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Exclusivity and Control

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Working Paper

08-009

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May 6, 2008

Abstract

We analyze platform competition for content in the presence of strategic interactions between content distributors and content providers. We provide a model of bargaining and price competition within these industries, and show that whether or not a piece of content ends up exclusive to one platform depends crucially on whether or not the content provider maintains control over the pricing of its own good. If the content provider sells its content outright and relinquishes control over its price, the content will tend to be exclusive unless there are sufficient market expansion effects. On the other hand, if the content provider maintains control of its pricing, the strategic interaction between prices set by the content provider and by the platforms leads to a non-monotonic relationship between exclusivity and content quality: both high and low quality content will multihome and join both platforms, but there will be a range of quality for which content will be exclusive despite foreclosing itself from selling to a portion of the market. In addition, we show that contrary to standard results on double marginalization and pricing of complementary goods, a platform who already has exclusive access to content may prefer to relinquish control over pricing and associated revenues from the content to the content provider in order to reduce price competition at the platform level.

1 Introduction

Music, television shows, movies, Internet and mobile content, computer software, and other forms of media often require a consumer to join a platform in order to access or utilize it. This affiliation may take the form of a subscription to a distribution channel (e.g., satellite TV and cable providers, online music stores, web

*We thank Patrick Rey, Yossi Spiegel, and seminar participants at the Fourth Bi-annual Conference on the Economics of the Software and Internet Industries in Toulouse for helpful comments and suggestions.

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portals) or purchase of a hardware device (e.g., DVD player, Windows based PC). One of the primary means of differentiation and competition between platforms for consumer adoption is the acquisition of premium or quality content. However, whether or not certain content is exclusive to one platform or is present on multiple platforms varies significantly from industry to industry.

In the video game industry, prominent video game publishers have the vast majority of their hit games present on all major video game consoles.[1] Indeed, very few games other than those produced by the hardware manufacturers themselves are exclusive to any one console. At the other end of the spectrum, U.S. satellite radio providers Sirius and XM Radio primarily broadcast media which is exclusive. For instance, Sirius has exclusive rights to broadcast NFL, NBA, and NHL games, whereas XM has exclusive rights to broadcast MLB games. In fact, platforms sometimes offer deals involving large payments for such exclusive privileges, as illustrated by Sirius' $500M, 5-year contract with radio personality Howard Stern[2] or DirecTV's $700M offer for exclusive rights to out-of-market MLB games.[3] Sometimes, there exists both multihoming and exclusivity: Paramount threw its exclusive support to HD-DVD over rival next-gen DVD format Blu-ray when most movie studios were offering their catalogues on both formats.[4] Indeed, taking a looser view of "content," one can even view Apple's exclusive U.S. provision of the iPhone to AT&T – whereas Motorola provided its hit RAZR phone to all carriers – as even more variation in the degree of exclusivity across industries.

Why is it that some forms of content are available only on one platform, whereas others are distributed through several or all platforms available – that is, they "multihome"? Our paper analyzes the propensity for exclusivity in these types of industries, and presents a model of platform competition whereby in the first stage two platforms bargain for access to a third party's content, and in the second stage the platforms engage in price competition for consumers. The content provider can either choose to exclusively provide the content to one platform or can provide it to both. We demonstrate that exclusivity depends crucially on the allocation of both

[1] For example, Electronic Arts has its most successful franchises (e.g., Madden NFL) present on all of the major video game consoles.

[2] "Sirius Lands a Big Dog: Howard Stern," *Washington Post*, October 7, 2004.

[3] "Extra Innings Exclusively on DirecTV," *New York Times*, January 20, 2007. A few months later, following a Congressional hearing, MLB agreed to extend access to cable television providers ("Baseball Strikes Deal to Keep 'Extra Innings' Package on Cable," *Associated Press*, April 4, 2007).

[4] "Paramount Chooses HD-DVD over Blu-ray," *T*he Wall Street Journal, August 21, 2007.

control rights over variables that impact the demand the content provider faces, and whether or not the content provider maintains cash flow rights on the sale of its good.[5]

For the first stage bargaining game, we leverage a particular 3-party bargaining setup whereby both platforms make take-it-or-leave-it offers to the content provider which specify payments contingent on whether the content provider joins one or both platforms. In this case, we show that the equilibrium industry outcome – exclusive or non-exclusive – is the one that maximizes industry profits *subject to second stage price competition*. Although similar to the model utilized in Bernheim and Whinston (1998)'s analysis of exclusive dealing between two manufacturers and one retailer, in their *common agency* setting the retailer is the sole decision-maker after the bargaining game, and thus the outcome is the one that maximizes joint-cooperative profits across all agents. Since in our setting both platforms (and potentially the content provider) price non-cooperatively following the bargaining stage, profits will be strictly lower than the cooperative level.[6] Furthermore, for clarity of exposition, we restrict the contract space to fixed-fee transfers in order to separate second stage competition from the contracts signed in stage one.[7]

We examine two scenarios: (1) the content is sold outright to either a single or both platforms, and the platforms exercise control over both the access price consumers pay to the platforms and the price of the content itself; (2) the content is merely "affiliated" with one or both platform(s), whereby the content provider maintains pricing power over its own content and charges its own separate price (independent of platforms) to consumers for access to its content after platforms choose their own price.[8] The second case – whereby the content provider has a direct channel to interact with consumers – is possible only in platform industries, and does not apply to standard vertical chains (i.e., most manufacturer-retailer and "upstream-downstream" settings).[9]

[5] This model implicitly assumes that the market is already "split" between two platforms, and each platform has existent content acquired beforehand. See e.g. Lee (2006) for an analysis when 2 platforms compete over N content providers.

[6] Bernheim and Whinston (1998) categorize this competition as a form of "contracting externality" which occurs subsequent to the contracting stage.

[7] We also later discuss how allowing for variable fees (royalties) may change results; in general, they do not alter the main thrust of the paper.

[8] One could interpret exclusivity under the first case as vertical integration.

[9] Platform markets are also referred to as "two-sided markets" in the literature (see, e.g., Caillaud and Jullien (2003), Rochet and Tirole (2006), Armstrong (2006)), although we focus on instances whereby one "side" comprises oligopolistic firms as opposed to a distribution of small, atomless

In our model, if a provider sells its content outright and foregoes its cash flow and control rights, then whenever the content is sold to both platforms, the platforms compete away the gains each received from acquiring that content. In this case, the gains to obtaining exclusivity for a platform are quite high and exclusivity will tend to be the equilibrium outcome. However, when there are significant market expansion effects, each platform worries more about attracting new customers rather than "stealing" customers from its rival, and therefore the economic gains can be greater if the content provider multihomes; high quality content may then multihome in equilibrium. In the case of affiliation, although high quality content may allow a platform to extract greater rents *in the event of exclusivity* since it results in a greater competitive advantage vis a vis its competitor, it now also means that the cost of being exclusive relative to multihoming increases for the content provider as it can no longer access and sell to a portion of the market. This latter effect dominates in most situations, which indicates a content provider will most likely multihome. Nonetheless, for a range of "mid-quality" content, the strategic interaction which occurs when platforms set prices before the content provider does can "soften" price competition at the platform level enough to offset the losses incurred by the content provider when it joins a single platform exclusively, and allow for an exclusive relationship to exist.[10] Without this particular form of interaction (e.g., if platforms and content priced simultaneously), content would never be exclusive but instead multihome.

Accounting for the strategic pricing interactions of these complementary products – the content and the platforms – also allows us to tackle a richer set of issues, which to the best of our knowledge have not been previously addressed. Not only do we show that the propensity for content to be exclusive is actually non-monotonic in the content's quality, but we also show that platforms with exclusive access to content may choose to relinquish their control over content pricing to the third party provider in order to increase platform profits. This is contrary to standard double-marginalization results in the vertical contracting and complementary pricing literature, which hold that internalizing price setting via integration or other forms of coordination is generally profit-enhancing. Here, by giving up control over content pricing, a platform is in effect committing to charging higher access prices

firms.

[10]The strategic interaction extends to other variables aside from prices, such as for example advertising levels, distribution efforts, etc.

and thereby relaxing price competition with its rival platform. The competitive pressure is "unloaded" onto the content provider, which has to internalize the price increase by the platform it is affiliated with.

This analysis implies that exclusive arrangements in platform industries with affiliated content may harm consumer welfare at the expense of industry profits – not only are certain consumers on the excluded platform foreclosed from accessing the content, but platforms can sustain higher prices to consumers. Thus, fierce bidding and competition between platforms *for content exclusivity* does not imply nor should be mistaken for fierce price competition for consumers.

In the introductory examples of the video game industry and satellite radio and television, the distinction in the forms of pricing manifests itself clearly. Satellite radio and television users are charged monthly subscription fees for access, and the content provider does not charge users for each piece of content they consume – consequently, our model predicts that premium content will tend to be exclusive. However, a gamer must purchase a new game from the content provider even after having obtained the video game console, and thus it is likely that most high-quality games will tend to multihome.[11] Indeed, institutional issues may prevent certain forms of pricing from being practical in certain situations (e.g., it does not seem reasonable for the NFL to charge radio listeners for each game they listen to for a variety of reasons, including transactions costs, monitoring problems, and technological issues), and thus our analysis implies that the likelihood of exclusivity within an industry may be determined to a larger extent by the providers' ability to directly charge users for their content (and maintain control and cash flow rights), than by content quality.

A similar theme is analyzed in Hagiu (2006a), who examines the tradeoffs between buying content outright ("merchant" mode) versus having the content providers merely affiliated ("two-sided platform" mode) from the perspective of a monopoly platform dealing with many small content providers. He shows that the merchant mode is preferred when coordination issues among content providers are more severe and when there is a higher degree of complementarity among sellers' products. Conversely, "affilliation" is preferred when seller investment incentives are important or when there is asymmetric information regarding seller product quality.

[11] Those games that are exclusive tend to be first-party games which are developed by the platform manufacturers themselves; via integration, it is equivalent to the platform having bought the content outright.

Most of the previous literature on exclusive dealing concerns itself with the effects of exclusivity on foreclosure, entry deterrence and efficiency, and focuses on standard upstream-downstream/manufacturer-retailer settings whereby once contracts are signed between parties, only one side of the market (typically the retailers) has any strategic actions left to take.[12] Our model has parallels to the models with 1 manufacturer competing for representation with 2 retailers as used in Hart and Tirole (1990) (as well as O'Brien and Shaffer (1992) and McAfee and Schwartz (1994)) in that one can interpret the platforms as "retailers" of content. Nonetheless, since we focus on the strategic interactions between platforms and content providers, the platform paradigm we build here differs in several important respects. First, platforms are not the final end-users of the content and instead compete in a "downstream" market for consumers – as in Fumagalli and Motta (2006), the welfare implications and likelihood of exclusivity changes when these "buyers" of content compete. Secondly, whereas the "upstream" firm in the literature typically has the bargaining power, here platforms typically are the ones bidding and competing for content. Finally, and most importantly, since consumers purchase directly from both the content and platform providers, both upstream and downstream firms have strategic choices that need to be made subsequent to the contracting stage.

One paper that does match our setup and is close in spirit is Stennek (2006), who also studies the relationship between content quality and exclusivity; however, his model crucially assumes the content provider never has control over any strategic variable. Finally, our observation that relinquishing control over certain strategic variables to a content provider may "soften" competition at the platform level is reminiscent of the effects illustrated in Fudenberg and Tirole (1984) and Bulow, Geanakoplos, and Klemperer (1985) with regard to strategic complements and substitutes.

2 Model

In this section we introduce our basic stylized model. There is one content provider C and two symmetric "platforms" A and B which the content provider can join. The content provider may select to join only one platform (in which case it is *exclusive* to that platform), or can join both (in which case it *multihomes* with both platforms).

[12]See e.g., Posner (1976), Bork (1978), Aghion and Bolton (1987), Rasmusen, Ramseyer, and Wiley (1991), Bernheim and Whinston (1998), Segal and Whinston (2000).

Consumers may join at most one platform, and may purchase C only if they join the platform that C has also joined.

There are two different ways in which a content provider may join a platform. We refer to the first as *outright sale*: the content provider relinquishes control over the content's pricing as well as any cash flows resulting from its sale to users in exchange for a fixed payment from the platform provider(s). In this case, the setup is similar to Hart and Tirole (1990), whereby C can be thought of as a manufacturer who can sell to both retailers (platforms) or just one; once the decision is made, C no longer has any strategic choices to make. The second way C may join a platform is denoted as *affiliation*, in which case the content provider is "allowed" to sell content to the users of the platform(s) it joins, but retains control over its pricing and keeps the resultant sales revenues. This latter case is new, and does not have a parallel in the existing exclusive dealing literature. For now, we assume that the way in which the content provider joins the platform(s) is exogenously given – e.g., it may determined by industry-specific conditions.[13]

Once the means by which a content provider joins a platform are specified, there are two main stages in the game we consider:

I. Platforms A and B bargain with C for access to content; C chooses to join one platform exclusively or multihome (i.e. join both).[14]

II. Given the affiliation or outright sale decision of C, platforms choose access prices P_A and P_B charged to consumers. If C maintains control rights over the pricing of its content, it also chooses p_C. Consumers choose which platform to join and choose whether or not to purchase the content.

The precise timing within Stage II does matter, and will be discussed in detail in the next section. For now, we will assume the equilibrium actions of platforms, content provider, and consumers are well defined in the Stage II price competition game following any Stage I outcome.[15] If C has an exclusive agreement with one platform, we denote by Π_P^{e+}, Π_P^{e-} and Π_C^{e} the stage II net profits accruing to the

[13] In section 3.3 we discuss how the choice between outright sale and affiliation might be determined by the relative preferences and bargaining powers of the two types of agents (platforms and content provider).

[14] In equilibrium, the content provider will always choose to join at least one platform; otherwise, it will receive 0 as consumers will have no means of accessing the content.

[15] I.e., either the equilibrium actions are unique or there is a way to select among possible equilibria.

platform that carries the content (the exclusive platform), the one that does not (the excluded platform), and the content provider respectively. If C multihomes, Π_P^{ne} and Π_C^{ne} denote the stage II profits for the platforms (which are symmetric) and C. For a variety of stage II price competition models (including the one we will use), the following two conditions hold:

$$\Pi_C^{ne} \leq 2\Pi_C^{e} \tag{2.1}$$

$$\Pi_P^{e+} > \Pi_P^{ne} > \Pi_P^{e-} \tag{2.2}$$

The first represents the fact that platforms are imperfect substitutes from the content provider's point of view: this is natural in the context we have in mind since consumers split between the platforms and must single-home. The second assumption says that in Stage II, a platform prefers to have C join exclusively than have it multihome, and a platform prefers C to multihome rather than have C join only the other platform.

2.1 Stage II: Price Competition

We begin by describing the nature of comptition in Stage II. There is a group of consumers distributed uniformly along a Hotelling segment. Platforms are situated at the two extremities and consumers have linear transportation costs t. The stand-alone utilities for a consumer "located" at $\theta \in [0,1]$ from purchasing access to platform A and B, respectively, are:

$$u_A(\theta) = V - t\theta - P_A$$

$$u_B(\theta) = V - t(1-\theta) - P_B$$

where P_A and P_B are the respective access prices charged by the two platforms and V represents the stand alone utility generated from access to just that platform (e.g., derived from the platform itself or from other existent content).

If content provider C is affiliated with a platform A, consumers who subscribe to A may buy access to the content for price p_C and now receive total utility:

$$u_A(\theta, C) = V + S - t\theta - P_A - p_C$$

where S denotes the gross consumer surplus created by the content. So that exclusivity of content does not tip the market completely to one platform, we also assume $S < 3t$. A consumer having adopted platform A will buy the content if and only if $p_C \leq S$. Furthermore, note that we assume there is a single price p_C charged for the content *even if* C is affiliated with both platforms.

We also allow for the possibility that each platform faces a downward sloping demand of "loyal" consumers on each side of the unit interval (i.e., "hinterlands") – these are consumers who will never consider buying the alternative platform. Assume the standalone utility from getting access to any of the two platforms is V and that loyal consumers for each platform have transportation costs $\frac{2t}{u}$, where $u \geq 0$. When the content is exclusive with platform A, if both platforms capture a positive share of the Hotelling segment, then the demand for each platform is given by:

$$D^A = \frac{1}{2t}\left(t + S - P^A + P^B\right) + \frac{\left(V + S - P^A\right)u}{2t}$$

$$D^B = \frac{1}{2t}\left(t - S - P^B + P^A\right) + \frac{\left(V - P^B\right)u}{2t}$$

Thus, $u > 0$ captures the possibility that the market may possibly expand beyond the covered unit interval. Note that as u gets closer to 0, each platform cares less about attracting its loyal customers and instead will compete more fiercely for the middle segment of customers; this would be equivalent to having no market expansion effect. As u increases, each platform cares less about competing for the middle customer group and therefore the platforms' markets are more independent of each other. Costs for providing both the content and each platform are assumed to be 0.

The exact timing for stage II is as follows:

II. 1. Platforms set their prices P_A and P_B for consumers.

II. 2. If the content provider maintains control over the price of its content, it chooses price p_C. If it sells the content outright, each platform that obtains the content as a result of stage I bargaining chooses the price of the content on its own platform.[16]

[16] For expositional convenience, we assume that if the content provider does not maintain control over its pricing, $p_C = 0$ and each platform implicitly includes the access price to the content within its own access price P_i. Results do not change if we allow each platform to choose both P_i and p_C since they are set simultaneously.

II. 3. Each consumer decides which platform to subscribe to and, if the content is available on the platform he has chosen, decides whether or not to buy it as well.

Note that in the timing specified – whenever the content provider maintains control rights over its content's price and prices before consumers act – there exists a form of strategic interaction between the prices set by platforms and the prices set by the content provider: the content provider accounts for the effect its price has on overall consumer demand for the platform(s) it joins. When content is sold outright, no such interaction exists. This distinction is what drives many of the following results.

We have also assumed that platforms credibly set their own prices before the content provider can price (Stage II.1 precedes II.2). This assumption is justified in many of the industries we have in mind, as whenever content requires a particular platform in order to be accessed or utilized, that platform typically is the Stackelberg leader on pricing vis a vis the content provider.[17] Though this is the case we primarily focus on, we will also illustrate how results change if the timing is different, and C prices either simultaneously with platforms or after consumers make their adoption decision.

Finally, we always assume that C prices before consumers. There are two justifications for this. First, we focus on strategic content providers, which are critical to platform adoption: in these cases, their participation generally has to be secured for platform launch and their commitment and pricing decisions are quite "visible" to users, who will factor them into their platform adoption decisions. Second, given that C prices after the platforms, note that C will always have an incentive to announce its price (or any other strategic decisions) before users make their platform adoption decisions. If it does not, then users will anticipate the optimal price for C *ex-post* (i.e. once users have committed) and make adoption decisions accordingly, even though this may not be the *ex-ante* optimal price for C.

2.2 Stage I: Bargaining for Access

In stage I, one can utilize a variety of 3-party bargaining games. For the sake of concision, we focus on a "bidding game" similar to the one used in Bernheim and Whinston (1998) whereby platforms make simultaneous take-it-or-leave-it offers

[17] E.g., see Hagiu (2006b) for a discussion of how this holds in the video game industry.

consisting of fixed transfers to C.[18] We will show show that the method of joining a platform which maximizes industry profits *subject to price competition* – i.e., the sum of A, B, and C's second period payoffs when they compete for consumers – will always be an equilibrium outcome. In section 4, we show how this same result also holds in a related "offer game," where C makes the initial offers to the platforms. Although the division of surplus changes, the equilibrium outcomes do not.

In the bidding game, the timing is as follows:

I. 1. Platforms A and B make offers (T_A^e, T_A^{ne}) and (T_B^e, T_B^{ne}) to C, where T_i^e is the monetary transfer from platform i to the content provider in exchange for exclusivity, and T_i^{ne} is the transfer when the content provider multihomes.

I. 2. The content provider chooses which platform(s) to join. If the content provider joins platform i exclusively, the provider will receive a total payoff of $\Pi_C^e + T_i^e$ (accounting for the resultant Stage II payoffs), i receives $\Pi_P^e - T_i^e$, and platform $j \neq i$ receives Π_P^{e-}. If the provider joins both platforms, it receives $\Pi_C^{ne} + T_A^{ne} + T_B^{ne}$ and each platform i receives $\Pi_P^{ne} - T_i^{ne}$.

Using subgame perfect Nash Equilibrium as the solution concept, we prove the following:

Proposition 2.1. *An exclusive equilibrium in which the content provider joins either platform A or platform B always exists; any such equilibrium will involve a transfer* $T_A^e = T_B^e = \Pi_P^{e+} - \Pi_P^{e-}$ *from the exclusive platform to* C*. A multihoming equilibrium exists if and only if:*

$$2\Pi_P^{ne} + \Pi_C^{ne} \geq \Pi_P^{e+} + \Pi_P^{e-} + \Pi_C^e \tag{2.3}$$

and the unique Pareto-undominated equilibrium for the platforms involves transfers $T_A^{ne} = T_B^{ne} = \Pi_P^{e+} + \Pi_C^e - (\Pi_P^{ne} + \Pi_C^{ne})$

(All proofs are located in the appendix).

The fact that exclusivity may always occur is an artifact of the bargaining setup – A or B can eliminate the ability of C to multihome by demanding a sufficiently high enough payment. However, since multihoming can occur only if industry profits

[18] Note that in Bernheim and Whinston (1998), it is the two (upstream) manufacturers who make offers to the (downstream) retailer. Here, platforms essentially make offers "upstream" to C.

are maximized, we will assume that multihoming occurs if (2.3) holds; otherwise, we will assume exclusivity arises.

Proposition 2.1 extends the first efficiency principle in Bernheim and Whinston (1998) to our setting: multihoming by the content provider arises as an equilibrium outcome if and only if it maximizes total industry profits *subject to Stage II price competition*.[19] However, a natural question is what happens when one allows more general contracts (i.e. not restricted to fixed fees). Bernheim and Whinston (1998) show that in their setting with 2 manufacturers bidding for representation by a single retailer, when the manufacturers can offer general contracts, contingent on the type of representation (exclusive or common) and on the quantity bought by the retailer, there exists an undominated equilibrium in which the maximum joint cooperative payoff is achieved. Rather than strictly a function of the general transfer space, this result comes from the fact that subsequent to the contracting stage, *a single* agent – the retailer – takes actions that determine payoffs for all three firms. In such a *common agency* framework, there are no *contracting externalities* which restrict the outcome that maximizes joint payoffs from being achieved. In our setting, both platforms (and, in the case of affiliation, C as well) price strategically following the contracting stage, which restricts joint payoffs from achieving the joint cooperative outcome.

Note that we have separated the effect the Stage I bargaining outcome (including contracts signed) have on the Stage II pricing game by restricting attention to lump-sum fixed fees. In section 4 we show that enlarging the contracting space by allowing platforms to charge royalties does not affect the ability of agents (platforms and content provider) to achieve joint maximizing profits, but serves to add complexity to the analysis. Since our main insights remain unchanged, for clarity of exposition we will restrict attention to fixed fees throughout the rest of the paper.

3 Analysis: Impact of Control on Exclusivity

Explicitly analyzing the bargaining game for exclusive content allows us to examine the effect of content quality on the likelihood of exclusivity. We first analyze the case where the content provider sells the content outright to the platforms before

[19] As in Bernheim and Whinston (1998), we will take an "efficient" outcome to mean an outcome that maximizes total economic gains for industry participants – i.e., this definition does not account for what happens to consumer surplus.

moving on to the case where it maintains control and cash flow rights.

3.1 Content Provider Sells Control Rights

If the content provider sells its content outright to a platform, then it forgoes any revenues from consumer adoption. Then its total profits comprise only the lump sum transfers made by the platforms in stage I. In other words, the content provider's stage II revenues are 0 in all cases.

Proposition 3.1. *The market equilibrium depends on the magnitude of market expansion u and the quality of the content S in the following way:*

- *With no market expansion ($u = 0$), exclusivity prevails for all values of S;*
- *For positive but sufficiently small market expansion effects ($u < \overline{u}$), there exists a threshold quality level $\overline{S}(u)$ such that multihoming prevails for $S \leq \overline{S}(u)$ and exclusivity prevails for $S > \overline{S}(u)$;*
- *When market expansion effects are large ($u > \overline{u}$), multihoming prevails for all possible quality levels.*

The intuition for these results is straightforward. Recall that $u = 0$ corresponds to no market expansion effects. The reason exclusivity always occurs in this case is that the benefits of having the content are completely competed away by the platforms if C multihomes. Consequently, the aggregate gains to the industry participants if one platform obtained the content exclusively are strictly greater since more surplus can be extracted from consumers when the platforms are differentiated in quality.

Importantly, note here that it is the case that both platforms would have preferred the situation where the content provider was not present; total platform profits would be higher had there been no upstream content provider to compete over, since then each platform would receive $\frac{t}{2}$ as opposed to $\Pi_P^{e-} < \frac{t}{2}$.[20] However, since the content provider is assumed to exist, there is no equilibrium where both platforms refuse to contract with the content provider.[21]

[20] Indeed, Proposition 2.1 implies that platform profits net of transfers are Π_P^{e-} under content exclusivity. And the proof of proposition 3.1 in the appendix implies $\Pi_P^{e-} = \frac{t}{2}\left(1 - \frac{S}{3t}\right)^2 < \frac{t}{2}$ for $u = 0$.

[21] Platforms are explicitly forbidden to collude, and if one platform competitor does not contract with the content provider, the other can do strictly better by contracting.

In our Hotelling model used for Stage II, A and B are located on the endpoints of the unit interval, which means that any gain in consumers for one platform necessarily comes from a loss in consumers for the other. If on the other hand u is sufficiently large and platforms can also attract "outside" consumers, then if C multihomed it would attract new consumers to each platform which would subsequently mitigate second stage price competition. When such effects are strong, platforms would essentially be competing in independent markets, and multihoming will be restored as the equilibrium outcome.

In many ways, these results parallel those between a single manufacturer and two retailers. With undifferentiated retailers, as in Hart and Tirole (1990), a manufacturer will always choose to integrate or deal exclusively. If, however, the retailers are located in separate markets then the manufacturer will always choose to supply to both retailers since each retailer is effectively a local monopoly; in our model, this corresponds to having strong market expansion effects.

3.2 Content Provider Maintains Control Rights

If C affiliates with platforms such that it sets the price for its own content and receives the associated cash flow, market outcomes will be different relative to the case when C sells its content outright. Indeed, on the surface C would seem to have a greater incentive to multihome when setting its own price since it will be able to access the entire base of consumers by doing so. Although high quality content may allow a platform to extract greater rents *in the event of exclusivity* since it results in a greater competitive advantage vis a vis its competitor, it now also means that the cost of being exclusive relative to multihoming may increase for C as it can no longer access and sell to a portion of the market. This latter effect turns out to dominate in many instances.

In particular, we will show that even in the absence of market expansion effects, i.e. $u = 0$, the relationship between content quality and exclusivity becomes non-trivial and non-monotonic (which is in contrast to Proposition 3.1, which has shown that with outright sale and no market expansion effects, exclusivity always prevails). From now on we assume $u = 0$.

3.2.1 No strategic pricing effects on the content provider

To clarify the role of the timing in Stage II, we begin by first analyzing the cases when C prices simultaneously with platforms, and when C prices *after* consumers have chosen a platform. In both of these cases, platform prices have no strategic impact on C's pricing decision. As a result, C will always choose to multihome, since neither A or B can compensate C enough in order to induce it to be exclusive.

Proposition 3.2. *In the absence of market expansion effects ($u = 0$), if C prices either after consumers act or simultaneously with platforms, then C will always multihome.*

When C prices *after* consumers adopt a platform, then C will simply set its price p_C to extract the entire surplus S from each consumer. Since this nullifies any competitive advantage a platform might obtain over its competitor by signing up C exclusively, neither A nor B will offer C any more than they would for it to multihome. This implies that in equilibrium C will always multihome. By contrast, recall that, in the absence of market expansion effects, C was always exclusive when it was sold outright and maintained no pricing control. This was because if it multihomed, neither A, B, nor C could extract the consumer surplus created by C – A and B competed it away and C had no pricing instruments.

If C prices simultaneously with platforms after its affiliation decision, a similar logic holds. A provider whose content is of quality $S \geq t$ will also choose to price at $p_C = S$. A provider of lower quality content will charge less than S; at the same time however, whatever competitive advantage it provides to the platform it joins exclusively, it is not sufficient to compensate C for forgoing the other platform's users.

3.2.2 Platforms Price First

As discussed earlier when detailing the price competition stage, neither allowing C to price after consumers act or simultaneously with platforms accurately captures the pricing interactions between platforms and content providers. C typically prices after A and B have chosen their prices, but before consumers act. Consequently, C must internalize the price set by A and B, and in turn, A and B will price to influence C's actions. This difference has significant effects. As the following proposition illustrates, we find that not only will both an exclusive and multihoming equilibrium exist, but the likelihood of exclusivity is not monotonic in S, and indeed may be *lower* for *higher* "content quality" S.

Proposition 3.3. *For the following ranges of S:*

- $S \le 2(\sqrt{2}-1)t \approx 0.825t$, *$C$ will multihome in equilibrium.*
- $S \in [\frac{10}{7}t, \frac{1}{5}(35-12\sqrt{5})t)]$[22], *$C$ will affiliate exclusively with one platform.*
- $S \in [\frac{1}{5}(35-12\sqrt{5})t, 3t)]$, *$C$ will multihome.*

This result hinges on the new form of strategic interaction created when A and B credibly set prices before C. Consider the case when C is exclusive to A: when C is allowed to control the price of its content, it turns out both A *and* B earn higher stage II profits than in the case where A buys the content outright. The reason is that C is forced to internalize the effect of p_C on user demand for platform A, and will therefore feel compelled to lower p_C when A increases P_A. In turn, A internalizes C's best-response function and will set a higher price relative to the case where it had bought the content outright and controlled p_C. A's desire to restrain C from charging a higher price in stage II.2 by charging a higher price in stage II.1 serves as a commitment device on A's part not to compete as severely on price against platform B, which allows B to charge a higher price as well. In other words, by having the content provider set its own price after the platforms act, the marginal gain of raising price for the platform carrying the content exclusively is increased since any price increase now has a less negative effect on user demand due to lower future prices set by the content provider. Consequently, both the exclusive and excluded platform profits rise in Stage II under content affiliation compared to outright sale. The extra surplus that can be extracted from consumers by "softening" platform competition in this manner is enough to offset the losses incurred by C excluding a portion of the market. Exclusivity can thus maximize industry profits and be an equilibrium outcome.

To see this more generally, let D_i denote consumer demand for platform i and assume platform A has exclusive access to C. Platform A's stage II profits are

$$\Pi_A = P_A D_A(P_A, P_B, p_C(P_A, P_B))$$

[22]The range is approximately $(1.428t, 1.633t)$.

where $\frac{\partial D_A}{\partial P_A} < 0$, $\frac{\partial D_A}{\partial P_B} > 0$, $\frac{\partial D_A}{\partial p_C} < 0$ and:

$$p_C\left(P_A, P_B\right) = \arg\max_{p_C}\left\{p_C D_A\left(P_A, P_B, p_C\right)\right\}$$

If D_A is a separable function in the three prices P_A, P_B, p_C (this is the case with any linear demand model such as the one used in this paper) then p_C and P_A are *strategic substitutes*: $\frac{\partial p_C}{\partial P_A} < 0$. The first order condition for profit maximization in P_A is:

$$\frac{d\Pi_A}{dP_A} = D_A + P_A\left(\frac{\partial D_A}{\partial P_A} + \frac{\partial D_A}{\partial p_C}\frac{\partial p_C}{\partial P_A}\right) = 0$$

where the last term $\frac{\partial D_A}{\partial p_C}\frac{\partial p_C}{\partial P_A} > 0$ was not present in the case when the content was sold outright, nor when C priced either after consumers acted or simultaneously with platforms. As a result, platform A's marginal gain to raising its price is increased, hence the optimal access price charged by platform A is higher.

The ability to extract greater surplus when one platform signs the content provider to an exclusive contract only occurs for an intermediate range of content quality. For low quality content, C sets $p_C = S$ regardless of the affiliation decision and the prices set by A or B, because content exclusivity does not provide a sufficient competitive advantage to the platform that obtains it. On the other hand, for very high quality content, the losses incurred by C forgoing the portion of the market served by the excluded platform are too large and cannot be offset by the excess surplus received by the platforms when C is exclusive.

3.3 Aggregate Profits

So far we have not discussed the total profits that accrue to each platform and C: by including transfers, it may be that certain parties prefer one form of control rights environment over the other. Total industry profits are always higher when the content provider can merely affiliate with a platform and maintain control over its pricing decision. Separating control over pricing between the platforms and the content provider allows these firms to extract more consumer surplus. Although industry profits as a whole are higher in the event a content provider maintains control rights, it is not true that both platforms and content providers prefer this outcome. It turns out that given a choice, the content provider would prefer to sell its content outright and give up all control *and* cash flow rights, whereas the platform provider would not wish to acquire them.

Corollary 3.4. *Under the bidding game, for all $S \geq \frac{10}{7}t$, platforms earn higher total equilibrium profits and the content provider earns lower total equilibrium profits under content affiliation than under outright sale.*

Since the transfer required to induce exclusivity – the difference $\Pi_P^{e+} - \Pi_P^{e-}$ – is smaller under affiliation than outright sale, the content provider does not realize the gains captured by the platforms. On the other hand, for high quality content such that C multihomes under affiliation, platforms can extract payment from the content provider in exchange for the right to affiliate: $T^{ne} < 0$ whenever multihoming is efficient under affiliation (see proof of Corollary 3.4).

This is despite the fact that under outright sale, the content provider makes no Stage II profits and loses all future cash flow rights; it more than makes up for this loss through the payments made during the Stage I bargaining game. Hence, although industry profits are strictly higher when the content provider maintains control rights, most of the industry profits are appropriated by the platforms – regardless of whether the content provider is exclusive or not.

Thus, even if the relationship between the content provider and platforms (outright sale or affiliation) is not explicitly chosen by industry characteristics (e.g., the ability to charge per-consumer fees on consumption of content is infeasible), the choice between the two may possibly be a result of whichever party possesses "greater" ex ante negotiating power. For example, the NFL as a content provider sold the right to broadcast packages of games to television networks without controlling per-consumer pricing or realizing advertising gains; video game publishers however only affiliate with each platform provider, and maintain control over the prices of their games. In each case, the party with arguably greater power (the NFL or the video game console manufacturers) was able to select the nature of the relationship most beneficial to its interests. Indeed, as long as at some point in time such a power imbalance existed, there may have been some historical process exogenous to our model that converged on the outcome preferred by a particular side of the market.

4 Applications and Extensions

4.1 Licensing of Content

Our analysis also leads to another surprising result regarding the desirability of platform vertical integration into content. Starting with a situation in which A already has an exclusive deal with C (or owns C), one might expect it to be better off by maintaining control over the price p_C and keeping the associated revenue stream. However, this may not be true: spinning off the content provider entirely may be profitable! Indeed, relinquishing control over the content's price and revenue streams may reduce price competition at the platform level to a sufficient degree (transferring the burden of lowering prices to C) to offset the revenue losses incurred.

Corollary 4.1. *If* $S \in \left(\frac{10}{7}t, \frac{3\left(\frac{5\sqrt{2}}{6}-1\right)}{1-\frac{\sqrt{2}}{2}}t\right)$[23] *then the platform carrying the content exclusively makes higher profits in Stage II when the content provider maintains control over pricing (and keeps the associated profits) relative to a platform who buys the content outright. The excluded platform will always make higher stage II profits when the content provider only sells access to the rival platform and keeps control over pricing.*

It is in the interest of *both* the exclusive and excluded platform to have the content provider independent – each platform thus can extract greater consumer surplus by softening competition and increasing their own prices. This result is in the spirit of Rey and Stiglitz (1995): in their model, producers may wish to engage in exclusive territory arrangements with downstream retailers and delegate pricing to them in order to decrease upstream competition; here, the setting is reversed with "downstream" platforms leveraging exclusivity to increase prices, but the mechanism is similar. Finally, we stress that this particular effect may offset the benefits of integration and joint-price setting implied by the standard analysis of double marginalization or pricing of complementary goods.[24]

[23] The range is approximately $[t, 1.828t]$.

[24] See e.g. Tirole (1988), Chapter 4. The "softening" of competition between platforms as a result of control delegation is also comparable to the results in Bulow, Geanakoplos, and Klemperer (1985) and Fudenberg and Tirole (1984), although here in an altogether different context.

4.2 Contracts with royalties

For completeness, the following proposition shows that even with royalties, the Stage I bargaining outcome will still be the industry structure that maximizes industry profits subject to price competition in Stage II, which in turn restricts outcomes from achieving the maximum joint cooperative payoffs.

Proposition 4.2. *Allow contracts to take the form* $(T_j^e, r_j^e, T_j^{ne}, r_j^{ne})$*, which now include per-unit royalties in addition to fixed fee transfers. An exclusive equilibrium in which the content provider affiliates either with platform A or with platform B always exists; a multihoming equilibrium exists if and only if:*

$$2\Pi_P^{ne}(r_A^{ne*}, r_B^{ne*}) + \Pi_C^{ne}(r_A^{ne*}, r_B^{ne*}) \geq \Pi_P^{e+}(r_A^{e*}) + \Pi_P^{e-}(r_A^{e*}) + \Pi_C^{e}(r_A^{e*}) \tag{4.1}$$

where r_j^{e*} *and* r_j^{ne*} *indicate platform j's equilibrium royalty rate under exclusivity and non-exclusivity, respectively, and are given by:*

$$\begin{aligned} r_j^{e*} &= \arg\max_{r_j^{e'}} \{\Pi_j^{e+}(r_j^{e'}) + \Pi_C^{e}(r_j^{e'})\} \\ r_j^{ne*} &= \arg\max_{r_j^{ne'}} \{\Pi_j^{ne}(r_j^{ne'}, r_{-j}^{ne*}) + \Pi_C^{ne}(r_j^{ne'}, r_{-j}^{ne*})\} \end{aligned}$$

Here, Stage II profits are now a function of the royalty payments contracted upon in Stage I since they influence the prices that will be chosen by platforms and C.[25] Enlarging the contracting space does not affect the ability of agents to achieve the joint maximizing profits, but serves to add an additional layer of complexity for analysis.

4.3 Offer Game

The Stage I bargaining game can be altered such that it is now C who makes a set of offers to each platform:

I. 1. C offers a menu of contracts $T_A = \{T_A^e, T_A^{ne}\}$ and $T_B\{T_B^e, T_B^{ne}\}$ to each respective platform, where T_i^e is the monetary transfer from platform i to the content provider in exchange for exclusive affiliation, and T_i^{ne} is the transfer when the content provider multihomes.

[25] In this notation, $\Pi_P(\cdot)$ and $\Pi_C(\cdot)$ not only are functions of, but also include royalty payments, since they are assumed to occur in Stage II.

I. 2. Each platform i simultaneously decides to accept neither, one, or both of the exclusive and non-exclusive components of offered transfers.

I. 3. C chooses which platform(s) to join, where C can join platform i exclusively only if i accepted T_i^e, and C can join both platforms only if both platforms each accepted T_i^{ne}. Payoffs are as in the bidding game.

Note that by since C makes its offers public and cannot "secretly" affiliate with another platform after promising the other exclusivity, the *opportunism* problem of Hart and Tirole (1990) can be avoided. The results from the offer game are similar to those obtained earlier, as the following proposition shows.

Proposition 4.3. *If* $2\Pi_P^{ne} + \Pi_C^{ne} \leq \Pi_P^{e+} + \Pi_P^{e-} + \Pi_C^e$, *an exclusive equilibrium exists whereby* C *extracts* $T_i^e = \Pi_P^{e+} - \Pi_P^{e-}$ *from the exclusive platform.*

If $2\Pi_P^{ne} + \Pi_C^{ne} \geq \Pi_P^{e+} + \Pi_P^{e-} + \Pi_C^e$, *a multihoming equilibrium exists whereby* C *extracts* $T_i^{ne} = \Pi_P^{ne} - \Pi_P^{e-}$ *from each platform.*

We find that total profits under exclusivity are unchanged from the bidding game:

$$
\begin{aligned}
\hat{\Pi}_P^{e+} &= \Pi_P^{e-} \\
\hat{\Pi}_P^{e-} &= \Pi_P^{e-} \\
\hat{\Pi}_C^{e} &= \Pi_C^{e} + \Pi^{e+} - \Pi^{e-}
\end{aligned}
$$

However, total profits under multihoming are now different:

$$
\begin{aligned}
\hat{\Pi}_P^{ne} &= \Pi_P^{e-} \\
\hat{\Pi}_C^{ne} &= \Pi_C^{ne} + 2(\Pi_P^{ne} - \Pi_P^{e-}) = \Pi_{IND}^{ne} - 2\Pi_P^{e-}
\end{aligned}
$$

Here, since platforms now can only capture their individual excluded Stage II profits Π_P^{e-} *regardless of the outcome*, C's objective is to maximize total industry profits under exclusivity or multihoming. Note this is in contrast to the bidding game, where C wished to only increase the value it contributed to an exclusive pairing.

5 Concluding Remarks

We have argued in this paper that in order to understand the relationship between content quality and exclusivity, it is important to fully specify control over variables related to the content being transferred. These control rights crucially affect the degree to which competition among industry players can reduce or enhance industry profits under either a multihoming or exclusive regime, and consequently determine which industry structure will emerge.

When the content provider sells outright, the logic is similar to that of the traditional manufacturer-retailer literature: in a mature market with no market expansion effects, the content provider will typically end up exclusive with one platform; otherwise, as market expansion effects increase, higher quality content will be more likely to multihome. However when the content provider maintains control of its pricing and cash flow rights, the likelihood of exclusivity is no longer monotonic in quality and the strategic interactions between platforms and the content provider can push the industry structure to go in either direction. High quality content will multihome since foreclosing a portion of the market by being exclusive will be too costly; mid-quality content will be exclusive since it can soften price competition at the platform level enough to offset the losses from excluding a portion of the market; and finally, low quality content will multihome since it does not yield any comparative advantage even if it were exclusive.

Though the delegation of control may be exogenously determined by industry factors, it may also be chosen by platforms or the content provider. In that regard, the preferences of the two types of agents conflict: the platforms prefer that the content provider maintain control over its own prices, whereas the content provider wishes to sell its content and associated control outright. We have also shown that a platform having gained exclusive rights to content may prefer to relinquish control over pricing and associated revenues to the content provider in order to relax price competition with the rival platform. Although our model is highly stylized, it is nonetheless sufficient to demonstrate how platform industries exhibit significantly different strategic effects among firms than previously analyzed vertical models.

We conclude with two possible extensions to our analysis. First, a natural follow-up to our results would be to enrich our Stage I bargaining game by allowing platforms to bargain not only over exclusivity taking the allocation of control rights as given, but also over the allocation of control rights themselves. In the model we have used up to now, this would be equivalent to allowing platforms to make transfers contingent on who controls the price and derives the associated revenue streams from content. Second, in showing that the likelihood of exclusivity is crucially determined by the division of control rights over content between the platform(s) and the content owner, we have restricted attention to the pricing of content as the only control variable. However, control often involves choosing other variables aside from prices: advertising expenditures, investments in improving the quality of the content and/or its distribution channels, and so forth. Our model may be extended by asking the following questions: under what conditions does devolving control over any strategic variable (e.g., price, advertising, investment) to the content provider raise the profits of the platform carrying the content exclusively relative to the situation in which that platform maintains full control (and extracts the revenues associated with the content)? And does this depend on whether the variable is a strategic substitute or complement between platforms or between the platform and content provider?

6 Proofs

Proof of Proposition 2.1. We first show that an exclusive equilibrium always exists where C joins platform j exclusively. Clearly, if $T_j^{ne} = -\infty$, then a best response for i is to set $T_i^{ne} = -\infty$ as well – thus, forcing exclusivity is a unilateral decision. Necessary conditions for T_j^e, $j = A, B$ to be an equilibrium are:

$$\begin{aligned} \Pi_C^e + T_i^e &= \Pi_C^e + T_j^e \geq 0 \\ \Pi_P^{e+} - T_j^e &\geq \Pi_P^{e-} \geq \Pi_P^{e+} - T_i^e \end{aligned}$$

Indeed, if the equality in the first condition does not hold then either C prefers platform i to platform j or platform j can reduce T_j^e slightly and thus increase its profits. The first inequality in the second condition is simply platform j rationality; if the second one is violated then platform i can profitably deviate by lowering T_i^e, which will be accepted given the first condition. Due to platform symmetry, any exclusive equilibrium must satisfy the following:

$$T_i^e = T_j^e = \Pi_P^{e+} - \Pi_P^{e-}$$

and will exist.

Let us now turn to the existence of multihoming equilibria (T_A^{ne}, T_A^e) and (T_B^{ne}, T_B^e). The first set of necessary conditions for a multihoming equilibria to exist is:

$$\Pi_C^{ne} + T_A^{ne} + T_B^{ne} = \Pi_C^e + T_j^e \geq 0$$

If the first equality does not hold then either exclusivity with j is better than multihoming for the content provider, or i can profitably decrease T_i^{ne} without inducing C to change its action.

The second necessary condition is:

$$\Pi_P^{e+} - T_j^e \leq \Pi_P^{ne} - T_j^{ne}$$

otherwise $T_j^e + \varepsilon$ is a profitable deviation for j given the first set of necessary conditions above.

Finally, we must also have:

$$\Pi_P^{e-} \leq \Pi_P^{ne} - T_j^{ne}$$

otherwise $T_j^{ne} = -\infty$ is a profitable deviation given the first set of necessary conditions above.

The unique Pareto-undominated equilibrium for the platforms (i.e. the equilibrium most favorable to platforms) involves:

$$\Pi_P^{e+} - T_j^e = \Pi_P^{ne} - T_j^{ne}$$

which implies:

$$T_j^{ne} = \Pi_C^e + \Pi_P^{e+} - \Pi_C^{ne} - \Pi_P^{ne}$$

so that platform j's profits are:

$$\Pi_C^{ne} + 2\Pi_P^{ne} - \Pi_C^e - \Pi_P^{e+}$$

and the content provider's profits:

$$2\Pi_C^e - \Pi_C^{ne} + 2\left(\Pi_P^{e+} - \Pi_P^{ne}\right)$$

which are always positive by (2.1) and (2.2).

Therefore, since this is the best equilibrium for the platforms and the least favorable to the content provider, we can conclude that in any multihoming equilibrium the content provider will make positive profits. However, the most favorable multihoming equilibrium for platforms exists if and only if each platform makes higher profits than what it would make if the content provider were affiliated exclusively with the other platform, i.e.:

$$\Pi_C^{ne} + 2\Pi_P^{ne} - \Pi_C^{e} - \Pi_P^{e+} \geq \Pi_P^{e-}$$

which yields the condition in the text. $\square$

Proof of Proposition 3.1. Recall when the content is exclusive with platform A, if both platforms capture a positive share of the Hotelling segment, then:

$$D^A = \frac{1}{2t}\left(t + S - P^A + P^B\right) + \frac{\left(V + S - P^A\right)u}{2t}$$

$$D^B = \frac{1}{2t}\left(t - S - P^B + P^A\right) + \frac{\left(V - P^B\right)u}{2t}$$

Assuming interior solutions, we obtain the following equilibrium in platform access prices:

$$P^{A*} = \frac{3 + 2u}{4\left(1 + u\right)^2 - 1}\left(t + Vu\right) + \frac{2\left(1 + u\right)^2 - 1}{4\left(1 + u\right)^2 - 1}S$$

$$P^{B*} = \frac{3 + 2u}{4\left(1 + u\right)^2 - 1}\left(t + Vu\right) - \frac{1 + u}{4\left(1 + u\right)^2 - 1}S$$

For this equilibrium to be interior, we need to impose:

$$P^{B*} \geq 0 \Longleftrightarrow S \leq \frac{\left(t + Vu\right)\left(3 + 2u\right)}{1 + u}$$

and:

$$t - S - P^{B*} + P^{A*} \geq 0 \Longleftrightarrow S \leq \frac{\left(1 + u\right)\left(1 + 2u\right)}{4\left(1 + u\right)^2 - 1}t$$

Platform profits are then:

$$\Pi^A = \Pi_P^{e+} = \frac{1 + u}{2t\left(4\left(1 + u\right)^2 - 1\right)^2}\left[\left(3 + 2u\right)\left(t + Vu\right) + \left(2\left(1 + u\right)^2 - 1\right)S\right]^2$$

$$\Pi^B = \Pi_P^{e-} = \frac{1 + u}{2t\left(4\left(1 + u\right)^2 - 1\right)^2}\left[\left(3 + 2u\right)\left(t + Vu\right) - \left(1 + u\right)S\right]^2$$

When the content provider multihomes, platform demands are:

$$D^A = \frac{1}{2t}\left(t + u\,(V+S) - P^A\,(1+u) + P^B\right)$$

$$D^B = \frac{1}{2t}\left(t + u\,(V+S) - P^B\,(1+u) + P^A\right)$$

yielding equilibrium prices:

$$P^A = P^B = \frac{t + u\,(V+S)}{1+2u}$$

and profits:

$$\Pi^A = \Pi^B = \Pi^{ne} = \frac{\left(t + u\,(V+S)\right)^2 (1+u)}{2t\,(1+2u)^2}$$

Given our solution concept, exclusivity will arise as the equilibrium outcome if and only if $2\Pi^{ne} < \Pi^{e+} + \Pi^{e-}$ which, using the expressions above, is equivalent to:

$$2u\,(3+2u)^2\,(t+Vu) + F\,(u)\,S \leq 0$$

where:

$$F\,(u) = 4u^4 + 8u^3 - 3u^2 - 10u - 2$$

Note therefore that for all u sufficiently small, $F\,(u) < 0$, hence the equilibrium outcome is multihoming for $S \in \left[0, \overline{S}\,(u)\right]$ and exclusivity for $S > \overline{S}\,(u)$. When u becomes large enough, $F\,(u) > 0$, hence multihoming is the only outcome. □

Proof of 3.2. Consider the following two cases:

- *C prices after consumers act:* When C prices, it can do no better than charging $p_C = S$ regardless of which platform(s) it is affiliated with. This is because consumers have already chosen which platforms to adopt, and thus C no longer has any influence over their prices. If this is the case, then being an exclusive platform has no comparative advantage over its competitor since consumers expect to have any surplus from the exclusive content fully extracted by C. Thus, platform profits are always $\Pi_P^{ne} = \Pi_P^{e+} = \Pi_P^{e-} = t/2$. C will receive $\Pi_C^{ne} = S$ when it multihomes, and $\Pi_C^{e+} = S/2$ if it's exclusive (since it only serves half the market).
- *C prices simultaneously with platforms:* When C multihomes, Stage II profits

are $\Pi_C^{ne} = S$ and $\Pi_P^{ne} = t/2$ – recall that when C multihomes, platforms have no comparative advantage over the other and thus realize the same stage II payoffs as if neither had the content. Each platform will split the market with a price of $P_A = P_B = t$. The content provider now will set $p_C = S$.

When C is exclusive with A, the pricing equilibrium can be solved as follows:

$$\begin{aligned} P_A &= t + \frac{S - p_C}{3} \\ P_B &= t - \frac{S - p_C}{3} \\ p_C &= \min(S, \frac{3t + S}{4}) \end{aligned}$$

(Note C will never charge more than S, since then no one will ever buy its content). Consequently, there are two relevant ranges to consider:

- $S < t$: In this case, C will price at S yielding stage II profits $\Pi_C^{ne} = S/2$ and $\Pi_P^{e+} = \Pi_P^{e-} = t/2$
- $S \geq t$: Now profits are

$$\begin{aligned} \Pi_P^{e+} = \Pi_C^{e} &= \frac{(S + 3t)^2}{32t} \\ \Pi_P^{e-} &= \frac{(5t - S)^2}{32t} \end{aligned}$$

In all of these instances, total industry profits are greater when C multihomes, and by 2.1 the results follow. $\square$

Proof of 3.3. The proof follows immediately from Proposition 2.1 and the following Lemma.

Lemma 6.1. *When the content provider is exclusively affiliated with platform A and sets its price independently and after observing the two platforms' prices, the equilibrium of the pricing game is as follows:*

- *For $S \leq 2(\sqrt{2} - 1)t \approx 0.8284t$, there exists a unique pure strategy equilibrium with $P_A = P_B = t$ and $p_C = S$. The equilibrium (stage II) profits are:*

$$\begin{aligned}\Pi_P^{e+} = \Pi_P^{e-} &= \frac{t}{2} \\ \Pi_C^{e} &= \frac{S}{2}\end{aligned}$$

- *For* $2(\sqrt{2}-1)t < S < 5(3\sqrt{2}-4)t \approx 1.213t$, *there exists no equilibrium in pure strategies*
- *For* $5(3\sqrt{2}-4)t \leq S$, *there exists a unique pure strategy equilibrium with* $P_A = \frac{5t}{3} + \frac{S}{3}$, $P_B = \frac{7t}{3} - \frac{S}{3}$ *and* $p_C = \frac{5t}{6} + \frac{S}{6}$. *The equilibrium (stage II) profits are:*

$$\begin{aligned}\Pi_P^{e+} &= \frac{t}{2}\left(\frac{5\sqrt{2}}{6} + \frac{S\sqrt{2}}{6t}\right)^2 \\ \Pi_P^{e-} &= \frac{t}{2}\left(\frac{7\sqrt{2}}{6} - \frac{S\sqrt{2}}{6t}\right)^2 \\ \Pi_C^{e} &= \frac{t}{2}\left(\frac{5}{6} + \frac{S}{6t}\right)^2\end{aligned} \tag{6.1}$$

Furthermore, both pure strategy equilibria described above are stable.
When the content provider multihomes, stage II profits are always:

$$\begin{aligned}\Pi_P^{ne} &= \frac{t}{2} \\ \Pi_C^{ne} &= S\end{aligned}$$

Proof of Lemma 6.1. As noted in the text, if the content provider multihomes, platforms realize the same stage II payoffs as if neither had the content and they split the market. The content provider thus sells to all users and will set $p_C = S$.

Consider now the case in which the content provider is exclusive to platform A. In stage II.2., the consumer demand faced by the content provider D_C is:

$$\begin{cases} \frac{1}{2} + \frac{S+P_B-P_A-p_C}{2t} & \text{if} \quad p_C \leq S \\ 0 & \text{if} \quad p_C > S \end{cases}$$

Thus, the profit maximizing p_C as a function of P_A, P_B is:

$$p_C(P_A, P_B) = \min\left(S, \frac{t + S + P_B - P_A}{2}\right) \tag{6.2}$$

The two platforms take this into account when they set their prices in stage II.1. Platform A sets P_A to maximize:

$$P_A \frac{1}{2t}\left(t + P_B - P_A + S - \min\left(S, \frac{t + S + P_B - P_A}{2}\right)\right) \tag{6.3}$$

whereas B sets P_B to maximize:

$$P_B \frac{1}{2t}\left(t + P_A - P_B - S + \min\left(S, \frac{t + S + P_A - P_B}{2}\right)\right) \tag{6.4}$$

We proceed as follows: i) determine the best response functions $P_A(P_B)$ and $P_B(P_A)$ ii) determine the possible equilibria for different values of S and t. The only complication comes from the fact that we need to take into account the kinks in the consumer demand functions for the two platforms.

Using the expressions derived in the text, profits for platform A are:

$$\Pi_A = \begin{cases} P_A \frac{1}{4t}(t + P_B + S - P_A) = \Pi_A^r(P_A) & \text{if} \quad P_A \geq t - S + P_B \\ \\ P_A \frac{1}{2t}(t + P_B - P_A) = \Pi_A^l(P_A) & \text{if} \quad P_A \leq t - S + P_B \end{cases}$$

Taking the derivatives of the two expressions ($\Pi_A^r(P_A)$ and $\Pi_A^l(P_A)$) and evaluating them at $P_A = t - S + P_B$, we have:

- if $P_B \leq 3S - t$ then $\Pi_A^r(P_A)$ is maximized by $P_A = \frac{t+S+P_B}{2}$
- if $P_B \geq 3S - t$ then $\Pi_A^r(P_A)$ is maximized by $P_A = t - S + P_B$
- if $P_B \leq 2S - t$ then $\Pi_A^l(P_A)$ is maximized by $P_A = t - S + P_B$
- if $P_B \geq 2S - t$ then $\Pi_A^l(P_A)$ is maximized by $P_A = \frac{t+P_B}{2}$

Thus:

- If $P_B \leq 2S - t$ platform A profits $\Pi_A(P_A)$ are maximized by $P_A = \frac{t+S+P_B}{2}$
- If $P_B \geq 3S - t$ platform A profits $\Pi_A(P_A)$ are maximized by $P_A = \frac{t+P_B}{2}$

When P_B is in the intermediate region $(2S-t, 3S-t)$, the maximum attained by Π_A^r is $\frac{1}{16t}(t+S+P_B)^2$ (for $P_A = \frac{t+S+P_B}{2}$) and the maximum attained by Π_A^l is $\frac{1}{8t}(t+P_B)^2$ (for $P_A = \frac{t+P_B}{2}$). The latter is higher if and only if $P_B > (\sqrt{2}+1)S - t \approx 2.4142S - t$.

We have therefore:

$$\arg\max_{P_A} \Pi_A(P_A) = \begin{cases} \frac{t+S+P_B}{2} & \text{if} \quad P_B \leq (\sqrt{2}+1)S - t \\ \\ P_A = \frac{t+P_B}{2} & \text{if} \quad P_B > (\sqrt{2}+1)S - t \end{cases}$$

Similarly:

$$\Pi_B = \begin{cases} P_B \frac{1}{2t}(t + P_A - P_B) = \Pi_B^r(P_B) & \text{if} \quad P_B \geq S - t + P_A \\ \\ P_B \frac{1}{4t}(3t - S + P_A - P_B) = \Pi_B^l(P_B) & \text{if} \quad P_B \leq S - t + P_B \end{cases}$$

implying:

- if $P_A \leq 5t - 3S$ then $\Pi_B^l(P_B)$ is maximized by $P_B = S - t + P_A$
- if $P_A \geq 5t - 3S$ then $\Pi_B^l(P_B)$ is maximized by $P_B = \frac{3t-S+P_A}{2}$
- if $P_A \leq 3t - 2S$ then $\Pi_B^r(P_B)$ is maximized by $P_B = \frac{t+P_A}{2}$
- if $P_A \geq 3t - 2S$ then $\Pi_A^l(P_A)$ is maximized by $P_B = S - t + P_A$

We have:

$$5t - 3S \geq 3t - 2S \iff 2t \geq S$$

Assume first that $S \leq 2t$. Then:

$$\arg\max_{P_B} \Pi_B(P_B) = \begin{cases} \frac{t+P_A}{2} & \text{if} & P_A \leq 3t - 2S \\ \\ S - t + P_A & \text{if} & 3t - 2S < P_A < 5t - 3S \\ \\ \frac{3t-S+P_A}{2} & \text{if} & 5t - 3S \leq P_A \end{cases}$$

If on the other hand $S > 2t$ then $5t - 3S < 0$ and $3t - 2S < 0$. Therefore, since

$P_A \geq 0$ necessarily:

$$\arg\max_{P_B} \Pi_B \left(P_B\right) = \frac{3t - S + P_A}{2} \text{ if } S > 2t$$

There are consequently 6 possible equilibria. Let us analyze each of them in turn:

1) $P_A = \frac{t+P_B}{2}$ and $P_B = \frac{t+P_A}{2}$, which is equivalent to:

$$P_A = P_B = t$$

This equilibrium exists if and only if $t > (\sqrt{2}+1)S - t$ and $t \leq 3t - 2S$, which is equivalent to:

$$S \leq 2(\sqrt{2}-1)t \approx 0.8284t$$

2) $P_A = \frac{t+P_B}{2}$ and $P_B = S - t + P_A$, leading to:

$$P_A = S$$

$$P_B = 2S - t$$

The existence of this equilibrium requires $2S - t > (\sqrt{2}+1)S - t$, which is impossible.

3) $P_A = \frac{t+P_B}{2}$ and $P_B = \frac{3t-S+P_A}{2}$, leading to:

$$P_A = \frac{5t}{3} - \frac{S}{3}$$

$$P_B = \frac{7t}{3} - \frac{2S}{3}$$

This equilibrium exists either if $\frac{7t}{3} - \frac{2S}{3} > 2.4142S - t$ and $\frac{5t}{3} - \frac{S}{3} \geq 5t - 3S$ or if $\frac{7t}{3} - \frac{2S}{3} > (\sqrt{2}+1)S - t$ and $S \geq 2t$. It is easily verified that none of these two pairs of conditions can ever be satisfied.

4) $P_A = \frac{t+S+P_B}{2}$ and $P_B = \frac{t+P_A}{2}$, leading to:

$$P_A = t + \frac{2S}{3}$$

$$P_B = t + \frac{S}{3}$$

This equilibrium exists if and only if $t+\frac{S}{3} \leq (\sqrt{2}+1)S - t$ and $t+\frac{2S}{3} \leq 3t-2S$, which is impossible.

5) $P_A = \frac{t+S+P_B}{2}$ and $P_B = S - t + P_A$, leading to:

$$P_A = 2S$$

$$P_B = 3S - t$$

The existence of this equilibrium requires $3S - t \leq (\sqrt{2}+1)S - t$, which is impossible.

6) $P_A = \frac{t+S+P_B}{2}$ and $P_B = \frac{3t-S+P_A}{2}$, leading to:

$$P_A = \frac{5t}{3} + \frac{S}{3}$$

$$P_B = \frac{7t}{3} - \frac{S}{3}$$

This equilibrium exists if and only if $\frac{7t}{3} - \frac{S}{3} \leq (\sqrt{2}+1)S - t$ and $\frac{5t}{3} + \frac{S}{3} \geq 5t - 3S$ or if $\frac{7t}{3} - \frac{S}{3} \leq (\sqrt{2}+1)S - t$ and $S \geq 2t$. The first pair of conditions is equivalent to $S \geq 5(3\sqrt{2}+4)t \approx 1.2132t$ and the second one to $S \geq 2t$. Therefore this equilibrium exists if and only if $S \geq 5(3\sqrt{2}+4)t$.

Thus, only equilibrium candidates 1) and 6) can exist. In addition, note that in both of these equilibria, the best response function $P_B\,(P_A)$ crosses $P_A\,(P_B)$ from above in a (P_A, P_B) plane, which ensures stability.

Using (6.2), we have $p_C = \min\left(S, \frac{S+t}{2}\right) = S$ when $S \leq 0.8284t$ (equilibrium 1)) and $p_C = \min\left(S, \frac{5t+S}{6}\right) = \frac{5t+S}{6}$ when $S \geq 1.2132t$ (equilibrium 6)).

Finally, the profit expressions in the text are directly obtained by plugging the expressions of P_A, P_B and p_C into (6.3) and (6.4) above. □

□

Proof of Corollary 3.4. When exclusivity is efficient and occurs under content affiliation (for values of $S \in \left[\frac{10}{7}t, \frac{1}{5}(35 - 12\sqrt{5})t\right]$), the stage I equilibrium involves each platform offering a transfer:

$$T_A^e = \Pi_P^{e+} - \Pi_P^{e-} = \frac{t}{2}\left(\left(\frac{5\sqrt{2}}{6} + \frac{S\sqrt{2}}{6t}\right)^2 - \left(\frac{7\sqrt{2}}{6} - \frac{S\sqrt{2}}{6t}\right)^2\right) = \frac{2}{3}(S-t)$$

and the content affiliates with one platform exclusively. Recall that when the content was purchased outright, the transfer necessary to induce exclusivity was $\frac{2}{3}S$ and exclusivity was always efficient. However, here content is acquired exclusively only for sufficiently low S and at lower transfer $\frac{2}{3}(S-t)$. Since Π_P^{e-} (the profits realized by each platform under exclusivity in Stage II) is higher under affiliation than under outright sale, the platforms would prefer to affiliate as opposed to buying a piece of content outright. The content provider, however, obtains total Stage I and Stage II payoffs of $\frac{2}{3}S$ if it sells outright, and $\frac{2}{3}(S-t)+\Pi_C^e$ if it maintains control rights. A content provider, thus, will prefer to affiliate than sell outright as long as $S \geq (4\sqrt{3}-5)t \approx 1.93t$. Consequently, a content provider would choose (if it could) to sell its content outright instead of affiliating when exclusivity is efficient under affiliation, i.e. when $S \in \left[\frac{10}{7}t, \frac{1}{5}(35-12\sqrt{5})t\right]$.

When multihoming occurs under content affiliation ($S \in \left[\frac{1}{5}(35-12\sqrt{5})t, 3t\right]$), equilibrium transfers are

$$T^{ne} = \Pi_C^e + \Pi_P^{e+} - \Pi_C^{ne} - \Pi_P^{ne} = \frac{t}{2}\left[\frac{13}{12} - \frac{14S}{12t} + \frac{S^2}{12t^2}\right]$$

Platform j's profits are:

$$\Pi_C^{ne} + 2\Pi_P^{ne} - \Pi_C^e - \Pi_P^{e+} = \frac{t}{2}\left[\frac{14S}{12t} - \frac{1}{12} + \frac{S^2}{12t^2}\right]$$

and the content provider's profits are:

$$2\Pi_C^e - \Pi_C^{ne} + 2\left(\Pi_P^{e+} - \Pi_P^{ne}\right) = \frac{t}{2}\left[\frac{13}{6} - \frac{S}{3t} + \frac{S^2}{6t^2}\right]$$

Recall again that under outright sale, exclusivity always arises at a transfer of $\frac{2}{3}S$, the platforms make $\frac{t}{2}\left(1-\frac{S}{3t}\right)^2$ and the content provider makes $\frac{2}{3}S$. Straightforward numerical comparisons show that the platforms prefer to affiliate if and only if $7\frac{S^2}{t^2} - 66\frac{S}{t} + 39 \leq 0$, which is equivalent to $S \in [0.633t, 8.795t]$. The content provider prefers the affiliation mode if and only if $\frac{S^2}{t^2} - 10\frac{S}{t} + 13 \geq 0$, which is never true when $S \in \left[\frac{1}{5}(35-12\sqrt{5})t, 3t\right]$. □

Proof of Proposition 4.2. As in proposition 2.1, clearly an equilibrium with exclusivity always exists.

Assume $\{(r_j^{ne}, T_j^{ne}, r_j^e, T_j^e)\}_{j\in\{A,B\}}$ is an equilibrium whereby C multihomes.

Then C receives utility

$$U \equiv \Pi_C^{ne}(r_A^{ne}, r_B^{ne}) + T_A^{ne} + T_B^{ne} = \Pi_C^e(r_j^e) + T_j^e \geq 0$$

where the equality must hold for all j since if this were not the case, either A or B could profitably deviate by reducing T_i^{ne}.

The following three conditions must hold as well:

$$r_j^{ne} = r_j^{ne*} \equiv \arg\max_{r_j^{ne'}} \{\Pi_j^{ne}(r_j^{ne'}, r_{-j}^{ne}) - T_j^{ne}\} = \arg\max_{r_j^{ne'}} \{\Pi_j^{ne}(r_j^{ne'}, r_{-j}^{ne}) + \Pi_C^{ne}(r_j^{ne'}, r_{-j}^{ne})\}$$

which is simply the equilibrium profit maximizing condition for each platform, substituting in the first constraint for T_j^{ne};

$$\Pi_B^{ne}(r_A^{ne}, r_B^{ne}) - T_B^{ne} \geq \Pi_B^{e-}(r_A^e)$$

otherwise B can profitably deviate by refusing to contract with C (i.e., set $T_B^{ne} = -\infty$); and:

$$\Pi_A^{ne} - T_A^{ne} \geq \max_{r_A^{e'}} \{\Pi_A^{e+}(r_A^{e'}) + \Pi_C^e(r_A^{e'}) - U\}$$

or A could profitably deviate by offering a new contact $(r_A^{e'}, T_A^{e'})$ with $T_A^{e'} = U - \Pi_C^e(r_A^{e'})$ which would induce C to be exclusive.

Let $r_A^{e*} = \arg\max_{r_A^{e'}} \{\Pi_A^{e+}(r_A^{e'}) + \Pi_C^e(r_A^{e'})\}$. Adding the previous two inequalities, substituting in the definition of U, and rearranging yields the following necessary inequality:

$$\Pi_A^{ne}(r_A^{ne*}, r_B^{ne*}) + \Pi_B^{ne}(r_A^{ne*}, r_B^{ne*}) + \Pi_C^{ne}(r_A^{ne*}, r_B^{ne*}) \geq \Pi_A^{e+}(r_A^{e*}) + \Pi_B^{e-}(r_A^{e*}) + \Pi_C^e(r_A^{e*})$$

which is the condition in the text.

To show that this condition is sufficient for a multihoming equilibrium to exist, note that the equilibrium royalty rates are already provided by $\{r_j^{e*}, r_j^{ne*}\}_{j\in\{A,B\}}$. Allowing the first, third, and fourth inequalities in the proof to bind allows for the construction of the equilibrium lump sum transfers $\{T_j^e, T_j^{ne}\}_{j\in\{A,B\}}$. □

Proof of Proposition 4.3. C can induce exclusivity and get the highest payment by setting $T_A = \{\Pi_P^{e+} - \Pi_P^{e-}, -\infty\}, T_B = \{\Pi_P^{e+} - \Pi_P^0 - \varepsilon, -\infty\}$. This will induce both platforms A, B to accept the contracts, and C will be exclusive with A.

C can induce multihoming subject to

$$\begin{aligned} \Pi_C^{ne} + T_i^{ne} + T_j^{ne} &\geq \Pi_C^e + T_i^e \geq 0 \; \forall i \\ \Pi_P^{ne} - T_i^{ne} \geq \Pi_P^{e-} \; \forall i \end{aligned}$$

The first equation is the (IC) constraint on C (otherwise C would prefer to be exclusive); the second is the (IR) constraint on platforms. Consequently, the highest C can set transfers are $T_i^{ne} = \Pi_P^{ne} - \Pi_P^{e-}$, and to do so C sets $T_i^e \leq \Pi_C^{ne} - \Pi_C^e + 2(\Pi_P^{ne} - \Pi_P^{e-})$.

Multihoming will an equilibrium if total profits under multihoming are higher than exclusivity; exclusivity will be equilibrium under reverse. Computing C's profits yields the result. □

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