Welfare Effects of Platforms' Exclusivity Clauses

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Abstract

Consumers are often active on multiple digital platforms, while gatekeeper platforms can force sellers contractually to use one platform exclusively. This paper considers the welfare effects of such exclusivity clauses for buyers, sellers and platforms in a platform duopoly with seller membership fees. A set-up with partially multihoming buyers and sellers is compared to one with partially multihoming buyers and singlehoming sellers. It is shown that exclusivity clauses generally harm total welfare. Buyers suffer when sellers are exclusive on one platform, while platforms and sellers benefit from exclusivity clauses under certain conditions. In rare cases, the positive effect on platforms' profits and sellers' surplus of exclusive clauses outweighs the negative impact on the consumers' surplus. Exclusive contracts are preferred if sellers derive a low value from joining a platform and have a low differentiation cost and a high cross-group effect from meeting buyers.

Keywords: Platform competition, two-sided markets, exclusive contracts, multihoming

JEL classification: D43, D47, D62, L13, L22

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1 Introduction

Digital companies have grown and intensified their presence in people's lives in recent decades. The business model of many of these companies is to connect two sides of a market, i.e., the consumer and the seller side. Firms with such platform business models are, e.g., *Airbnb*, *Booking.com*, *Uber*, *Lift*, *Lieferando* and *Delivery Hero*. Consumer participation on a platform requires a few clicks only. Therefore, many consumers are active on more than one platform. Joining a platform as a seller involves more bureaucratic and technical effort. Additionally, platforms can contractually establish and enforce an exclusivity clause on the seller side. Some platforms have reached such a strong intermediation position that sellers' economic success depends on these so-called gatekeepers (Digital Markets Act, 2022).

In the literature, platform participants, who exclusively join one platform, are categorized as singlehoming. Participants, who join more than one platform, are considered as multihoming (Rochet and Tirole, 2003). Partial multihoming occurs when some participants multihome while the remaining participants singlehome (Bakos and Halaburda, 2020). In digital markets, multihoming is common on the consumer side (Choi 2010; Athey et al. 2018). Whether sellers singlehome or multihome depends on the platforms' contractual terms. The content platform *Twitch*, the e-commerce platform *Alibaba* and the food delivery platform *Meituan* used such exclusivity clauses (AFK Gaming 2022; Global Times 2021). Also, *Spotify* provides and *Tencent* provided exclusive content for their consumers (Digital Music News, 2021).

Exclusivity clauses are often criticized by regulators, e.g., the Chinese regulators banned exclusive agreements for music content (Reuters, 2022). Also, the European regulators consider the lack of multihoming as a threat to fair competition and emphasize that multihoming should be facilitated (Digital Markets Act, 2022). This paper examines for whom exclusivity clauses are harmful or beneficial. It considers the effects of exclusivity clauses on buyers' and sellers' surpluses, platforms' profits and total welfare. The results are obtained by comparing the outcomes of a duopoly platform market with a seller membership fee and without exclusivity clauses to the same setting with exclusivity clauses.

The foundation of a theoretical analysis of two-sided markets with membership fees has been modeled by Armstrong (2006). This analysis focuses on market participants with exclusive platform choices and their pricing. He also formulates an approach for a market scenario where one market side is singlehoming, while the other side is multihoming. The so-called competitive bottleneck scenario is further specified in Armstrong and Wright (2007). Belleflamme and Peitz (2019) compare these two market environments. The authors identify a set of possible market outcomes. They find that shifting toward multihoming sellers may benefit all parties. In other parameter constellations, platforms benefit from exclusive sellers, while at least one of the participating sides is worse off. In turn if, platforms prefer mulithoming sellers, buyers or sellers buyers benefit from singlehoming sellers. Shekhar (2022) considers price discrimination in a setting with partially multihoming sellers and singlehoming buyers. Platforms charge different prices to singlehoming and multihoming sellers. He finds more fiercely competition with price discrimination relative to uniform seller prices.

Choi (2010) emphasizes the relevance of multihoming on the consumer side in digital markets. However, he assumes the fraction of multihoming consumers to be exogenously given. Bakos and Halaburda (2020) and Jeitschko and Tremblay (2020) endogenize the multihoming decision on the buyer and seller side and analyze the effects on participants' fees. Jeitschko and Tremblay (2020) find that prices are lower when multihoming occurs. Bakos and Halaburda (2020) show that when both sides multihome, the subsidy of one fee through the opposite market side's fee disappears. Liu and Zhou (2021) also consider a market environment with multihoming on each side. Contrary, they consider a market with transaction fees and extend the analyzes to oligopoly platform markets. Pires (2020) studies the appearance of multihoming consumers on digital media market. He studies the effect of partially multihoming consumers on media firms' decisions on advertising and content provision level.

Questions concerning the effect of exclusive contracts in platform markets were raised first by Doganoglu and Wright (2009). Exclusivity clauses can be used as a tool to deter entry. In their model, the timing structure is decisive. They examine the effects of exclusivity clauses introduced by an incumbent platform and find that all sellers sign an exclusive contract with the incumbent firm. Thus, all buyers join the incumbent and have no reason to multihome. The authors conclude that banning exclusive dealing positively affects buyers' surplus and total welfare. Brühn and Götz (2016) study exclusive agreement in a competitive bottleneck environment of two shopping centers with free market entry. They conclude that exclusive agreements can be profitable to shopping centers if their competition is intense. Chica et al. (2021) extend the entry deterrence analysis to an oligopoly market. They consider the optimal number of exclusive sellers on a platform when consumers are singlehoming.

Other papers discuss which sellers should be targeted for exclusivity clauses. Carroni et al. (2020) study the contractual choices of superstar content providers (equivalent to our sellers) on their exclusivity. The authors find positive spillover effects of exclusive deals of superstars to smaller content providers. They conclude that banning exclusivity contracts may harm welfare. Ishihara and Oki (2021) study the choice of exclusivity clauses of a monopolistic content provider in a situation with partial multihoming on both market sides. The content provider chooses the fraction of exclusive content provided to platforms by considering its effect on the bargaining power toward the platforms. Saruta (2022) studies the effect of exclusive contracts in a duopoly platform market, where only one platform can offer exclusive contracts. Sellers with exclusive contracts enter the platform for free. Saruta (2022) derives the optimal number of exclusive sellers and considers the welfare effects in the two limit cases where platforms offer exclusive contracts to all or no sellers. Also, Cong et al. (2022) consider the welfare effects of exclusivity clauses. They focus on asymmetric platforms. The authors assume that buyers do not pay a membership fee and normalize the network effects and the buyers' transportation costs. They find that exclusivity makes a strong platform to compete less aggressively and the weak one more aggressively. They conclude that exclusive contracts can benefit society when a strong platform introduces it.

This paper considers the welfare effects of exclusivity clauses on the seller side, building on the Belleflamme and Peitz (2019) framework. However, we assume that buyers are partially multihoming in both environments, which suits digital markets better. Buyers' decisions to multihome are endogenized, similar to the model of Bakos and Halaburda (2020). Our paper considers the welfare effects on all three participant groups and also the total welfare, which has not previously been done in this setting. Contrary to the model of Cong et al. (2022), we consider heterogeneous cross-group effects on the buyer and seller side.

It can be shown that the seller membership fee is higher in a set-up with exclusive seller clauses. Thus, platforms offer exclusive contracts whenever the additional sellers from a non-exclusive setting cannot offset the lower fee. When platforms decide to enforce exclusivity on the seller side, the aggregate of sellers and buyers suffer from the decision. We find that prohibiting exclusivity clauses generally increases total welfare. Buyers would unambiguously benefit from such a ban. More buyers would join only a single platform but obtain a higher utility from joining the platform as they meet more sellers. Sellers would also benefit from such a ban. They benefit from the lower membership fee, but in the aggregate, the differentiation costs increase. In rare cases, the total welfare is larger with exclusivity clauses. This occurs if sellers derive a low value from joining a platform and they have a low differentiation cost and a high cross-group effect from meeting buyers.

The remainder of the paper is structured as follows: Section 2 introduces the model set-up and considers the market outcomes without exclusivity clauses. In Section 3, the platforms enforce exclusivity on the seller side. The equilibrium outcomes are derived when sellers singlehome and buyers are partially multihome. A comparison of the scenarios is presented in Section 4. Section 5 summarizes the findings and concludes the paper.

2 Platform Competition without Exclusivity Clauses

We consider a duopoly market with platforms connecting buyers and sellers. The optimal pricing strategy is derived from a two-stage game. In the first stage, platforms set the membership fees sellers must pay to enter the platform. In the second stage, buyers and sellers simultaneously decide which platform they want to join.[1] Preferences of buyers b and sellers s are uniformly distributed on standardized Hotelling lines, $x_b \sim U[0,1]$ and $x_s \sim U[0,1]$. Platform A is located at $x_g^A = 0$ and platform B at $x_g^B = 1$ on the buyer and seller side $g = \{b, s\}$. Buyers obtain a standalone value $r_b > 0$ from joining a platform and a cross-group effect $\beta_b > 0$ for each seller joining the platform. The number of sellers joining the platform $i = \{A, B\}$ is denoted by n_s^i. The buyers' gross utility from joining platform i is $u_b^i = r_b + n_s^i\beta_b$. The platform charges a membership fee m_s^i on the seller side. The sellers' gross utility from joining platform i is $u_s^i = r_s + n_b^i\beta_s - m_s^i$. In the following scenario, buyers and sellers can multihome. A buyer who joins two platforms obtains the gross utility $u_b^M = 2r_b + \beta_b$. In this section, it is assumed that sellers do not have exclusive contracts with platforms. Thus, sellers can join both platforms. As multihoming occurs on both market sides, some buyers and sellers meet each other twice. However, buyers and sellers derive no additional value from meeting the other party a second time. Therefore, a multihoming buyer only derives the network benefit of meeting all sellers once. Additionally, the multihoming buyer enjoys the standalone values of joining both platforms. A seller who joins two platforms obtains the gross utility $u_s^M = 2r_b + \beta_b - (m_s^i + m_s^j)$. The multihoming seller benefits from joining both platforms, but the membership fee must be paid twice.

In the second stage of the game, participants decide to join a platform. Platforms in digital space are horizontally differentiated by consumer preferences. When joining a platform, the participants obtain a linearly increasing utility loss equal to the participants' differentiation parameter $\tau_g > 0$. Buyers can either join one platform or two platforms. They consider the utility and the differentiation cost of joining platform A $(u_b^A - \tau_b x_b)$, joining B $(u_b^B - \tau_b(1 - x_b))$ or joining both $(u_b^M - \tau_b)$. The multihoming buyers have to bear the cost of differentiation for the entire length of the line segment. The buyer who is indifferent between joining platform A in addition to platform B or staying exclusive on platform B is located at x_b^{BA}. The number of buyers joining platform A equals the location of the indifferent buyer $n_b^A = x_b^{BA}$. The last buyer joining platform B in addition to platform A is located at x_b^{AB}. Buyers located on the right side of the indifferent one will join platform B. Consequently, the number of buyers joining platform B amounts

[1] The game follows Bakos and Halaburda (2020). In the game at hand, however, buyers do not pay a membership fee to access the platform.

$n_b^B = 1 - x_b^{AB}$. The buyer participation on platform i with $i, j = A, B, i \neq j$ is

$$n_b^i = \frac{r_b + (1 - n_s^j)\beta_b}{\tau_b}. \tag{1}$$

The fraction of sellers who choose to stay exclusively on platform i is equal to $(1 - n_s^j)$. Hence, the platform attracts more buyers if it hosts more exclusive sellers. The number of sellers on platform i is derived as

$$n_s^i = \frac{r_s + (1 - n_b^j)\beta_s - m_s^i}{\tau_s}. \tag{2}$$

The more exclusive buyers $(1 - n_b^j)$ a platform host, and the lower the membership fee, the more favorable the platform is. Solving (1) and (2) yields

$$n_b^i = \frac{\tau_s(r_b + \beta_b) - \beta_b(r_s - m_s^j + \beta_s)}{\tau_b\tau_s - \beta_b\beta_s},$$
$$n_s^i = \frac{\tau_b(r_s - m_s^i + \beta_s) - \beta_s(r_b + \beta_b)}{\tau_b\tau_s - \beta_b\beta_s}.$$

In the first stage, platform i maximizes its profit function $\pi_i = (m_s^i - c_s)n_s^i$ with respect to the seller membership fee m_s^i. Both platforms charge the membership fee only on the seller side of the market, and incur a symmetric cost c_s per seller. They choose the symmetric strategy $i = j$ in equilibrium, therefore, the seller membership[2] is

$$m_s^{NE} = \frac{\tau_b(h_s + \beta_s) - \beta_s(r_b + \beta_b)}{2\tau_b} + c_s. \tag{3}$$

The variable h_s denotes the standalone value of joining a platform net of costs, i.e., $h_s = r_s - c_s$. The higher the net standalone value for sellers, the higher their fee. As a benchmark result, we consider the case without the interconnection of the two market sides by neglecting the cross-group effect ($\beta_b = \beta_s = 0$). When platforms set the seller fee independent of the effect on the buyer side, it is equal to the monopoly fee $1/2(r_s + c_s)$.

When analyzing how the buyer side affects the seller fee, we find that the fee rises if more buyers choose to remain exclusively on one platform. According to (1), the number of buyers decreases as the buyers' differentiation cost increases and the buyers' cross-group effect decreases. Consequently, for large values of buyers' differentiation cost and low cross-group effects more buyers stay exclusively on one platform. Concurrently, the increase in the buyers' differentiation cost and a decrease in their cross-group effect leads to an increase in the seller membership fee.

The first-order conditions determine the optimal membership fee (3) as long as the

[2]The superscript NE denotes equilibrium outcomes when sellers are not required to stay exclusively on one platform.

second-order conditions

$$\tau_b > 0 \text{ and } \tau_b\tau_s > \beta_b\beta_s \tag{4}$$

are satisfied. The differentiation parameters must outweigh the cross-group effect. Thereby, it is guaranteed that the two platforms can co-exist in the same market due to the adequate level of differentiation (Armstrong, 2006).

In the subgame perfect equilibrium, the platform participations read

$$n_s^{NE} = \frac{\tau_b(h_s+\beta_s) - \beta_s(r_b+\beta_b)}{2(\tau_b\tau_s - \beta_b\beta_s)}, \text{ and} \tag{5}$$

$$n_b^{NE} = \frac{r_b + (1-n_s^{NE})\beta_b}{\tau_b}. \tag{6}$$

If one group has a greater incentive to join the platform, fewer participants of the other group will join. Given that condition (4) holds, the denominator of (5) is positive. The numerator indicates that the number of sellers increases as they derive a higher net standalone value. The parameters which lead to fewer buyers on a platform positively affect the number of sellers. The number of buyers (6) on a platform increases when fewer sellers decide to join the platform. The number of multihoming buyers is calculated by $\mu_b^{NE} = 2n_b^{NE} - 1$, leading to

$$\mu_b^{NE} = \frac{r_b+\beta_b}{\tau_b} + \frac{\tau_s(r_b+\beta_b) - \beta_b(h_s+\beta_s)}{\tau_b\tau_s - \beta_b\beta_s} - 1. \tag{7}$$

The equilibrium platform profit is

$$\pi^{NE} = \frac{(\tau_b(h_s+\beta_s) - \beta_s(r_b+\beta_b))^2}{4\tau_b(\tau_b\tau_s - \beta_b\beta_s)}. \tag{8}$$

and increases when the differentiation parameter outweighs the cross-group effects. As the platform derives revenue from the seller side, it prefers to host many sellers and to be able to set a high membership fee. This is observed if buyers stay exclusively on one platform. The gross utilities of buyers are

$$u_b^{NE} = r_b + n_s^{NE}\beta_b,$$
$$u_b^{M,NE} = 2r_b + \beta_b.$$

The gross utilities of sellers are

$$
\begin{aligned}
u_s^{NE} &= h_s + \beta_s \frac{r_b + \beta_b}{\tau_b} - \frac{\tau_s(\tau_b(h_s + \beta_s) - \beta_s(r_b + \beta_b))}{2(\tau_b\tau_s - \beta_b\beta_s)} \\
u_s^{M,NE} &= h_s + \beta_s \frac{r_b + \beta_b}{\tau_b} .
\end{aligned}
$$

The sellers' utility increases in their net standalone value. Additionally, it increases by a second term $\beta_s \frac{r_b+\beta_b}{\tau_b}$. This term indicates that sellers derive a higher utility if buyers' standalone value and cross-group effect lead to high participation on the buyer side (see equation (1)). The utility of a singlehoming seller is reduced by a third term. Therefore, the gross utility of a multihoming seller is greater than that of a singlehoming seller since singlehoming sellers derive the network benefits only from buyers who are active on the same platform. The aggregated surplus from all buyers is

$$
\begin{aligned}
CS^{NE} &= \int_0^{x_b^{AB}} (u_b^A - \tau_b x_b)\, dx_b + \int_{x_b^{AB}}^{x_b^{BA}} (u_b^M - \tau_b)\, dx_b + \int_{x_b^{BA}}^{1} (u_b^B - \tau_b(1 - x_b))\, dx_b \\
&= 2u_b^{NE}(1 - n_b^{NE}) + u_b^{M,NE}(2n_b^{NE} - 1) - \tau_b(n_b^{NE})^2 \\
&= \frac{r_b^2 + \beta_b(1 - n_s^{NE})(2(r_b - \tau_b) + \beta_b(1 - n_s^{NE}))}{\tau_b} + \beta_b. \qquad (9)
\end{aligned}
$$

In the aggregate, the differentiation cost for each buyer group is considered. Multihoming buyers are located between x^{AB} and x^{BA}. The singlehoming buyers obtain the utility of joining only one platform and carry the differentiation cost of joining the closest platform. The first term of the second line denotes the gross utility of all singlehoming buyers. The second term denotes the gross utility of all multihoming buyers. The last term captures the total differentiation costs. Similarly, the aggregated surplus of all seller amounts to

$$
\begin{aligned}
PS^{NE} &= \int_0^{x_s^{AB}} (u_s^A - \tau_s x_s)\, dx_s + \int_{x_s^{AB}}^{x_s^{BA}} (u_s^M - \tau_s)\, dx_s + \int_{x_s^{BA}}^{1} (u_s^B - \tau_s(1 - x_s))\, dx_s \\
&= 2u_s^{NE}(1 - n_s^{NE}) + u_s^M(2n_s^{NE} - 1) - \tau_s(n_s^{NE})^2 \\
&= \frac{\beta_s((r_b + \beta_b)\tau_s - (\tau_b\tau_s + \beta_b h_s))}{\tau_b\tau_s - \beta_b\beta_s} + \frac{\beta_s(r_b + \beta_b)}{\tau_b} + \tau_s(n_s^{NE})^2 \qquad (10)
\end{aligned}
$$

To calculate the total welfare, buyers' and sellers' surpluses as well as platform profits of both firms are taken into account[3]. It yields

$$
\begin{aligned}
W^{NE} &= CS^{NE} + PS^{NE} + 2\pi^{NE} \\
&= \frac{r_b^2 + \beta_b(1-n_s^{NE})(2(r_b-\tau_b)+\beta_b(1-n_s^{NE})) + \beta_s(r_b+\beta_b) + (n_s^{NE})^2(\tau_b\tau_s - \beta_b\beta_s)}{\tau_b} \\
&+ \frac{\beta_s((r_b+\beta_b)\tau_s - (\tau_b\tau_s + \beta_b h_s))}{\tau_b\tau_s - \beta_b\beta_s} + \tau_s(n_s^{NE})^2 + \beta_b. \qquad (11)
\end{aligned}
$$

Some conditions must be met in order to observe this market outcome. Partial multihoming only occurs if there is an overlap between the indifferent buyers. If some buyers multihome, all buyers join at least one platform. Additionally, it must be assumed that not all buyers multihome. The conditions imply $0 < x_b^{AB} < x_b^{BA} < 1$. Considering the locations in the equilibrium outcome and solving them for h_s gives

$$
\frac{(2\tau_b\tau_s - \beta_b\beta_s)(r_b+\beta_b-\tau_b)}{\tau_b\beta_b} < h_s < \frac{(2\tau_b\tau_s - \beta_b\beta_s)(r_b+\beta_b-\tau_b) + \tau_b(\tau_b\tau_s - \beta_b\beta_s)}{\tau_b\beta_b}. \qquad (12)
$$

Similarly, partial multihoming occurs on the seller side only if $0 < x_s^{AB} < x_s^{BA} < 1$. Reformulating the conditions gives

$$
\frac{\tau_b\tau_s + \beta_s r_b - \tau_b\beta_s}{\tau_b} < h_s < \frac{2\tau_b\tau_s - \beta_b\beta_s + \beta_s(r_b - \tau_b)}{\tau_b}. \qquad (13)
$$

Thus, the parameter h_s must satisfy the strictest minimum and the maximum condition.

3 Platform Competition with Exclusivity Clauses

Platforms can enforce exclusivity on one market side through an exclusive contract. It is more feasible for platforms to implement a contract and verify its execution on the seller side than on the buyer side (Doganoglu and Wright, 2009). If platforms impose an arbitrarily high membership fee on the non-exclusive contract option, which no seller is willing to pay, exclusivity can also be enforced (Armstrong and Wright, 2007). If at least one of the two platforms requires exclusivity, the sellers can select only one platform and exclusivity is set for the entire market (Cong et al., 2022). Therefore, all sellers can only join one platform.[4] In the second stage, buyers and sellers decide which platform they join. As the decision for buyers does not change, the number of buyers is still given by (1). Sellers consider the utility and the differentiation cost of joining platform A ($u_s^A - \tau_s x_s$) and joining platform B ($u_s^B - \tau_s(1-x_s)$). They join the platform with the highest net utility. The seller being indifferent between joining platform A or platform B has the same

[3]The total welfare follows Lefouili and Pinho (2020).

[4]The game follows Belleflamme and Peitz (2019). In the game at hand, however, buyers do not pay a membership fee to access the platform

net utility on both platforms. The location of the indifferent seller x_s^0 indicates the buyers' demand for platform A, i.e., $n_s^A = x_s^0$. As all sellers decide on a platform exclusively, the end of platform A's range implies the beginning of platform B's range. Thus, platform B's seller demand is $n_s^B = 1 - x_s^0$. The number of sellers joining platform i yields

$$n_s^i = \frac{1}{2} + \frac{(n_b^i - n_b^j)\beta_s - (m_s^i - m_s^j)}{2\tau_s}. \tag{14}$$

A platform can attract more sellers by hosting more buyers and lowering the seller membership fee. As sellers are active exclusively on one platform, it must hold that $n_s^i = 1 - n_s^j$. Using this fact and solving the equation system (1) and (14) gives the participation on both market sides depending on the seller membership fees:

$$n_b^i = \frac{r_b}{\tau_b} + \frac{\beta_b}{\tau_b}\left(\frac{1}{2} - \frac{\tau_b(m_s^i - m_s^j)}{2(\tau_b\tau_s - \beta_b\beta_s)}\right)$$
$$n_s^i = \frac{1}{2} - \frac{\tau_b(m_s^i - m_s^j)}{2(\tau_b\tau_s - \beta_b\beta_s)}$$

In the next step, platform i maximizes its profit function $\pi_i = (m_s^i - c_s)n_s^i$ with respect to the seller membership fee m_s^i. Due to symmetry, the seller membership fee[5] is

$$m_s^E = \tau_s + c_s - \beta_s\frac{\beta_b}{\tau_b}. \tag{15}$$

The seller price equals the Hotelling formulation $(\tau_s + c_s)$ and is adjusted downward by the benefit of an additional buyer on the platform. Each buyer increases the sellers' utility by the cross-group effect β_s. The weight of adjustment is determined by $\frac{\beta_b}{\tau_b}$, indicating how many buyers join when one additional seller joins the platform (see equation (1) with $n_s^i = 1 - n_s^j$). Thus, the seller membership is decreased if the additional seller who joins the platform, due to the reduction, causes a benefit on the buyer side of the platform (Armstrong, 2006).

The second-order condition requires

$$\frac{-\tau_b}{\tau_b\tau_s - \beta_b\beta_s} < 0$$

and holds as long as the sufficient conditions (4) hold. Using the equilibrium membership fee to derive the number of participants for buyers and sellers leads to

$$n_b^E = \frac{2r_b + \beta_b}{2\tau_b} \text{ and } n_s^E = \frac{1}{2}.$$

More buyers join a platform if they derive a high standalone value and a high cross-group

[5]The superscript E indicates the equilibrium outcomes with exclusivity clauses on the seller side.

effect from meeting sellers. Fewer buyers join the platform as they incur more costs of differentiation. As platforms choose a symmetric membership fee, the market share for sellers is equally shared. Each platform hosts half of the sellers. Using the equilibrium membership fee and number of sellers on a platform to derive the platforms' profit

$$\pi^E = \frac{\tau_b \tau_s - \beta_b \beta_s}{2\tau_b} \quad . \tag{16}$$

Higher differentiation parameters increase platform profits by reducing competition. Therefore, platforms can charge a higher membership fee on the seller side. The cross-group effects fierce competition and, thus, lead to lower platform profits. In equilibrium, the gross utility of buyers yields

$$u_b^E = r_b + \frac{1}{2}\beta_b \text{ and } u_b^{M,E} = 2r_b + \beta_b.$$

The gross utility of a singlehoming seller is

$$u_s^E = h_s + \frac{2r_b + \beta_b}{2\tau_b}\beta_s + \frac{\beta_b}{\tau_b}\beta_s - \tau_s.$$

The surplus increases as the sellers' net standalone value increases and more buyers join the platforms. Additionally, the surplus increases the higher the downward adjustment $\frac{\beta_b}{\tau_b}\beta_s$ in their membership fee is. The surplus decreases the higher the sellers' differentiation parameter is, as the platform charges them a higher membership fee. The number of multihoming buyers is

$$\mu_b^E = \frac{2r_b + \beta_b}{\tau_b} - 1. \tag{17}$$

The aggregated surplus for all buyers is

$$\begin{aligned} CS^E &= \int_0^{x_b^{AB}} (u_b^A - \tau_b x_b)\ dx_b + \int_{x_b^{AB}}^{x_b^{BA}} (u_b^{AB} - \tau_b)\ dx_b + \int_{x_b^{BA}}^1 (u_b^B - \tau_b(1 - x_b))\ dx_b \\ &= \frac{(2r_b + \beta_b)^2}{4\tau_b} \quad . \end{aligned} \tag{18}$$

The buyers' surplus increases the more buyers are active on the platform. The aggregated surplus for all sellers is

$$\begin{aligned} PS^E &= u_s - \int_0^{\frac{1}{2}} \tau_s x_s\ dx_s - \int_{\frac{1}{2}}^1 \tau_s(1 - x_s)\ dx_s \\ &= h_s + \frac{2r_b + \beta_b}{2\tau_b}\beta_s + \frac{\beta_b}{\tau_b}\beta_s - \frac{5}{4}\tau_s. \end{aligned} \tag{19}$$

Since all buyers singlehome, the utility of a singlehoming buyer is multiplied by the mass of buyers (equal to 1). Additionally, the total differentiation costs are considered. Summing up the buyers' and sellers' surpluses and platform profits gives the total welfare

$$W^E = h_s + \frac{(2r_b + \beta_b)^2 + 2\beta_s(2r_b + \beta_b) - \tau_b\tau_s}{4\tau_b}. \tag{20}$$

If platforms generate more value through a high standalone value and cross-group effects, the overall welfare is higher. Higher differentiation parameters lead to a reduction in welfare.

In order to observe partial multihoming on the buyer side, $0 < x_b^{AB} < x_b^{BA} < 1$ must hold. Reformulating this condition leads to

$$\frac{1}{2}(\tau_b - \beta_b) < r_b < \frac{1}{2}(2\tau_b - \beta_b). \tag{21}$$

Additionally, all sellers must be willing to participate. Thus, the net utility of joining a platform has to be positive, i.e., $u_s^E - x_s\tau_s > 0$. Inserting the equilibrium outcomes yields the condition

$$h_s > \frac{3(\tau_b\tau_s - \beta_b\beta_s) - 2r_b\beta_s}{2\tau_b}. \tag{22}$$

Thus, the market outcome is only observed if both parameters satisfy the conditions.

4 Comparison of the Two Scenarios

4.1 Precondition of Comparison

In order to compare the equilibrium outcomes of the two set-ups, the second-order conditions must be satisfied. As long as the second-order condition in Section 2 is satisfied, the second-order condition in Section 3 is satisfied, too.

Further, the participation condition and the partial multihoming conditions must be fulfilled. Equations (12), (13) and (22) can be summarized in

$$h_s^{\min} < h_s < h_s^{\max}$$

with

$$h_s^{\min} \equiv \max\left\{\frac{(2\tau_b\tau_s - \beta_b\beta_s)(r_b + \beta_b - \tau_b)}{\tau_b\beta_b}, \frac{3(\tau_b\tau_s - \beta_b\beta_s) - 2r_b\beta_s}{2\tau_b}, \frac{\tau_b\tau_s + \beta_s r_b - \tau_b\beta_s}{\tau_b}\right\},$$
$$h_s^{\max} \equiv \min\left\{\frac{(2\tau_b\tau_s - \beta_b\beta_s)(r_b + \beta_b - \tau_b) + \tau_b(\tau_b\tau_s - \beta_b\beta_s)}{\tau_b\beta_b}, \frac{2\tau_b\tau_s - \beta_b\beta_s + \beta_s(r_b - \tau_b)}{\tau_b}\right\}.$$

The sellers' standalone value must satisfy the strictest maximum and the strictest minimum condition. Additionally, the standalone value on the buyer side must satisfy

$$\frac{1}{2}(\tau_b - \beta_b) < r_b < \frac{1}{2}(2\tau_b - \beta_b).$$

We can compare the market outcomes only if the parameters h_s and r_b are within the defined ranges.

4.2 Platforms' Perspective

Platforms have the power to define contract terms because they are the only channel to interact with the opposing market side. Platforms enforce exclusivity on the seller side when the derived profits are larger than the profit derived in a situation where some sellers multihome, i.e., $\pi^E - \pi^{NE} > 0$. The profits (7) and (16) are inserted into the inequality and the inequality is solved for h_s. The derived thresholds $h^{\pi}_{s|1}$ and $h^{\pi}_{s|2}$ denote where platforms are indifferent between enforcing an exclusive agreements or not. The threshold values are

$$h^{\pi}_{s|1,2} \equiv \frac{\beta_s(r_b + \beta_b - \tau_b) \pm \sqrt{2}(\tau_b\tau_s - \beta_b\beta_s)}{\tau_b}.$$

For values of h_s in between the thresholds, platforms derive a higher profit if they enforce exclusivity on the seller side. The platforms' profit functions depend on the seller membership fee and the number of sellers joining a platform.

First, the effect of sellers membership fee is considered. Sellers pay a higher membership fee if they are forced to singlehome if $m_s^E - m_s^{NE} > 0$ holds. Inserting the seller fee (3) and (15) into the inequality and solving for h_s yields

$$h_s^{m_s} \equiv \frac{2\tau_b\tau_s - \beta_b\beta_s + \beta_s(r_b - \tau_b)}{\tau_b}.$$

The threshold $h_s^{m_s}$, where sellers pay the same in both market environments, is identical to one of the two h_s maximum conditions above. Partial multihoming only occurs on the seller side if $0 < x_s^{AB}$ and $x_s^{BA} < 1$ hold. The conditions can be reformulated as the decisive h_s maximum condition. Below $h_s^{m_s}$, sellers pay more when all sellers singlehome. Therefore, when sellers partially multihome, the fee paid is lower than that in a market environment with exclusivity clauses. The underlying effect is the price sensitivity effect, which was first observed by Chen and Riordan (2008) and applied to the agents' homing analysis by Belleflamme and Peitz (2019). Platforms are more effective in attracting sellers by a fee cut when sellers can multihome. Therefore, they lower the fee to a stronger extend in the environment without exclusive clauses.

Second, the effect of sellers participation is taken into account. By definition, the number of sellers joining a platform will be greater if sellers can join two platforms but must join at least one. The additional sellers, who pay the membership fee, make non-exclusive contracts more attractive to platforms.

The number of multihoming buyers is higher when platforms impose exclusivity on the seller side if $\mu_b^E - \mu_b^{NE} > 0$. Solving the inequality for h_s gives

$$h_s^{\mu_b} \equiv \frac{\tau_b \tau_s + \beta_s(r_b - \tau_b)}{\tau_b}.$$

This corresponds to one of the three h_s minimum conditions. Above the threshold $h_s^{\mu_b}$, more buyers multihome if sellers sign exclusivity clauses. This trend can already be seen from equation (1). A platform attracts more buyers if they host many exclusive sellers. In the extreme case, when all sellers are exclusive on one platform, the number of buyers is the highest.

Offering non-exclusive contracts can only be attractive to platforms if the greater participation on the seller side offsets the lower membership fee. To illustrate the effects more clearly, a numerical example is introduced. Figure 1 displays the outcomes. The figure shows how market outcomes change as the sellers' net standalone value and differentiation cost develop. Due to the second-order conditions, only parameter constellations for

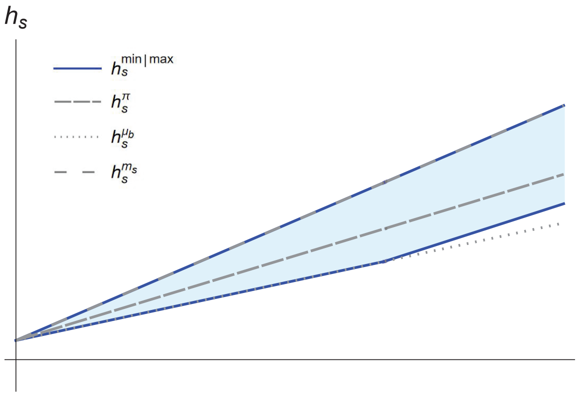
$$\tau_s > \frac{\beta_b \beta_s}{\tau_b}$$

are considered. The two scenarios can only be compared if h_s is in the shaded area between $h_s^{\min}$ and $h_s^{\max}$. For clarity, indifference curves strictly outside the feasible area are not displayed. The dashed line presents the platforms' profit indifference curve h_s^{π}. Below the line, platforms derive a higher profit if they enforce exclusivity on the seller side. The widely dashed line h^{m_s} indicates the threshold where sellers pay the same fee in both market environments. The dotted line $h_s^{\mu_b}$ indicates the indifference curve where the same amount of buyers multihome in the considered market environments. The market outcome varies with the externally given parameter values. To capture the effects of the variables four numerical variations are considered in Figure 1.

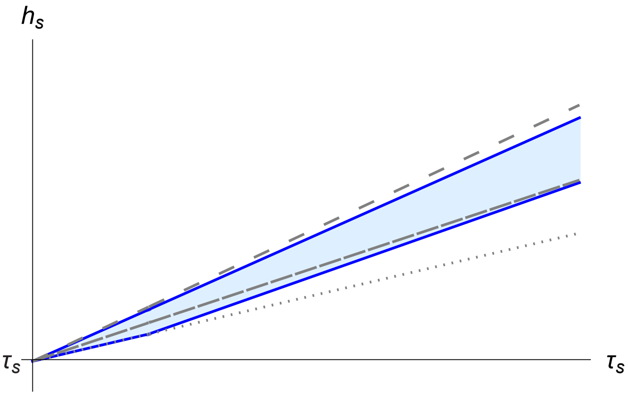
Figure 1a depicts the benchmark outcome. The illustration shows that sellers pay more and the number of multihoming buyers is higher if sellers singlehome. The shaded area is divided into two parts by h_s^{π}. Above h_s^{π} platforms prefer that a fraction of sellers multihome. In this area, the m_s^{NE} is lower than m_s^E, but the difference between the fees is small. Although the sellers fee is lower, it is beneficial for the platforms to allow sellers to multihome as the larger seller quantity offsets the lower fee. As h_s decreases, the fee m_s^{NE} also does. Below h_s^{π}, platforms force sellers to be exclusive on one platform. In this area, the additional sellers cannot offset the lower fee.

Figure 1b depicts the effect of an increase in the buyers' differentiation parameters. As τ_b increases the feasible area shrinks. An increase in differentiation cost makes multihom-

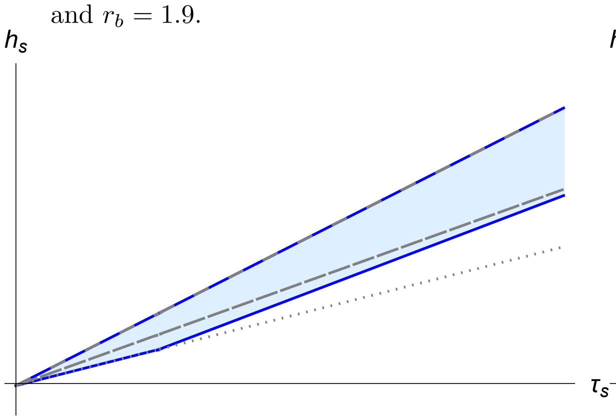
Figure 1: Indifference Curves of Platform Profits and Membership Fee



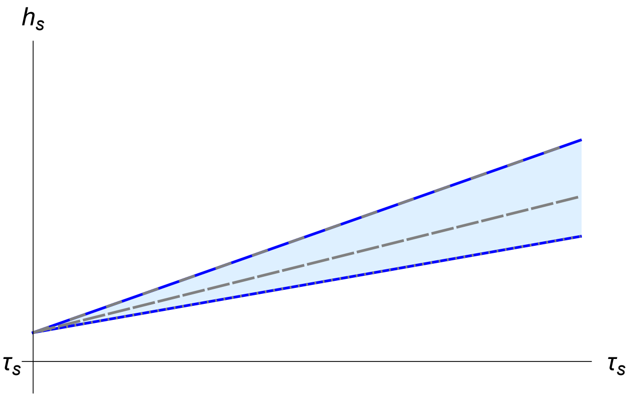
(a) Benchmark Case
The numerical values are $\tau_b = 3$, $\beta_b = 2$, $\beta_s = 2$ and $r_b = 1.9$.



(b) Increase of Buyers' Differentiation Cost
The numerical value of τ_b changes to 4.



(c) Decrease of Buyers' Cross-Group Effect
The numerical value of β_b changes to 1.



(d) Increase of Sellers' Cross-Group Effect
The numerical value of β_s changes to 3.

ing less attractive to buyers. At the same time, it makes the exclusive market environment less attractive to sellers as they meet fewer buyers and pay a higher fee. The area where platforms prefer non-exclusive sellers becomes proportionally larger. Figure 1c illustrates a decrease in the buyers' cross-group effect. If β_b decreases, the minimum condition of h_s shifts upward. A decrease in β_b makes the exclusive market environment less attractive to sellers. Similar to an increase in differentiation cost a decrease in buyers' cross-group effect leads to fewer buyers and higher fees. The area where platforms prefer non-exclusive sellers increases proportionally. Figure 1d illustrates how the market changes as the sellers' cross-group effect increases. If sellers' value from each additional buyer increases, the area where platforms prefer non-exclusive sellers becomes proportionally larger compared to the benchmark outcome.

4.3 Welfare Effects

To examine the effects of exclusivity clauses on platform markets, the effects on platforms, buyers and sellers must be considered. The surpluses derived in Section 2 and 3 allow us to investigate the buyers' and sellers' perspectives. First, the buyer side is examined.

On the buyer side, the gross utility of two exemplary groups is taken into account. Buyers who singlehome in both environments experience a change in gross utilities as some sellers multihome, i.e. $u_b^E - u_b^{NE} = (1/2 - n_s^{NE})\beta_b$. The change occurs as the number of sellers varies. As some sellers multihome it must hold $n_s^{NE} > 1/2$. Thus, the so-called participation effect indicates that singlehoming buyers have a disadvantage as they meet fewer sellers on a platforms when platforms enforce exclusivity on the buyer side. Buyers who multihome in both environments experience no change in gross utilities. Buyers' surpluses account for all buyers' gross utilities as well as their transportation costs. They are compared to see if exclusivity clauses benefit or harm buyers in aggregate. The surplus of buyers is greater with exclusivity clauses on the seller side if $CS^E - CS^{NE} > 0$. Inserting the buyers' surpluses (10) and (18) in the inequality and solving for h_s gives

$$h_{s|1,2}^{CS} \equiv \frac{(2\tau_b\tau_s - \beta_b\beta_s)(r_b + \beta_b - \tau_b)}{\tau_b\beta_b} \pm \frac{|2r_b + \beta_b - 2\tau_b|(\tau_b\tau_s - \beta_b\beta_s)}{\tau_b\beta_b}.$$

For values of h_s between the indifference curves $h_{s|1}^{CS}$ and $h_{s|2}^{CS}$ buyers prefer a market environment with exclusivity clauses. The first term of the function corresponds to one of the h_s minimum functions. Therefore, if the second part is subtracted, the lower threshold is outside the feasible area.

Second, the seller side is taken into account. A group of sellers singlehome in both settings. Their gross utility differs depending on the participation and price effect, i.e. $u_s^E - u_s^{NE} = (n_b^E - n_b^{NE})\beta_s - (m_s^E - m_s^{NE})$. As derived in Section 4.2, the number of buyers is higher if sellers are exclusive on one platform ($n_b^E > n_b^{NE}$). It was also shown that sellers pay more with exclusivity clauses ($m_s^E > m_s^{NE}$). As a result, sellers who singlehome in both environments benefit because they meet more buyers but suffer because they pay a higher fee, as exclusive clauses are enforced. Another group of sellers switch to multihoming if they are permitted to do so. Their obtained gross utility changes as they derive the additional standalone value and experience a difference in buyers met and price paid, i.e. $u_s^E - u_s^{M,NE} = r_s + (n_b^E - 1)\beta_s - (m_s^E - m_s^{NE})$. The sellers who switched meet more buyers as $n_b^E < 1$ and pay a lower fee without exclusivity clauses. The participation and the price effect make them a beneficiary of an environment without exclusivity clauses. The surplus of sellers in the aggregate is larger if they are required to be exclusive on one platform if $PS^E - PS^{NE} > 0$. Inserting the sellers' surpluses (11) and (19) in the inequality and solving for h_s gives

$$h_{s|1,2}^{PS} \equiv 2\tau_s + \frac{\beta_s(r_b - \beta_b - \tau_b)}{\tau_b} \pm \frac{\sqrt{\tau_b\tau_s(2\beta_b\beta_s - \tau_b\tau_s)}(\tau_b\tau_s - \beta_b\beta_s)}{\tau_b\tau_s}.$$

For values inside the range, sellers benefit if all of them singlehome.

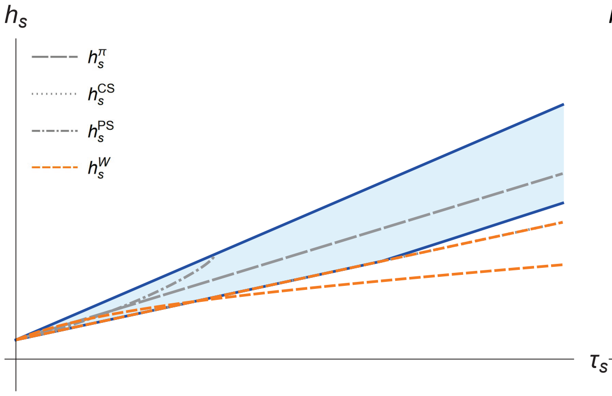
The surpluses of the different parties are summed up to consider the welfare effects. The total welfare is higher if platforms impose exclusivity for sellers if $W^E - W^{NE} > 0$.

Solving the inequality for h_s gives

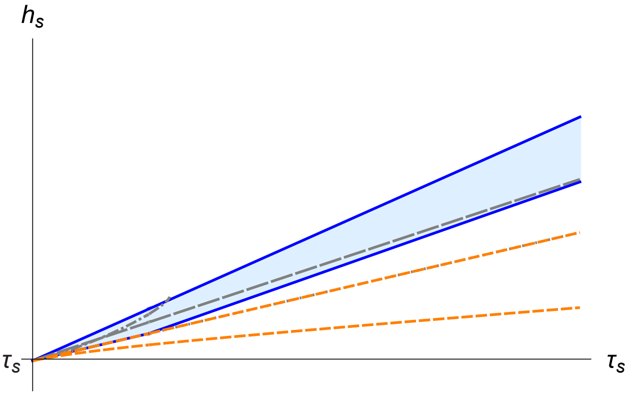
$$h^W_{s|1,2} \equiv \frac{(2\tau_b\tau_s - \beta_b\beta_s)(\beta_s(r_b - \tau_b) + \beta_b(r_b + \beta_b) - \tau_b(\tau_s + \beta_b)) + (\tau_b\tau_s - \beta_b\beta_s)\beta_s(r_b - \tau_b)}{\tau_b(3\tau_b\tau_s - 2\beta_b\beta_s + \beta_b^2)} + \frac{2(2(\tau_b\tau_s)^2 - (\beta_b\beta_s)^2) \pm |\beta_b(2r_b + \beta_b) - \tau_b(\tau_s + 2\beta_b) + 2\beta_s\beta_b|(\tau_b\tau_s - \beta_b\beta_s)}{\tau_b(3\tau_b\tau_s - 2\beta_b\beta_s + \beta_b^2)}.$$

The numerical example from above is used to facilitate the interpretation. The setting of Figure 2 is the same as in Figure 1. Again, the dashed line represents the platforms' profit indifference curve h^π_s. The dashed, dotted lines h^{PS}_s represent the indifference curve of sellers' surplus and the dotted lines h^{CS}_s represent the indifference curve of buyers' surplus. The orange dashed lines h^W_s represent the indifference curve of the total welfare. Again, curves strictly outside the feasible area are not displayed. The indifference curve of buyers' surplus h^{CS}_s is hidden behind the indifference curve of the total welfare h^W_s.

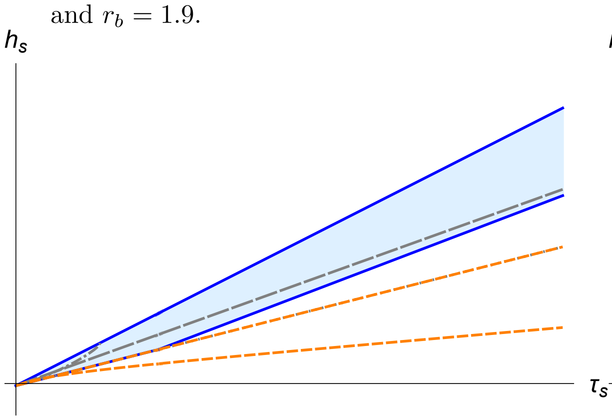
Figure 2: Indifference Curves of Surpluses



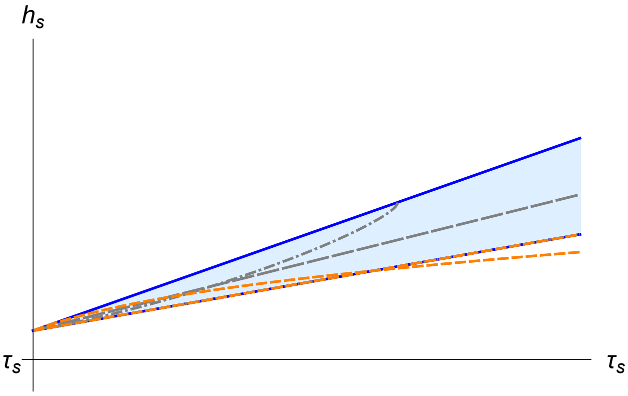
(a) Benchmark Case
The numerical values are $\tau_b = 3$, $\beta_b = 2$, $\beta_s = 2$ and $r_b = 1.9$.



(b) Increase of Buyers' Differentiation Cost
The numerical value of τ_b changes to 4.



(c) Decrease of Buyers' Cross-Group Effect
The numerical value of β_b changes to 1.



(d) Increase of Sellers' Cross-Group Effect
The numerical value of β_s changes to 3.

Figure 2a shows the market outcomes in the benchmark numerical example. Above the threshold value h^{PS}_s, the sellers' surplus is larger if they sign exclusive contracts. The considered area is located above the decisive h^π_s indifference line. In this area, the platforms will not offer exclusive contracts as it is not profitable for them. Hence, sellers suffer from the platforms' decisions. Sellers prefer exclusive contracts for high values of h_s and low values of τ_s. The positive effect of h_s and the negative effect of τ_s are more intensive on PS^E than on PS^{NE}. The sellers' surplus in the equilibrium with exclusivity clauses PS^E clearly increases in net standalone value h_s and decreases in differentiation cost τ_s. The effect of h_s on PS^{NE} is ambiguous. Voluntarily exclusive and non-exclusive sellers benefit from experiencing a higher h_s. However, the seller membership fee also increases, leading to a utility loss. Also, an increase in h_s leads to more multihoming sellers, which reduces the number of buyers. This, in turn, leads to a lower network benefit ($n_b^{NE}\beta_s$) for the remaining singlehoming sellers. Therefore, an area exists where multihoming on the seller side results but hurts a fraction of sellers. Additionally, the increased number of multihoming sellers leads to more differentiation costs incurred by the seller side. The effect of τ_s on PS^{NE} is also ambiguous. As τ_s increases the total differentiation costs on the seller side increase. However, the number of multihoming sellers decreases and differentiation costs are reduced in the aggregate.

In the feasible area, buyers prefer an environment without exclusivity clauses for sellers. The upper threshold of h_s^{CS} in the numerical example is the same as the $h_s^{\min}$ or the upper bound of h_s^W. The area where buyers would benefit from exclusive contracts is outside the feasible area. If a fraction of sellers multihome, fewer buyers multihome. Thus, buyers in the aggregate reduce the differentiation costs if sellers multihome.

Below the decisive h_s^π indifference line, platforms enforce exclusivity on the seller side. In this area, the aggregate of buyers and sellers have a lower surplus if exclusivity clauses are used. The total welfare is larger with exclusivity clauses for low τ_s and low h_s.

Figure 2b shows the market outcome when the buyers' differentiation parameter increases. The area where sellers prefer exclusivity clauses shrinks, while the area where sellers benefit from mutlihoming increases. A higher buyers' differentiation parameter makes multihoming more attractive to sellers as fewer buyers join the platform. A decrease in the buyers' cross-group effect as shown in Figure 2c has a similar effect. As meeting the seller side becomes less attractive to buyers fewer buyers join a platform. Thus, the seller side finds it more attractive to multihome. By joining two platforms, sellers can counteract the lower participation on the buyer side. The opposite happens as the sellers' cross-group effect increases as in Figure 2d. The area where sellers prefer exclusive contracts grows. Exclusive sellers benefit as the network benefit ($n_b^E\beta_s$) increases and their membership fee is lower.

Generally, the total welfare is larger in an environment without exclusivity clauses. However, Figures 2a and 2d show an area where the total welfare is larger if sellers sign exclusive agreements. These areas occur within the thresholds of $h_{s|1}^W$ and $h_{s|2}^W$. The total welfare is higher with exclusive clauses if the positive effects on sellers' surplus and platforms' profit outweigh the negative effect on buyers' surplus. This holds for low values of τ_s and h_s and a high value of β_s.

5 Summary and Conclusion

The paper compared a two-sided platform duopoly market with partial multihoming on the seller and buyer sides to a setting with partially multihoming buyers and singlehoming sellers. The singlehoming behavior on the seller side can be enforced by the platforms that offer exclusive contracts to sellers. The conditions are derived under which exclusive contracts for sellers benefit or harm platforms, buyers and sellers.

In the version without exclusivity clauses on the seller side, the attractiveness of a platform depends on the number of exclusive buyers. The number of sellers on a platform and the fee paid increase as many buyers stay exclusive on one platform. If platforms enforce seller exclusivity, buyers' and sellers' differentiation costs soften price competition, while cross-group effects lead to fiercer competition. Buyer participation increases as they derive more value from joining the platform and meeting sellers. Fewer buyers join the platform as their differentiation cost is high. We show that platforms charge a lower membership fee if sellers can multihome. They only allow sellers to multihome if the additional sellers joining a platform offset the lower fee. Buyers prefer a setting with sellers being active on both platforms. If a fraction of sellers multihome, fewer buyers decide to multihome. Thus, in the aggregate buyers' differentiation costs decrease. Sellers prefer exclusive contracts if the value of joining a platform is high and the sellers' differentiation cost is low. If joining a platform becomes less attractive to buyers, sellers benefit if they can multihome. By joining both platforms, sellers can counteract the lower participation on the buyer side. The total welfare is generally higher if sellers can multihome. Only for a few parameter constellations, it is not optimal to ban exclusive contracts. The exclusive outcome should be preferred if sellers have low standalone value, a low differentiation cost and a high cross-group effect.

Our results confirm that the regulators should critically review exclusive clauses on platform markets. A ban on such clauses would result in lower seller membership fees and a higher buyer surplus. When platforms offer exclusive contracts, it is to the disadvantage of sellers. Therefore, sellers would also benefit from a ban on exclusive contracts. Platforms, on the other hand, could make lower profits.

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