E C O N O M I C S B U L L E T I N

Platform competition with partial multihoming under differentiation: a note

Alexander Rasch
University of Cologne

Abstract

A model of a two-sided market with two horizontally differentiated platforms and multihoming on one side is developed. In contrast to recent contributions, it is shown that platforms do not necessarily generate all revenues on the multihoming side by charging a higher price. Also, whether platforms' pricing structures favor exclusivity over multihoming is ambiguous.

I would like to thank Bruno Jullien and Achim Wambach for very helpful comments and discussions. I am also very grateful to an anonymous referee as well as Matthew Mitchell, the Associate Editor, for their comments. Part of this work was done while I was visiting the Midi-Pyrénées School of Economics (MPSE) of the University of Toulouse 1--Science Sociales. I would like to express my sincere thanks for the hospitality I experienced throughout my stay. I am also very grateful to the Staedtler-Stiftung for financial support.
Citation: Rasch, Alexander, (2007) "Platform competition with partial multihoming under differentiation: a note." *Economics Bulletin*, Vol. 12, No. 7 pp. 1-8
Submitted: February 6, 2007. **Accepted:** March 27, 2007.
URL: http://economicsbulletin.vanderbilt.edu/2007/volume12/EB-07L10003A.pdf

1 Introduction

In two-sided markets platforms try to bring together two groups of customers each of which is interested in the participation by the other side.[1] In most two-sided markets, multihoming by at least one side plays an important role. Multihoming (unlike singlehoming) describes a situation where customers join more than one platform.

Multihoming is a distinctive feature of most two-sided markets. It is present in markets like apartment brokerage, media, online shopping portals, operating systems, payment cards, video game consoles, etc.[2] These industries generate revenues of several hundred billions of dollars each year. Platforms often generate most of their revenues from the multihoming side. Apartment brokers, for instance, tend to charge (potentially) multihoming buyers/renters and not singlehoming owners. Contrary to that, the online auction house eBay only charges singlehoming sellers a certain percentage of the sales price when a transaction takes place whereas (potentially) multihoming buyers receive services for free.[3] Given the importance of the markets involved and the different pricing structure that can be observed, it is necessary to better understand the relevant factors that affect pricing decisions by firms. The issue of (endogenous) multihoming has been dealt with by a number of authors (Caillaud and Jullien (2001, 2003), Gabszewicz and Wauthy (2004), Armstrong (2005), Armstrong and Wright (2005), and Roson (2005)). These papers differ from the present one with respect to the aspect of differentiation on the multihoming side. Without differentiation, *all* customers on one side make the same decision and platforms generate all revenues on the multihoming side by charging a higher price and thus leaving it with no surplus from trade. Contrary to that, the present note shows that due to product differentiation (i.e. heterogenous preferences among customers), partial multihoming arises. As a result, platforms neither always charge this side a higher price nor leave it without any surplus from trade. This is intuitive as partial multihoming implies that platforms are no longer local monopolists on the multihoming side which results in a price reduction. However, when it comes to the relative prices on both sides, there are ambiguous effects as to whether platforms prefer multihoming (which is equal to lowering the respective price even more in order to boost overall demand) or whether they do not (which is equal to making services more exclusive).

Belleflamme and Peitz (2006) simultaneously developed a model which partly follows the same logic and setup as the present one. However, their focus is

[1] For an introduction, see, e.g., Rochet and Tirole (2003, 2005).

[2] For these and other examples, see Evans (2003).

[3] See `www.ebay.com`.

different as they look at the implications of different platform types (free/not-for-profit/public vs. for-profit) for the incentives to innovate. They find that for-profit intermediation may increase or decrease investment incentives depending on which side of the market singlehomes. Moreover, Poolsombat and Vernasca (2006) also simultaneously developed a similar version of the present model with two heterogeneous groups of agents who differ in their valuation of the network benefit. They also find that platforms do not always generate all their revenues from the partially multihoming side but their results differ from the ones presented here in some important aspects.
In the next section, the model is presented. The third section discusses the results.

2 The model

The basic setup follows Armstrong (2005) who uses a Hotelling (1929) specification. Platform 1 is located at 0 and platform 2 is located at 1. Platforms incur marginal costs c^k per side-k customer served. Fixed costs are normalized to 0.
There are two groups of customers ($k \in \{a, b\}$) with mass 1 each. Customers are uniformly distributed on the linear city of unitary length. Unlike Armstrong (2005) side-b customers are assumed to have the opportunity to multihome whereas side-a customers singlehome.[4] Utility for some side-a (side-b) customer who is located at a distance Δ^a (Δ^b) from platform i ($i \in \{1, 2\}$) and who joins this platform (and possibly platform j) is defined as follows (where n_i^k denotes platform i's [overall] demand on side k [singlehoming and multihoming customers]):

$$u_i^a = \beta^a + \alpha^a n_i^b - p_i^a - t^a \Delta^a \tag{1}$$

and

$$u_i^b = \begin{cases} \beta^b + \alpha^b n_i^a - p_i^b - t^b \Delta^b & \text{when singlehoming} \\ \beta^b + \alpha^b - p_i^b - p_j^b - t^b & \text{when multihoming.} \end{cases} \tag{2}$$

Note that joining platform j only leads to a travel distance of $1 - \Delta^k$ and that $n_j^a = 1 - n_i^a$ as well as $n_j^b = 1 - n_{i,s}^b$ where $n_{i,s}^b$ denotes the number of side-b customers who join platform i exclusively. Moreover, customers derive some basic utility β^k which is independent of whether they join one or two platform(s). Both sides benefit from the participation of the other side the

[4]This setup is justified for the examples of apartment brokerage and online auctioning mentioned before: Placing an object with two or more platforms is not possible (from a legal point of view) as it cannot be rented/sold to more than one renter/buyer.

extent of which is measured by the two-sided network externality α^k, $\alpha^k > 0$. Customers incur linear transportation costs t^k per unit of distance traveled ($t^k > 0$). The market is depicted in *Figure 1.*

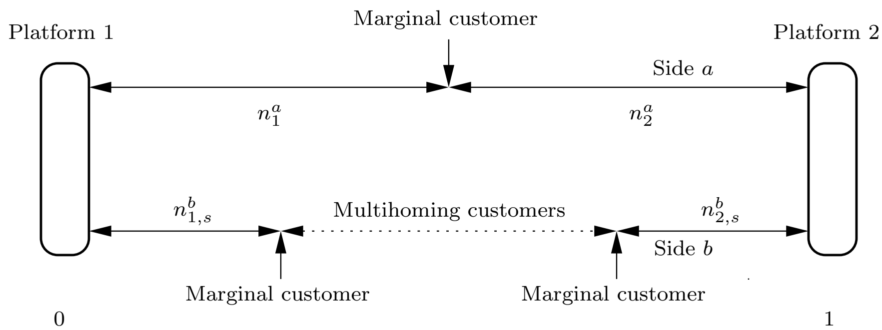

Figure 1: Differentiated two-sided market with partial multihoming

Before turning to the equilibrium analysis, the following assumptions are made:

Assumption 1 *β^k is sufficiently high such that the market is covered on both sides.*

Assumption 2 $t^a > \alpha^a$.

This assumption is due to Armstrong and Wright (2005)[5] and ensures that side-a customers have indeed no incentive to multihome.

Assumption 3 $t^b + c^b < \dfrac{\alpha^a + \alpha^b}{2} < 2t^b + c^b$.

This assumption ensures that multihoming demand does not exceed 1 and that the market is covered on side b.

Assumption 4 $8t^a t^b > {\alpha^a}^2 + {\alpha^b}^2 + 6\alpha^a\alpha^b$.

This is the necessary and sufficient condition for a market-sharing equilibrium with multihoming to exist.
Turning to the equilibrium analysis, the indifferent side-a customer is determined in the standard way by equating the utility derived from joining platform 1 and 2, respectively, and solving for the location variable. The same is done on side b for the two indifferent customers who are indifferent

[5]See their assumption *A2.* They provide a proof for this assumption in their *Lemma 1.*

between joining only one of the two platforms on the one hand and joining both on the other hand.
From the resulting implicit expressions, the following explicit expressions can be derived:

$$n_i^a = \frac{1}{2} - \frac{\alpha^a \left(p_i^b - p_j^b\right) + t^b \left(p_i^a - p_j^a\right)}{2(t^a t^b - \alpha^a \alpha^b)}, \tag{3}$$

$$n_{i,s}^b = 1 - \frac{\alpha^b}{2t^b} - \frac{\alpha^b \left(p_i^a - p_j^a\right)}{2\left(t^a t^b - \alpha^a \alpha^b\right)} - \frac{\alpha^a \alpha^b p_i^b - \left(2t^a t^b - \alpha^a \alpha^b\right) p_j^b}{2t^b \left(t^a t^b - \alpha^a \alpha^b\right)}, \tag{4}$$

and

$$n_i^b = \frac{\alpha^b}{2t^b} - \frac{\alpha^b \left(p_i^a - p_j^a\right)}{2\left(t^a t^b - \alpha^a \alpha^b\right)} - \frac{\left(2t^a t^b - \alpha^a \alpha^b\right) p_i^b - \alpha^a \alpha^b p_j^b}{2t^b \left(t^a t^b - \alpha^a \alpha^b\right)}. \tag{5}$$

Differentiating the resulting profit $\pi_i = (p_i^a - c^a)n_i^a + (p_i^b - c^b)n_i^b$ with respect to prices and setting the resulting first-order conditions equal to 0 leads to a system of equations with four unknowns.[6] Solving for (symmetric) prices yields:

Proposition 1 *With the possibility of multihoming for side-b customers, platforms will charge the following prices:*

$$p_i^a = t^a + c^a - \frac{\alpha^b \left(3\alpha^a + \alpha^b - 2c^b\right)}{4t^b} \tag{6}$$

and

$$p_i^b = \frac{c^b}{2} + \frac{\alpha^b - \alpha^a}{4}. \tag{7}$$

Hence, platforms charge side-a customers the Hotelling (1929) price $t^a + c^a$ which is reduced by a term reflecting the importance of the network externalities involved. On the second side, platforms charge a price consisting of—like in previous contributions without differentiation on the multihoming side[7]—a monopolistic term $\frac{c^b}{2} + \frac{\alpha^b}{4}$ (assuming that each side-b customer reaches half the customers on the other side which implies a gross willingness to pay of $\frac{\alpha^b}{4}$) which is, however, adjusted downward due to the network externality brought about by the other side.[8]
Comparing equilibrium prices yields:

---

[6]Note that the second-order conditions are satisfied due to *Assumption 4*.

[7]This is not the case in the Poolsombat and Vernasca (2006) model as they assume *equal* transportation costs on *both* sides.

[8]See also Belleflamme and Peitz (2006).

Corollary 1 *With the possibility of multihoming for side-b customers, $p_i^a > p_i^b$ may hold.*

Hence, partial multihoming may lead to a situation where platforms will not always generate all revenues from the multihoming side by setting a higher price.[9] Let $F \equiv p_i^a - p_i^b$. Then, $\frac{\partial F}{\partial \alpha^a} = \frac{t^b - 3\alpha^b}{4t^b} \lesseqgtr 0$, $\frac{\partial F}{\partial \alpha^b} = -\frac{t^b + 3\alpha^a + 2\alpha^b - 2c^b}{4t^b} < 0$ (due to *Assumption 2*), $\frac{\partial F}{\partial t^a} = 1 > 0$, and $\frac{\partial F}{\partial t^b} = \frac{\alpha^b(3\alpha^a + \alpha^b - 2c^b)}{4{t^b}^2} > 0$ (due to *Assumption 2*).
Equilibrium prices will lead to market shares of

$$n_i^a = \frac{1}{2}, \tag{8}$$

$$n_{i,s}^b = 1 + \frac{c^b}{2t^b} - \frac{\alpha^a + \alpha^b}{4t^b}, \tag{9}$$

and

$$n_i^b = \frac{\alpha^a + \alpha^b - 2c^b}{4t^b}. \tag{10}$$

Due to *Assumptions 2* and *4*, $\frac{1}{2} < n_i^b < 1$ holds, i.e. some side-b customers will multihome. Note that $\frac{\partial n_i^b}{\partial \alpha^a} = \frac{\partial n_i^b}{\partial \alpha^b} = \frac{1}{4t^b} > 0$ and $\frac{\partial n_i^b}{\partial t^b} = -\frac{\alpha^a + \alpha^b - 2c^b}{4{t^b}^2} < 0$.
The profit for platform i amounts to

$$\pi_i = \frac{t^a}{2} + \frac{{c^b}^2}{4} - \frac{{\alpha^a}^2 + 6\alpha^a\alpha^b + {\alpha^b}^2}{16t^b}.^{10} \tag{11}$$

3 Discussion

The pricing decision here is in contrast to a *competitive-bottleneck*[11] scenario *without* differentiation on the multihoming side which is the driving force behind the results in the contributions mentioned in the introduction. There, once the singlehoming side is attracted by the platforms, the latter have some form of local monopoly power to connect the multihoming side to the singlehoming base. This means that the multihoming side is left with no surplus

[9] Unlike in the Poolsombat and Vernasca (2006) model, this is not necessarily related to the scope of multihoming. They derive this result only for a low degree of multihoming by agents with a high network benefit. Here, a large t^a is sufficient.

[10] Note that the profit increases with the costs on the multihoming side. This is reminiscent of the result in Caillaud and Jullien (2003) where the profit increases with an increase in the cost for the singlehoming side.

[11] See Armstrong (2002) and Wright (2002) for telecommunication services as well as Armstrong (2005) and Armstrong and Wright (2005) for two-sided markets.

from trade. Due to the lack of differentiation, *all*—if any—agents on one side multihome. On the other hand, singlehoming customers benefit from an increased competition among platforms to get them on board.
The local monopoly element is still present here. However, due to differentiation on the multihoming side, there is only *partial* multihoming, i.e. some customers do not multihome because of the increased overall transportation costs.[12] This means that customers are no longer captive which reduces platforms' local monopoly power. As a result, instead of leaving customers with no surplus from trade, the price for side-b customers may be lower than the one for side-a customers.
Consider first the implications of an increase in t^b which makes multihoming less attractive. There are two opposing strategic considerations: First, it may make sense for platforms to reduce their price on the multihoming side in order to increase their demand and boost their attraction on the other side. Second, less multihoming means that there are more singlehoming customers left on the multihoming side. Singlehoming customers, however, can only be accessed through the respective platform which makes the platforms' services more exclusive. Thus, it is possible to charge the singlehoming side a higher price. From the equilibrium prices, it becomes clear that the second effect is stronger which means that exclusivity is more important than demand expansion and that multihoming customers are less valuable. Not surprisingly, this is true for an increase in t^a and a decrease in α^b too.
However, the opposite may be true when considering an increase in α^a which leads to a decrease in prices on both sides. The (exclusive) singlehoming side benefits from the fact that an increase in α^a makes the externality relatively more important compared to t^a, i.e. competition is increased. With respect to relative prices, the following reasoning applies: If t^b is very large ($> 3\alpha^b$), i.e. if there are hardly any multihoming customers, the price decrease is stronger on the multihoming side. In such a situation, delivering a great number of side-b customers is more important to the singlehoming side. Hence, it makes sense for platforms to increase the overall demand on the potentially multihoming side through a greater price cut. This is in contrast to the model of media markets by Ambrus and Reisinger (2006) where multihoming viewers are always less valuable.

[12] See also Ambrus and Reisinger (2006) and Poolsombat and Vernasca (2006) as well as the setup by Doganoglu and Wright (2006) with two different types of customers.

References

Ambrus, A., and M. Reisinger (2006) "Exclusive vs. overlapping viewers in media markets" Munich Economics Discussion Paper 2006-25.

Armstrong, M. (2002) "The theory of access pricing and interconncetion" in *Handbook of telecommunications economics, Vol. 1* by M.E. Cave, S.K Mujumdar, and I. Vogelsang, Eds., North-Holland: Amsterdam, 297–384.

Armstrong, M. (2005) "Competition in two-sided markets" *The RAND Journal of Economics*, forthcoming.

Armstrong, M., and J. Wright (2005) "Two-sided markets, competitive bottlenecks and exclusive contracts" *Economic Theory*, forthcoming.

Belleflamme, P., and M. Peitz (2006) "Intermediation and investment incentives" CORE Discussion Paper 2006-94 and Working Paper 47/2006, International University in Germany.

Caillaud, B., and B. Jullien (2001) "Competing cybermediaries" *European Economic Review* **45**, 797–808.

Caillaud, B., and B. Jullien (2003) "Chicken & egg: competition among intermediation service providers" *The RAND Journal of Economics* **34**, 309–328.

Doganoglu, T., and J. Wright (2006) "Multihoming and compatibility" *International Journal of Industrial Organization* **24**, 45–67.

Evans, D.S. (2003) "The antitrust economics of multi-sided platform markets" *Yale Journal on Regulation* **20**, 325–381.

Gabszewicz, J.J., and X.Y. Wauthy (2004) "Two-sided markets and price competition with multi-homing" CORE Discussion Paper 2004/30.

Hotelling, H. (1929) "Stability in competition" *The Economic Journal* **39**, 41–57.

Poolsombat, R., and G. Vernasca (2004) "Partial multihoming in two-sided markets" Discussion Paper in Economics No. 2006/10, The University of York.

Rochet, J.-C., and J. Tirole (2003) "Platform competition in two-sided markets" *Journal of the European Economic Association* **1**, 990–1029.

Rochet, J.-C., and J. Tirole (2005) “Two-sided markets: a progress report” *The RAND Journal of Economics*, forthcoming.

Roson, R. (2005) “Platform competition with endogenous multihoming” FEEM Working Paper No. 20.05.

Wright, J. (2002) “Access pricing under competition: an application to cellular networks” *The Journal of Industrial Economics* **L**, 289–315.