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# Exclusion policies on two-sided platforms

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**Abstract**

This paper investigates the role of competition on a platform's incentives to adopt an exclusion policy. I present a theoretical model in which an intermediary can restrict access to a low-quality seller. The analysis suggests that the intermediary has a dominant strategy to limit competition between sellers as much as possible. Exclusion policies are, therefore, desirable if consumers are willing to pay a sufficiently large premium for a high-quality product. However, this result does not necessarily hold if the platform can use first-degree price discrimination. In that case, the platform's pricing strategy can be sufficiently powerful to limit competition. Finally, exclusion policies can not only reduce competition within platforms but also between platforms. An asymmetric exclusion equilibrium allows two *ex-ante* homogeneous platforms to share the market profitably.

# Contents

# 1 Introduction

Two-sided platforms are everywhere in daily life. Examples include payment systems, shopping malls, dating clubs, and online marketplaces. In all of these situations, two groups of agents interact through an intermediary. Much research has been done on the efficiency and pricing decisions of these two-sided platforms. Less well studied is their openness, while this is an essential strategic variable for intermediaries (Rysman, 2009). There are many practical examples of intermediaries that restrict access to at least one side of the market. Specific dating platforms, such as Inner Circle, only allow certain groups to use their platforms to find a partner (Smithuijsen, 2017). Furthermore, online retailers, such as Amazon, eBay, and Apple, reserve the right to exclude third-party suppliers from their platform (Hagiu, 2009b). Apple, for example, has removed several applications from its store (Boudreau & Hagiu, 2009).

Earlier research on exclusion policies in two-sided markets is done by Hagiu (2009a). He finds that if one side of the market cares about the quantity and the quality of the other side, the intermediary might find it profitable to exclude some members of the other side. A missing aspect in Hagiu's analysis is competition between agents on one side of the market. Competition between agents on a platform is, however, an essential determinant for an intermediary's profit (Belleflamme & Peitz, 2019). Consider a platform on which sellers compete for buyers. On the one hand, competition can lower prices and increase product variety. As these two consequences are desirable for buyers, the platform could be less inclined to adopt an exclusion policy in order to reduce competition between sellers. On the other hand, fierce competition could negatively affect the sellers' willingness to join the platform since competition can lower their profits. This effect could enhance the desire for exclusion policies.

The example above raises the question of whether incentives to exclude could be driven by the desire to reduce competition on the platform. This paper, therefore, builds a theoretical model to investigate the role of competition in exclusion policies. In this model, buyers care about both the quantity and quality of sellers. In turn, the sellers compete in prices on the platform to win buyers. The intermediary can use a pricing strategy and an exclusion policy to influence both access and interaction on the platform. Since exclusion is based on a minimum quality standard, the platform can refuse access to a low-quality seller.

The paper presents three main findings. First, I find that if a platform sets a uniform fee for sellers, it is never optimal to have two different sellers competing. More specifically, the intermediary maximizes their profit by having either a high- or low-quality seller as a monopolist. Hence, the platform has an incentive to exclude the low-quality seller if the buyers' marginal valuation for high-quality is sufficiently large. Second, I show that this result does not necessarily hold if the platform can set differential fees for sellers. In that case, there exists an equilibrium in which the platform never wants to exclude. Third, exclusion policies can not only profitably reduce competition on platforms but potentially also between two competing intermediaries. More specifically, two *ex-ante* homogeneous intermediaries can profitably share the market if one of them adopts an exclusion policy. Again important is that the buyers' marginal premium for high-quality has to be sufficiently large.

The remainder of this paper is organized as follows. The following section provides an overview of the relevant literature on two-sided platforms, their pricing strategy, and exclusion policies. Section 3 gives an outline of the model. Section 4 presents the results of the baseline model. Section 5 studies the effect of price discrimination by the intermediary. Section 6 considers platform competition. The paper ends with a conclusion.

## 2 Literature review

**Defining two-sided platforms** Two-sided markets are characterized by the interaction of two groups of agents through an intermediary (Armstrong, 2006). In general, four types of intermediaries can be distinguished: exchanges, advertising-supported media, transaction devices, and software platforms (Evans & Schmalensee, 2005). Important for all these types of platforms is that members of one group of the market derive value from interacting with members of the other group.

One reason why agents use two-sided platforms is the presence of indirect network externalities. Indirect network externalities arise when the expected gains of at least one group of agents increase in the number of agents in the other group (Caillaud & Jullien, 2003). This is because a larger pool on one side of the market leads to a higher probability of finding a match for the other side (Evans, Schmalensee, Noel, Chang, & Garcia-Swartz, 2011). For example, if a platform can attract more buyers, the platform is more valuable for sellers.

In addition to these indirect network externalities, sorting externalities might arise on the platform (Belleflamme & Peitz, 2015). These externalities emerge when agents on one side of the market care more about the characteristics of the agents on the other side of the market than about their number of matching prospects. When an agent joins the platform, they change the composition of their pool of participants. Consequently, they affect the welfare of the agents of the other group, hence the externalities.

**Pricing strategy** Since the intermediary creates value by hosting the two groups of agents, it is important to have both groups on board (Rochet & Tirole, 2006). In order to achieve this, the platform must use a well-designed pricing strategy (Evans et al., 2011). In this context, there are two major considerations: the price level and pricing structure. The price level is the total price paid by the two sides of the market. An intermediary has two main instruments to set a price: membership fees and transaction fees (Caillaud & Jullien, 2003). A membership fee is paid *ex-ante*, while a transaction fee is paid *ex-post*. In e-commerce, sellers traditionally face a flat transaction fee on the monetary value of the transaction (Evans et al., 2011). Second, the pricing structure refers to the allocation of the total price between the two sides of the market. For example, sellers on e-commerce platforms are often charged by the platform for their service, while buyers are not directly charged.

An essential question in the platform's pricing strategy is whether agents are "single-homing" or not (Armstrong, 2006). If agents use only one platform, they are said to be single-homing. Meanwhile, if an agent uses multiple platforms, the agent is "multi-homing". Consider the case in which one side of the market is single-homing, and the other side is multi-homing. The multi-homing agents have to use the platform of the single-homing side if they want to interact with them. Consequently, the intermediary can ask for monopoly prices on the multi-homing side of the market if it can host the single-homing side. Meantime, the intermediary has to compete with other platforms to attract the single-homing side. Low prices on the single-homing side then balance out the profits generated from the multi-homing side.

**Exclusion policies** On top of the pricing strategy, there are other strategic decisions for an intermediary to get both sides of the market on board. A main strategic instrument is the set of governance rules (Hagiu, 2014). These rules can be divided into two categories: rules regulating access to the platform and rules regulating the interaction between the users on the platform (Broekhuizen et al., 2021). The former set of rules determines whether there is a restriction of access to the platform for at least one side of the market. The latter set of rules determines what the various sides can do on the platform after admission is granted. Most literature on openness on two-sided platforms focuses on the access dimension.

One way a platform can restrict access to specific agents is through screening for a minimum quality (Hagiu, 2009a). There are many practical examples of intermediaries who exclude specific agents from using the platform's infrastructure if they do not meet the platform's standards. Internet retailers, such as Amazon, eBay, and iTunes, for example, restrict access to third-party sellers (Hagiu, 2009b). Furthermore, certain dating platforms, such as Inner Circle and eHarmony, first screen their applicants before they can enter the platform.

Adopting rules that restrict access for certain agents to the platform has several costs and benefits (Lee, 2013). First, exclusion policies could be anti-competitive since they might deter entry and reduce competition between sellers (Motta, 2004). Belleflamme and Peitz (2019) highlight that this is harmful to consumers in the absence of asymmetric information. Anti-competitive practices are a relevant consideration in this context. Analyses on anti-competitive behavior in two-sided markets are not as clear-cut as in one-sided markets (Evans, 2003). For example, pricing below marginal costs on one side of the market is not necessarily predatory behavior, as one should look at the total price level and total costs for all sides of the market. Moreover, the interest in anti-trust issues in two-sided markets has grown over the last years. For example, various big tech companies, among which Amazon, were questioned this summer by Congress on their anti-competitive behavior.

The second cost of exclusion policies is that they could limit product variety on the platform. Having various products on the platform is desirable if consumers value variety (Broekhuizen et al., 2021). In essence, if a platform attracts different types of sellers, it implicitly uses price discrimination towards the consumers. Price discrimination implies that different goods are sold for different prices (Belleflamme & Peitz, 2015). If the sellers have market power, they can set different prices for different consumers, depending on the available information. Three types of differential pricing can be distinguished: personalized pricing, versioning, and group pricing (Shapiro & Varian, 1998). Personalized pricing implies that each user is charged a different price. Group pricing means that different groups of consumers pay different prices.

Versioning is somewhat different from the other two types, as the consumers choose the version and corresponding price from a product line. From a two-sided market point of view, having various sellers on the platform can therefore be seen as versioning. Exclusion policies that deter low-quality sellers from entering the platform could counteract for price discrimination and product variety.

Exclusion policies also have benefits. First, they might encourage sellers to invest in offering high-quality products or services (Rysman, 2009). Second, agents may derive value from the screening process by the platform. If there is asymmetric information, setting a quality standard can increase the probability of finding a good match (Evans & Schmalensee, 2005). Exclusion policies could therefore be a strategic instrument to improve the matching efficiency on the platform. Third, restricting access to specific agents can prevent a "lemons market failure" in case of asymmetric information (Hagiu, 2014; Akerlof, 1970). Leland (1979), for example, investigates quality standards in one-sided markets, and finds that markets with asymmetric information can benefit from having minimum quality standards. These standards can be imposed by a public regulator. From a two-sided market perspective, the intermediary can take on the role of the public regulator in setting the quality standard.

To the best of my knowledge, the only theoretical analysis on the profitability of these quality standards in a two-sided market is done by Hagiu (2009a). In contrast to Leland (1979), the need for exclusion is not driven by an asymmetry in information but by an appreciation for average quality on the platform. More specifically, the utility of the users on one side of the market (W) does not only depend on the number of users on the other side (M) but also on the average quality of side M. The platform faces a trade-off between the quality and quantity of side M. By setting a minimum quality standard, the platform can exclude specific users of side M from using the platform. Four different considerations are relevant in this context. If platform users on side W care more about the quality of side M, the platform is always more inclined to exclude. Preferences for a larger quantity on side M reduce these incentives. These two effects are unambiguous. By contrast, the proportion of high-quality users on side M and the relative cost advantage of these high-quality users have an ambiguous effect on the incentives to exclude. On the one hand, the benefits of exclusion decrease if there are more high-quality users on side M. On the other hand, having relatively more high-quality users reduces the cost of exclusion by reducing the loss in quantity on the platform. The reasoning for the effect of the relative cost advantage for the high-quality users on side M is similar. If these high-quality users have a more significant cost advantage, they are more likely to join the platform. Consequently, there is a higher fraction of high-quality users for given prices, and the average quality is higher. Again, exclusion policies come with lower gains but also with lower costs.

My model adds two novel elements to this line of research. First of all, I introduce competition between agents on one side of the market. That is, I assume sellers compete in prices to win buyers. While reducing competition on the platform can be harmful to consumers, it might be desirable for the intermediary (Belleflamme & Peitz, 2019). This could enhance the incentive to exclude. Second, I allow for heterogeneous preferences for quality. Whereas Hagiu (2009a) assumes that marginal valuation for quality is equal among members of one side of the market, I will assume that valuation for high-quality products differs among buyers.

# 3 Model

**Agents** For clarity, I will refer to the two sides of the market as sellers and buyers. To simplify the model as much as possible, I first assume that there are two sellers, two buyers, and one monopolist intermediary.

First, there are two sellers on the platform, $j \in \{H, L\}$. These sellers differ in their product quality $s_j$. This quality is exogenously determined. Seller $H$ offers a high-quality product, denoted with $s_H$. Producing the high-quality product comes with marginal cost $c_H \in [0, 1]$. The other seller, $L$, offers a low-quality product, denoted with $s_L$. The low-quality seller does not incur any costs: $c_L = 0$. In order to sell their product, the sellers compete as Bertrand duopolists. The price asked by a seller is equal to $P_j$. Each seller has to pay a fee to the intermediary on its revenue. This fee is given by $F \in [0, 1]$. In the baseline model, I assume that the fee is equal for all sellers. This gives the following profit function for a seller:

$$\pi_j = (1 - F)P_j Q_j - c_j Q_j \tag{3.1}$$

Second, there are two different buyers, given by $i \in \{h, \ell\}$. $h$ is the high-type buyer, while $\ell$ is the low-type buyer. The buyers differ in their valuation for high-quality $\theta_i(s_H) \in [0, 1]$. The high-type buyer is willing to pay a premium for the high-quality product, while the low-type buyer is not willing to pay a premium. The valuation for the low-quality product, $\theta_i(s_L) \in [0, 1]$, is equal among the consumers. To simplify the analysis as much as possible, I assume that this valuation for low-quality is equal to the marginal cost of the high-quality product: $\theta_i(s_L) = c_H$. All of the valuations are common knowledge. To summarize, the valuations for quality are as follows:

1. Valuation of high-type buyer $= \theta_h(s_j)$
2. Valuation of low-type buyer $= \theta_\ell(s_j)$
3. $\theta_h(s_L) = \theta_\ell(s_L) = c_H$
4. $\theta_\ell(s_H) = \theta_\ell(s_L)$
5. $\theta_h(s_H) > \theta_h(s_L)$

Furthermore, both buyers have a unit demand, meaning they buy one product at max from one of the sellers. If they buy a product, they only pay the seller $P_j$ for the product. In other words, the buyers are not directly charged by the intermediary. Combining this leads to the following utility function for buyers:

$$U_i = \theta_i(s_j) - P_j \tag{3.2}$$

Finally, the intermediary allows the sellers and buyers to interact through their infrastructure. As explained above, they can ask for a flat transaction fee on the sellers' revenue for this service. The intermediary does not have any costs. This results in the following profit function:

$$\pi^P = F(P_H Q_H + P_L Q_L) \tag{3.3}$$

In this equation, $P_H Q_H$ denotes the revenue of the high-quality seller, while $P_L Q_L$ is the revenue of the low-quality seller. In addition to the pricing strategy, the platform can opt for an exclusion policy. Restriction of access is based on a minimum quality standard. That is, the intermediary can prevent the low-quality seller from entering the platform. If the platform decides to do so, only the high-quality seller can sell to the buyers.

**Timing** The timing of the events is as follows. First, the intermediary decides whether to adopt an exclusion policy. Then, they determine their profit-maximizing fee. Subsequently, the sellers can decide to offer their product on the platform. If so, they set their optimal price. Buyers observe this and decide to buy from one of the sellers or not. Finally, the agents receive their payoffs.

# 4 Exclusion by a monopolist platform

As explained in the model setup, I first assume the intermediary to be a monopolist. The monopolist has an incentive to exclude the low-quality seller if this yields more profit than having the two sellers compete. I start by calculating the platform's profit under exclusion. In this analysis, there are two relevant scenarios. In the first scenario, the high-quality seller sells to both types of consumers. In the second scenario, it only sells to the high-type. To solve the model, I will use backward induction.

## 4.1 Exclusion

### 4.1.1 *H* sells to both consumers

**Consumers** The highest price $H$ can ask when trying to sell to both consumers is equal to the valuation of the low-type consumer, i.e. $\theta_\ell(s_H)$.[1]

**Sellers** Given $P_H \leq \theta_\ell(s_H)$, $H$'s profit is equal to:

$$\pi_H = 2(1-F)P_H - 2c_H \tag{4.1}$$

Based on this profit function, the participation constraint (PC) and incentive compatibility constraint (ICC) of $H$ can be determined. These conditions are relevant for the intermediary:

[1] This is assuming that buyers are willing to buy the product when indifferent. I will continue on this assumption throughout the remainder of this paper. Alternatively, I could assume the maximum price a seller can ask is just below the consumers' willingness to pay.

they determine whether $H$ is willing to sell at all, and whether selling to both consumers is more profitable than selling to the high-type only. The PC and ICC[2] are given by:

$$2(1-F)P_H - 2c_H \geq 0 \tag{4.2}$$

$$2(1-F)P_H - 2c_H \geq (1-F)P_H - c_H \tag{4.3}$$

As I assumed $\theta_\ell(s_L) = c_H$, the PC is met if and only if $F = 0$ and $P_H = \theta_\ell(s_L)$. In other words: $H$ is only willing to sell to both consumers if they can sell for the highest price possible and does not have to pay a fee. Proof:

$$2(1-0)\theta_\ell(s_L) - 2c_H = 0 \tag{4.4}$$

However, the ICC is never satisfied if $F = 0$. After all, seller $H$ could deviate and try to sell to the high-type only. As will be explained in the coming scenario, the optimal price is then the high-type's willingness to pay: $P_H = \theta_h(s_H)$. This yields strictly more profit than selling to both consumers:

$$(1-0)\theta_h(s_H) - c_H > 2(1-0)\theta_\ell(s_H) - 2c_H \Leftrightarrow \theta_h(s_H) - c_H > 0 \tag{4.5}$$

This result is intuitive. If $H$ wants to sell to both types of consumers, their price has to be smaller or equal to the low-type's willingness to pay. However, this willingness to pay is equal to $H$'s marginal costs. Hence, for any fee $F \in [0,1]$, selling to both types of consumers is strictly dominated by selling to the high-type consumer only. As a result, there cannot be an equilibrium in which $H$ sells to both consumers.

### 4.1.2 *H* sells to the high-type consumer only

**Consumers** In the second scenario, $H$ only sells to the high-valuation consumer. The highest price they can ask is now the willingness to pay of this consumer, $\theta_h(s_H)$.

**Sellers** As in the previous scenario, the platform needs to meet the PC and ICC of seller $H$. As explained, there can never be an equilibrium in which $H$ sells to both consumers. Hence, it is sufficient to check whether $H$ is willing to sell at all:

$$(1-F)P_H - c_H \geq 0 \tag{4.6}$$

It is important to note that the left-hand side of the inequality, which represents $H$'s profit, increases in $P_H$. Therefore, $H$ has an incentive to set their price equal to the high-type's

[2] Note that the price $P_H$ on the right-hand side of the ICC does not need to be equal to the price on the left-hand side. After all, if $H$ only tries to sell to the high-type consumer, it can set its price above $\theta_\ell(s_L)$.

willingness to pay. Substituting this into equation (4.6) yields the following restriction on the fee:

$$(1-F)\theta_h(s_H) - c_H \geq 0 \Leftrightarrow F \leq 1 - \frac{c_H}{\theta_h(s_H)} \tag{4.7}$$

Given $P_H$ and $Q_H$, the intermediary's profit strictly increases in $F$. Hence, the optimal fee[3] and corresponding profit for the platform are given by:

$$F^* = 1 - \frac{c_H}{\theta_h(s_H)} \tag{4.8}$$

$$\pi^P = \theta_h(s_H) - c_H \tag{4.9}$$

## 4.2 No exclusion

Next, I will consider the scenario in which the platform does not set a minimum quality standard. When the platform allows both sellers to sell through their infrastructure, two cases can be distinct: either $L$ sells to both types of consumers, or $H$ and $L$ share the market.[4]

### 4.2.1 *L* sells to both consumers

**Consumers** If $L$ wants to sell to both consumers, the maximum price they can ask is not only determined by the consumers' marginal valuation for the low-quality product but also by their outside option. First, the consumers' willingness to pay is given by $\theta_h(s_L) = \theta_\ell(s_L)$. Second, it is important to recall that the low-type consumer never buys from seller $H$, as $H$ has no incentive to sell to this consumer. Hence, the only outside option for the low-type consumer is not to buy at all. Third, the high-type buyer does not have an outside option either when $H$ does not want to sell at all. This happens, for example, when $H$'s PC is not met.[5] The maximum price $L$ can ask is then only restricted by the consumers' willingness to pay.

**Sellers** Suppose that the PC of $H$ is not met. If $L$ sets $P_L \leq \theta_\ell(s_L)$, their profit is equal to:

$$\pi_L = 2(1-F)P_L \tag{4.10}$$

This profit function illustrates that for any $F \in [0,1)$, $L$ is best off by setting their price equal to the consumers' willingness to pay. For $F = 1$, the seller is indifferent between any price. To

[3] Strictly speaking, $H$ is indifferent between setting their price equal to $P_H = \theta_h(s_H)$ or not selling at all, given the fee in equation (4.8). For simplicity, I assume that $H$ is playing a pure strategy and is willing to sell if they are indifferent. Alternatively, I could assume that the platform sets their fee equal to $\lim F \to 1 - \frac{c_H}{\theta_h(s_H)}^-$. In that case, $H$ would have a strict preference for setting their price as high as possible.

[4] After all, given any $F \in [0,1]$ selling to the low-valuation consumer is a strictly dominated strategy for $H$.

[5] Another possibility would be if $L$ charges a sufficiently low price. However, this case will not be relevant as the platform will ask for a sufficiently high fee.

simplify the analysis, I assume that $L$ still sets $P_L = \theta_\ell(s_L)$, even if $F = 1$.[6] As a result, the PC and ICC of this seller are:

$$2(1 - F)\theta_\ell(s_L) \geq 0 \tag{4.11}$$

$$2(1 - F)\theta_\ell(s_L) \geq (1 - F)\theta_\ell(s_L) \tag{4.12}$$

Evidently, these restrictions hold for any $F \in [0, 1]$. The intermediary can therefore set their fee as high as possible in order to appropriate all value created on the platform:

$$F^* = 1 \tag{4.13}$$

$$\pi^P = 2\theta_\ell(s_L) \tag{4.14}$$

Trivially, with $F^* = 1$, the PC of $H$ is never met:

$$(1 - 1)\theta_h(s_H) - c_H < 0 \tag{4.15}$$

### 4.2.2 *L* and *H* share the market

**Consumers** The second case under no exclusion considers the scenario in which $H$ and $L$ share the market. As explained in the previous sections, the low-valuation consumer will always buy from $L$. The high-valuation consumer's choice is not clear cut. It is important to note that there must be a positive probability that $H$ sells to this high-type consumer for this analysis to be relevant. If $L$ always sells to both consumers, there is no incentive for $H$ to join the platform.

**Sellers** Suppose the sellers both play a pure strategy when competing in prices. The lowest price $L$ can ask is 0 since they do not incur any marginal costs. $H$ will always ask for a minimum price of $\frac{c_H}{1-F}$, since asking a price lower than that is never profitable.[7] $H$ can always serve the high-type consumer if:

$$\theta_h(s_H) - \frac{c_H}{1 - F} \geq \theta_h(s_L) - 0 \tag{4.17}$$

Suppose that condition (4.17) is met, and $H$ sets their price as low as possible. This would imply that $H$ can always serve the high-type consumer[8], while $L$ can only serve the low-type consumer. If $L$ knows that they cannot serve the high-type consumer, they will set their price equal to the maximum willingness to pay of the low-type, $\theta_\ell(s_L)$. Given the price of $L$, $H$ will increase their price as well, such that it is equal to the high-type's valuation of high-quality,

[6] Alternatively, I could assume that the platform never sets their fee exactly equal to 1, but to $\lim F \to 1^-$ instead. $L$ would then always have a strict preference for setting their price equal to the consumers' marginal valuation.

[7] This expression can be found by equating $H$'s profit to 0, i.e.:

$$(1 - F)P_H - c_H = 0 \Leftrightarrow P_H = \frac{c_H}{1 - F} \tag{4.16}$$

[8] This is assuming that the high-type buyer still buys from $H$ even if they are strictly speaking indifferent between the two sellers.

$\theta_h(s_H)$. In response, $L$ will slightly lower their price to try to sell to both consumers. $H$ will lower their price as well to serve the high-type again, and so on. Hence, there exists no equilibrium in pure strategies in prices.

However, there could be a mixed strategy equilibrium in which the sellers set their price $P_j$ according to a distribution function. Recall that $L$ can always serve the low-type consumer by setting their price equal to $\theta_\ell(s_L)$. Their profit would then be equal to:

$$\pi_L = (1 - F)\theta_\ell(s_L) \tag{4.18}$$

For a lower price, they could potentially serve the high-type buyer as well. This would double the number of sales. However, $L$ is only willing to lower their price if this yields at least as much profit as selling to the low-type only. Hence, the lowest price $L$ would be willing to ask can be determined as follows:

$$2(1 - F)\underline{P_L} = (1 - F)\theta_\ell(s_L) \Leftrightarrow \underline{P_L} = \frac{\theta_\ell(s_L)}{2} \tag{4.19}$$

The range of prices over which $L$ could be willing to mix is therefore:

$$P_L \in \left[\frac{\theta_\ell(s_L)}{2}, \theta_\ell(s_L)\right] \tag{4.20}$$

For $H$, this range of prices can be determined in a similar way. First, the maximum price they can ask is the high-type's willingness to pay for high-quality. This is the upper bound of the price range. Second, the lower bound is determined by the outside option of the high-type buyer. Suppose that $L$ is mixing over the whole range of prices given in equation (4.20). The maximum utility for the high-type buyer is then reached when the price of $L$ is as low as possible, that is when $P_L = \frac{\theta_\ell(s_L)}{2}$. In that case, the lowest price $H$ needs to ask to win the high-type buyer is:

$$\theta_h(s_H) - \underline{P_H} = \theta_h(s_L) - \frac{\theta_\ell(s_L)}{2} \Leftrightarrow \underline{P_H} = \theta_h(s_H) - \frac{\theta_\ell(s_L)}{2} \tag{4.21}$$

Important to note is that this lower bound is feasible for $H$ if and only if:

$$(1 - F)\left(\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}\right) \geq c_H \tag{4.22}$$

Assuming that condition (4.22) is met, the range of prices over which $H$ is willing to mix is given by:

$$P_H \in \left[\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}, \theta_h(s_H)\right] \tag{4.23}$$

The next question is whether the sellers are actually willing to mix over these price ranges. Suppose the sellers set their prices over a distribution function $G_j$. $L$ is willing to mix over the range given in (4.20) if they are indifferent between any of these prices. Recall that the upper bound of this range assures this seller of receiving the full valuation of the low-type consumer. For a lower price, they might sell to both consumers. For $L$ to be indifferent, all of these prices have to generate as much profit as selling to the low-type consumer only:

$$(1-F)P_L(1+Pr[P_H > P_L + \theta_h(s_H) - \theta_\ell(s_L)]) = (1-F)\theta_\ell(s_L) \tag{4.24}$$

$$P_L(1+(1-G_H[P_L + \theta_h(s_H) - \theta_\ell(s_L)])) = \theta_\ell(s_L) \tag{4.25}$$

$$G_H = 2 - \frac{\theta_\ell(s_L)}{P_L} \tag{4.26}$$

Furthermore, $H$ needs to be indifferent between any of the prices given in equation (4.23). Note that the lower bound of this price range is sufficiently low, such that the high-type consumer would always buy from $H$. Setting a higher price introduces the risk of not selling at all. For $H$ to be indifferent between these prices, any of them needs to yield an equal amount of profit:

$$((1-F)P_H - c_H)Pr[P_H < P_L + \theta_h(s_H) - \theta_\ell(s_L)]) = (1-F)\left(\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}\right) - c_H \tag{4.27}$$

$$((1-F)P_H - c_H)(1 - G_L[P_H - \theta_h(s_H) + \theta_\ell(s_L)]) = (1-F)\left(\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}\right) - c_H \tag{4.28}$$

$$G_L = 1 - \frac{(1-F)(\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}) - c_H}{(1-F)P_H - c_H} \tag{4.29}$$

If both sellers set their price $P_j$ according to their distribution function $G_j$, the platform earns:

$$E(\pi^P) = F\left[\int_{\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2}}^{\theta_h(s_H)} P_H * (1-G_L)\, dG_H + \int_{\frac{\theta_\ell(s_L)}{2}}^{\theta_\ell(s_L)} P_L * (1+(1-G_H))\, dG_L\right] \tag{4.30}$$

To grasp this profit function, note that the fee $F$ is multiplied by two terms. The first term represents the expected revenue of $H$. The second term captures the expected revenue of $L$. For $L$, the expected revenue is equal to their expected profit before fees. After all, $L$ did not have to incur any marginal costs. Hence, the profit function can be rewritten as:

$$E(\pi^P) = F\left[\int_{\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2}}^{\theta_h(s_H)} P_H * (1-G_L)\, dG_H + \theta_\ell(s_L)\right] \tag{4.31}$$

Finally, the maximum profit for the intermediary under market sharing can be determined by maximizing the function above with respect to the fee $F$:

$$= \max_F F\left[\int_{\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2}}^{\theta_h(s_H)} P_H * \left(\frac{(1-F)(\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2})-c_H}{(1-F)P_H-c_H}\right) d\left(2-\frac{\theta_\ell(s_L)}{P_L}\right) + \theta_\ell(s_L)\right] \quad (4.32)$$

## 4.3 Equilibrium

To summarize, if there is an exclusion policy, $H$ only serves the high-type consumer. If the platform does not exclude, either $L$ will serve the whole market or share the market with $H$. However, the latter is never profitable if the platform can adopt an exclusion policy. In order to prove this algebraically, I introduce a fictitious expected market sharing profit:

$$E(\pi^P_+) = F\left[\int_{\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2}}^{\theta_h(s_H)} P_H * \left(\frac{(1-F)(\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2})}{(1-F)P_H}\right) d\left(2-\frac{\theta_\ell(s_L)}{P_L}\right) + \theta_\ell(s_L)\right] \quad (4.33)$$

In the Appendix, I show that this fictitious expected profit is always at least as high as the actual expected profit under market sharing:

$$E(\pi^P_+) \geq E(\pi^P) \quad (4.34)$$

Second, taking into account the restriction on the fee, I show that the maximum of this fictitious profit is equal to:

$$E(\pi^P_+) = \left(1-\frac{c_H}{\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2}}\right)\left(\theta_h(s_H)+\frac{\theta_\ell(s_L)}{2}\right) \quad (4.35)$$

Consequently, it can be shown that even this maximum is not sufficiently high to have a profit-maximizing equilibrium in which the sellers compete. In other words, even if the platform receives the maximum of $E(\pi^P_+)$, it is never more profitable having the two sellers compete than having either $H$ or $L$ serve the market as a monopolist. The proof for this will be presented in the coming two sub-sections.

### 4.3.1 Exclusion

Having an exclusion policy is more profitable than having the two sellers share the market if:

$$\theta_h(s_H) - c_H \geq \left(1-\frac{c_H}{\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2}}\right)\left(\theta_h(s_H)+\frac{\theta_\ell(s_L)}{2}\right) \quad (4.36)$$

$$\theta_h(s_H) \geq \frac{5}{2}\theta_\ell(s_L) \tag{4.37}$$

### 4.3.2 No exclusion

Second, $L$ serving both consumers yields more profit compared to market sharing if:

$$2\theta_\ell(s_L) \geq \left(1 - \frac{c_H}{\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}}\right)\left(\theta_h(s_H) + \frac{\theta_\ell(s_L)}{2}\right) \tag{4.38}$$

$$\theta_h(s_H) \leq \left(\frac{2\sqrt{2}+3}{2}\right)\theta_\ell(s_L) \tag{4.39}$$

### 4.3.3 Equilibrium

Altogether, the combination of (4.37) and (4.39) shows that it is never profitable to have the two sellers share the market. Next, the question remains when exclusion is profitable. This is the case if:

$$\theta_h(s_H) - c_H \geq 2\theta_\ell(s_L) \tag{4.40}$$

$$\theta_h(s_H) \geq 3\theta_\ell(s_L) \tag{4.41}$$

To summarize, the equilibrium is as follows. The platform will exclude $L$ if the high-valuation consumer is willing to pay a sufficiently large premium for high-quality. All combinations of valuations within the grey area in figure 1 meet this condition. $H$ will then only sell to this high-type consumer, setting their price equal to the willingness to pay of this consumer. Meanwhile, the high-type's premium for better quality is not sufficiently large in the white area. The intermediary then prefers to not exclude, and to set their fee as high as possible such that $L$ can serve the market as a monopolist. $L$ will sell to both consumers by setting their price equal to the marginal valuation for the low-quality product. Finally, combinations of valuations in the black area are not possible, as the valuation of the low-quality product can never exceed the high-type's valuation of the high-quality product.

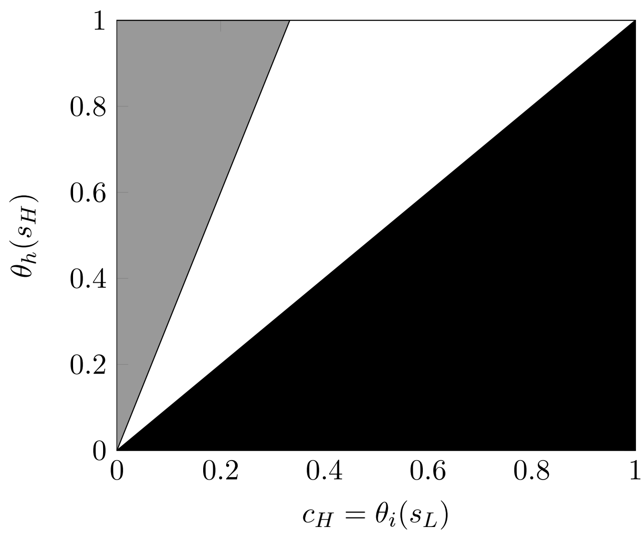


Figure 1: Cut-off for having an exclusion equilibrium

**Proposition 1** *The platform has an incentive to exclude the low-quality seller if the high-type consumer is willing to pay a sufficiently large premium for high-quality.*

The result that exclusion is only profitable if the premium for the high-quality product is sufficiently large is intuitive. Since the platform operates as a monopolist, they can appropriate all surplus on the platform if there is a monopolist seller. Hence, if the marginal valuation for high-quality is relatively large compared to the cost and the valuation for low-quality, more value will be created by only offering a high-quality product. Similar as Hagiu (2009a) concluded, these preferences for quality increase the incentives to adopt an exclusion policy.

On the other hand, the result that having a monopolist seller is always more profitable than having a duopoly on the platform is less clear-cut. After all, having a duopoly would imply that both consumers could be buying a product from their preferred seller. This form of versioning on the platform could therefore increase sales and surplus (Shapiro & Varian, 1998). However, having multiple sellers comes with a significant cost for the platform: competition. The result that competition among sellers can hurt the platform is in line with Belleflamme and Peitz (2019). First, competition between sellers gives rise to lower prices for consumers, and hence less revenue on the platform. As the platform's profit is linear is this revenue, the profit declines. Second, lower revenue implies that the platform has to decrease the fee to ensure that seller $H$ is still willing to sell on the platform. Again, since the platform's profit is linear in the fee, the profit falls if the fee drops.

As suggested by Belleflamme and Peitz (2019), quality-based exclusion turns out to be an effective tool to decrease competition, but can be harmful for consumers in the absence of asymmetric information. As the results illustrate, consumers are indeed worse off with the exclusion policy. After all, when the sellers shared the market, an equilibrium was only possible when they played a mixed strategy in their prices. As a result, there was a positive probability that the consumers did not have to pay their total willingness to pay. Meanwhile, if there was no market sharing, the consumers always had to pay their total willingness to pay.

# 5 Price discrimination

A first extension to the baseline model considers the possibility for the platform to set differential fees. As established in section 4, it is never optimal for the platform to let the two sellers share the market. This was driven by the fact that competition resulted in relatively low prices for consumers and relatively low fees for sellers. However, if the platform can set different fees for the two sellers, market sharing on the platform might become profitable as the decrease in the fees might be limited. Consider the baseline model, with the additional possibility for the platform to set a differential fee for each seller. Let $F_H$ and $F_L$ denote the fee for the high- and low-quality seller, respectively.

Given the assumptions of the model, it seems plausible that the intermediary can set discriminatory fees. First, the intermediary is a monopolist, and therefore has market power over the sellers. Second, I assumed they can perfectly distinguish the different types of sellers. Third, they know the sellers' reservation value, as they are aware of the sellers' pricing strategy and costs.

## 5.1 Exclusion

If the platform sets a minimum quality standard, the equilibrium is unaffected by differentiated fees. After all, there is just one type of seller. Optimal fee and profit are:

$$F_H^* = 1 - \frac{c_H}{\theta_h(s_H)} \tag{5.1}$$

$$\pi^P = \theta_h(s_H) - c_H \tag{5.2}$$

## 5.2 No exclusion

### 5.2.1 *L* sells to both consumers

Similarly, if the platform does not exclude and wants $L$ to serve the whole market, fees and profit are:

$$F_L^* = F_H^* = 1 \tag{5.3}$$

$$\pi^P = 2\theta_\ell(s_L) \tag{5.4}$$

### 5.2.2 *L* and *H* share the market

In the absence of price discrimination, there does not exist an equilibrium in which the sellers play a pure strategy and share the market. However, if the platform can set discriminatory fees, such a pure strategy equilibrium does exist. Consider the following fees for the high- and low-quality seller:

$$F_H^* = 1 - \frac{c_H}{\theta_h(s_H)} \tag{5.5}$$

$$F_L^* = 1 \tag{5.6}$$

First note that the fee for the high-quality seller induces this seller to set their price equal to the high-type consumer's willingness to pay for the high-quality product, $\theta_h(s_H)$. Setting a lower price than $\theta_h(s_H)$ would yield a loss, while setting a higher price would result in no sales. Proof:

$$\left(1 - \left(1 - \frac{c_H}{\theta_h(s_H)}\right)\right)\theta_h(s_H) - c_H = 0 \tag{5.7}$$

Second, note that the fee for the low-quality seller is equal to 1. In other words: this seller never makes a profit and is indifferent between any price. Suppose that seller $L$ sets their price equal to the consumers' willingness to pay: $P_L = \theta_\ell(s_L)$.

Given these prices, the sellers can share the market. More specifically, $H$ sells to the high-type buyer, while $L$ sells to the low-type.[9] The platform's profit would then be equal to:

$$\pi^P = \left(1 - \frac{c_H}{\theta_h(s_H)}\right)\theta_h(s_H) + 1 * \theta_\ell(s_L) \tag{5.8}$$

$$= \theta_h(s_H) - c_H + \theta_\ell(s_L) \tag{5.9}$$

### 5.3 Equilibrium

Comparing the market sharing profit to the profit under exclusion, it is evident that the former is always strictly higher. Hence, the platform never has an incentive to adopt an exclusion policy if the sellers play this market sharing equilibrium. Furthermore, market sharing is more profitable than having $L$ as a monopolist if:

$$\theta_h(s_H) - c_H + \theta_\ell(s_L) \geq 2\theta_\ell(s_L) \tag{5.10}$$

$$\theta_h(s_H) \geq 2\theta_\ell(s_L) \tag{5.11}$$

All in all, the equilibrium is as follows. In contrast to the case in which the platform sets a uniform fee, a market sharing equilibrium is possible with discriminatory fees. The platform's differential fees can induce the sellers to set their prices equal to the valuations of the buyers. This way, each seller serves exactly one consumer. The platform strictly prefers this equilibrium over an equilibrium in which the low-quality seller is excluded. Whether this market sharing equilibrium is more profitable than having $L$ as a monopolist, depends on the high-type's premium for better quality. That is, the platform will set two differential fees to initiate market

[9] Important to stress is that this is only one possible equilibrium. Seller $H$ is indifferent between selling at $P_H = \theta_h(s_H)$ and not selling at all. Seller $L$ is indifferent between any $P_L$. This implies that there are infinitely many equilibria possible in which the sellers compete for the buyers. However, out of all market-sharing equilibria, this is the most desirable one from the platform's perspective.

sharing if the valuation for high-quality is sufficiently large compared to the cost and the valuation for low-quality. This is the case for valuations within the grey region of figure 2. If this premium is not sufficiently high, more value is created by only offering a low-quality product on the platform. This is the case for combinations of valuations within the white area. In that scenario, the platform sets their fee as high as possible, such that the high-quality seller is not willing to sell, while the low-quality seller is. The black area is again by assumption not possible.

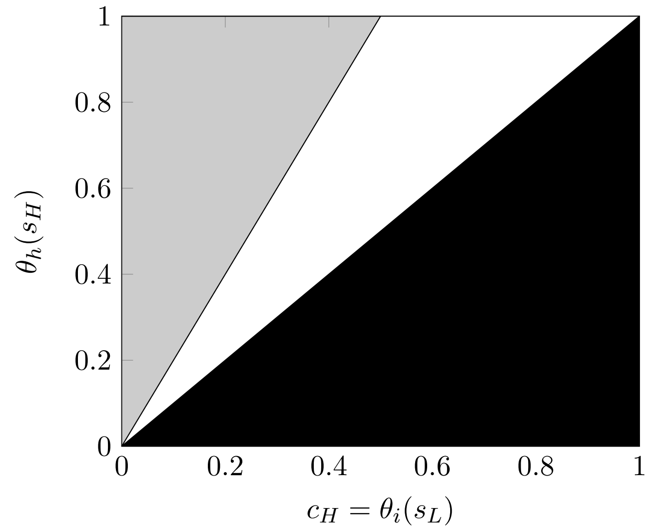


Figure 2: Cut-off for having a market-sharing equilibrium

**Proposition 2** *If first-degree price discrimination is possible, there exists a pure strategy market sharing equilibrium that makes exclusion undesirable for the platform.*

The result that the monopolist platform can increase their profit using first-degree price discrimination is in line with both the literature on price discrimination and the literature on platform pricing. First, the result that the platform can fully extract the producer surplus using price discrimination is similar to the one-sided market case in which a seller can fully extract the consumer surplus (Belleflamme & Peitz, 2015). Second, the discriminatory fees allow the platform to select sellers with specific characteristics (Belleflamme & Peitz, 2019). Having various sellers on board can be desirable for the platform to attract consumers (Broekhuizen et al., 2021). More specifically, having multiple sellers results in some form of versioning on the platform, which can increase total revenue made on the platform (Shapiro & Varian, 1998). As the intermediary can appropriate this revenue, price discrimination can increase the intermediary's profit. Important in this extension is that price discrimination not only allows the platform to select sellers with specific characteristics, but also to reduce competition between these sellers. This highlights the importance of a well-designed pricing strategy. In fact, I show that there exists an equilibrium in which the sellers do not compete at all and set their prices as high as possible. This is desirable for the intermediary, as they can appropriate all value created this way. Hence, in contrast to Hagiu (2009a), preferences for quality do not necessarily make exclusion desirable if the intermediary has a well-designed pricing mechanism.

# 6 Platform competition

A second interesting extension to the baseline model is to introduce platform competition. More specifically, I will investigate whether exclusion policies can also soften competition between intermediaries. Consider the baseline model, but now with two *ex-ante* homogeneous platforms instead of one. Let them be denoted by $k \in \{1, 2\}$. Like the sellers, the platforms compete in prices, denoted by $F_k$. Suppose that if the intermediaries set the same fee, the sellers will host at platform 1. As in the baseline model, each of the platforms first decides whether to exclude the low-quality seller. After the intermediaries have observed the other's exclusion policy, they compete in fees. Sellers consequently decide on which platform they want to offer their product. This implies that the sellers are single-homing. Finally, buyers observe the choice of the sellers and choose a platform and seller to buy from.

## 6.1 Both platforms exclude

If both platforms exclude the low-quality seller, they compete as Bertrand duopolists for the high-quality seller. As $H$ can observe the fees at both platforms, it is optimal to pick the platform with the lowest fee. Consequently, competition between the platforms is so fierce that they both set their fees equal to their marginal costs:

$$F_1^* = F_2^* = 0 \tag{6.1}$$

$$\pi_1^P = \pi_2^P = 0 \tag{6.2}$$

## 6.2 Both platforms allow

Second, if both intermediaries do not exclude $L$, they will compete to get both sellers on board. Both sellers will home at the platform that sets the lowest fee. Again, competition will drive down fees to 0, such that none of the platforms makes a profit:

$$F_1^* = F_2^* = 0 \tag{6.3}$$

$$\pi_1^P = \pi_2^P = 0 \tag{6.4}$$

## 6.3 One platform excludes

The third case explores the situation in which one intermediary adopts an exclusion policy while the other does not. Consider w.l.o.g. that platform 1 excludes seller $L$, while platform 2 does not.

**Buyers and sellers** If platform 1 excludes seller $L$, then platform 2 has monopoly power over this seller. This is desirable for 2, as this seller always sells to the low-type buyer. Hence, this platform is now able to make a positive profit. Meanwhile, platform 1 can only make a profit if seller $H$ sells to the high-type consumer through their infrastructure.[10] Suppose again that the sellers compete for the high-type buyer playing the mixed strategy as in the baseline model. Recall that in equilibrium, the sellers set their price $P_j$ according to a distribution function $G_j$. Expected revenue for $L$ and $H$ respectively are then once again:

$$E(R_L) = \int_{\theta_\ell(s_L)-\frac{\theta_\ell(s_L)}{2}}^{\theta_(s_L)} P_L * (1 + (1 - G_H))\, dG_L \tag{6.5}$$

$$= \theta_\ell(s_L) \tag{6.6}$$

$$E(R_H) = \int_{\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2}}^{\theta_h(s_H)} P_H * (1 - G_L)\, dG_H \tag{6.7}$$

$$= \int_{\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2}}^{\theta_h(s_H)} P_H * \left( \frac{(1 - F_k)(\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}) - c_H}{(1 - F_k)P_H - c_H} \right) d\left(2 - \frac{\theta_\ell(s_L)}{P_L}\right) \tag{6.8}$$

It is important to note that the expected revenue of $L$ is independent of the fee that it has to pay. Meanwhile, the expected revenue of $H$ does depend on this fee. Seller $H$ is only willing to sell if:

$$(1 - F_k)\left(\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}\right) \geq c_H \Leftrightarrow F_k \leq 1 - \frac{c_H}{\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}} \tag{6.9}$$

This implies that there can only be a positive fee for the platform that hosts $H$ if:

$$1 - \frac{c_H}{\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}} \geq 0 \tag{6.10}$$

$$\theta_h(s_H) \geq c_H + \frac{\theta_\ell(s_L)}{2} = \frac{3}{2}\theta_\ell(s_L) \tag{6.11}$$

Note that if the condition above holds, the sellers both have a positive expected revenue before fees. For $L$, this is trivial: they can always serve the low-type consumer. Additionally, $H$ can serve the high-type consumer by setting their price equal to the lower bound of the price range over which they are mixing. This implies that the expected revenue of $H$ needs to be positive as well.

### 6.3.1 Pure strategy in fees

First, there could exist an equilibrium in which the platforms play a pure strategy in fees. Consider the scenario in which platform 2 only attracts seller $L$. In that case, the optimal fee

[10] It is important to note that for an equilibrium in which both intermediaries can make a profit, discriminatory fees are not a feasible solution. After all, platform 2 can always make a profit by attracting seller $L$. Meanwhile, competition between the two platforms for seller $H$ will be so fierce that this would drive down this seller's fee to 0.

is given by $F_2 = 1$.[11] Corresponding profit would then be:

$$E(\pi_2^P) = E(R_L) = \theta_\ell(s_L) \tag{6.12}$$

If 2 would not try to attract $H$, and $H$ would be willing to sell through 1's infrastructure, the expected profit of 1 can be calculated in a similar way:

$$E(\pi_1^P) = F_1 E(R_H(F_1)) \tag{6.13}$$

$$= F_1 \left[ \int_{\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}}^{\theta_h(s_H)} P_H * \left( \frac{(1-F_1)(\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}) - c_H}{(1-F_1)P_H - c_H} \right) d\left(2 - \frac{\theta_\ell(s_L)}{P_L}\right) \right] \tag{6.14}$$

Recall that the fee in the equation above needs to meet two conditions. First, the fee has to meet the PC of $H$, as described in equation (6.9). Second, the fee has to meet the "no-deviation" constraint of platform 2. That is, the fee must be sufficiently low, such that platform 2 does not have an incentive to undercut platform 1 to win seller $H$. Platform 2 is willing to undercut up until undercutting yields just as much profit as having only seller $L$ on the platform. The lowest fee, say $\underline{F_2}$, for which platform 2 is indifferent, can be determined as follows:

$$\underline{F_2} \left[ \int_{\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}}^{\theta_h(s_H)} P_H * \left( \frac{(1-\underline{F_2})(\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}) - c_H}{(1-\underline{F_2})P_H - c_H} \right) d\left(2 - \frac{\theta_\ell}{P_L}\right) + \theta_\ell(s_L) \right] = \theta_\ell(s_L) \tag{6.15}$$

Note that the left-hand side of the equation implies that platform 2 wins both sellers. Attracting both sellers implies that the platform could earn a fee over the total revenue made, which can of course never exceed $\theta_h(s_H) + \theta_\ell(s_L)$. Meanwhile, if platform 2 would not compete, their expected profit would be given by $\theta_\ell(s_L)$. This is given by the right-hand side of the equation. In the optimal scenario, platform 2 would be willing to lower their fee up until:

$$F_2(\theta_h(s_H) + \theta_\ell(s_L)) = \theta_\ell(s_L) \Leftrightarrow F_2 = \frac{\theta_\ell(s_L)}{\theta_h(s_H) + \theta_\ell(s_L)} \tag{6.16}$$

Hence, equation (6.16) represents the lowest fee platform 2 will ever set. Suppose the PC of $H$, as given in equation (6.9), is sufficiently restrictive compared to the lowest fee platform 2 is willing to set:

$$1 - \frac{c_H}{\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}} \leq \frac{\theta_\ell(s_L)}{\theta_h(s_H) + \theta_\ell(s_L)} \tag{6.17}$$

[11] Alternatively, platform 2 could set set their fee such that $\lim F_2 \to 1^-$, such that seller $L$ is only indifferent between the prices over which they are mixing.

$$\theta_h(s_H) \leq 2\theta_\ell(s_L) \tag{6.18}$$

In this case, platform 1's optimal fee is determined by the PC of $H$. Recall that if condition (6.11) is met, there exists a positive fee that meets this requirement. Hence, if conditions (6.11) and (6.18) are met, there exists a pure strategy equilibrium in which platform 1 sets their optimal fee to win seller $H$, while platform 2 does not want to compete for this seller. This is the case for $\theta_h(s_H) \in \left[\frac{3}{2}\theta_\ell(s_L), \frac{4}{2}\theta_\ell(s_L)\right]$. Both platforms can then make a positive profit:

$$E(\pi_1^P) = F_1^* E(R_H(F_1^*)) \tag{6.19}$$

$$= F_1^* \left[ \int_{\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2}}^{\theta_h(s_H)} P_H * \left( \frac{(1-F_1^*)(\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}) - c_H}{(1-F_1^*)P_H - c_H} ) \right) d\left(2 - \frac{\theta_\ell(s_L)}{P_L}\right) \right] > 0 \tag{6.20}$$

$$E(\pi_2^P) = E(R_L) = \theta_\ell(s_L) > 0 \tag{6.21}$$

To summarize, there could exist an equilibrium in which one platform excludes, both play a pure strategy in fees and make a positive profit. This is the case for combinations of valuations within the grey area in figure 3. In the left white area, such an equilibrium does not need to exist. The fee that platform 1 then sets is then not necessarily restricted by the PC of $H$ but potentially by the "no-deviation constraint" of platform 2. As a consequence, it could be possible that $F_1^* > \underline{F_2}$. In that case, one of the platforms could always have an incentive to change their fee, given the other's fee. Suppose, for example, that platform 1 sets their fee just below $\underline{F_2}$. They will then have seller $H$ on board. Platform 2 will not compete for this seller and set their fee equal to $F_2 = 1$. However, given this fee, platform 1 could have an incentive to increase their fee above $\underline{F_2}$. Platform 2 will, in turn, lower their fee, and so on. Hence, the equilibrium as described above does not need to exist in that region. Furthermore, in the right white area, a profitable asymmetric exclusion equilibrium does not exist, as it is impossible to set a positive fee and meet the PC of seller $H$. Combinations of valuations within the black area do not exist.

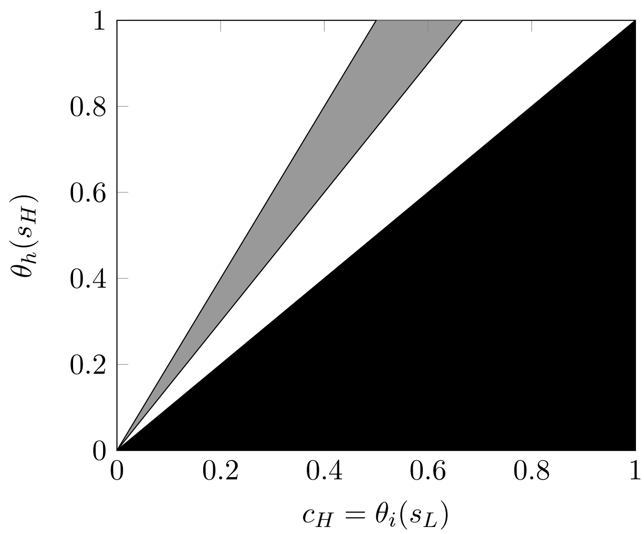


Figure 3: Region for an asymmetric exclusion equilibrium with pure strategies in fees

### 6.3.2 Mixed strategy in fees

Alternatively, there could exist an equilibrium in which the platforms mix in fees. Suppose platform 1 sets their fee $F_1$ according to distribution function $H_1$, while platform 2 sets their fee $F_2$ according to distribution function $H_2$. Again, both platforms will have to meet the PC of seller $H$, as given in equation (6.9), if they want to have this seller on board.[12]

Recall that the platforms play a pure strategy in their exclusion decision. Suppose platform 2, the non-excluding platform, would be mixing in fees. The highest fee this platform can set is $F_2 = 1$. In that case, they would host seller $L$ and receive a profit of $\theta_\ell(s_L)$. If they set a lower fee, they might win seller $H$. They are only willing to do so if this yields at least as much profit as having only $L$ on their platform. The lowest fee this platform is willing to set is denoted by $\underline{F_2}$ and determined as in equation (6.15).

If platform 1, the excluding platform, sets their fee just below $\underline{F_2}$, they attract seller $H$ for sure. On the other hand, given that seller $H$ will sell through their infrastructure, the optimal fee for platform 1 is $F_1^*$. This fee can be determined by maximizing the function from equation (6.14) with respect to $F_1$. Setting a higher fee than $F_1^*$ is never optimal. Again, if $F_1^* \leq \underline{F_2}$, there exists an equilibrium in which the intermediaries play a pure strategy in fees. Platform 1 will exclude and set $F_1 = F_1^*$. Platform 2 will not exclude and set their fee equal to $F_2 = 1$. This is the equilibrium as described in the previous subsection. On the other hand, if $F_1^* > \underline{F_2}$, an equilibrium in which both platforms make a positive expected profit is only feasible if they mix in their fees. In this case, the range over which platform 1 is willing to mix is given by:

$$F_1 \in [\underline{F_2}, F_1^*] \tag{6.23}$$

[12]Recall that an intermediary can set a positive fee that meets this constraint if:

$$\theta_h(s_H) \geq c_H + \frac{\theta_\ell(s_L)}{2} = \frac{3}{2}\theta_\ell(s_L) \tag{6.22}$$

Suppose that platform 1 is mixing over this whole range. If platform 2 is not trying to compete for seller $H$, they are willing to set $F_2 = 1$. If they would try to win $H$, they do not have an incentive to set their fee greater or equal to $F_1^*$, as this would imply that they would never win seller $H$. Additionally, the lowest fee they were willing to set is $\underline{F_2}$. Hence, if this intermediary would be competing for seller $H$, they are willing to mix over:

$$F_2 \in \{[\underline{F_2}, F_1^*), 1\} \tag{6.24}$$

Next, the intermediaries must be willing to mix over these price ranges. First, platform 1 must be indifferent between any of the fees in equation (6.23). Note that they can always host seller $H$ by setting their fee equal to $\underline{F_2}$. This is not necessarily the case for a higher fee. Platform 1 is willing to mix over the fees from the range in equation (6.23) if:

$$F_1 E(R_H(F_1)) Pr[F_2 \geq F_1] = \underline{F_2} E(R_H(\underline{F_2})) \tag{6.25}$$

$$F_1 E(R_H(F_1))(1 - H_2) = \underline{F_2} E(R_H(\underline{F_2})) \tag{6.26}$$

$$H_2 = 1 - \frac{\underline{F_2} E(R_H(\underline{F_2}))}{F_1 E(R_H(F_1))} \tag{6.27}$$

As the function above illustrates, platform 2 needs to play $F_2 = 1$ with a strictly positive probability. That is, even if platform 1 sets their fee equal to the upper bound of the price range over which they are mixing, there is still a positive probability that platform 2 sets a higher fee. Second, platform 2 also needs to be indifferent between any of the fees in equation (6.24). As explained, all of these fees need to yield $\theta_\ell(s_L)$:

$$F_2(Pr[F_1 > F_2] E(R_H(F_2)) + \theta_\ell(s_L)) = \theta_\ell(s_L) \tag{6.28}$$

$$F_2((1 - H_1) E(R_H(F_2)) + \theta_\ell(s_L)) = \theta_\ell(s_L) \tag{6.29}$$

$$H_1 = 1 - \frac{\theta_\ell(s_L)(1 - F_2)}{E(R_H(F_2)) F_2} \tag{6.30}$$

In equilibrium, each intermediary sets their fee according to distribution function $H_k$. As explained, platform 2 will then always make a profit:

$$E(\pi_2^P) = \theta_\ell(s_L) > 0 \tag{6.31}$$

Furthermore, this is also the case for platform 1:

$$E(\pi_1^P) = \int_{\underline{F_2}}^{F_1^*} F_1(1 - H_2) E(R_H(F_1)) dH_1 \tag{6.32}$$

$$= \underline{F_2} E(R_H(\underline{F_2})) > 0 \tag{6.33}$$

This result implies that the set of possible equilibria in which the platforms can make a positive expected profit is larger than the pure strategy case. More specifically, the left white area from figure 3 is now also part of the region in which an asymmetric exclusion equilibrium is feasible. All combinations of valuations within the grey area in figure 4 can now yield a profitable asymmetric exclusion equilibrium. Again, the white area on the right represents combinations of valuations for which there cannot be a profitable market sharing equilibrium. Combinations of valuations in the black area are not possible.

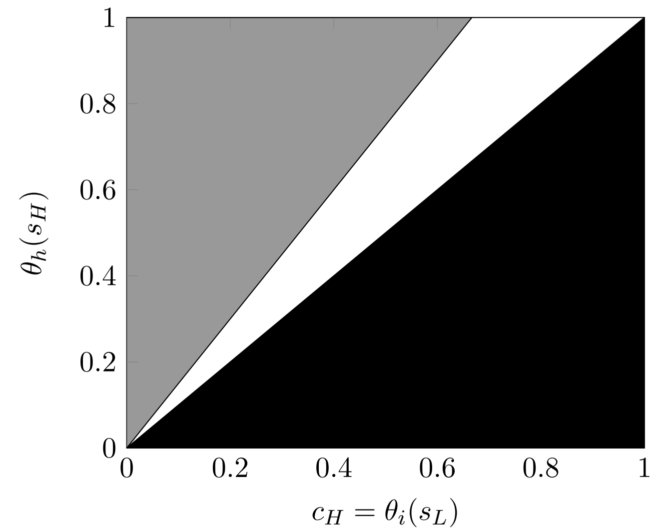


Figure 4: Region for an asymmetric exclusion equilibrium with pure and mixed strategies in fees

## 6.4 Equilibrium

If both platforms exclude or allow, they cannot make a profit in equilibrium. This is an intuitive result: as the platforms are identical, competition drives down fees to 0. This result is in line with the literature on Bertrand competition in two-sided markets (Hagiu, 2006). However, if one platform excludes, while the other platform allows, there could exist an equilibrium in which their expected profit is strictly positive. A necessary condition for such an equilibrium to exist is that the valuation for high-quality is sufficiently high compared to the cost for high-quality and the valuation for low-quality. This condition is satisfied for combinations of valuations within the grey regions in figures 3 and 4. Hence, exclusion policies can not only profitably reduce competition within a platform but also between platforms. Less severe competition is desirable for the competing platforms, as it increases their profit. This is in line with the literature on competition policy (Belleflamme & Peitz, 2015; Motta, 2004).

**Proposition 3** *If the marginal valuation for high-quality is sufficiently high compared to the marginal valuation for low-quality, exclusion by one intermediary could soften competition between the two intermediaries.*

Furthermore, the set of valuations for which there could exist a profitable exclusion equilibrium is expanded in the competing platform case compared to the monopolist case: the grey area in figure 4 is larger than the grey area in figure 1. This is intuitive: for larger values of $\theta_\ell(s_L)$, the monopolist platform has a strictly better outside option than the competing platforms have. After all, the competing platforms could not make any profit if they would both allow the low-quality seller.

Buyers, on the other hand, are not necessarily better off with the exclusion policy. Important is that I assumed that sellers were single-homing and that buyers could buy from their preferred seller. Suppose buyers would be single-homing and had to choose which platform to join before seeing the sellers' choice. In that case, exclusion policies could potentially benefit from the screening process by the platform (Evans & Schmalensee, 2005). Consider a case in which sellers host at different platforms. As buyers want to buy from their preferred seller, they benefit from knowing at which platform each seller hosts. If a minimum quality standard can serve as a credible signal for product quality at the platform, consumers can learn the type of seller each intermediary attracts before joining the platform.

# 7 Conclusion

This paper investigates the role of competition on an intermediary's incentives to exclude. Whereas most literature on two-sided platforms has focused on optimal pricing strategies, exclusion policies are also a relevant strategic instrument for intermediaries. Therefore, I developed a theoretical model in which an intermediary can set a minimum quality standard. Setting this quality standard allows the intermediary to exclude a low-quality seller. Exclusion, therefore, reduces competition on the platform, since it allows a high-quality seller to operate as a monopolist.

I have found that setting a quality threshold can be profitable for a monopolist intermediary if there is competition on the platform. An important condition is that the premium that consumers are willing to pay for better quality is relatively large. If the premium is small, the platform is best off with having the low-quality seller operating as a monopolist. The intermediary thus always aims to minimize the competition on the platform. This can be reached either through setting their fee sufficiently high or by adopting an exclusion policy. Second, I have shown that this result does not necessarily hold when the intermediary can use first-degree price discrimination. In that case, there exists an equilibrium in which the pricing strategy can limit competition between the sellers. The high fees under price discrimination induce the sellers to set high prices. This is desirable for the intermediary, as they can now benefit from having a variety of products on the platform without the negative side effects of competition. Finally, exclusion policies can not only reduce competition within platforms but also between platforms. More specifically, exclusion allows two *ex-ante* homogeneous platforms to share the market profitably. In equilibrium, one of the platforms does not exclude the low-quality seller, while the other platform does. Similar as in the baseline model, the marginal valuation for high-quality needs to be sufficiently high.

Various interesting extensions can be made to my model. A natural first extension would be to investigate further the effect of more complex pricing strategies on the profitability of exclusion policies. In this model, I assumed that the platform could only charge a transaction fee on sellers. While this is a common pricing strategy for e-commerce platforms, it is plausible that an intermediary can charge both sides of the market. This could have important implications for my results. For example, I found that competition is undesirable for the platform, as it decreases prices for consumers and the fee for sellers. However, the lower consumer prices would increase the consumer's net utility from buying. If the platform can charge consumers for their service, it could reap part of these gains from the competition. Competition would then be less undesirable, which could limit the need for exclusion policies.

Additionally, the potential benefits from exclusion policies for consumers need to be investigated. In my analyses, consumers do not benefit from the exclusion policies. In fact, I found that consumers are strictly worse off if there is less competition on platforms. This result strongly depended on the assumption of perfect information: consumers could perfectly distinguish the different types of sellers. However, if there is asymmetric information on sellers' quality, consumers might benefit from a quality standard on the platform. The quality standard could reduce uncertainty on quality and lower search costs. This is desirable for consumers. For future research, it would be interesting to investigate the role of asymmetric information on the welfare effects of exclusion policies.

All in all, this paper shows that exclusion policies can be driven by the desire to reduce competition on a platform. This result is important from a competition policy perspective, as criticism towards the dominant position of various big tech intermediaries is already growing. However, this does not necessarily imply I would advise anti-trust authorities to prohibit these policies. As explained, this paper provides a one-sided analysis of exclusion policies in two-sided markets. The potential benefits for consumers are unexplored in this analysis. Hence, it is crucial to investigate the potential side effects of exclusion policies to make judgments on whether the reduction in competition is harmful to society.

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# Appendix

Recall that the expected profit from market sharing is equal to:

$$E(\pi^P) = F\left[\int_{\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2}}^{\theta_h(s_H)} P_H * \left(\frac{(1-F)(\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2})-c_H}{(1-F)P_H-c_H}\right) d\left(2-\frac{\theta_\ell(s_L)}{P_L}\right) + \theta_\ell(s_L)\right] \quad (7.1)$$

As yet explained, the fictitious expected market sharing profit is given by:

$$E(\pi^P_+) = F\left[\int_{\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2}}^{\theta_h(s_H)} P_H * \left(\frac{(1-F)(\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2})}{(1-F)P_H}\right) d\left(2-\frac{\theta_\ell(s_L)}{P_L}\right) + \theta_\ell(s_L)\right] \quad (7.2)$$

Ignoring the assumption that $c_H = \theta_\ell(s_L)$, the second expression could be derived by filling in $c_H = 0$ in the first expression. It is important to note that:

$$\frac{\partial}{\partial c_H}\left(\frac{(1-F)(\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2})-c_H}{(1-F)P_H-c_H}\right) = \frac{-((1-F)P_H-c_H)+(1-F)(\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2})-c_H)}{((1-F)P_H-c_H)^2} \quad (7.3)$$

$$= \frac{(1-F)(\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2})-(1-F)P_H}{((1-F)P_H-c_H)^2} \leq 0 \quad (7.4)$$

Note that this derivative is smaller or equal than 0 as the range of $P_H$ is given by:

$$P_H \in \left[\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2}, \theta_h(s_H)\right] \quad (7.5)$$

This implies that given the fee $F$:

$$E(\pi^P_+) \geq E(\pi^P) \quad (7.6)$$

Second, working out this fictitious profit yields:

$$E(\pi^P_+) = F\left[\int_{\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2}}^{\theta_h(s_H)} P_H \left(\frac{(1-F)(\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2})}{(1-F)P_H}\right) d\left(2-\frac{\theta_\ell(s_L)}{P_L}\right) + \theta_\ell(s_L)\right] \quad (7.7)$$

$$= F\left[\left(\frac{(1-F)(\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2})}{(1-F)}\right)\int_{\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2}}^{\theta_h(s_H)} \frac{P_H}{P_H} * d\left(2 - \frac{\theta_\ell(s_L)}{P_H - \theta_h(s_H) + \theta_\ell(s_L)}\right) + \theta_\ell(s_L)\right] \tag{7.8}$$

$$= F\left[\left(\frac{(1-F)(\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2})}{(1-F)}\right)\int_{\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2}}^{\theta_h(s_H)} \frac{\theta_\ell(s_L)}{(P_H - \theta_h(s_H) + \theta_\ell(s_L))^2}\, dP_H + \theta_\ell(s_L)\right] \tag{7.9}$$

$$= F\left(\left(\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}\right)\theta_\ell(s_L)\left[-\frac{1}{(P_H - \theta_h(s_H) + \theta_\ell(s_L))}\right]_{\theta_h(s_H)-\frac{\theta_\ell(s_L)}{2}}^{\theta_h(s_H)} + \theta_\ell(s_L)\right) \tag{7.10}$$

$$= F\left(\left(\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}\right)\theta_\ell(s_L)\frac{1}{\theta_\ell(s_L)} + \theta_\ell(s_L)\right) \tag{7.11}$$

$$= F\left(\theta_h(s_H) + \frac{\theta_\ell(s_L)}{2}\right) \tag{7.12}$$

This fictitious profit function is strictly increasing in $F$. In other words: a higher fee increases the fictitious expected profit. The fee for the actual expected profit is, however, bounded by the PC of seller $H$ at:

$$F^* \leq 1 - \frac{c_H}{\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}} \tag{7.13}$$

Plugging the highest value of $F$, given this restriction, in the fictitious profit function yields:

$$E(\pi_+^P) = \left(1 - \frac{c_H}{\theta_h(s_H) - \frac{\theta_\ell(s_L)}{2}}\right)\left(\theta_h(s_H) + \frac{\theta_\ell(s_L)}{2}\right) \tag{7.14}$$

Recall that the fictitious expected profit was always greater or equal to the actual expected profit for a given fee. This implies that the maximum profit in equation (7.14) is always at least as high as the actual expected profit.