Competition between a platform and merchants for
selling services

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Abstract

In this paper, we study competition between a platform and merchants for selling
services. In our setting, consumers can buy different versions of the same product either
through a platform or directly from a merchant. The platform’s and the merchant’s
selling services are differentiated both on the consumers’ side and on the merchants’
side. We examine whether restrictions that are imposed by platforms to sellers such as
price parity clauses or exclusive arrangements reduce consumer surplus. We show that
in some cases, the platform can impose restrictions that are socially optimal.

Keywords: Two-Sided Markets, Exclusivity, Selling Channel.

JEL Codes: E42; L1; O33.

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1 Introduction

In several markets, selling services impact consumers’ perception of product quality. Retailers can strategically decide to sell through a proprietary selling channel or to outsource their selling services to a platform. For example, a florist may decide whether to sell flowers directly at his physical shop or via an online marketplace such as Interflora. A hotel can choose to allow the booking of its rooms via his own website or via Booking.com. However, platforms have sometimes enough market power to impose restrictions to retailers, such as price parity clauses or exclusive arrangements. Price parity clauses are agreements whereby the price of the product sold on the platform cannot be higher than the price available on the merchant’s website. Exclusive contracts prevent merchants from selling through a competitive selling channel, such as direct sales or another platform. A key policy question is whether these restrictions reduce consumer surplus and social welfare.

In this paper, we analyze merchants’ incentives to outsource their selling services to a monopolistic platform in an agency model (i.e., when merchants set retail prices), assuming that the quality of the product depends on the selling channel. We also study the platform’s choice to impose restrictions to retailers. We are able to show that the platform’s restrictions are not always detrimental to consumers and merchants when selling services are differentiated in quality both on the consumers’ side and the merchants’ side.

Our paper examines a case that has been unexplored in the literature. Consumers can buy a service through two different selling channels, either a monopolistic platform or a monopolistic merchant. The two selling modes are exogenously differentiated both on the consumers’ side and on the merchants’ side. The platform can impose to merchants two different types of restrictions: either to single-home when they sell through the platform or price parity. When merchants single-home, they are forbidden to sell through their own selling channel (e.g., their own website) if they choose to sell through the platform. When the platform imposes price parity, merchants are forced to set the same final retail price when they sell through the platform or through their own selling channel.

Recently, several restrictions have been examined by competition authorities in platform markets. First, price parity clauses have been highly debated since they can constitute
horizontal agreements and be anti-competitive, in particular when the online platform has market power. There have been several recent antitrust cases regarding the E-Books market and the Online Hotel Booking cases.\footnote{In the US: District Court Judgment in 2013; Court of Appeals Judgment in 2015. In the EU: European Commission decisions in 2012 and 2013; new investigation in 2015. Online Hotel Booking cases: UK – OFT Decision in 2014; Germany: Court of Appeals Judgment in 2012; BKartA proceedings in 2013; new investigation in 2015. France, Italy and Sweden – Decisions in 2015.} Second, competition authorities or regulators have also enquired about exclusive contracts offered by platforms. In such cases, merchants were left with the possibility to renounce to use the intermediary’s selling channel and sell their products only via their own website of physical shop. For example, in 2008, eBay UK and Australia (a platform) proposed the “PayPal only” policy, i.e. sellers on eBay could only offer PayPal or cash as payment methods. They were indeed forbidden to offer a different payment service from the one proposed by eBay. Nevertheless, the Australian Competition and Consumer Commission (ACCC) threatened to start a procedure against eBay because this policy could substantially lessen competition in the market in which PayPal was operating.\footnote{Therefore, eBay did not put the “PayPal-only” policy in place. Nevertheless, the anticompetitive effect of this policy was debated, given that in the precise Australian market, according to some scholars, eBay was not in a dominant position.} A similar debate on exclusive contracts arose recently in the online booking industry.\footnote{See the decision 15-D-06 of the 21st April 2015 by the French Competition Authority on the case Booking.com.} Accor, the French company that owns more than 3700 hotels all around the world, entered the market of online reservations to compete with the well-known platform Booking.com. Given the amount of fees paid to online reservation platforms,\footnote{The percentage grew of about 28 % on each transaction in the last 4 years. See the article on Le Figaro (October, 2014) : "La parade d’Accor pour résister à Booking.com". Accor owns the hotel chains Ibis and Campanile.} Accor decided to forbid the hotels of the company from publicizing their rooms on Booking.com. In platform markets, exclusive contracts can take the form of a restriction that forces merchants to single-home when they sell through the platform. In our paper, we will look at this type of restriction, assuming that single-homing prevents a merchant from selling through its proprietary selling channel.\footnote{Our work does not study the case in which exclusive contracts prevent merchants from dealing with two different platforms. This issue would deserve another paper.}

We build a model to study competition between a platform and a continuum of monop-
olic merchants to market a service. The platform and merchants do not compete on the (main) retail market but only to extract the surplus that consumers obtain when they buy through their preferred selling channel.\textsuperscript{6} Merchants have to decide whether to offer their product through the platform or sell it directly to consumers, or through both channels (i.e., they single-home or multi-home). The platform charges a transaction fee both to consumers and merchants. Since consumer demand is elastic to prices, merchants pass through a fraction of their transaction costs to consumers. The platform’s marketplace is differentiated from the merchant’s selling channel both in terms of value added to the consumer’s buying experience and in terms of value added to the merchant’s sales. First, the platform offers differentiated services to consumers (such as price comparison opportunities or information). Second, in some markets, the platform may also bring a reduction of the transaction costs or additional benefits to merchants. By contrast, in other markets, merchants prefer to sell through their own proprietary solution because it is less costly or they can collect information on their consumers. Our model aims at analyzing the impact of the restrictions imposed by the platform in a variety of cases according to the value added both on the consumers’ side and on the merchants’ side (See Figure 1 below). The platform can impose two restrictions to merchants: either the impossibility to multi-home or price parity. If the platform imposes to merchants single-homing, they are forbidden to sell through their own selling channel when they market their product through the platform. If the platform imposes to merchants price parity, merchants are forbidden to price discriminate according to the selling channel.

In the figure 1 below, we summarize the various cases that can arise when a platform competes with merchants to sell a product or a service. For instance, the platform Booking.com adds value to both the consumers and merchants (and can be found in the category "A" of the table below): to merchants because it provides the reservation and cancellation services online, which can be costly to develop for the merchant; to consumers because it provides information about the hotels. On the contrary, platforms offering merely price comparison

\textsuperscript{6}The literature on online commerce platforms refers to this model as the agency model. By contrast, when the platform buys the primary product directly from the retailer and resells it to consumers, the vertical structure is said to be organized according to the wholesale model. Nevertheless, even if we adopt an agency model, in this paper sales revenue is not split between suppliers and retailers according to endogenously pre-determined shares and the entire revenue coming from the product is of the merchant.
(under the category "B" in the table below), such as crunchbase.com, reduce search costs for consumers and at the same time increase competition among merchants. Category C in the table represents those platforms that add value to merchants and not much value to consumers. Indeed, these platforms sell a service which is already offered by merchants in traditional markets with high fixed costs. For example, the platform Uber provides a very similar service to that offered by the traditional taxi system, without implying the high fixed costs of the taxi license for drivers. Lastly, under the group D, there are platforms that do not add any particular value to merchants and consumers with respect to the merchant’s service.

<table>
<thead>
<tr>
<th>Value Added To</th>
<th>Merchants</th>
</tr>
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<tbody>
<tr>
<td>Consumers</td>
<td>HIGH</td>
</tr>
<tr>
<td>HIGH</td>
<td>A</td>
</tr>
<tr>
<td>$\lambda_I &gt; \lambda_S$ and $\sigma^I &gt; \sigma^S$</td>
<td>$\lambda_I &gt; \lambda_S$ and $\sigma^I &lt; \sigma^S$</td>
</tr>
<tr>
<td>The platform re-elaborates the product; Reputations/informative platforms (e.g. Booking.com).</td>
<td>High fixed costs on the consumers’ side; Left out of the market (e.g. LendingClub); Price comparison platforms (increased competition for merchants).</td>
</tr>
<tr>
<td>LOW</td>
<td>C</td>
</tr>
<tr>
<td>$\lambda_I &lt; \lambda_S$ and $\sigma^I &gt; \sigma^S$</td>
<td>$\lambda_I &lt; \lambda_S$ and $\sigma^I &lt; \sigma^S$</td>
</tr>
<tr>
<td>High fixed costs on the merchant side (e.g. Airbnb or Uber).</td>
<td>No particular benefit on both sides.</td>
</tr>
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In the first part of the paper, we determine consumer demand and merchants’ profits according to the number of versions (qualities) of the product that are sold on the market.

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5In our model, $\lambda_I$ is the added-value provided by the platform’s version to consumers, while $\lambda_S$ is the added-value provided by the merchant’s version to consumers. $\sigma^I$ and $\sigma^S$ are respectively the value added to merchants from selling via the platform or directly (See Section 3). In our article we will focus on the cases A and B.
We start by the general case in which a merchant sells only one version of the product through a given selling channel. Then, we determine the merchant’s profit when he sells two different versions of the same product through two different selling modes, if price discrimination is allowed. The merchant’s profit of selling both qualities is equal to the sum of the monopoly profit of selling the low quality to all consumers and the additional profit (loss) that the merchant makes of selling the high quality to consumers who buy it. If price discrimination is not allowed, the merchant only offers the high quality only if it is less costly than the low quality.

Then, we determine the merchant’s choice of the number of versions (qualities) to sell on the market, depending on whether or not the platform imposes restrictions. By choosing to market another version of its product through a platform, the merchant can extract additional surplus from consumers but incurs different marginal costs. The additional surplus extracted from consumers depends on the differences in costs (related to the degree of differentiation on the merchant side) but also on the degree of differentiation between both selling channels on the consumers’ side. Both under single-homing and multi-homing, the merchant’s decision to offer the platform’s service depends on the degree of differentiation. We determine in all cases the conditions under which a merchant markets its product through the platform and we show that it depends on the platform’s total transaction fee. When the merchant is not allowed to price discriminate between both version of the product, his decision to sell through the platform only depends on the fee he pays to the platform.

Later, we study the platform’s pricing strategy in various scenarios: when there are no restrictions, when multi-homing is not allowed and when price discrimination is not allowed. Subsequently, we look at the profit-maximizing strategy of the platform and we compare it to the strategy that maximizes consumer surplus and social welfare. For given platform’s fees, merchants would prefer to be given the opportunity to offer more selling modes through multi-homing. However, depending on the elasticity of consumer and merchant demand, the platform can reduce its fees under single-homing. Therefore, merchant surplus may also increase under single-homing. For consumers, the variation in their surplus depends on three effects when multi-homing is allowed. Firstly, more consumers may be able to consume the higher quality. Secondly, the transaction fees may decrease in some cases under multi-
homing. Third, merchant’s acceptance always increases under multi-homing.

In our numerical simulations, we find that in many cases, the platform chooses a strategy which also maximizes consumer surplus and total user surplus. We also find that the interest of consumers and merchants are often not aligned, but we are able to identify cases in which all agents (platform, merchants and consumers) prefer that the platform imposes single-homing. For low levels of differentiation between the platform and the merchant’s service on the consumer side, if the platform adds high value on the merchant side, it always imposes price parity, which benefits consumers to the detriment of merchants, whose surplus is maximized by multi-homing. On the other side, if the platform does not add value on the merchant side, we find that merchant surplus is maximized by single-homing, because transaction fees are lower, while social welfare is maximized by multi-homing.

In the last section, we look at the case in which the platform only delivers the low quality service with respect to merchants and we see that merchants always accept the platform’s service under multi-homing and that if the platform forbids merchants to price discriminate across selling channels, consumers never buy through the platform.

The reminder of the paper is as follows. In Section 2, we survey the literature that is related to our study. In Section 3, we introduce the model and our assumptions. In Section 4, we analyze a merchant’s incentives to sell its product through the platform. In Section 5, we study whether the platform chooses a strategy that maximizes consumer surplus when the platform’s quality on the consumer side is higher than the merchant’s selling channel. In Section 6, we briefly comment the case in which the platform’s quality on the consumer side is low. Finally, we conclude.

2 Related literature

Our work is linked to several strands of literature on platform markets. First, several papers study whether price coherence reduces consumer surplus. When a platform imposes price coherence, merchants have to set the same retail price for consumers who buy through the platform and through another selling channel. Wang and Wright (2015) build a model in which consumers can search for firms directly or through a platform. Therefore, differently
from our work, they model search costs and they study the possibility for consumers to use platforms as showrooms to learn and compare prices without concluding the transaction through them. They find that price coherence has several anticompetitive effects. Firstly, it eliminates competition between the merchant and the platform on the selling channel. As a matter of fact, without price coherence merchants can adjust the retail prices with respect to the fees charged by the platform, and if prices are too high, then consumers will buy directly at the merchant’s shop. With price coherence, the platform will charge higher fees and as a consequence incentivize showroaming. Secondly price coherence eliminates the possibility for platforms to compete on the fees, for example.

Justin Johnson compares the wholesale and the agency models. He shows that most-favored nation clauses (MFNs)\textsuperscript{8} may raise industry profits but lower consumer surplus. However, when profit-sharing rather than revenue-sharing contracts are used, MFNs may have a procompetitive effect by encouraging retailer entry. Edelman and Wright (2015) study the impact of price coherence on buyers’ and sellers’ choice to access a platform (i.e., consumers pay the same price whether or not they buy the product sold by the merchant through the platform). They find that platforms have incentives to restrict sellers from charging more for intermediated transactions. This restriction increases retail prices and causes an overconsumption of intermediaries’ services, over-investment in benefits to buyers, and a reduction in consumer surplus and sometimes welfare. Yet, there is no heterogeneity on the merchants’ side. Another work by these authors (2015) explores several examples of platforms requiring sellers to offer their lowest prices through the platform. This restriction poses an harm to competition because it forbids sellers to offer lower prices for direct sales or through competing platforms. Nonetheless, it prevents “showroaming” on the platforms and excessive surcharging of platforms’ services.

Moreover, our article is related to the literature on selling modes. This strand of the literature examines merchants’ incentives to market a product or a service through a platform

\textsuperscript{8}Most favoured nation (MFN) clauses are agreements according to which the supplier agrees to offer the distributor a price or rate no higher than the lowest offered to other clients. In the hotel online booking sector, an MFN clause obliges the hotel to always give the platform with which it has signed the clause the best price for hotel online bookings, the highest number of available rooms and the most favourable conditions for booking and cancellation.
and whether the presence of a platform increases efficiency. In Baye and Morgan (2001) the value of subscribing to the intermediary stems from the ability to capture distant consumers and the possibility to post a price. Galeotti and Gonzales (2008) study a two-sided market where a monopolistic platform attracts differentiated sellers and buyers. In their model, the platform is able to fully extract the rents generated on the retail market, unless consumers have the outside option of buying the product outside the platform. They show that the presence of the platform does not add any additional distortion over those arising from the market power of sellers. In our model, by contrast, consumers are able to compare the price posted on the platform and on the merchant’s selling channel, and decide whether or not to make a transaction through the platform after observing the prices. Furthermore, we assume vertical differentiation between the platform and merchants. It follows that the presence of the platform can even reduce distortions caused by seller market power.

Hagiu and Wright (2014) study the choice and the trade-offs faced by an intermediary between operating as a marketplace, as a reseller, or as a hybrid between the two, having some products offered under each of the two different modes. Nevertheless, they do not model competition between the marketplace and the reseller, as we do in our model. Einav et al. (2016) review various examples of peer-to-peer markets and build a model to show that peer-to-peer platforms bear lower fixed costs, are more flexible, and emerge in markets with high volatility of demand.

Lastly, our paper is related to the literature on bypass and platform competition. Bourreau and Verdier (2010) examine the incentives of a merchant to bypass a payment platform by issuing private cards, and find that the payment platform can only deter entry by lowering the level of the interchange fee. However, in their model, merchants’ participation to the platform is fixed and they do not study the platform’s incentives to impose restrictions on merchants.

\section{The model}

We build a model to study whether consumers benefit from competition between merchants and a platform when they offer different qualities of service, and when merchants decide on
how many selling channels to offer to consumers.

**Merchants** A continuum of monopolistic merchants offer different versions of the same service to consumers through different selling channels, i.e., either a platform or directly (online or offline). The quality of service depends on the selling channel.\(^9\) For example, a consumer can book an hotel room either online through a booking platform or directly from a merchant. Some consumers may perceive the quality of service offered by the booking platform as higher because they value for instance the possibility to obtain additional information. Each merchant decides on the price of the service and on how many selling channels (i.e., qualities) to offer to consumers.

The selling channel is denoted by \( k = I, S \), where \( I \) stands for the platform (the intermediary) and \( S \) stands for the merchant (the seller). The quality \( j \) of the service can be low \((j = L)\) or high \((j = H)\). The merchant’s profit depends on how many qualities he sells to consumers. We denote it by \( \pi^2 \) if two qualities are available and \( \pi^k_j \) if only quality \( j \) is available at selling channel \( k \). The retail price of a service of quality \( j \) sold through selling channel \( k \) is \( p^k_j \). The total net cost of selling quality \( j \) through selling channel \( k \) is \( c^k_j \).

Merchants differ across their total net selling cost. For all \( j = H, L \) and all \( k = I, S \), the benefit of selling quality \( j \) through selling channel \( k \) is \( \sigma^k_j(b_S) \), where where \( b_S \) is drawn from the continuously differentiable distribution \( H_S \) on \([0, b_S]\) with a density of \( h_S \). When a merchant sells directly to consumers, he incurs a marginal cost \( d \). When he sells through the platform, he pays a fee \( f^S \) to the intermediary but incurs no marginal cost. Therefore, we have \( c^S_j = d - \sigma^S_j(b_S) \) and \( c^I_j = f^S - \sigma^I_j(b_S) \). For \((j, j') \in (H, L)\), the difference \( c^S_j - c^I_j \) represents the degree of differentiation between a merchant and the platform.

**Buyers** Each merchant faces a continuum of buyers. A buyer gives a value \( y \) to the basic version of the service that is drawn independently from \( b_S \) on the support \([0, v]\) from the continuously differentiable distribution \( F \) with a density of \( f \). The survival function is \( D(.) = \)

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\(^9\)We do not study the case in which the two qualities are sold through the same selling channel. In our model, we choose to focus on competition between merchants and a platform and therefore, we abstract from modelling strategic interactions between merchants.
The net utility of buying a service of quality \( j \) through selling channel \( k \) is

\[
u^k_j = \lambda^k_j(y) - p^k_j - (f^B_k)^k,
\]

where \( \lambda^k_j(y) \) is the fixed utility of consuming the service, \( p^k_j \) the retail price paid to the merchant, and \( (f^B_k)^k \) the transaction fee paid for buying through selling channel \( k \).\(^{10}\) If he does not buy, the consumer’s utility is equal to zero. We assume that a consumer pays no additional transaction fee when he buys directly from the merchant, that is, we have \( (f^B_j)^S = 0 \), and that he pays a transaction fee to the platform. The functions \( \lambda^k_j \) and \( \lambda^k_H - \lambda^k_L \) are continuous and strictly increasing. The difference \( \lambda^k_H - \lambda^k_L \) represents the degree of differentiation between selling channel \( k \) and selling channel \( k' \) on the consumers’ side, \( k \) denoting the selling channel for the high quality and \( k' \) the selling channel for the low quality.

The consumer’s choice depends on how many qualities are available. When only one quality is available, a consumer chooses between buying the available quality and not consuming. We denote by \( y^k_j \) the indifferent consumer between buying and not buying if only quality \( j \) is available through selling channel \( k \). If two qualities are available, a consumer chooses between buying either the high quality, the low quality and not consuming. We denote by \( y^2_H \) the consumer who is indifferent between buying the high and the low quality and by \( y^2_L \) the consumer who is indifferent between buying the low quality version and not consuming.

**The platform** The platform is a marketplace that acts as intermediary between consumers and merchants.\(^{11}\) Consumers and merchants pay respectively the fees \( (f^B)^I \) and \( f^S \) to use the platform. The platform’s total intermediation cost is \( c_P \) and the total transaction fee is \( f^T \). The platform can impose restrictions to sellers. The first is the impossibility to multihome. This means that if a merchant decides to sell through the platform, it cannot sell directly to consumers. The second is the impossibility to price discriminate according to the selling channel. In this case, the seller is constrained to choose the same retail price for all

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\(^{10}\) The specification of the fixed utility follows McAfee (2007).

\(^{11}\) Therefore, we do not analyze the case in which the platform is a reseller. The platform does not choose the price of the service.
selling channels. The platform’s profit is $\pi^i$ for $i \in \{mh, sh, npd\}$, where $mh$ denotes the multi-homing case, $sh$ the single-homing case and $npd$ the case in which price discrimination is not allowed.

An example:
Throughout the paper, we develop an example in which consumers’ and merchants’ valuations for quality are linear, respectively. We assume that $\sigma^k_j(b_S) = \sigma^k_j b_S$ and $\lambda^k_j(y) = \lambda^k_j y$ for $j = L, H$ and $k = I, S$. Furthermore, we assume that $b_S$ is uniformly distributed on $[0, 1]$ and that $y$ is uniformly distributed on $[0, v]$. We also assume that $\lambda^S_j v \geq d$. This assumption ensures that there is a positive demand for the merchant’s service.

Timing of the game:
The timing of the game is as follows:

1. The platform sets the consumer fee $(f^B_j)^I$ and the merchant fee $f^S$ and decides whether or not to impose restrictions to merchants.

2. Merchants learn their transaction benefit $b_S$. They decide on how many selling channels to offer to consumers and on the price of the service.

3. Consumers learn their value for the service $y$, decide whether or not to consume and which version to buy.

4 The number of selling channels
In this section, we study whether a merchant prefers to sell through one or two selling channels when he is able to offer different qualities to consumers.

4.1 The merchant’s profit of selling one quality
If a merchant sells quality $j$ through selling channel $k$, he makes profit

$$\pi^k_j = D(y^k_j)(p^k_j - c^k_j),$$
where \( y_j^k \) is the consumer who is indifferent between consuming or not the service. Since 
\[ \lambda_j^k(y_j^k) = p_j^k + (f_j^B)^k, \]
we have
\[ \pi_j^k = D(y_j^k)(\lambda_j^k(y_j^k) - (f_j^B)^k - c_j^k). \] (1)

Hence, the choice of the profit-maximizing price is equivalent to the choice of the indifferent consumer. As in McAfee (2007), we denote the merchant’s marginal revenue by
\[ MR_j^k(p) = p - (\lambda_j^k)'((\lambda_j^k)^{-1}(p))D((\lambda_j^k)^{-1}(p))/f((\lambda_j^k)^{-1}(p)), \]
and we assume that \( MR_j^k \) is strictly increasing. The merchant chooses his price such that his marginal revenue equals his marginal cost. We denote by \( \tilde{y}_j^k \) the indifferent consumer at the profit-maximizing price and we have
\[ MR_j^k(\lambda_j^k(\tilde{y}_j^k)) = (f_j^B)^k + c_j^k. \]

Since \( MR_j^k \) and \( \lambda_j^k \) are strictly increasing, \( g_j(.) = MR_j^k(\lambda_j^k(\cdot)) \) is strictly increasing. At the profit-maximizing price, the indifferent consumer is given by
\[ \tilde{y}_j^k = g_j^{-1}((f_j^B)^k + c_j^k). \] (2)

Since a merchant passes through its marginal cost to consumers, the indifferent consumer depends on the total cost of making a transaction for the joint agent (consumer+merchant). The merchant also internalizes the transaction fee paid by the consumer in its pricing decision. The literature refers to this behavior as merchant internalization (Wright, 2012).

At the equilibrium of stage 3, from (1), if the merchant sells only quality \( j \) through selling channel \( k \), he makes profit
\[ \pi_j^k(\tilde{y}_j^k) = D(\tilde{y}_j^k)(\lambda_j^k - g_j)(\tilde{y}_j^k). \] (3)

The merchant’s profit is a function of \( \tilde{y}_j^k \) or \( (f_j^B)^k + c_j^k \). Since \( g_j \) is increasing, we have the standard result that the monopoly’s profit \( \pi_j^k \) is decreasing with \( (f_j^B)^k + c_j^k \).
4.2 The merchant’s profit if price discrimination is not allowed

If price discrimination is not allowed, we denote the common price for the two versions by $p$, the selling channel for the high quality by $k$ and the selling channel for the low quality by $k'$, where $k \neq k'$ and $(k, k') \in \{I, S\}^2$. If the difference in transaction fees is too high such that $(\lambda^k_H - \lambda^{k'}_L)^{-1}((f^B_H)^k - (f^B_L)^{k'}) > v$, a consumer never buys the high quality. If $(\lambda^k_H - \lambda^{k'}_L)^{-1}((f^B_H)^k - (f^B_L)^{k'})$ belongs to $[0, v]$ some consumers buy the high quality. If the merchant sells both qualities, the indifferent consumer between the high and the low qualities is given by $(\lambda^k_H - \lambda^{k'}_L)(y_H) = (f^B_H)^k - (f^B_L)^{k'}$ and the indifferent consumer between buying and not buying $\lambda^{k'}_L(y_L) = p + (f^B_L)^{k'}$. If $y_H \geq y_L$, the merchant’s profit is given by

$$\pi^2 = \pi^L(y_L) + D(y_H)(c_L^{k'} - c_H^k).$$

If $c_L^{k'} < c_H^k$, the merchant’s profit is lower when he offers both qualities than when he offers only the low quality. Therefore, he only sells the low quality through selling channel $k'$. If $c_L^{k'} \geq c_H^k$ and $(\lambda^k_H - \lambda^{k'}_L)^{-1}((f^B_H)^k - (f^B_L)^{k'})$ belongs to $[0, v]$, the merchant sells both qualities. We denote by $\hat{y}_j$ the indifferent consumer at the profit-maximizing price when price discrimination is not allowed for $j \in \{L, H\}$. We have $\hat{y}_L = \hat{y}_L^{k'} = \hat{y}_L^k$ and $\hat{y}_H = (\lambda^k_H - \lambda^{k'}_L)^{-1}((f^B_H)^k - (f^B_L)^{k'})$. If $c_L^{k'} \geq c_H^k$ and $(\lambda^k_H - \lambda^{k'}_L)^{-1}((f^B_H)^k - (f^B_L)^{k'}) \geq \hat{y}_L^{k'}$, the merchant’s profit when price discrimination is not allowed is

$$\pi^{npd}(\hat{y}_L^{k'}) = \pi^L(\hat{y}_L^{k'}) + D((\lambda^k_H - \lambda^{k'}_L)^{-1}((f^B_H)^k - (f^B_L)^{k'}))(c_L^{k'} - c_H^k). \quad (4)$$

If $(\lambda^k_H - \lambda^{k'}_L)^{-1}((f^B_H)^k - (f^B_L)^{k'}) < \hat{y}_L^{k'}$, the merchant only sells the high quality because consumers always obtain a lower utility of buying the low quality. He makes profit

$$\pi^{npd}(\hat{y}_H^{k'}) = \pi^H(\hat{y}_H^{k'}).$$

If $c_L^{k'} < c_H^k$, the merchant prefers to sell only the low quality because it is less costly than to sell the two qualities, and we have

$$\pi^{npd}(\hat{y}_L^{k'}) = \pi^L(\hat{y}_L^{k'}). \quad (5)$$
4.3 The profit of selling two qualities under price discrimination

If price discrimination is allowed, the merchant can sell a service of quality $L$ through selling channel $k'$ at a price $p^k_{H}$ and quality $H$ through selling channel $k$ at a price $p^k_{L}$. If the merchant sells the two qualities through selling channels $k$ and $k'$ respectively for $k \neq k'$, he makes profit

$$\pi^2 = D(y^2_{H})(p^k_{H} - c^k_{H}) + (F(y^2_{H}) - F(y^2_{L}))(p^k_{L} - c^k_{L}),$$

provided that $y^2_{H} \geq y^2_{L}$. Since $\lambda^k_{H}(y^2_{H}) - p^k_{H} - (f^B_H)^k = \lambda^k_{L}(y^2_{H}) - p^k_{L} - (f^B_L)^k'$ and $\lambda^k_{H}(y^2_{L}) = p^k_{L} + (f^B_L)^k'$, the merchant’s profit when he sells both qualities can be expressed as follows

$$\pi^2 = \pi^L_k(y^2_{L}) + \pi^H_k(y^2_{H}) - \pi^L_k(y^2_{H}).$$

The merchant’s profit of selling both qualities is equal to the sum of the monopoly profit of selling the low quality to all consumers and the additional profit (loss) that the merchant makes of selling the high quality to the consumers who buy it. We denote by $\tilde{y}^2_{H}$ and $\tilde{y}^2_{L}$ the indifferent consumers at the profit-maximizing prices. At the equilibrium prices, the indifferent consumer between buying the low quality and not buying is identical whether or not the high quality is offered by the merchant, that is, we have $\tilde{y}^2_{H} = \tilde{y}^2_{L}$. Indeed, since $(\pi^2)'(\tilde{y}^2_{H}) = (\pi^L)'(\tilde{y}^2_{L})$ and $(\pi^2)'(\tilde{y}^2_{L}) = 0$, we have $(\pi^L)'(\tilde{y}^2_{L}) = 0$. Therefore, $\pi^L_k$ reaches its maximum at $\tilde{y}^2_{L}$ and we have

$$\tilde{y}^2_{L} = \tilde{y}^k_{L}. \quad (6)$$

We now determine the indifferent consumer between the high and the low quality when both qualities are available at the profit-maximizing prices. Since $(\pi^2)'(\tilde{y}^2_{H}) = 0$ and $(\pi^2)'(y^2_{H}) = (\pi^L)'(y^2_{H}) - (\pi^L)'(y^2_{H})$, we have $(\pi^L)'(\tilde{y}^2_{H}) = (\pi^L)'(\tilde{y}^2_{H})$. We assume that the function $g_2(.) = MR^L_k(\lambda^k_{H}(.) - MR^L_k(\lambda^k_{L}(.))$ is strictly increasing. This enables us to define $\tilde{y}^2_{H}$ as

$$\tilde{y}^2_{H} = g_2^{-1}((f^B_H)^k + c^k_{H} - (f^B_L)^k'). \quad (7)$$

We are now able to compare consumer demand for the high and the low quality, respectively, according to the number of selling channels offered to consumers.
Lemma 1  Consumer demand for the service of high quality is reduced when both qualities are available if and only if

\[ g_2^{-1}((f_H^B)^k + c_{H}^k - (c_L^k + (f_L^B)^{k'})) \geq g_H^{-1}((f_H^B)^k + c_{H}^k). \]

Consumer demand for the low quality is always reduced when both qualities are available. Total consumer demand is identical whether one or two qualities are available.

Proof. From (7), we have \( \tilde{y}_H^2 \geq \tilde{y}_H^{k'} \) if and only if \( g_2^{-1}((f_H^B)^k + c_{H}^k - (c_L^k + (f_L^B)^{k'})) \geq g_H^{-1}((f_H^B)^k + c_{H}^k) \). Since \( \tilde{y}_L^2 = \tilde{y}_L^{k'} \), total consumer demand is identical whether one or two qualities are available, and consumer demand for the low quality is reduced when both qualities are available. ■

In our linear example, from Lemma 1, since \( \tilde{y}_H^2 = \tilde{y}_H^{k'} = \tilde{y}_L^2 = \tilde{y}_L^{k'} \), consumer demand for the service of high quality is reduced when both qualities are available if and only if

\[ \frac{\lambda_{k'}^L((f_H^B)^k + c_{H}^k) - \lambda_{k}^H(c_{L}^k + (f_L^B)^{k'})}{2\lambda_{k}^H(\lambda_{k}^H - \lambda_{k'}^L)} \geq 0. \]

The variation of consumer demand for the high quality according to the number of selling channels available depends both on the degree of differentiation between selling channels on the merchants’ side \( c_{H}^k - c_{L}^{k'} \) and on the consumers’ side \( \lambda_{k}^H - \lambda_{L}^{k'} \).

At the equilibrium of stage 3, if price discrimination is allowed, the merchant makes profit

\[ \pi^2(\tilde{y}_H^2, \tilde{y}_L^2) = \pi_H^k(\tilde{y}_H^2) - \pi_L^k(\tilde{y}_H^2) + \pi_L^k(\tilde{y}_L^2), \] (8)

if he sells both qualities.
4.4 The merchant’s choice of the quality of service and the number of selling channels

4.4.1 Case 1: price discrimination and multi-homing are allowed

A merchant offers both qualities through two different selling channels if and only if for all \( j = L, H \), we have

\[
\pi^2(\tilde{y}_H^2, \tilde{y}_L^2) \geq \pi_j^k(\tilde{y}_j^k).
\]

We denote by \( S_k^l \) the set of merchants that sell through selling channel \( k \) when \( l \) selling modes are available.

**Lemma 2** A merchant always prefers to offer both qualities rather than only the high quality. He prefers to offer both qualities rather than only the low quality if and only if

\[
(\lambda_H^k - \lambda_L^k)(\tilde{y}_H^2) + (f_L^B)^k' - (f_H^B)^k + c_L^k - c_H^k \geq 0.
\] (9)

**Proof.** We start by analyzing whether a merchant makes more profit by offering both qualities rather than only the high quality. From (8) and (6), we have \( \pi^2(\tilde{y}_H^2, \tilde{y}_L^2) = \pi^2(\tilde{y}_H^2, \tilde{y}_L^2) \). Since \( \pi^2 \) reaches a maximum at \((\tilde{y}_H^2, \tilde{y}_L^2)\), we have \( \pi^2(\tilde{y}_H^2, \tilde{y}_L^2) \geq \pi^2(\tilde{y}_H^2, \tilde{y}_L^2) \). From (8), we have \( \pi^2(\tilde{y}_H^2, \tilde{y}_L^2) - \pi^2(\tilde{y}_H^2, \tilde{y}_L^2) = \pi^k(\tilde{y}_L^2) - \pi^k(\tilde{y}_H^2) \). Since \( \pi^k \) reaches its maximum at \( \tilde{y}_L^2 \), we have \( \pi^k(\tilde{y}_L^2) - \pi^k(\tilde{y}_H^2) \geq 0 \). Therefore, we have \( \pi^2(\tilde{y}_H^2, \tilde{y}_L^2) - \pi^2(\tilde{y}_H^2) \geq 0 \). This implies that \( \pi^2(\tilde{y}_H^2, \tilde{y}_L^2) \geq \pi^2(\tilde{y}_H^2) \) and \( \pi^2(\tilde{y}_H^2, \tilde{y}_L^2) \geq \pi^2(\tilde{y}_H^2) \). Hence, a merchant always makes more profit by offering both qualities than only the high quality. We now analyze whether the merchant makes more profit by offering both qualities rather than only the low quality. From (8) and (6), we have that

\[
\pi^2(\tilde{y}_H^2, \tilde{y}_L^2) - \pi^k(\tilde{y}_L^2) = \pi^k(\tilde{y}_H^2) - \pi^k(\tilde{y}_H^2).
\]

Replacing for \( \pi^k \) and \( \pi^k \) into the equality above, we find that

\[
\pi^2(\tilde{y}_H^2, \tilde{y}_L^2) - \pi^k(\tilde{y}_L^2) = D(\tilde{y}_H^2)((\lambda_H^k - \lambda_L^k)(\tilde{y}_H^2) + (f_L^B)^k' - (f_H^B)^k + c_L^k - c_H^k).
\]

Since \( D(\tilde{y}_H^2) \geq 0 \), we have that \( \pi^2(\tilde{y}_H^2, \tilde{y}_L^2) - \pi^k(\tilde{y}_L^2) \geq 0 \) if and only if (9) holds. ■

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A merchant’s decision to offer the service through two different selling channels depends on how much surplus he can extract from consumers by offering an additional selling channel and on the marginal costs incurred respectively in each selling channel.\textsuperscript{12} When a monopoly sells only the high quality at the monopoly price to \( D(\bar{y}^H) \) consumers, it can increase its profit by selling the low quality as well. There is a market expansion effect that increases the merchant’s profit by \( \pi^L_k(\bar{y}^L_k) - \pi^L_k(\bar{y}^H_k) \) (i.e., the profit of selling the low quality to all consumers plus the loss of not selling the low quality to \( D(\bar{y}^H_k) \) consumers). The merchant can further increase its profit by adjusting the price of the high quality. Therefore, a merchant always makes more profit by offering both qualities than by offering only the high quality.

When a monopoly sells only the low quality at the monopoly price to all consumers, it does not necessarily increase its profit by offering the high quality as well. There is no market expansion effect in this case, because the price of the low quality remains unchanged. Hence, whether or not the monopoly offers an additional quality depends on the additional margin that it earns from consumers who buy the high quality. The additional surplus extracted from consumers depends on the degree of differentiation between both selling channels on the consumers’ side (i.e., the function \( (\lambda^k_H - \lambda^k_L)(\cdot) \)) and on difference in the fees paid by consumers for buying through a specific selling channel. The difference of marginal costs depends on the degree of differentiation between both selling channels for the merchant (i.e., the function \( (\sigma^k - \sigma^{k'})(\cdot) \)).

\subsection*{4.4.2 Case 2: multi-homing is not allowed}

If multi-homing is not allowed, a merchant offers the high quality through selling channel \( k \) rather than the low quality through selling channel \( k' \) if and only if

\[ \pi^k_H(\bar{y}^k_H) \geq \pi^{k'}_L(\bar{y}^{k'}_L). \]  \hspace{1cm} (10)

\textsuperscript{12}Anderson and Dana (2008) provide general conditions under which price discrimination is a profitable strategy.
4.4.3 Case 3: Price discrimination is not allowed

If price discrimination is not allowed, a merchant sells both qualities if \( c_L' \geq c_H \) and \((\lambda_H^k - \lambda_L^k)^{-1}((f_H^{B^k})^k - (f_L^{B^k})^k') \geq \hat{y}_L\), only the high quality if \( c_L' \geq c_H \) and \((\lambda_H^k - \lambda_L^j)^{-1}((f_H^{B^j})^k - (f_L^{B^j})^k') < \hat{y}_L\), and only the low quality otherwise.

5 A high quality platform

In this section, we focus on the case of a platform that delivers a higher quality to consumers than merchants. We analyze the merchants’ decision to offer the platform’s service and the platform’s incentives to impose restrictions to sellers. The analysis of Section 4 applies for \( k = I \) and \( k' = S \).

5.1 A merchant’s decision to offer the platform’s service

5.1.1 Case 1: multi-homing is allowed

From Lemma 1, since a merchant never offers the high quality alone, he never offers the platform’s service alone. Therefore, a merchant trades off between offering both qualities through \( I \) and \( S \) or offering only a service of low quality through \( S \). From (9), since \( c_L^S = d - \sigma^S(b_S) \), \( c_H^I = f^S - \sigma^I(b_S) \) and \((f_L^B)^S = 0\), a merchant offers the platform’s service if and only if

\[
(\lambda_H^I - \lambda_L^S)(\hat{y}_H^2) + d + (\sigma^I - \sigma^S)(b_S) - ((f_H^B)^I + f^S) \geq 0,
\]

where from (7), \( \hat{y}_H^2 \) is given by

\[
\hat{y}_H^2 = g_2^{-1}((f_H^B)^I + f^S + (\sigma^S - \sigma^I)(b_S) - d).
\]

A merchant’s decision to offer the platform’s service depends on the difference in the degree of differentiation between the platform and the merchant on the selling benefits (i.e., \( \sigma^S - \sigma^I \)) and the degree of differentiation on the consumers’ side (i.e., \( \lambda_H^I - \lambda_L^S \)). From (7), the set of merchants that sell through the platform when two selling modes are available is
given by

\[ S^2_I = \{ b_S \in [0, \bar{b}_S], (\lambda'_H - \lambda'_L)((g_2)^{-1}(z)) \geq z \text{ and } z = f^S + (f^B_H)^I - d + (\sigma^S - \sigma^I)(b_S) \} . \]  

(13)

This implies that merchant’s acceptance of the platform’s service when the two selling channels are available depends on the platform’s total transaction fee \((f^B_H)^I + f^S = f^T\). This result is due to the fact that merchants internalize a fraction of consumer surplus in their decisions to accept the platform’s service.

**An example:** In our linear example, we find that \(S^2_I = [0, 1]\).

5.1.2 Case 2: multi-homing is not allowed

If multi-homing is not allowed, merchants trade off between selling the high quality through the platform and selling the low quality through their own selling channel. From (10), the set of merchants that sell through the platform is given by

\[ S^1_I = \{ b_S \in [0, \bar{b}_S], \pi'_I(\bar{y}_H) \geq \pi^S_L(\bar{y}_L) \} . \]  

(14)

From (2) and (3), we have

\[ S^1_I = \{ b_S \in [0, \bar{b}_S], D(\bar{y}_H)(\lambda'_H - g_H)(\bar{y}_H) \geq D(\bar{y}_L)(\lambda'_L - g_L)(\bar{y}_L) \} , \]

where

\[ \bar{y}_H^I = g_H^{-1}((f^B_H)^I + f^S - \sigma^I(b_S)) , \]  

(15)

and

\[ \bar{y}_L^S = g_L^{-1}(d - \sigma^S(b_S)) . \]  

(16)

Therefore, merchants’ acceptance of the platform’s service under single-homing depends on the platform’s total transaction fee \((f^B_H)^I + f^S = f^T\).
An example: In our linear example, \( \pi_H (y_H^I) - \pi_L (y_L^S) \) is a polynomial function of \( b_S \). The coefficient of \( b_S^2 \) is \( \lambda_L^S (\sigma^I)^2 - \lambda_H^I (\sigma^S)^2 \). If \( \lambda_L^S (\sigma^I)^2 > \lambda_H^I (\sigma^S)^2 \) (resp., \( < 0 \)), the polynomial function is convex (resp., concave). Note that the convexity of the function \( \pi_H (y_H^I) - \pi_L (y_L^S) \) depends on the relative differentiation between the platform’s service and the merchant’s service on the consumers’ side with respect to the merchants’ side. If the platform’s advantage is relatively higher on the merchants’ side than on the consumers’ side, the function \( \pi_H (y_H^I) - \pi_L (y_L^S) \) is convex, whereas it is concave otherwise. To simplify the computations, we focus on two polar cases, that is \( \sigma^I = 0 \) and \( \sigma^S > 0 \) (case a), and \( \sigma^I > 0 \) and \( \sigma^S = 0 \) (case b).

The first case (case a) corresponds to a situation where the platform does not bring any cost reduction to merchants (\( \sigma^I = 0 \)), whereas a proprietary solution brings high value to merchants. The equation \( \pi_H (y_H^I) - \pi_L (y_L^S) = 0 \) admits two solutions and is concave. We denote the highest of these two solutions by \( b_S^a \), and we have \((S_1^I)^a = [0, \min(\max(b_S^a, 0), 1)]\), where

\[
b_S^a = \frac{1}{\sigma^S} \left( (d - \lambda_L^S v) + \sqrt{\frac{\lambda_L^S}{\lambda_H^I} (\lambda_H^I v - f_T)} \right).
\]

The higher the total price charged by the platform or the benefits of a proprietary solution on the merchants’ side, the lower merchants’ acceptance of the platform’s service.

The second case (case b) corresponds to a situation where the platform reduces merchants’ transaction costs compared to a proprietary selling channel (\( \sigma^S = 0 \)). In case b, we denote the highest of the two solutions of \( \pi_H (y_H^I) - \pi_L (y_L^S) = 0 \) by \( b_S^b \). We have \((S_1^I)^b = [\max(\min(b_S^b, 1), 0), 1]\), where

\[
b_S^b = \frac{1}{\sigma^I} \left( (f_T - \lambda_H^I v) + \sqrt{\frac{\lambda_H^I}{\lambda_L^S} (\lambda_L^S v - d)} \right).
\]

The higher the price charged by the platform and the lower the benefits of the platform’s service for merchants, the lower merchants’ acceptance of the platform’s service. Compared to the multi-homing case, merchant acceptance of the platform’s service is reduced under single-homing.
5.1.3 Case 3: price discrimination is not allowed

If $c_L' < c_H^*$, we showed that the merchant never offers the platform’s service. If $c_L' \geq c_H^*$, the merchant either offers the platform’s service alone or both services. Therefore, if $(\sigma^I - \sigma^S)(b_S) < f^S - d$, the merchant does not offer the platform’s service. The set of merchants that sell through the platform is given by

$$S_{npd}^p = \{ b_S \in [0, b_S^*], (\sigma^I - \sigma^S)(b_S) \geq f^S - d \}. \quad (17)$$

When the platform forbids price discrimination, merchant acceptance is related to the fee that merchants pay to the platform. Merchants do not internalize the fee paid by consumers in their decisions to accept the platform’s service.

An example

In our linear example, the merchant offers the platform’s service if and only if $b_S \geq b_{npd}^p$, where $b_{npd}^p \equiv (f^S - d)/(\sigma^I - \sigma^S)$.

5.2 The platform’s fees if there are no restrictions

If the platform does set any restrictive rules on merchants’ activities, the set of merchants that accept the platform’s service is $S_2^I$. Since the platform competes with merchants and offers the high quality of service, the demand of consumers who buy through the platform at a merchant of type $b_S$ is $D(\gamma_H^2)$, provided that $D(\gamma_H^2) \in [0, 1]$. Therefore, the volume of transactions is given by

$$\int_{S_2^I} D(\gamma_H^2) h_S(b_S) db_S,$$

and the platform’s profit is

$$\pi^{mh} = ((f_H^B)^I + f^S - c_P)\int_{S_2^I} D(\gamma_H^2) h_S(b_S) db_S.$$

The platform chooses the fees $(f_H^B)^I$ and $f^S$ that maximize its profit. From (11) and (12), the platform’s profit depends on the total transaction fee $(f_H^B)^I + f^S$. We denote the equilibrium total transaction fee under multi-homing by $f^{mh}$ and we assume that there is an interior
solution to the maximization of platform’s profit.\footnote{Remark that the platform can choose a price $f^T$ such that some merchants do not offer the high quality.} If the platform does not set any restrictive rules on merchants’ activities, it makes profit

$$\pi^{mh} = (f^{mh} - c_P) \int_{S^I} D(g_2^{-1}(f^{mh} + (\sigma^S - \sigma^I)(b_S) - d)) h_S(b_S) db_S.$$

An example:

In our linear example, the profit-maximizing total transaction fee is given by

$$f^{mh} = \frac{1}{4}(2v(\lambda_H^I - \lambda_L^S) + 2d + 2c_P + (\sigma^I - \sigma^S)).$$

The total transaction fee increases with the degree of differentiation between the platform’s service and the merchant’s service on the consumers’ side ($\lambda_H^I - \lambda_L^S$) and with the benefits that are brought by the platform compared to a proprietary solution ($\sigma^I - \sigma^S$) for the merchant.

The platform’s profit under multi-homing is

$$\pi^{mh} = \frac{1}{32v(\lambda_H^I - \lambda_L^S)} (2v(\lambda_H^I - \lambda_L^S) + 2d - 2c_P + (\sigma^I - \sigma^S))^2.$$  

The platform’s profit increases with the degree of differentiation between the platform and the merchant on the selling benefit. The impact of the degree of differentiation on the consumers’ side depends on $\lambda_H^I - \lambda_L^S$. For $\lambda_H^I - \lambda_L^S \leq (2d - 2c_P + \sigma^I - \sigma^S)/(2v)$, $\pi^{mh}$ is decreasing with $\lambda_H^I - \lambda_L^S$ and then it is increasing with $\lambda_H^I - \lambda_L^S$. $\pi^{mh}$ reaches a minimum when the degree of differentiation on the consumers’ side equals $(2d - 2c_P + \sigma^I - \sigma^S)/(2v)$. In this case, the platform makes profit

$$\pi^{mh} = \frac{\sigma^I - \sigma^S + 2d - 2c_P}{4}.$$

5.3 The platform’s fees if multi-homing is not allowed

If the platform imposes single-homing to merchants, it obtains the exclusivity of distribution to consumers when merchants sell through its selling channel. The set of merchants that accepts the platform’s service is $S^I_1$. Since the platform does not compete with merchants,
the demand of consumers who buy the service through the platform at a merchant of type $b_S$ is $D(\tilde{y}_H^I)$ provided that $D(\tilde{y}_H^I) \in [0, 1]$. Therefore, the volume of transactions is given by

$$\int_{S^i} D(\tilde{y}_H^I) h_S(b_S) db_S$$

and the platform’s profit is

$$\pi^{sh} = ((f_B^H)^I + f^S - c_P) \int_{S^i} D(\tilde{y}_H^I) h_S(b_S) db_S.$$

From (15) and (14), the platform’s profit under single-homing depends on the total transaction fee $(f_B^H)^I + f^S = f^T$. We denote the equilibrium total transaction fee under single-homing by $f^{sh}$ if there is an interior solution. When the platform imposes single-homing to merchants, it makes profit

$$\pi^{sh} = (f^{sh} - c_P) \int_{S^i} D(g_H^{-1}(f^{sh} - \sigma^I(b_S))) h_S(b_S) db_S.$$

**An example:**

In our linear example, it is possible to compute analytically the optimal total transaction fees under single-homing in cases (a) and (b). However, the equations are too complex to be reported. A numerical example can be found in Appendix A.

### 5.4 The platform’s fees if price discrimination is not allowed

If price discrimination is not allowed, consumer demand for the platform’s service is

$$D((\lambda_H^I - \lambda_L^S)^{-1}((f_B^H)^I)),$$

and the total volume of transaction is given by

$$D((\lambda_H^I - \lambda_L^S)^{-1}((f_B^H)^I)(1 - H_S((f^S - d)/(\sigma^I - \sigma^S))))$$. 

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We denote by $D_B((f^B_H)^I) = D((\lambda^I_H - \lambda^S_L)^{-1}((f^B_H)^I)$ the demand of consumers and by $D_S(f^S) = 1 - H_S((f^S - d)/(\sigma^I - \sigma^S))$ the demand of merchants. The platform makes profit

$$\pi^{npd} = D_B((f^B_H)^I)D_S(f^S)((f^B_H)^I + f^S - c_P).$$

The profit-maximizing transaction fees depend on the elasticity of consumer demand and merchant acceptance, respectively. Indeed, as in the model of Rochet and Tirole (2003), the total price is given by

$$\frac{(f^B_H)^I + f^S - c_P}{(f^B_H)^I} = \frac{1}{\varepsilon_B},$$

and

$$\frac{(f^B_H)^I}{f^S} = \frac{\varepsilon_B}{\varepsilon_S},$$

where $\varepsilon_B = -((f^B_H)^I/D_B)(dD_B/d(f^B_H)^I)$ and $\varepsilon_S = -(f^S/D_S)dD_S/df^S$. Therefore, when price discrimination is not allowed, the platform can use the price structure to increase its profit. It can even subsidize the demand on one side of the market to increase it on the other side. On the contrary, in the multi-homing case with price discrimination, both consumer demand and merchants’ acceptance depend on the total transaction fee.

### 5.5 Consumer and merchant surplus

In this section, we analyze consumer and consumer surplus when the platform offers the high quality of service. We denote by $CS^j$ and $MS^j$ consumer and merchant surplus, respectively, for $j \in \{mh, sh, npd\}$. Total User Surplus is given by $TUS = CS^j + MS^j$. Social welfare is defined as the sum of total user surplus and the platform’s profit, that is, we have

$$W^j = TUS^j + \pi^j.$$

#### 5.5.1 Consumer and merchant surplus when multi-homing is allowed

Firstly, we look at consumer surplus when multi-homing is allowed. For merchants that accept the platform’s service (i.e., with $b_S \in S^I_H$), consumers such that $y$ belongs to $[y^2_H, v]$ buy through the platform, whereas consumers such that $y$ belongs to $[y^2_L, y^2_H]$ buy from
the merchant’s selling channel. For merchants that refuse the platform’s service (i.e., with \( S = 2 \S_I \)), consumers such that \( y \) belongs to \([y_L^S, v]\) buy from the merchant’s selling channel. Since \( \lambda^S_L(y_L^S) = p^S_L \), \( (\lambda^I_H - \lambda^S_L)(y_H^2) + \lambda^S_L(y_L^2) = p^I_H + (f^I_H)^B \), \( \lambda^S_L(y_L^S) = p^S_L \) and \( y_L^S = y_L^2 \), consumer surplus under multi-homing can be rewritten as follows

\[
CS^{mh} = \int_0^{b_S} \int_{y_L^2}^v (\lambda^S_L(y) - \lambda^S_L(y_L^2)) f(y) h_S(b_S) dy db_S \\
+ \int_{b_S \in S^S_I} (\lambda^I_H(y) - \lambda^I_H(y_H^2) + \lambda^S_L(y_H^2) - \lambda^S_L(y)) f(y) h_S(b_S) dy db_S.
\]

This equation can be interpreted in a simple way. All consumers who buy the service (either through the platform or a merchant) obtain at least the same surplus as when a merchant sells only the low quality. For consumers who are able to buy the high quality through the platform when the merchant accepts it, that is, such that \( y \) belongs to \([y_H^2, v]\) and \( b_S \) belongs to \( S^S_I \), there is an additional surplus that is equal to the difference of utility between the high and the low quality. Therefore, consumers always benefit from multi-homing with both qualities compared to the case in which merchants only sell the low quality. The additional surplus that consumers can obtain under multi-homing depends on merchants’ acceptance of the platform’s service under multi-homing and on the total cost of buying the service that includes the retail price and the transaction fee for buying through the platform.

When the platform offers a high quality of service, merchant surplus under multi-homing is given by

\[
MS^{mh} = \int_{b_S \in S^S_I} \pi^S(y_H^2, y_L^2) db_S + \int_{b_S \notin S^S_I} \pi^S_L(y_L^S) db_S.
\]

**An example:** In our linear example, since \( S^S_I = [0, 1] \), \( y \) is uniformly distributed on \([0, v]\) and \( b_S \) uniformly distributed on \([0, 1]\), we have

\[
CS^{mh} = \frac{\lambda^S_L}{v} \int_0^1 \int_{y_L^2}^v (y - y_L^2) dy db_S + \frac{(\lambda^I_H - \lambda^S_L)}{v} \int_0^1 \int_{y_H^2}^v (y - y_H^2) dy db_S.
\]

Merchant surplus is given by

\[
MS^{mh} = \int_{b_S \in S^S_I} \pi^S(y_H^2, y_L^2) db_S + \int_{b_S \notin S^S_I} \pi^S_L(y_L^S) db_S,
\]
where
\[
\pi^2(y_H^2, y_L^2) = \frac{(v\lambda_S^H + \sigma_S b_S - d)^2}{4v\lambda_L^H} + \frac{(v(\lambda_L^H - \lambda_H^I) + f_H^S + f_B^H - d + \sigma_S b_S)^2}{4v(\lambda_H^I - \lambda_L^S)} ,
\]
and
\[
\pi^S_L(y_L^S) = \frac{(v\lambda_L^H + \sigma_S b_S - d)^2}{4v\lambda_L}.
\]

5.5.2 Consumer and merchant surplus under single-homing

If the platform imposes single-homing to merchants, consumers buy either the high quality through the platform if merchants accept its service or the low quality through the merchant’s selling channel otherwise. Since \(\lambda_H^I(y_H^I) = p_H^I + (f_H^I)^B\) and \(\lambda_L^S(y_L^S) = p_L^S + (f_L^S)^B\), consumer surplus can be written as
\[
CS_{sh} = \int_{b_S \in \mathbb{S}_1} \left( \int_{y_H^I}^v (\lambda_H^I(y) - \lambda_H^I(y_H^I)) f(y) h_S(b_S) dy \right) db_S + \int_{b_S \notin \mathbb{S}_1} \left( \int_{y_L^S}^v (\lambda_L^S(y) - \lambda_L^S(y_L^S)) f(y) h_S(b_S) dy \right) db_S.
\]

Consumer surplus under single-homing depends on merchants’ acceptance of the platform’s service under single-homing and on the price paid to the merchant and the platform for making a transaction.

Merchant surplus under single-homing is given by
\[
MS_{sh} = \int_{b_S \in \mathbb{S}_1} \pi_H^I(y_H^I) db_S + \int_{b_S \notin \mathbb{S}_1} \pi_L^S(y_L^S) db_S.
\]

An example: To simplify our computations in our linear example, we can restrict our analysis to cases (a) and (b). In case (a), we have \((S^1)^a = [0, b_S^a]\). Therefore, in case (a), we have
\[
CS_{sh} = \frac{\lambda_H^I}{v} \int_{b_S^a}^{b_S^b} \left( \int_{y_H^I}^v (y - y_H^I) dy \right) db_S + \frac{\lambda_L^S}{v} \int_{b_S^a}^{b_S^b} \left( \int_{y_L^S}^v (y - y_L^S) dy \right) db_S.
\]
In case (b), we have \((S^1)^b = [b_S^b, 1]\). Therefore, in case (b), we have
\[
CS_{sh} = \frac{\lambda_H^I}{v} \int_{b_S^b}^{1} \left( \int_{y_H^I}^v (y - y_H^I) dy \right) db_S + \frac{\lambda_L^S}{v} \int_{b_S^b}^{1} \left( \int_{y_L^S}^v (y - y_L^S) dy \right) db_S.
\]

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5.5.3 Consumer and merchant surplus under no price discrimination

If the platform imposes no price discrimination to merchants, consumers buy either the high quality through the platform if merchants accept its service or the low quality through the merchant’s selling channel otherwise, and we have

\[
CS_{npd} = \int_{b_S \in S_I^{npd}} \left( \int_{y_H}^{y_L} (\lambda_H(y) - p^*) f(y) h_S(b_S) dy \right) db_S \\
+ \int_{b_S \in S_I^{npd}} \left( \int_{y_L}^{y_H} (\lambda_L(y) - p^*) f(y) h_S(b_S) dy \right) db_S \\
+ \int_{b_S \notin S_I^{npd}} \left( \int_{y_L}^{y_H} (\lambda_L(y) - p^*) f(y) h_S(b_S) dy \right) db_S,
\]

where \( p^* \) denotes the retail price chosen by the merchant. Merchant surplus under no price discrimination is given by

\[
MS_{npd} = \int_{b_S \in S_I^{npd}} \pi_{npd}(\gamma_L) db_S + \int_{b_S \notin S_I^{npd}} \pi_{npd}(\gamma_L) db_S.
\]

**An example:**

In our linear example, for merchants that accept the platform’s service (i.e., with \( b_S > b_S^{npd} \)), consumers such that \( y \) belongs to \([\gamma_H, v]\) buy through the platform, whereas consumers such that \( y \) belongs to \([\gamma_L, \gamma_H]\) buy from the merchant’s selling channel. For merchants that refuse the platform’s service (i.e., with \( b_S < b_S^{npd} \)), consumers such that \( y \) belongs to \([\gamma_L, v]\) buy from the merchant’s selling channel. Therefore, consumer surplus is given by

\[
CS_{npd} = \frac{1}{v} \int_{0}^{b_S^{npd}} \int_{\gamma_L}^{\gamma_H} (\lambda_L y - p^*) dy db_S \\
+ \frac{1}{v} \int_{b_S^{npd}}^{u} \int_{\gamma_L}^{\gamma_H} (\lambda_H y - p^* - f_B) dy db_S \\
+ \int_{b_S^{npd}}^{1} \int_{\gamma_L}^{\gamma_H} (\lambda_L y - p^*) dy db_S.
\]
5.6 Is the platform’s strategy socially optimal?

5.6.1 Comparison of the platform’s strategy and the socially optimal strategy

We denote the platform’s strategy by $i_0 \in \{mh, sh, npd\}$. For all $(i_1, i_2) \in (\{mh, sh, npd\} \setminus \{i_0\})^2$ and $i_0 \neq i_1 \neq i_2$, the strategy $i_0$ maximizes the platform’s profit if and only if

$$
\pi^{i_0} \geq \max(\pi^{i_1}, \pi^{i_2}),
$$

and it maximizes social welfare if and only if

$$
W^{i_0} \geq \max(W^{i_1}, W^{i_2}).
$$

We analyze the impact of imposing single-homing on consumer and merchant surplus. First of all, for a given level of transaction fees, the imposition of single-homing decreases merchant surplus because it reduces merchant’s choice to sell different versions of the good. As a matter of fact, merchants are potentially able to enlarge their costumer base under multi-homing. However, in some cases and for some levels of parameters, the transaction fees chosen by the platform under single-homing can be lower than the transaction fees under multi-homing. Therefore, merchant surplus does not systematically decrease under single-homing.

For consumers, the effect of the imposition of single-homing on their surplus is ambiguous as it depends on three effects. Firstly, more consumers may be able to consume the higher quality, and there may be less consumers purchasing the low quality. Secondly, the transaction fees may decrease in some cases under multi-homing. Third, as already mentioned, merchant’s acceptance always increases under multi-homing and consumers have a larger choice set under multi-homing.

5.6.2 The impact of the degree of differentiation between selling modes on the platform’s strategy

We are now able to analyze how the degree of differentiation on each side of the market impacts the platform’s incentives to impose single-homing or price parity. The platform’s
incentives to impose a restriction to merchants depends on the elasticity of consumer demand or merchant demand to the degree of differentiation, respectively. To see why, consider the linear example. All merchants accept the platform’s service under multi-homing, whereas, under single-homing, merchants’ acceptance is elastic to the degree of differentiation both on the consumers’ side and on the merchants’ side.

We denote consumer demand at the equilibrium of stage 1 by \( D^i \) for \( i \in \{mh, sh, npd\} \). We have

\[
D^{mh} = \frac{1}{2} - b_S \sigma^S - d + f^{mh} \frac{\lambda^I_H - \lambda^S_L}{2v},
\]

and

\[
D^{sh} = v \lambda^I_H - f^{sh} \frac{\lambda^I_H}{2v},
\]

and

\[
D^{npd} = 1 - \frac{(f^H_B)^{npd}}{v(\lambda^I_H - \lambda^S_L)}.\]

Therefore, for given platform fees, the higher the degree of differentiation between the platform and the merchant’s service on the consumers’ side, the higher consumer demand under multi-homing and no price discrimination. The higher the value added by the platform on the consumer’s side, the higher consumer demand under single-homing. Also, a higher value of the quality of service for direct sales on the merchant side reduces the demand for the platform’s service under single-homing.

To understand how a quality (differentiation) parameter \( \mu \in \{\lambda^I_H; \lambda^S_L; \lambda^I_H - \lambda^S_L; \sigma^S\} \) impacts the platform’s incentives to impose single-homing or multi-homing, we take the derivative of \( \pi^{sh} - \pi^{mh} \) with respect to \( \mu \) when \( \sigma^I = 0 \). From the envelop theorem, we have that

\[
\frac{d(\pi^{sh} - \pi^{mh})}{d\mu} = (f^{sh} - c_P) \left( \int_{b_S^L}^{b_S^H} \frac{\partial D^{sh}}{\partial \mu} h_S(b_S) db_S - \frac{\partial b_S^H}{\partial \mu} D^{sh}(b_S^H) h_S(b_S^H) \right)
- (f^{mh} - c_P) \int_{0}^{1} \frac{\partial D^{mh}}{\partial \mu} h_S(b_S) db_S.
\] (18)

Therefore, the impact of a quality parameter on the platform’s incentives to impose single-homing depends on the relative elasticity of consumer demand both under single-homing
and multi-homing, and on the elasticity of merchants’ acceptance under single-homing. For example, if $\mu = \lambda_H^I$ we have

$$
\frac{d(\pi^{sh} - \pi^{mh})}{d\lambda_H^I} = (f^{sh} - c_P)\int_{\lambda_H^I}^{1} \frac{f^{sh}}{(2\lambda_H^I)^2} db_S + \frac{v}{\sigma^I}(1 - \frac{\sqrt{\lambda_L^S}}{2\sqrt{\lambda_H^I}})D^{sh}(y_S^k)
$$

$$
-(f^{mh} - c_P)\int_{0}^{1} \frac{f^{mh}}{4v^2(\lambda_H^I - \lambda_L^S)^2} db_S.
$$

This example reveals that the choice of the restrictions is not simple and depends on the trade-off for the platform between extracting surplus from consumers and from merchants. We can also use a similar reasoning to analyze the cases $\sigma^I = 0$.

### 5.6.3 Numerical examples

To be more precise, we resort to numerical simulations (See Appendix A). We divide our analysis in two cases. In case a, we have $\sigma^I = 0$, the merchant has no benefit from selling its products via the platform, but draws a benefit by selling it directly. In case b, we have $\sigma^S = 0$ and the merchant has no benefit from selling its products directly to consumers, but draws a benefit by selling it on an online marketplace.

When $\sigma^I = 0$ we show that for high level of differentiation between the platform and the merchant on the consumers’ side, the profit-maximizing strategy to allow multi-homing is also welfare maximizing. At the same time, since consumer demand increases under single-homing and transaction price decreases for high level of value added by the platform on the consumer’s side, merchant’s surplus is maximized under single-homing.

When $\sigma^S = 0$, we show that, for low levels of differentiation between the platform and the merchant benefit on the consumer side, the optimal strategy for the platform is to impose price parity clauses to merchants. This strategy is also optimal for consumers as the platform sets negative transaction fees for them. Moreover merchants’ acceptance is relatively high as merchants retrieve a higher benefit from selling via the platform than from selling directly. Nevertheless, merchants’ surplus is reduced under price parity, and the optimal strategy for them would have been to multi-home. This happens because they are charged a relatively
high transaction fee from the platform, and they cannot adjust upwards the retail price to recover from the increase in marginal cost. In general, social welfare is maximized by the imposition of the price parity clause because the positive effect on consumers and on the platform is stronger than the negative effect on merchants. On the contrary, when there is a high level of differentiation between the platform and the merchant on the consumers’ side, the welfare maximizing strategy is to impose single-homing. This occurs because the higher the value added by the platform on the consumer’s side the higher the consumer demand under single-homing. Moreover, merchants’ acceptance is almost total.

6 A low quality platform

If the platform delivers a lower quality of service to consumers, merchants always accept the platform’s service under multi-homing. Since consumer demand for the low quality product is higher under single-homing than under multi-homing, the platform always prefers to impose single-homing to merchants. Furthermore, if the platform forbids merchants to price discriminate across selling channels, consumers never buy through the platform. Indeed, they can obtain a better quality without paying a fee to the platform. Therefore, the platform always allows merchants to price discriminate.

7 Conclusion

In this article, we contribute to the debate on price parity clauses and exclusive arrangements by analyzing competition between a platform and merchants to market a product, when the platform can impose these restrictions on merchants. We analyze whether this may reduce competition and social welfare. We find that, for some level of differentiation between the quality of the service offered by the merchant and the platform, the strategy chosen by the platform is socially optimal. Therefore, regulators should analyze for each specific market, the type of platform and the quality that is provided by the latter to both merchants and consumers, in their decision to forbid restrictive clauses. For example, if the platform brings a high benefit to merchants, social welfare is always maximized by the imposition of price
parity. In this case, to forbid price parity may leave the platform out of the market and therefore reduce consumers’ choice.

What is left for future research is to study the case in which the platform also offers two qualities of the service, that is a high and low version of the service. Moreover, another interesting case would be to look at a situation where there are three selling channels competing, that is the case in which the merchant can market the product either by its own website, directly in the physical shop or via the platform. Finally, it would be also relevant to endogenize investments in quality.

References


7.1 Appendix

Appendix A  Low quality on the merchant’s side: $\sigma^f = 0$.

By using the following set of parameters $(d = 0.1; v = 8.)$, we analyze the case in which there is high quality platform on the consumer side and $\sigma_I = 0$. In this case, for $\sigma_S = 4$, and $\lambda^I_H = 0.9$, $\lambda^S_L = 0.8$. Consumer demand under multi-homing is such that $0 < D^{mh} < 1$, where $D^{mh} = \frac{1}{2} - \frac{p^{mh} - d + b_S(\sigma_S - \sigma^I)}{2v(\lambda^I_H - \lambda^S_L)}$. A the equilibrium of stage 1, the platform may choose a total user price such that this condition does not hold. In this case, merchants’ acceptance under multi-homing is reduced and the indifferent merchant between accepting the platform’s service and not accepting it is given by: $b^{lim}_S = (v(\lambda^I_H - \lambda^S_L) - p^{mh})/(\sigma_S - \sigma^I)$. Given this indifferent merchant and with this set of parameters, no merchants will accept the platform’s service under multi-homing. Moreover, no merchant accepts neither single-homing nor price parity clauses.
\[
\begin{array}{|c|c|c|}
\hline
\sigma^S = 4 & \lambda^I_H = 0.9, \lambda^S_L = 0.8 & \lambda^I_H = 2, \lambda^S_L = 0.1 \\
\hline
\pi^{\text{mh}} & 0 & 1.45 \\
p^{\text{mh}} & 0 & 6.65 \\
\pi^{\text{sh}} & 0 & 0.75 \\
p^{\text{SH}} & 0 & 4.73 \\
b^{\text{sh}} & 0 & 0.45 \\
\pi^{\text{npd}} & 0 & 0 \\
p^{\text{npd}} & 0 & 0 \\
P_B & 0 & 0 \\
p^{\text{SD}} & 0 & 0 \\
b^{\text{npd}} & 0 & 0 \\
\hline
& \text{MH} & \\
\hline
CS^{\text{mh}} & 0 & 1.67 \\
CS^{\text{sh}} & 0 & 1.59 \\
CS^{\text{npd}} & 0 & 0 \\
\hline
& \text{MH} & \\
\hline
MS^{\text{mh}} & 0 & 2.94 \\
MS^{\text{sh}} & 0 & 3.19 \\
MS^{\text{npd}} & 0 & 0 \\
\hline
& \text{SH} & \\
\hline
SW^{\text{mh}} & 0 & 6.06 \\
SW^{\text{sh}} & 0 & 5.53 \\
SW^{\text{npd}} & 0 & 0 \\
\hline
& \text{MH} & \\
\hline
\end{array}
\]

**High quality on the merchant’s side: \( \sigma^S = 0 \).**

Secondly, by using the same set of parameters \( (d = 0.1; v = 8) \), we look at the case in which the merchant has no benefit from selling its products directly to consumers, but draws a benefit by selling it on an online marketplace.
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