price each firm charges. Other things being equal, multi-purchasing will lead to lower prices if the horizontal differentiation is large, due to the overlap.

The firms choose exclusivity to enforce single-purchasing due to the overlap and product differentiation. We show that the equilibrium exclusivity strategy is determined by the firm with a quality advantage. We also demonstrate that the equilibrium exclusivity level chosen by firms is greater than the socially optimal one. In addition, if we analyze from the competition policy perspective, exclusive products is optimal if and only if the transportation cost is not large. Furthermore, the social welfare maximizer

is more likely to have the same strategy for exclusivity as the firms rather than the competition authority.

One topic for further research is to analyze the exclusivity level and multi-purchase in a two-sided market framework. Many markets, such as online TV channels and online newspapers, are characterized as platforms that obtain profits from advertisement. In the two-sided market, exclusivity affects not only the competition on the consumer side but also the competition on the advertisement side due to the inter-group externalities. Another interesting extension is to study firms' choice of the degree of overlap. In our model, the degree of overlap is exogenously given. The greater the degree of overlap, the less benefit to firms from choosing nonexclusive products. It is worthwhile to analyze the equilibrium degree of overlap and exclusivity level.

## REFERENCES

Aghion, P. and P. Bolton, 1987. Contracts as a Barrier to Entry. *American Economic Review* **77(3)**, 388-401.

Ambrus, A., E. Calvano, and M. Reisinger, 2016. Either or Both Competition: A "Two-Sided" Theory of Advertising with Overlapping Viewerships. *American Economic Journal: Microeconomics* **8(3)**, 189-222.

Anderson, S. P. and S. Coate, 2005. Market Provision of Broadcasting: A Welfare Analysis. *Review of Economic Studies* **72(4)**, 947-972.

Anderson, S. P., Ø. Foros, and H. Kind, 2017. Product functionality, Competition and Multi-Purchasing. *International Economic Review* **58(1)**, 183-210.

Doganoglu, T. and J. Wright, 2006. Multihoming and Compatibility. *International Journal of Industrial Organization* **24(1)**, 45-67.

Gabszewicz, J., D. Laussel, and N. Sonnac, 2004. Programming and Advertising Competition in the Broadcasting Industry. *Journal of Economics and Management Strategy* **13(4)**, 657-669.

Gabszewicz, J., N. Sonnac, and X. Wauthy, 2001. On Price Competition with Complementary Goods. *Economic Letters* **70(3)**, 431-437.

Gabszewicz, J. and X. Y. Wauthy, 2003. The Option of Joint Purchase in Vertically Differentiated Markets. *Economic Theory* **22(4)**, 817-829.

Gabszewicz, J. and X. Y. Wauthy, 2004. Two-Sided Markets and Price Competition with Multi-homing. *Working Paper*

Kim, H. and K. Serfes, 2006. A Location Model with Preference for Variety. *Journal of Industrial Economics* **54(4)**, 569-595.

Segal, I. and M.D. Whinston, 2000. Naked Exclusion: Comment. *American Economic Review* **90(1)**, 296-309.