Exclusive dealing with network effects

Toker Doganoglu* Julian Wright†

Abstract

This paper explores the ability of an incumbent to use exclusive deals or introductory offers to dominate a market in the face of entry when network effects rather than scale economies are present. When consumers can only join one or other firm, the incumbent will make discriminatory offers that are anticompetitive and inefficient. Allowing consumers to multihome, we find offers that only require consumers to commit to purchase from the incumbent are not anticompetitive, while contracts which prevent consumers from also buying from the entrant in the future are anticompetitive and inefficient. The finding extends to two-sided markets, where the incumbent signs up "sellers" exclusively with attractive offers and exploits "buyers".

JEL: L12, L13, L42

Keywords: Exclusive Deals, Networks, Foreclosure, Two-sided markets

*Center for Information and Network Economics, University of Munich. I would like to thank Volkswagen Stiftung for the generous financial support which made this research possible.

†Contact author. Department of Economics, National University of Singapore: e-mail: jwright@nus.edu.sg. We thank conference participants at the University of Toulouse for helpful comments, particularly our discussant Mark Armstrong.

1 Introduction

In existing models of naked exclusion such as in Rasmusen *et al.* (1991) and Segal and Whinston (2000), scale economies allow an incumbent to exclude a rival by signing up customers to deny the rival the necessary scale to profitably enter. This paper provides an example of naked exclusion where such scale economies can be completely absent. Instead, our model relies on an incumbent which sells a good subject to network effects. The incumbent can sign up consumers prior to the entry of a rival firm. By attracting a sufficient number of consumers to its network, the incumbent reduces the demand for the entrant's product from the remaining consumers, thereby denying even a more efficient rival the ability to profitably sell to any consumers in head-to-head competition.

This simple logic is extended to take into account that in network markets consumers will often want to multihome, that is buy from both firms so as to obtain greater network benefits. When consumers can multihome, the incumbent may no longer be able to profit just by signing up consumers before the entrant competes with it. Provided it is not too costly to do so, consumers that sign with the incumbent will later also buy from the entrant, if its network is intrinsically more desirable. In order that signing up consumers in the initial stage remains profitable for the incumbent, it must instead do so exclusively. Consumers that sign with the incumbent not only have to commit to buy from the incumbent but must also agree not to purchase from the entrant as well. Where such contracts are feasible, the incumbent will profitably sign up some of the available consumers, doing so exclusively, and then exploit those that do not sign subsequently. Such exclusive deals raise the incumbent's profit at the expense of the entrant, at the expense of those consumers not offered exclusive deals, and at the expense of efficiency.

Our main finding is that in the absence of significant economies of scale for the entrant or costs to firms of dealing with each customer, contracts in which consumers commit to purchase from the incumbent before the entrant competes in the market do not harm competition or lower welfare, while contracts which prevent consumers from also buying from the entrant in the future are anticompetitive and inefficient. We show this conclusion also holds in a two-sided market setting, where the incumbent signs up sellers exclusively and then exploits buyers. Buyers have all their surplus exploited while sellers benefit from exclusive deals. A ban on the use of such contracts by an incumbent prior to competition from an entrant can raise consumer surplus and welfare.

Our analysis applies to the use of exclusive dealing in markets with network effects. Balto (1999) and Shapiro (1999) contain detailed discussions of exclusionary actions in a number of these markets, including ATM networks, computer reservation systems, credit card networks, floral delivery networks, Pay-TV, and video game systems. Here we note three such examples, all of which suggest exclusive dealing may act as a powerful barrier to entry in network industries (the example of Pay-TV is discussed in Section 5).

Florist Telegraph Delivery (FTD) network developed in the 1940s so that people could send flowers to distant locations through other member flourists. It enjoyed the participation of the majority of large flourists. To prevent flourists trying to develop their own such networks, FTD adopted an exclusionary rule that florists could only be members if they did not belong to any other such network. In the face of strong network effects, these exclusive membership rules made it difficult for new networks to offer their customers a comparable service. Only once the Antitrust Division and the FTD entered into a constent decree in 1956, in which the FTD dropped its exclusive membership rule, did other floral networks such as AFS and Teleflora emerge. This decree still remains in effect — in fact, in 1995 it resulted in an Antitrust Division action over FTD's incentive program "FTD only" which was also deemed to have a similar exclusivity effect.

In the video game industry, Nintendo became a hit in 1985 with its popular Nintendo Entertainment System. It, however, maintained tight control over game developers. Among other things, it required game developers make their games exclusively available on its system for two years following their release. Developers of hit games therefore preferred to produce them for Nintendo rather than its rivals (Atari and Sega), given Nintendo's much larger installed base of users at the time. As a result, consumers had no reason to shift to one of the rival systems. Shapiro (1999, p.4) notes that Nintendo dominated the video game business from 1985-1992 and that its "*grip on the market relaxed only after it abandoned these practices in the face of antitrust challenge*."

A final example is the exclusivity practices used by Western Union in the money transfer industry. Until 1979, Western Union operated as a regulated monopolist in the market for wire money transfers. The system was based on a network of money transfer agents, with agents benefiting from the presence of many other agents which belong to the same network. In 1979, FCC deregulated the industry and allowed entry by other money transfer networks. However successful entry took more than a decade, until the entry of Moneygram, an American Express subsidiary, in the late 1980s. According to Balto (1999), the main reason for such belated entry was the long-term exclusive deals Western Union had in place with many of its agents. The entry attempt by Citibank, in the mid-eighties failed due to impossibility of building a large enough network of agents in the face of the large number of exclusive deals that Western Union had.[1] Thus, it seems that the combination of network effects and exclusive deals may have been a powerful barrier to entry in this industry. Our model provides a formal setting to consider such claims.

Throughout the paper we assume consumer expectations that minimize the scope for coordination failures amongst consumers. For instance, the coordination failure in the existing naked exclusion literature, in which consumers signing contracts would do better if they could coordinate on an equilibrium

[1]The successful entry of Moneygram may be attributed to its unique advantage as an American Express subsidiary. It could simply rely on the network of travel offices and money order agents of American Express which was already established.

that allows for entry does not arise in our setting. Despite this, consumers in aggregate are still worse off as a result of exclusive deals. This reflects the ability of the incumbent to divide consumers' interests, by making an attractive offer to a group of users initially, and then exploiting the remaining users in the subsequent competition game.

Our paper connects with several related literatures. Berheim and Whinston (1998) explain the general ability of exclusive deals to be anticompetitive when cross-market links are present. Such cross-market links naturally arise in markets with network effects, since convincing some consumers to commit to purchasing its product, a firm increases the benefit to the remaining consumers from purchasing its product as well. Our analysis highlights the role of limited offers and exclusivity conditions, which the incumbent uses to split the market in order to exploit cross-market effects, as well as the role of multihoming and consumer expectations in determining how exclusive deals work.

When multihoming is assumed not to be possible, exclusive deals can be interpreted as simple purchase commitments or introductory offers. These offers are similar to those studied in earlier models of introductory pricing in markets with network effects, such as that of Katz and Shapiro (1986). They assume two different groups of consumers arrive at different times, so firms can set different prices to each cohort of consumers. In our model all consumers are present from the beginning, but we allow the incumbent to limit the number of consumers it sells to in the initial stage thereby making the number of second-stage consumers endogenous.[2] By attracting a group of consumers at a low price to purchase first (or commit to purchase), the incumbent induces the remaining consumers to buy the incumbent's product in the competition stage, even if, other things equal, the entrant's network is more desirable. A key difference with Katz and Shapiro's framework is they assume both firms can make offers at each stage whereas we allow the incumbent a first-mover advantage in attracting consumers.

Our analysis without multihoming is also related to Jullien (2001) who endogenizes the choice of price discrimination in markets with network effects, focusing on divide-and-conquer type strategies. He shows this eliminates any inefficiency that might arise in uniform pricing due to expectations favoring one of the firms. We consider the polar case, considering the ability of an incumbent to use its first-mover advantage to block sales by a rival firm that may otherwise have an advantage due to its more desirable network when expectations are neutral.

None of these models of network effects allow for the possibility that consumers may buy from both firms, and therefore the incentive firms may have to use exclusivity in their "exclusive deals" to rule out the possibility of multihoming. Recently, Armstrong and Wright (2006) have considered this aspect but in the context of a symmetric competition game in a two-sided market. Instead, we have the incumbent making

[2] In the analysis of two-sided markets, the two groups (buyers and sellers) are exogenously determined. However, unlike Katz and Shapiro, both are present from the start.

its offers first, before competing with the entrant. Another important difference is the expectations assumed. Armstrong and Wright adopt expectations that afford platforms with considerable market power. Thus, in the absence of exclusive deals they find a competitive bottleneck equilibrium whereas we obtain an equilibrium more akin to the usual Bertrand competition outcome. These differences explain why they find that exclusive deals may promote efficiency, whereas we obtain the opposite result. Finally, we consider both one-sided and two-sided markets.

The rest of the paper proceeds as follows. Section 2 develops our basic framework. Subsequent sections consider the case of a one-sided market where multihoming is not feasible (Section 3), the case of a one-sided network where multihoming is feasible (Section 4), and the case of a two-sided market where multihoming is feasible (Section 5). Section 6 contains some brief conclusions.

2 The basic model and preliminaries

There are a continuum of consumers with mass normalized to one. Two firms, an incumbent I and an entrant E, can produce a network good, each at a cost of $c \geq 0$ per unit sold. The incumbent's price is denoted p while the entrant's price is denoted q. Suppose N_I consumers buy exclusively from I, N_E consumers buy exclusively from E, and the remaining $1-N_I-N_E$ consumers multihome. Then consumers are assumed to get net utility $v+\beta(1-N_E)-p$ buying from I only, $v+(\alpha+\beta)(1-N_I)-q$ buying from E only, and $v+\alpha(1-N_I)+\beta-p-q$ if they multihome. Utility is increasing in the number of other consumers buying the same good, but consumers may also get a stand alone benefit v from purchasing which satisfies $v \geq c$. We assume $\alpha > 0$ and $\beta > 0$, so that network effects are positive for both firms and higher for E than I. Due to positive network effects, efficiency is highest when all consumers buy from the same firm, and from a welfare perspective this should be the entrant. There is no horizontal differentiation between the firms.

The timing of the game is as follows. In the first stage, I makes an initial offer to a set of the consumers. Viewing this offer, consumers decide whether to accept the offer or not. Then in the second stage, I and E compete in prices. We have in mind a situation where two rivals are introducing a new network product that has already been developed, but that one firm has a headstart in reaching the market. (As an extension, we consider how our results change when E also faces a fixed entry cost.) Observing the number of consumers that have accepted offers from I in stage 1, the remaining unattached consumers then decide which firm to buy from given these prices. We assume initially that consumers cannot multihome but relax the assumption in Sections 4 and 5.

We denote (generically) I's price in stage 1 with p_X and the corresponding number of consumers accepting its offer n_X. Consumers who receive an offer in stage 1 have the choice of buying from I in stage 1 at p_X, or buying from either I or E in stage 2 at prices p and q. Thus, in the absence of a multihoming possibility, the initial offer can be given the interpretation of an exclusive deal with a price commitment, since it may be that the product is not actually consumed until stage 2. This is why we write p_X for the price in stage 1. To start with we assume firms can only set a single price in a given stage. However, a form of price discrimination is allowed, in that the incumbent can limit the number of consumers that can take up its first stage offer, which it could do with an introductory offer (say, using a first-come first-served rule).[3]

The model can be interpreted either as one in which I makes an introductory offer to preempt or influence the nature of any subsequent competition, or that I signs up consumers through exclusive deals to the same effect. However, given we subsequently allow for multihoming, we distinguish these two types of offers. Stage 1 offers require consumers to buy (or commit to buy) I's product and are referred to as introductory offers. When offers, at either stage, also require the consumers to commit not to buy from the rival firm, they are referred to as exclusive deals. Introductory offers may or may not be exclusive deals, while exclusive deals may be offered by I and E in stage 2 (as well as by I in stage 1), if allowed.

As is well known in competition games with pure network effects, there may be multiple consistent demand configurations for a given set of prices offered by firms. For instance, if all consumers are expected to buy from I in stage 2 then I can attract all demand at a higher price than E. However, at these prices, all consumers buying from E is also an equilibrium, say if consumers all buy from the cheapest firm. Given network effects, the number of consumers that buy from I in stage 1 can influence this set of equilibria in stage 2. Moreover, for given prices in stage 1 and expectations about the equilibrium played in stage 2, there can also be multiple equilibrium configurations in stage 1 depending on what consumers expect others to do in stage 1. This means often a unique demand function is not defined at either stage, and some rule is needed to select a unique demand configuration.

There are three commonly used rules from the literature on network effects. These are often referred to as rules about how consumers form expectations.[4] The three are: (1) expectations (stubbornly) favor firm I; (2) expectations (stubbornly) favor firm E; and (3) expectations are based on maximal surplus. More precisely, the rules correspond to: (1) select the equilibrium demand configuration at each stage which has the highest demand for firm I (and of these, the lowest demand for firm E) where demand refers to the demand from those consumers choosing between the firms; (2) the same as (1) but with I and E switched; and (3) select the equilibrium demand configuration at each point which has the

[3] If new consumers are allowed to enter in stage 2, then such limited offers would not be necessary to obtain our qualitative results provided there are not too many new consumers for the entrant to attract. However, the incumbent may still do better by limiting the number of consumers receiving offers in the first stage.

[4] See Farrell and Klemperer (2006) for a discussion of the relevant literature and different rules to describe consumer expectations.

highest joint surplus for those consumers choosing between the firms. Regardless of the rule used, all equilibria are subgame perfect. Throughout we will focus on the third rule since it minimizes the scope for coordination failures amongst those consumers making decisions at each stage. Thus, our analysis is not as vulnerable to the criticism sometimes leveled at the naked exclusion literature, that it relies on consumers receiving offers not being able to coordinate on the right equilibrium. In the competition stage, these beliefs also provide the closest analogy to the homogenous Bertrand competition assumed in the existing naked exclusion literature. We will refer to this rule as consumers being "optimal coordinators".

Finally, since there is no natural tie-breaking rule when consumers are optimal coordinators, we adopt the standard approach of using whichever rule is necessary to avoid open set problems in defining equilibria. For instance, if consumers are indifferent between buying from I and E at the prices $p = c$ and $q = c + \alpha$, we assume consumers will buy from E since if not, E could set a slightly lower price to attract the consumers, obtaining almost the same profit (note I cannot profitably do the same thing). Where there is no such open set problem in defining equilibria, as would be the case in the above example if $\alpha = 0$, we assume indifferent consumers choose E over I, choose to buy from a single firm rather than to multihome, and to buy from at least one firm rather than not buy at all.

3 Results with singlehoming

In this section, we consider one-sided networks and assume that multihoming, whereby consumers can buy from both firms in order to obtain maximal network benefits, is not allowed. Whether multihoming is possible or not, may come down to technical considerations. In some cases it may not be practical for consumers to multihome (for instance, most consumers would not consider running two seperate operating systems such as Linux and Microsoft Windows). In other cases, it may be prohibitively expensive to do so, which will be the case if c is sufficiently large.[5]

Before turning to our main analysis, consider first what happens when consumers' beliefs instead follow one of the other two rules noted above. If consumers stubbornly prefer buying from I, then its ability to make introductory offers will play no role given it already enjoys expectations that stubbornly favor it and can already extract all of consumers' network benefits from buying from it. The analysis of introductory offers is not interesting under such beliefs. Alternatively, if expectations favor E, then E has considerable market power since in the absence of introductory offers it will extract all of users' network benefits. It can be shown that I can continue to use similar types of offers as those studied below in stage 1 to attract all demand, but that unlike the analysis below, this will lead to an increase in consumer surplus. This reflects that I's ability to use introductory offers in stage 1 helps offset E's

[5] Clearly a sufficient condition is that $2c > v + \alpha + \beta$, so that even when consumers only pay the cost of buying from each firm (which is necessary for the firms to break even), the consumers' net surplus is negative.

market power in stage 2, leading to more symmetric competition and lower prices. This is a similar effect to the one studied by Jullien (2001). By focusing on consumers that are optimal coordinators we are ruling out such a situation.

We start by characterizing the equilibrium in the second stage assuming that n_X consumers buy from I in stage 1. Figure 1 displays the different consistent demand configurations in stage 2 given n_X, p and q. Lemma 1 establishes that the points highlighted in Figure 1 represent the equilibria of the stage 2 subgame.

Figure 1 around here.

Lemma 1 *Define $n_1 = \alpha/(\alpha+\beta)$. If $n_X > n_1$, then the incumbent makes all the sales in stage 2 and the equilibrium prices are given by $p = c + \beta n_X - \alpha(1-n_X)$ and $q = c$. If on the other hand, $n_X \leq n_1$, then the entrant makes all the sales in stage 2 and equilibrium prices are $p = c$ and $q = c + \alpha(1-n_X) - \beta n_X$.*

Proof. As is illustrated in figure 1, provided $p \leq \beta$ there is a consistent demand configuration in which all unattached consumers buy from I in stage 2, denoted configuration I, and provided $q \leq (\alpha+\beta)(1-n_X)$ there is a consistent demand configuration in which all unattached consumers buy from E, denoted configuration E. (We indicate the region of prices where no one joins either platform as configuration Ø). Subject to prices being in the range where both configurations I and E apply, optimal coordination by consumers implies they will buy from I in stage 2 if $p < q + \beta n_X - \alpha(1-n_X)$, will buy from E if $p > q + \beta n_X - \alpha(1-n_X)$, and are indifferent if $p = q + \beta n_X - \alpha(1-n_X)$. Provided that $n_X > n_1$, I can charge a price at least as high as E and still get all the consumers. As competition forces E's price to cost, the equilibrium is obtained when $p = c + \beta n_X - \alpha(1-n_X) > c$ and $q = c$, with all consumers buying from I. On the other hand, whenever $n_X < n_1$, E can charge a price that is higher than I's and still serve all the free consumers. In this case, equilibrium is established, when $p = c$ and $q = c + \alpha(1-n_X) - \beta n_X$ with all free consumers buying from E. Finally, if $n_X = n_1$, then both firms will compete price down to cost, with all consumers buying from E given our tie-breaking assumption. ■

The critical value of n_X defined in Lemma 1 is the value at which $\beta = (\alpha+\beta)(1-n_X)$. For higher n_X, consumers get lower network benefits joining E than joining I. For lower n_X, E offers greater network benefits even though it has n_X fewer consumers. Whichever firm offers greater total network benefits captures all remaining demand in stage 2. Thus, by signing up enough consumers in stage 1, I can reduce the network benefits of E's network to the point that it more than offsets E's intrinsic advantage. The remaining consumers then prefer to join I over E. If E's advantage measured by α is large, then I has to sign up a large proportion of consumers to achieve this point.

Next we turn to stage 1. So as to attract any consumers at stage 1, the incumbent must offer them at least $v - c + \beta$ which is what they can obtain waiting till stage 2 and enjoying competition between I and E. Bertrand-type competition means the entrant is only able to extract α, its network advantage. Thus, consumers will only accept an offer in stage 1 if $p_X < c$. This leaves I with a loss in stage 1. Thus, it will not offer any introductory offer unless it can make some profit on consumers in stage 2. This implies it will not want to make an introductory offer to all consumers in stage 1 since then there will be no consumers left to exploit in stage 2. If I is not allowed to limit the number of consumers receiving its first-stage offers, this provides a benchmark result in which no one signs with I, E makes all sales in stage 2 at a price of $q = c + \alpha$ and consumers are left with a total surplus of $CS_0 = v - c + \beta$.[6] Since $\alpha > 0$, this is the first-best outcome.

The incumbent can make a positive profit by restricting the number of consumers that can sign up in stage 1.

Proposition 1 *If consumers are optimal coordinators and the incumbent can limit the number of consumers buying in stage 1, $n_X = 1/2 + \alpha/(2\alpha + 2\beta)$ consumers will buy from the incumbent in stage 1 at the price of $p_X = c$, and the rest of the consumers will buy from the incumbent in stage 2 at the price $p = c + \beta/2$. The entrant makes no sales. The outcome is inefficient, with consumer surplus lower than in the benchmark case without introductory offers.*

Proof. The incumbent sets a price p_X to n_X consumers in stage 1. If they all reject, the second stage equilibrium implies all consumers get utility of $v - c + \beta$ buying from the entrant (I then gets zero profit). If instead the n_X consumers accept the offer, they get $v - p_X + \beta$ buying from I, provided $n_X > n_1$ so that from Lemma 1 the incumbent will sell to all the remaining consumers in stage 2. Thus, I can attract the n_X consumers with minimal loss by setting $p_X = c$. This gives it a profit of $(\beta n_X - \alpha(1 - n_X))(1 - n_X)$, which is maximized by choosing $n_X = 1/2 + \alpha/(2\alpha + 2\beta) > 1/2$ which also satisfies $n_X > n_1$. The profit of I following this strategy is given by

$$\pi_I = \frac{\beta^2}{4(\alpha + \beta)} > 0. \tag{1}$$

This is an inefficient outcome given $\alpha > 0$. Moreover, all consumers would be better off if introductory offers were eliminated. Compared to the benchmark without introductory offers in which consumer surplus is $v - c + \beta$, consumers who receive the introductory offer get the same surplus while the surplus of those that miss out is lower by $\beta/2$. Total consumer surplus is

$$CS_1 = v - c + \left(\frac{4\alpha + 3\beta}{4\alpha + 4\beta}\right)\beta < CS_0.$$

[6] A similar result holds even with growing markets, provided there are more than $\beta/(\alpha + \beta)$ new consumers in stage 2. With only a limited (but positive) number of new consumers in stage 2, Lemma 1 implies the incumbent could profitably use an introductory offer even if the offer has to made to all stage 1 consumers.

■

Proposition 1 shows the incumbent will prevent the efficient entrant making any sales by selling the product to a majority of consumers at cost in the first stage via introductory offers. In fact, it will sign up more than the minimum number of consumers necessary to do so. This allows the incumbent to further raise the willingness to pay from the remaining minority of consumers, making maximum profits in stage 2 by charging a high price to them. To achieve this outcome the incumbent has to compensate the consumers that sign for the lower network benefits they get from its inferior network. Although consumers pay a lower price in stage 1, they obtain exactly the same surplus they would have if they bought from the more efficient entrant. Nevertheless, the consumers who buy in stage 2 are hurt and lose $\beta/2$ each. This loss aggregated over second stage buyers is transferred to the incumbent as profits as defined in (1).

While the pricing in Proposition 1 is easy to implement, the incumbent can do even better if it is able to discriminate between individual consumers in stage 1. Such fully discriminatory contracts with externalities have been studied by Segal (2003). To demonstrate how powerful such price discrimination can be, consider the extreme case where the incumbent can make sequential offers to consumers in the first stage, with each offer in the sequence depending on the uptake of previous offers. That is, suppose the incumbent can order consumers and make a sequence of offers, one to each consumer in turn in stage 1. The second stage is modelled as before.

Following the same logic as Segal and Whinston (2000), the incumbent will then be able to attract all consumers at almost the same price as if it enjoys favorable expectations, namely at $p_X = c + \beta$. The first consumer that is made an offer knows that if it rejects, I has a feasible strategy to convince all the remaining consumers to accept its offer. Thus, the first consumer is willing to pay almost $c + \beta$ to sign. In general, assume that incumbent orders the consumers by a variable $t \in [0, 1]$ in an arbitrary way and consider the pricing function of the incumbent for the consumer at t, when y preceding consumers have already accepted the deal that is given by $p_X(t, y) = \max(c, c - \alpha + (\alpha + \beta)(1 + y - t))$. It can be verified that this ensures all consumers agree to sign with the incumbent and gives it the same profits as if expectations favored it. Thus, when sophisticated deals can be made, consumers are left with just the stand-alone surplus $v - c$.

If consumer surplus is weighted more highly than profits (e.g. to capture that demand is elastic in practice), this is the least desirable outcome from a welfare perspective. However, such complicated sequential contracts seem unrealistic in most applications. Instead we restrict attention to simple limited offers in what follows since (i) this setting captures similar insights to those obtained without limited offers but allowing for some new consumers to arrive in stage 2; (ii) it would anyway be hard to prevent the incumbent make such introductory offers (say on a first-come first-served basis) as in Proposition 1;

and (iii) this setting also captures the key insights obtained by analyzing more sophisticated forms of price discrimination.

3.1 Fixed costs of entry

Before turning to allow for multihoming we consider one important extension of the analysis above. Our analysis up to this point has assumed that the entrant has no fixed costs of entry. As noted earlier, this can be interpreted as both firms having already developed the product, but that one firm (the incumbent) has a headstart in reaching the market (that is, doing deals with consumers). An alternative situation of interest is that the incumbent also has a headstart in developing the product, so that the entrant has to decide whether to incur fixed entry costs (such as product development costs) after the incumbent has already had a chance to sign up consumers. The fact that the entrant may be absent in the second stage will not only alter the behavior of the incumbent in the second stage, but also influence its design of its introductory offers in the first stage.

Formally, we can add an additional (intermediate) period between stage 1 and stage 2 in which E decides whether to enter or not. We assume that entry is costly so that E has to incur a positive fixed cost of entry, denoted by F. In addition, we restrict our attention to the case where $0 < F < \alpha$ which ensures that the efficient outcome would involve entry. Otherwise the model is exactly the same as described in section 2.

Provided entry occurs, the results obtained in Lemma 1 for the second stage equilibria when consumers are optimal coordinators continue to apply. On the other hand, if E does not enter, I will have a monopoly which means it will extract all consumer surplus. Specifically, I charges the monopoly price $p = v + \beta$ and makes sales to all the remaining consumers in stage 2.

Given that E has to incur fixed costs of F and n_X people are already committed to buy from I, the following lemma characterizes E's optimal entry decision.

Lemma 2 *If n_X consumers have signed an introductory offer in stage 1, in the presence of a fixed entry cost F, entry will takes place if and only if*

$$n_X < n_1 - \frac{\sqrt{\beta^2 + 4\,(\alpha+\beta)\,F} - \beta}{2\,(\alpha+\beta)} = n_2 < n_1.$$

Proof. Entry will occur if and only if E is able to make sufficient sales in the second period to cover its fixed costs in stage 1. With entry, its profit is $(1-n_X)(\alpha(1-n_X) - \beta n_X) - F$, which is positive if and only if $n_X < n_2$. ∎

In the absence of limited offers in stage 1, the incumbent either has to offer a bribe to all consumers to get them to buy (compensating them for its lower network benefits) or attract no consumers at all. Since offering a bribe to all consumers is not profitable, the incumbent cannot exploit the fact that the entrant needs to attain a minimum scale. This reflects that consumers are optimal coordinators, so the buyer mis-coordination of Rasmusen *et al.* (1991) and Segal and Whinston (2000) does not apply. Instead, the entrant makes all sales in stage 2 at a price of $q = c + \alpha$, leaving consumers with the surplus $v - c + \beta$, and the outcome is efficient. In contrast, if the incumbent can limit its offers in stage 1, it can easily block entry by bribing sufficiently many consumers in the first stage.

Proposition 2 *If consumers are optimal coordinators and the incumbent can limit the number of consumers buying in stage 1, in the presence of a fixed entry cost F, $n_X = n_2$ consumers will buy from the incumbent in stage 1 at the price of $p_X = c$, and the rest of the consumers will buy from the incumbent in stage 2 at the monopoly price $p = v + \beta$. Entry is inefficiently foreclosed with consumer surplus lower than in the benchmark case without introductory offers.*

Proof. The incumbent needs to sell to at least n_2 consumers to block the entry of the rival firm. Any consumer in the first stage would accept I's offer if $p_X = c$. This implies aggregate profits of $(1 - n_X)(v - c + \beta)$, which is a decreasing function of n_X. Hence, I makes its introductory offers to the smallest number of consumers necessary to deter entry; that is, $n_X^* = n_2$. This gives I a monopoly position in stage 2, so it sells to the remaining $1 - n_2$ consumers at the monopoly price $p = v + \beta$. Its profit is

$$\pi_I = (1 - n_2)(v - c + \beta).$$

Since $\alpha > 0$, the foreclosure of entry here is inefficient. Moreover, all consumers would be better off if these limited introductory offers were eliminated, in which consumer surplus is $v - c + \beta$. Compared to this benchmark, consumers who sign an exclusive deal get the same surplus while the surplus of those that miss out is lower by the full amount $v - c + \beta$ (they get no surplus). Total consumer surplus is

$$CS_2 = n_2 (v - c + \beta) < CS_0.$$

■

Compared to the case without fixed costs, the incumbent now signs up fewer consumers. Rather than having to bribe enough consumers in stage 1 so as to be able to attract remaining consumers in stage 2 despite competition with a more desirable entrant, now the incumbent just has to focus on signing up enough consumers to deny the entrant enough profit in stage 2 to cover its fixed cost of entry. Thus, the point of signing up consumers in stage 1 is to reduce the demand for the entrant's product in stage 2, thereby denying it the sufficient scale to recover its fixed costs. This is like the standard naked exclusion story without network effects, but network effects magnify the effect of the reduction in demand for the entrant's product.

An interesting feature of the result above is that even if the fixed entry cost is very close to zero, the existence of such fixed costs can still matter a lot for the profitability of the incumbent's introductory offers. By deterring entry, the incumbent gains a monopoly position in the second stage, which it can exploit by charging the remaining consumers the full amount of their surplus $v + \beta$. Previously it could only charge them $c + \beta/2$. Small entry costs can therefore amplify the impact of introductory offers or exclusive deals when there are network effects. Equivalently, consistent with the conjecture of Shapiro (1999), the entry deterring effects of fixed cost in the standard naked exclusion story are magnified by network effects, making them more powerful barriers to entry.

4 Multihoming in one-sided markets

In this section, the possibility that the consumers can buy from both firms in order to obtain greater network benefits is considered. This type of behavior is commonly referred to as "multihoming". The implications of multihoming in one and two-sided markets is studied by among others, Armstrong (2006), Armstrong and Wright (2006), Caillaud and Jullien (2003), Doganoglu and Wright (2006) and Rochet and Tirole (2003). When consumers multihome they are able to get the network benefits corresponding to interacting with users that can be reached from either network. The rest of the model remains the same, except we assume $v = c = 0$ for simplicity. Provided costs are low enough that multihoming is always a relevant option, the same qualitative results can be obtained allowing for small but positive values of $v > c > 0$.

There are two types of multihoming in our setting. First, attached consumers that join with I in stage 1 may also want to join E in stage 2. Second, unattached consumers may want to join both I and E in stage 2. Exclusive deals may be used at either stage to rule out multihoming. Exclusive offers just involve an exclusivity condition in which consumers purchasing agree not to also purchase from the rival. For example, the entrant can make its offers exclusive in stage 2, so that unattached consumers have to either buy from it or the incumbent, but cannot multihome. Similarly, the incumbent may make its offer exclusive in stage 1 (or stage 2) so as to prevent consumers buying from the entrant if they accept its offer. Notice as soon as one firm makes its offers exclusive, it rules out consumers multihoming and so the other firm's offer is also, in effect, exclusive.

To provide a benchmark for the effects of exclusive dealing, we first explore what happens when firms cannot offer such contracts to prevent consumers from multihoming. Thus, even if some consumers sign with the incumbent in stage 1, they still have the possibility of also buying from the entrant in stage 2. This is the relevant alternative if exclusive deals are banned.

Proposition 3 *When neither firm can offer exclusive deals at either stage, then no one buys from the* *incumbent in stage 1; in stage 2 they all buy, but only from the entrant. This is true even if the incumbent can limit the number of consumers who can obtain its first stage offers. The outcome is efficient.*

Proof. We first show that in equilibrium, all unattached consumers buy only from E, while those consumers who have bought from I multihome, buying also from E in stage 2. This then means I cannot obtain any profit from unattached consumers in stage 2, and since it can only attract consumers in stage 1 at a loss, it will choose not to make any such offers.

Assume that $n_X > 0$ consumers have accepted a non-exclusive offer from I in stage 1. We first characterize the demand as a function of both prices, and then determine the equilibrium prices in stage 2. We restrict to non-negative prices given a negative price will imply a firm makes a loss in stage 2. There are five different regions of consistent demand configurations: (i) unattached buy from I and attached do *not* buy from E (configuration I) when $p \leq \beta$; (ii) unattached buy from E and attached also buy from E (configuration E) when $q \leq \alpha + \beta(1 - n_X)$; (iii) unattached multihome and attached do *not* buy from E when $p \leq \beta n_X$ and $q = \alpha(1 - n_X)$; (iv) unattached buy from E and attached do *not* buy from E when $p = \beta n_X$ and $q = (\alpha + \beta)(1 - n_X)$; and (v) no one buys from either firm in stage 2 (configuration $\emptyset$) when $p > \beta n_X$ and $q > 0$

The configurations in (iii) and (iv) can be eliminated using the expectation rule that consumers coordinate on the configuration which gives them highest joint surplus. Both configurations I and E remain when $p \leq \beta$ and $q \leq \alpha + \beta(1 - n_X)$. The expectation rule implies configuration E arises if $q \leq \alpha + (1 - n_X)p$ and otherwise configuration I arises. If $p > \beta$ and $q > \alpha + \beta(1 - n_X)$ then configuration $\emptyset$ is the only consistent demand configuration. This defines demand uniquely for any given prices. We present how demand varies with prices in Figure 2.

Now consider a possible equilibrium in stage 2. Any equilibrium must involve configuration E being played. To see why note that at any point in configuration $\emptyset$, either firm has an incentive to lower its price, obtaining positive demand and profit. At any point in configuration I, the entrant can lower its price to move to configuration E and obtain a positive profit. Moreover, E cannot charge above α in equilibrium, otherwise I can always lower its price to move to configuration I, obtaining positive demand and profit. However, for any price $p > 0$, E has an incentive to increase its price above α. Thus, the unique equilibrium (given our expectation rule) arises when $p = 0$ and $q = \alpha$, with E attracting all consumers in stage 2. (Note, if I sets a negative price, it will induce consumers to multihome but will make a loss from doing so.) In this proposed equilibrium, I makes no profit in stage 2 and E's profit is α.

Now consider consumers deciding whether to buy from I in stage 1. If they do not do so they know from above they can get a surplus of β buying from E in stage 2. The best each consumer can do buying from I is if they all do so, which will only make them better off if $p_X < 0$. However, this implies a loss for I, and so it will not make such an offer and no one will buy from I in either stage. ■

Figure 2 around here.

Proposition 3 shows that the entrant, with its more desirable network, can overcome an installed base advantage of the incumbent. The ability of users to multihome plays an important role here. No matter how many consumers buy from the incumbent in the first stage, in stage 2 they will want to also buy from the entrant given it offers greater network benefits. The unattached consumers have the same preference. By doing so they can obtain some additional network benefits. Moreover, provided the costs of attracting each consumer is low enough (here it is assumed to be zero), the entrant can profitably sell to these additional consumers. Hence, the incumbent cannot make a positive profit from competition with the entrant in the second stage. This in turn means there is no way in stage 2 to take advantage of signing up consumers in stage 1. It also means consumers will not pay anything to buy from the incumbent in stage 1.

Proposition 3 provides a benchmark with which to compare the effects of exclusive deals. The benchmark involves a competitive and efficient outcome. This is in contrast to our findings with singlehoming in which limited offers in stage 1 were enough for the incumbent to inefficiently take the whole market.

We now turn to our main result — the case where firms can employ exclusive deals. These allow the firms to make their offers conditional on consumers not buying from their rival.

Proposition 4 *When firms can employ exclusive deals, and the incumbent can limit the number of consumers who can obtain its first stage offers, the incumbent will always use exclusive first stage offers. The incumbent signs up one half of the consumers exclusively in stage 1, with the remaining half multihoming in stage 2. A ban on exclusive deals increases consumer surplus and welfare.*

Proof. The proof is long, so we present it in four steps. The first step involves characterizing the second stage equilibrium assuming I attracts no buyers or sellers in the first stage. The second step involves doing the same thing assuming I attracts some consumers exclusively in stage 1. It turns out there are then two equilibria in stage 2, and so this step also involves determining which equilibrium will be selected. Having done this, we know what agents will need to be offered to be willing to accept an exclusive deal in stage 1, and so determine the optimal exclusive offer by I in stage 1. The third step involves showing I does not want to offer a non-exclusive deal in stage 1 instead. Finally, step four concludes by summarizing the implications of the resulting equilibrium.

1. *Stage 2 equilibria when no one signs in stage 1.*

If no one signs in stage 1, then we know by the same logic as used in the proof of Proposition 3, in stage 2 E will attract all users at the price $q = \alpha$. That logic did not rely on unattached consumers multihoming in stage 2, so exclusive deals play no role in this case.

2. *Equilibrium when some consumers sign exclusively with I in stage 1.*

Suppose I makes an exclusive offer to n_X consumers in stage 1. If consumers do not accept the offer, they all end up buying from E in the second stage to obtain a surplus of β as in step one. Therefore, to get consumers to accept its exclusive offers in stage 1, I has to offer them at least this surplus. Its most profitable option is to sign them up exclusively at the price $p_X = 0$ in stage 1, assuming it signs up enough consumers that the remaining consumers will all buy from I in stage 2 at a positive price (they may also multihome).

Now consider the second stage equilibrium analysis. There are four possible stage 2 equilibria: (i) firms both offer exclusive deals; (ii) neither firm offers exclusive deals; (iii) I makes a non-exclusive offer while E makes an exclusive offer; and (iv) I makes an exclusive offer while E makes a non-exclusive offer. It is straightforward to show (iii) and (iv) are not equilibria, since the firm which makes its offer exclusive can always profitably deviate making its offer non-exclusive to extract some more surplus from the consumers by allowing them to multihome. We proceed to characterize the possible equilibria arising in the subgames characterized by (i) and (ii).

(i) When first stage consumers sign exclusive deals, and firms make their offer exclusive in stage 2, no firm can do better by making their offers non-exclusive given consumers cannot multihome when the other firm's offers remain exclusive. The competition game becomes exactly as the one analyzed in Lemma 1 and Proposition 1. This implies the optimal number of consumers signed will be $n_X^* = 1/2 + \alpha/\left(2(\alpha+\beta)\right) > n_1$. This yields I the profits as given in (1).

(ii) Consider the possibility there is an equilibrium in stage 2 in which neither firm makes its offers an exclusive one. Since only unattached consumers have a choice to make in stage 2, there are only four possible consistent demand configurations: unattached consumers multihoming (configuration M) if $p \leq \beta n_X$ and $q \leq \alpha(1-n_X)$; unattached consumers buy from I (configuration I) if $p \leq \beta$ and $q \geq 0$; unattached consumers buy from E (configuration E) if $p \geq \beta n_X$ and $q \leq (\alpha+\beta)(1-n_X)$; unattached consumers do not buy from either firm (configuration $\emptyset$) when $p > \beta n_X$ and $q > 0$. Using our expectations rule, we select the configuration which maximizes the joint surplus of those consumers making a choice, in this case, the unattached consumers. The selected configurations are illustrated in Figure (3) for given prices, which defines demand uniquely.

Given these demands it is straightforward to see from Figure (3) that the unique non-exclusive pricing equilibrium in the second stage arises when $p = \beta n_X$ and $q = \alpha(1-n_X)$. At these prices and given unattached consumers multihome, if either firm sets a lower price, it cannot increase its demand, while if either firm sets a higher price, it will lose all its demand. At any other set of prices in the multihoming region, each firm has an incentive to raise its price to this level since it will not lose any demand. At any other set of prices outside the multihoming region, one of the firms always has an incentive to lower its price until it either obtains all the demand, or moves inside the multihoming region. Moreover, neither firm can do better making an exclusive offer in stage 2, since if either firm raises its price it will lose all demand from unattached consumers. The incumbent's profit is therefore $\beta n_X (1 - n_X)$, which is maximized by offering exclusive deals to $n_X = 1/2$ of consumers in stage 1. In this equilibrium, the incumbent obtains a profit of $\beta/4$.

Provided I offers exclusive deals in stage 1 so that $n_X > \alpha/(\alpha + \beta)$, we have established there are two second stage equilibria, one where I and E make exclusive offers and one where I and E make non-exclusive offers. To be precise, we select the equilibrium where the firms make non-exclusive offers (adopting the other equilibrium has similar implications, as we note below). Regardless of whether I sets $n_X = 1/2$ or $n_X = 1/2 + \alpha/(2(\alpha + \beta))$ in stage 1, the equilibrium where firms make non-exclusive offers in stage 2 gives each firm higher profits. Moreover, by choosing $n_X = 1/2$ in stage 1, I can signal it will play this equilibrium, so that by a forward induction refinement this equilibrium will be selected in stage 2. In other words, I would not set $n_X = 1/2$ if it intended to play the equilibrium with exclusive offers in stage 2 since it would then have preferred to set a higher n_X. (If $\alpha > \beta$, so that $n_X = 1/2 < \alpha/(\alpha + \beta)$, then the equilibrium where firms make non-exclusive offers in stage 2 is unique and the forward induction refinement is not needed.)

3. *The incumbent cannot do better signing consumers non-exclusively in stage 1.*

From Proposition 3, we know if I uses introductory rather than exclusive deals in stage 1, then in stage 2 E will attract all users at the price $q = \alpha$. This result remains true even if firms can make their offers exclusive in stage 2. This is because E will prefer to leave its offer non-exclusive in stage 2, since otherwise consumers who sign (non-exclusively) with I in stage 1 will not be able to buy from it in stage 2. Moreover, the logic in Proposition 3 did not rely on unattached consumers multihoming in stage 2, so exclusive deals cannot profitably be used by I in stage 2 either. Thus, I must make its stage 1 offer exclusive to make a positive profit.

4. *Summary of equilibrium properties.*

Compared to the equilibrium in Proposition 3, where exclusive deals were not feasible or not allowed at either stage, I's profit increases from zero to $\beta/4$ and E's profit decreases from α to $\alpha/4$. Previously, without exclusive deals, all consumers obtain the surplus of β. Now half of them get the same surplus (those signing the exclusive deal in stage 1) and the other half (that are not offered the exclusive deal in stage 1) get a surplus of only $\beta/2$. As a result of exclusive deals, consumer surplus is lower by $\beta/4$ and welfare is lower by $3\alpha/4$. ■

Figure 3 somewhere here.

Proposition 4 shows that offering exclusive deals is an effective way for the incumbent to maintain dominance even though it offers a less desirable network and even though consumers are optimal co-ordinators. By signing up some consumers exclusively in stage 1, the incumbent causes the remaining consumers to multihome in stage 2. They multihome so as to reach the consumers who are exclusively on the incumbent's network and so as to take advantage of the entrant's more desirable network. However, firms do not have to compete for multihoming consumers, allowing the incumbent to make a positive profit in stage 2. The incumbent can extract the full network benefits that the unattached consumers get from being able to reach the signed consumers. Since there are n_X signed consumers and $1 - n_X$ unattached consumers, and since it obtains no revenue from signed consumers, the incumbent maximizes its profit $\beta n_X (1 - n_X)$ by signing half of the consumers and exploiting the other half.

The more efficient entrant is partially foreclosed from the market since it cannot sell to the half of consumers that sign exclusively with the incumbent in stage 1. The outcome is inefficient. Banning exclusive dealing in stage 1 will restore the efficient outcome. Note that if instead exclusive dealing is only banned in stage 2, when both firms are already competing head-to-head, then such a ban cannot restore the efficient outcome. In fact, the equilibrium selected in Proposition 4 does not involve exclusive dealing in stage 2, so that such a ban would be futile.

Although our foreclosure result is only partial, the degree of foreclosure found would likely be sufficient for the behavior to be found illegal. In the key Supreme Court decision on exclusivity (*Tampa Electric Co. v. Nashville Coal Co.*), the court emphasized that exclusive dealing should involve a substantial share of the relevant line of commerce to be considered a restraint of trade (Balto 1999, p.552). Balto notes "*the ultimate issue in an exclusivity case is the degree of foreclosure*". Based on an analysis of cases, he argues that when exclusive contracts involve less than 30% of the market, no violation is found, while foreclosure is likely to be sufficient when it is greater than 50%, the degree of foreclosure our model predicts.

In proving the proposition, a forward induction argument was used to select the equilibria in the stage 2 subgame in which firms make non-exclusive offers. The same qualitative result holds if instead firms coordinate on the second stage equilibrium where they make exclusive offers. In fact, in this case the results are even more striking, since the incumbent will sign up more than half of the consumers exclusively in stage 1 and take the whole market exclusively in stage 2. The resulting loss in consumer surplus and welfare is even greater than before.

5 Two-sided markets

In this section, we extend the previous framework to analyze exclusive dealing in two-sided markets. Many of the network markets where exclusive dealing applies are actually two-sided markets. An important set of examples is content provision for entertainment or communication platforms such as Pay-TV, video-games and 3G mobile telephony. The use of exclusive deals by Nintendo was noted in the introduction. By having games exclusively on its platform, Nintendo could then attract consumers more effectively. A similar case arises for Pay-TV. (A recent example from the Singaporean Pay-TV market is discussed below).

Another reason for looking specifically at two-sided markets is the unique features that make the analysis of exclusive dealing in two-sided markets somewhat different to that of one-sided markets. We note three such features. In two-sided markets, users divide into two groups, so there is a natural way for platforms to price discriminate between the two groups of users even if they cannot discriminate between users of the same type. Moreover, rather than endogenously determining a subset of users which receive low price offers in stage 1 as in our one-sided setting, where we allowed the incumbent to make limited offers, here we have two groups of users determined exogenously by their types (for example, buyers and sellers). Finally, it is reasonable to assume platforms can only offer exclusive deals to one of the two sides. This seems likely to be the case if one side represents individual consumers while the other represents firms. It is typically not feasible for platforms to monitor and enforce exclusivity contracts with households but they may be able to do so with firms. For example, Nintendo could not prevent individuals from buying Sega's Genesis console but it could require game developers to only produce their games for its platform. We therefore assume exclusive deals can only be made on the seller side.[7]

Our analysis of exclusive dealing in two-sided markets can be compared to the analysis in Armstrong and Wright (2006), where exclusive dealing is explored as a way of overcoming a competitive bottleneck equilibrium. Caillaud and Julien (2001) also consider an equilibrium where agents can only join platforms exclusively and in which one platform is dominant, although they do not consider whether platforms will adopt exclusivity. Our analysis differs from these papers since, like standard models of naked exclusion such as Segal and Whinston (2000), we allow the incumbent to sign up agents first, while introducing an advantage to the entrant in any subsequent competition. Our paper also differs in the expectations assumed. As in the one-sided case, we assume agents deciding between platforms are optimal coordinators, so that we reduce the scope for coordination failures on the part of agents.

The previous model is extended to one in which there are two types of agents, denoted B and S, which

[7]We have also analyzed a version of the model assuming platforms can offer exclusive deals on both sides. The qualitative results are similar to those below, except that sellers no longer benefit as much from exclusive deals, with the incumbent benefiting more instead.

we will refer to generically as buyers and sellers. Each type values the number of agents of the opposite type it can interact with but not the number of the same type. The measure of buyers is set to one, as is the measure of sellers. Denote I's prices by p_B and p_S, and E's prices by q_B and q_S. As in the previous section, stand-alone benefits and costs are set to zero. Suppose N_I sellers join I exclusively, N_E sellers join E exclusively, and the remaining $1 - N_I - N_E$ sellers multihome. Then buyers get $\beta_B (1 - N_E) - p_B$ joining I only, $(\alpha_B + \beta_B)(1 - N_I) - q_B$ joining E only, and $\alpha_B (1 - N_I) + \beta_B - p_B - q_B$ if they multihome. The sellers' benefits can be defined in a symmetric fashion.

All other assumptions are the same as in the benchmark model of Section 2. In particular, I gets to make its offers in stage 1, and both platforms then compete for any remaining users in stage 2. We continue to focus on the setting in which agents are optimal coordinators, so where there are multiple equilibrium demand configurations for given prices, we select the equilibrium demand configuration at each point which has the highest joint surplus for those agents deciding about which platform(s) to join. Finally, as in our one-sided setting of Section 4, we allow multihoming and first consider the case in which platforms cannot make their offers exclusive (say because exclusive dealing is banned) and then allow them to make such offers.

Proposition 5 *If platforms cannot discriminate amongst users of the same type and cannot make their offers exclusive at either stage, then no one will join the incumbent, and all buyers and sellers will join the entrant's platform in stage 2. The outcome is efficient.*

Proof. First, suppose I attracts neither side in stage 1. The best I can offer users in stage 2 to compete with E will satisfy $p_B + p_S = 0$, so that I at least breaks even. Since I does not want to induce unprofitable multihoming, the best it can offer is then to set $p_B = p_S = 0$. It follows that the only equilibrium in stage 2 involves $q_B = \alpha_B$ and $q_S = \alpha_S$, with all agents joining E only. If E were to charge more to one side, I would have a profitable divide-and-conquer strategy attracting the other side with a bribe. If I were to charge more in total, then E would want to increase its charge to at least one of the sides. In this equilibrium I makes no profit and E makes a profit of $\alpha_B + \alpha_S$.

Suppose instead I makes an introductory offer to all sellers in stage 1. If they believe it will attract all buyers in stage 2, I must offer sellers more surplus than they can get if they reject the offer, in which case they get β_S from E. So I can only attract sellers in stage 1 by charging $p_S < 0$. A symmetric result holds for attracting buyers. Moreover, in any stage 2 equilibrium, both buyers and sellers will always join E's platform given there is no cost to E of selling to them and doing so gives them additional network benefits over joining only I's network. As a result, I cannot extract any surplus from agents in stage 2 and will make a loss with its introductory offer in stage 1. As a result I will never make such an offer in the first place. Thus, the equilibrium of the full game is the same as the equilibrium of the subgame in which I attracts no users in stage 1, so that E attracts all users at the prices $q_B = \alpha_B$ and $q_S = \alpha_S$ in stage 2. ■

The implication of the proposition is that absent the ability of firms to offer exclusive deals, the incumbent does not derive any advantage of being able to move first and attract users in stage 1 with introductory offers. This reflects that the entrant has a more desirable network and that agents can multihome, so that even if the incumbent could attract one group in stage 1, the entrant could still profitably attract both groups in stage 2. Competition is Bertrand-like, with the only profit being the "efficiency" profit that the entrant earns. Moreover, all agents join the entrant in equilibrium which is the efficient outcome. In this respect, the proposition is the two-sided equivalent of Proposition 3.[8] Now suppose platforms can offer exclusive deals to sellers.

Proposition 6 *If platforms cannot price discriminate amongst agents of the same type, and platforms can make exclusive offers at either stage (but only to sellers), then in equilibrium sellers sign exclusively with the incumbent's platform in stage 1 and buyers have all their surplus exploited. Banning exclusive dealing increases the surplus of buyers as well as total welfare, while sellers and the incumbent are generally worse off.*

Proof. Consider seperately the two cases (i) $\beta_S \geq \beta_B$ and (ii) $\beta_B > \beta_S$.

(i) Suppose no agents sign with I in stage 1. The equilibrium in Proposition 5, in which all agents join E (only) in stage 2, continues to apply. That is, prices in stage 2 are characterized by $p_B = 0$, $p_S = 0$, $q_B = \alpha_B$ and $q_S = \alpha_S$. Note E does not have to impose exclusivity on sellers in stage 2 to achieve this outcome. Moreover, if I tries to deviate by attracting sellers exclusively, it will have to set $p_S < q_S - (\alpha_S + \beta_S)$. It can then extract $p_B = \beta_B + \min(q_B, 0)$ from buyers. As a result, its profit at these prices will be $\beta_B - \beta_S < 0$, so the deviation is not profitable. Sellers corresponding surplus is β_S. Of course, the same equilibrium also holds if E adds an exclusivity condition on sellers. With such a condition, other equilibria are also possible in stage 2, since E can charge up to β_B less to sellers and corresponding more to buyers without I being able to profitably deviate given to do so it would have to attract sellers exclusively. All these different stage 2 equilibria imply identical profits for the platforms. Thus, the range of equilibria in stage 2 (if they do not sign in stage 1) implies sellers' surplus ranges from β_S to $\beta_B + \beta_S$.

As a result, to get sellers to accept an exclusive deal in stage 1, their surplus of $\beta_S - p_S$ must exceed their surplus of waiting and receiving between β_S and $\beta_B + \beta_S$ (depending on which equilibria is played

[8] If instead the platforms offer symmetric benefits, then other equilibria are possible. For instance, sellers may multihome on one side and buyers split between the two platforms on the other side, as in the competitive bottleneck result of Armstrong and Wright (2006). Interestingly, such equilibria are not possible here since with sellers multihoming, the entrant will always attract buyers exclusively given it offers superior benefits.

in stage 2). This requires the first stage price p_S to be between $-\beta_B$ and 0. Since I extracts all of the buyers' surplus in stage 2, it is willing to offer such an exclusive deal in stage 1. This gives I a profit of between 0 and β_B. The resulting outcome is inefficient as both sides should join E's platform instead. Previously buyers obtained a surplus of β_B and sellers a surplus of β_S. Now buyers obtain no surplus while sellers get at least as much (possibly more) surplus than before.

(ii) Suppose no agents sign with I in stage 1. If $\beta_B > \beta_S$, then the stage 2 equilibrium in Proposition 5 characterized by the prices $p_B = 0$, $p_S = 0$, $q_B = \alpha_B$ and $q_S = \alpha_S$ no longer applies. I can bribe sellers with the offer $p_S = -\beta_S$ if they join exclusively, and then extract all of the buyers' network benefit β_B. The resulting profit is $\beta_B - \beta_S > 0$. To prevent I using such a divide-and-conquer strategy in stage 2, E will charge sellers $q_S \leq \alpha_S + \beta_S - \beta_B - \min(q_B, 0)$ provided they join exclusively. We also require $q_S \leq \alpha_S$ to ensure I cannot profitably attract both sides (getting buyers to multihome with a small bribe and attracting sellers exclusively with $p_S < q_S - \alpha_S$). In addition, we require as before $p_B + p_S = 0$ and $q_B + q_S = \alpha_B + \alpha_S$, as well as that $p_B \geq 0$ (if I offered a negative price to buyers they would multihome causing it to make a loss) and $q_B \leq \alpha_B + \beta_B$ (the buyers' participation constraints must be satisfied). Taken together these constraints imply that $\alpha_B + \beta_B - \beta_S \leq q_B \leq \alpha_B + \beta_B$ and $\alpha_S - \beta_B \leq q_S \leq \alpha_S - (\beta_B - \beta_S)$. The corresponding seller surplus ranges from β_B to $\beta_B + \beta_S$.

As a result, to get sellers to accept an exclusive deal in stage 1, their surplus of $\beta_S - p_S$ must exceed their surplus of waiting and receiving between β_B and $\beta_B + \beta_S$ (depending on which equilibria is played in stage 2). This requires the first stage price p_S to be between $-\beta_B$ and $\beta_S - \beta_B$. Since I extracts all of the buyers' surplus in stage 2, it is willing to offer such an exclusive deal in stage 1. This gives I a profit of between 0 and β_S. The remainder of the proof follows as in (i) except that now sellers are strictly better off with exclusive deals since their surplus will be at least β_B compared to $\beta_S < \beta_B$ before. This increase in seller surplus comes at the expense of I. ■

The proposition shows that in a two-sided market where the entrant platform offers a more desirable network, if the incumbent can sign exclusive deals with sellers prior to facing competition from an entrant, it will indeed do so. The result is both anticompetitive and inefficient. Here foreclosure is complete, in the sense the entrant does not sell to either side in equilibrium despite it offering a superior platform.

The incumbent relies on dividing the interests of the two sides. In the first stage, it offers sellers a deal they cannot refuse. Regardless of what buyers do in stage 1, sellers are better off (or no worse off) signing exclusively. Sellers know that given they will want to sign exclusively with the incumbent, buyers will also join the incumbent's platform — if not in stage 1, then in stage 2. Having signed sellers exclusively, the incumbent can extract all of the buyers' surplus. As with one-sided markets, the results show that it is the exclusive nature of the incumbent's initial offers that are anticompetitive, not the fact it gets sellers on board before the entrant reaches the market. If the incumbent is not able or not allowed to prevent "sellers" joining both platforms, then the fact that it can make introductory offers does not help it.

Proposition 6 predicts that it is the incumbent and sellers (e.g. content providers) that benefit from exclusive deals, while buyers and the entrant are worse off. For instance, it implies that when Nintendo wrote exclusive deals with developers this benefited Nintendo and the developers at the expense of consumers and its rivals. The exact distribution of surplus depends on the particular equilibrium that is expected to be played in the absence of any exclusive deal in the introductory stage. The more aggressively the incumbent is expected to court sellers in the competition stage, the more surplus the incumbent must leave with sellers to get them to sign the original exclusive deal. However, the incumbent cannot commit not to compete aggressively for sellers if it does not sign them initially. It therefore ends up potentially giving away all its surplus to get sellers to sign in the first place.

The minimum surplus sellers will be left with under exclusive dealing is greater if buyers value sellers more than vice-versa. Ironically, this results from the incumbent's ability to use a divide-and-conquer strategy to attract sellers exclusively, so as to exploit the more lucrative buyers. To prevent the incumbent using this strategy, the entrant will leave sellers with at least the buyers' network benefit in the competition stage. As a result, the incumbent has to offer sellers more initially to get them to sign.

One special case of interest is when sellers receive no network benefits ($\alpha_S = \beta_S = 0$). This approximates situations where sellers care primarily about how much money they can raise selling their services to the platform, and not how many buyers they will ultimately reach. In this case, Proposition 6 implies a unique equilibrium in which sellers are paid the buyers' network benefits to sign exclusively with the incumbent in the first stage. This is the most the incumbent can offer sellers for signing with it. Interestingly, this seems to fit the Pay-TV setting quite well.

For instance, recently the Media Development Authority (MDA) in Singapore (see *www.mda.gov.sg*) investigated the use of StarHub's (the incumbent Pay-TV operator) practice of signing up content providers such as ESPN and HBO exclusively to its network.[9] The main potential entrant, SingTel, the largest telecommunications operator in Singapore, cited these exclusive deals for a lack of interest in entering the market. In May 2006, the MDA issued its decision that "*exclusive carriage agreements do not per se substantially foreclose potential entrant's access to key content for the Pay-TV market in Singapore*" but that it will continue to monitor such agreements.

Since that decision, the MDA has worked with SingTel to help it try to enter the market. In the face of SingTel's threaten entry, the incumbent Pay-TV operator StarHub recently signed a new three-

[9]One obvious difference with our model is that we assume agents are atomistic. However, since our sellers have identical interests and can coordinate, our results carry over to having just a few large sellers. An interesting extension is to consider what would happen when buyers value some sellers more than others, and platforms can discriminate between sellers.

year exclusive deal with English Premier League (EPL), the most popular sports program in Singapore. According to industry insiders, the average cost to StarHub of the exclusive deal works out to about forteen Singapore dollars per month per (current) subscriber, not including local production and marketing expenses.[10] This compares to the price StarHub charges consumers for its entire sports package, which is currently fifteen dollars per month. This has led to claims that it is the threat of SingTel's entry that forced StarHub to pay EPL more in its exclusive deal, and as a result StarHub will have to raise its subscription fees to consumers. Perhaps not surprisingly, there have been renewed calls for a regulatory ban on exclusive deals, especially as negotiations with some other key content providers (such as HBO) are yet to be finalized.

6 Concluding comments

We have studied how introductory offers, which may contain exclusivity provisions, can be used by an incumbent to weaken a more efficient rival's ability to compete in the face of network effects. By signing up some consumers early with attractive offers, the incumbent increases demand for its product from other consumers, which it exploits later on. Both consumer welfare and overall efficiency is reduced by the use of such exclusive deals. We distinguished two scenarios depending on the scope for multihoming (the ability of consumers to join both firms in order to obtain higher network benefits).

One case involved firms having positive costs of attracting consumers in which multihoming by consumers is not feasible. Then since consumers anyway buy from one or other firm, there is no role for exclusivity conditions in contracts. Rather, by getting a portion of consumers to (commit to) buy from the incumbent initially, the incumbent raises the willingness-to-pay from the remaining consumers to the point where, in head-to-head competition, the entrant obtains no demand. The incumbent chooses not to sign up all consumers, since it wants to leave some consumers to exploit in the competition stage. Unlike the standard naked exclusion literature, we obtained these results without needing to assume any scale economies. Introducing even a trivial level of entry costs for the rival in our setting allows the incumbent to foreclose the entrant from the market, thereby making exclusion more profitable for the incumbent and less desirable for consumers.

The other case involved no (or more generally, low) costs of attracting consumers, such that multihoming by consumers is feasible. The ability of consumers to buy from both the incumbent and the entrant changes the nature of the game considerably. Offers that only require consumers to commit to purchase from the incumbent are no longer effective. Consumers will sign the contracts if they receive a bribe for doing so, but will still join the entrant's more desirable network subsequently. In the face of

[10] See "Pay TV: Conditions must be right for competition to work". The Straits Times. November 29th, 2006 (H22).

such multihoming, the incumbent will make its offers exclusive, preventing consumers that sign from also buying from the entrant. The incumbent optimally signs up half of the consumers exclusively, allowing the remaining half to multihome in the competition stage. Such contracts are anticompetitive and result in inefficiencies. Despite this, the entrant is only partially foreclosed from the market.

The analysis is extended to two-sided markets, in which platforms seek to attract two groups of users (buyers and sellers), each of whom values the other. In this context, we allow platforms to make different offers to buyers and sellers so there is a natural form of price discrimination. Moreover, we adopt the realistic feature that only sellers can receive exclusive deals (on the buyers' side, Nintendo cannot stop consumers from purchasing rival consoles). When exclusive deals are not offered, the incumbent loses out to the more desirable entrant. The incumbent therefore offers exclusive deals in the first stage, signing up sellers exclusively so as to prevent multihoming, and extracts the full network benefits from buyers. The entrant is fully foreclosed. However, unlike the one-sided case, one group of users (i.e. sellers) can end up better off as a result of exclusive deals. In fact, sellers may be the primary beneficiaries of exclusive deals.

Relative to the existing literature on naked exclusion, our model introduces two new features — network effects and multihoming. Both effects arise naturally together as multihoming is a way for consumers to enjoy greater network benefits when networks are incompatible. It was these features, rather than the standard scale economies that lead to anticompetitive and inefficient exclusion by the incumbent in our model. Adding scale effects to the network effects we study can enable the incumbent to extract more surplus from consumers, as we found in the singlehoming setting.

Without considering multihoming, the "exclusive deals" studied in much of the existing literature may be better thought of as simply introductory offers. When consumers only want to purchase from one or other firm, the incumbent has no need to introduce an exclusivity condition. This was the first case we considered, in order to isolate the impact of adding network effects to the existing literature on exclusive dealing. Our main contribution, however, was to study what happens when consumers can multihome *and* firms can offer exclusive contracts. As such, it may also be interesting to study these questions in an environment without network effects.

This most naturally arises when buyers are downstream firms, who may buy from one or both of the competing upstream suppliers. Several authors have considered this problem when differentiated upstream suppliers can offer contracts at the same time (among them Besanko and Perry, 1994 and Bernheim and Whinston, 1998), while another recent strand of the literature has considered the case in which the incumbent gets to offer exclusive deals first but assumes upstream suppliers are identical (for example, Fumagalli and Motta, 2006 and Abito and Wright, 2007). This leaves one important case undone, in which an incumbent retains its first mover advantage in offering exclusive deals, while the potential entrant offers a differentiated product so that there is a natural reason for distinct competing downstream retailers to want to multihome.

7 References

Abito. J-M. and J. Wright (2007) "Exclusive dealing with imperfect downstream competition," *International Journal of Industrial Organization*, forthcoming.

Armstrong, M. (2006) "Competition in two-sided markets," *Rand Journal of Economics,* forthcoming.

Armstrong, M. and J. Wright (2006) "Two-Sided Markets, Competitive Bottlenecks and Exclusive Contracts," *Economic Theory*, forthcoming.

Balto, D. (1999) "Networks and Exclusivity: Antitrust Analysis to Promote Network Competition," *George Mason Law Review* 7: 523-576.

Bernheim, B. D. and M. D. Whinston (1998) "Exclusive Dealing," *Journal of Political Economy* 106: 64-103.

Besanko, D. and M. Perry (1994) "Exclusive Dealing in a Spatial Model of Retail Competition," *International Journal of Industrial Organization*, 12: 297-329.

Caillaud, B. and B. Jullien (2001) "Competing Cybermediaries," *European Economic Review* 45: 797-808.

Caillaud, B. and B. Jullien (2003) "Chicken and Egg: Competition among Intermediary Service Providers," *Rand Journal of Economics* 34: 309-328.

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

Farrell, J. and P. Klemperer (2006) "Lock-In and Compatibility," in *Handbook of Industrial Organization*, Volume 3. Edited by M. Armstrong and R.H. Porter. Published by Elsevier.

Fumagalli, C. and M. Motta (2006) "Exclusive dealing and entry, when buyers compete," *American Economic Review*, 96: 785-795

Jullien, B. (2001) "Competing in Network Industries: Divide and Conquer," IDEI Working Paper No. 112, 2001.

Katz, M. and C. Shapiro (1986) "Technology adoption in the presence of network externalities," *Journal of Political Economy* 94: 822-841.

Rasmusen E. B., J. M. Ramseyer, and J. J. S. Wiley (1991) "Naked Exclusion," *American Economic Review* 81: 1137-1145.

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

Segal, I. (2003) "Coordination and Discrimination in Contracting with Externalities: Divide and Conquer?," *Journal of Economic Theory* 113: 147-181.

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

Shapiro, C. (1999) "Exclusivity in Network Industries," *George Mason Law Review* 7: 673-684.

Figure 1: Demand equilibrium in Lemma 1

a) $n_X \geq \frac{\alpha}{\alpha+\beta}$ b) $n_X < \frac{\alpha}{\alpha+\beta}$

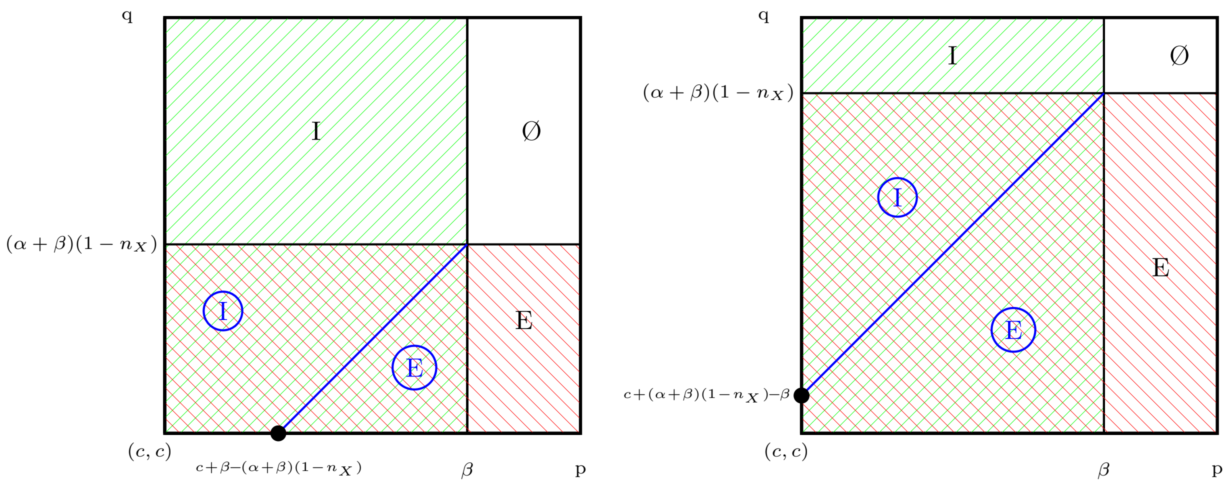

Figure 2: Demand equilibrium in Proposition 3

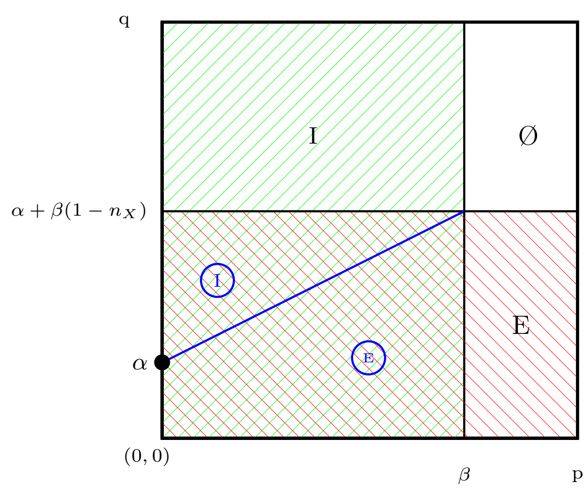

Figure 3: Demand equilibrium in Proposition 4 with non-exclusive prices