Exclusivity and Control*

Andrei Hagiu[†] Robin S. Lee[‡]

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Abstract

We model competition between content distributors (platforms) for content providers, and show that whether or not content is exclusive or "multihomes" depends crucially on whether or not content providers maintain control over their own pricing to consumers: if content providers sell their content outright and relinquish control, they will tend to be exclusive; on the other hand, if content providers maintain control and only "affiliate" with platforms, then multihoming is sustainable in equilibrium. We show that the outcome under affiliation depends on the tradeoff between platform rent extraction (which increases in exclusivity) and content rent extraction (which increases in multihoming), and demonstrate that the propensity for exclusivity can be increasing, decreasing, or even non-monotonic in content quality. Finally, if a content provider internalizes the effect of its own price on platform demand, we prove that a platform that already has exclusive access to content may prefer to relinquish control over content pricing to the content provider in order to reduce price competition at the platform level.

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[†]Harvard Business School, contact: ahagiu@hbs.edu.

[‡]Stern School of Business, New York University, contact: rslee@stern.nyu.edu.

1 Introduction

In the modern economy, consumers join a variety of "platforms" – including distribution channels (e.g., online music services or satellite or cable TV providers) and hardware devices (e.g., DVD players, videogame consoles, or Windows-based PCs) – in order to access or utilize music, movies, computer software, and other forms of media or "content." One of the primary means by which platforms differentiate themselves and compete for consumers is through the acquisition of premium or high-quality content. For example, both satellite television provider DirecTV and satellite radio provider Sirius-XM have exclusive content, such as broadcast rights to the NFL, that their cable television or terrestrial radio competitors do not. However, in the video game industry, most video game publishers have the vast majority of their hit games present on all major videogame consoles; one such example is *Electronic Arts*' Madden NFL videogame series. One major difference between these two settings is that although pricing to the consumer for individual television and radio content is often dictated by the platform, videogame publishers set prices for their own games.

Indeed, there is tremendous variance across industries and platforms along two dimensions: (i) whether content is exclusive to one platform or present on multiple platforms; and (ii) whether "control rights" over certain strategic variables related to consumer content distribution – such as advertising, marketing, and pricing – remain with content providers or are transferred to the platform. Our paper establishes the connection between these two dimensions, and is the first to analyze how the propensity for exclusivity in platform industries is influenced by who maintains such control rights over content pricing.[1] In doing so, we extend traditional upstream-downstream vertical contracting frameworks to a platform environment. The crucial difference is that whereas in standard vertical settings, after upstream and downstream firms contract only downstream parties have any strategic actions left to take;[2] in a platform environment, after contracting *both* upstream content providers *and* downstream platforms may choose prices and directly influence consumer behavior.

In our baseline model, we study a two-stage game between two platforms and a continuum of content providers. In the first stage, platforms compete for content providers by offering lump-sum transfers contingent on whether content providers join exclusively or multihome, and content providers simultaneously decide which platform(s) to join. In the second stage, firms engage in price competition for consumers. Our analysis distinguishes between two polar forms of contracting between platforms and content providers: (i) "outright sale" of content, in which platforms obtain control over both pricing and all revenues from content

[1] Our analysis also applies to other strategic choices.

[2] For instance, once an upstream manufacturer has set its wholesale price and sold its product to a downstream retailer, it typically no longer has influence over the final price charged to a consumer.

sales in the second stage;[3] or (ii) "affiliation" of content, in which content providers set their own prices and keep revenues from content sales in the second stage, regardless of whether they contract with one or both platforms.

We first prove that the allocation of content across platforms (i.e., how many are exclusive and how many multihome) in the first stage of this game is the one that maximizes industry profits *subject to the second stage pricing game*. We then contrast the two different allocations of control rights. When content is sold outright, we prove that content providers will all join the same platform exclusively in equilibrium: if content providers multihomed, there would be less differentiation among platforms, and economic value created by the presence of content onboard each platform would be competed away to consumers; as a result, exclusivity is the outcome which maximizes industry surplus. However when content affiliates, we prove that an equilibria where all content multihomes also exists. Whether exclusivity or multihoming prevails under affiliation depends fundamentally on the extent to which content providers are able to extract consumer surplus created by their content. If content providers' rent-extraction power is low (e.g., consumer demand is highly elastic with respect to content pricing), then the scope for vertical differentiation between platforms through exclusivity is high *and* the opportunity cost incurred by exclusive content providers (i.e., forgoing sales to consumers of the rival platform) is low; hence, exclusivity prevails. Conversely, if content providers' rent extraction power is high, the scope for platform vertical differentiation from content is small and the opportunity cost for content providers of being exclusive is high; thus, multihoming emerges as the equilibrium outcome.

We then extend our analysis to consider the case of a single "large" content provider, which is representative of situations where platforms compete for a "hit" piece of non-substitutable content. The structure of the two-stage game between platforms, content providers and consumers is unchanged, but the key difference relative to the baseline setting is that, under affiliation, the content provider now internalizes the effect of its own price on consumer demand for each platform.[4] While exclusivity remains the only possible outcome when content is sold outright, the analysis of the affiliation case becomes significantly more complex. We show that if platforms price before an exclusive content provider, the content provider can serve as a "buffer" and soften price competition among platforms as platform and content prices become strategic substitutes. This effect in turn can induce exclusivity under affiliation in circumstances in which multihoming would prevail with multiple "small" content providers.

[3] This scenario is similar to the standard vertical contracting settings; furthermore, exclusivity in this case can also be interpreted as vertical integration.

[4] With a continuum of content providers, each are sufficiently "small" so that they do not internalize the effect of their pricing (and other actions) on platform demand.

Accounting for these strategic pricing interactions between platforms and content providers allows us to address a richer set of issues, which to the best of our knowledge have not been previously addressed. For example, we prove that platforms with exclusive access to content may choose to relinquish control over both content pricing *and* the associated cash flows (while maintaining exclusivity) in order to increase platform profits. This is contrary to standard double-marginalization results in the vertical contracting and complementary pricing literature, which show that internalizing price setting via integration or other forms of coordination is generally profit-enhancing. In our setting, by giving up control over content pricing, a platform is in effect committing to relax price competition with its rival platform. The competitive pressure is "unloaded" onto the (now independent) content provider, which responds to increases in platform prices by decreasing its own price.

In the introductory examples of the video game industry and satellite radio and television, the differences in forms of pricing are clear: satellite radio and television users are charged monthly subscription fees for access, and content providers do not charge users for each piece of content they consume – consequently, our model predicts that premium "hit" content will tend to be exclusive. However, as videogame publishers set their own prices independently of the platform, our model predicts it is more likely that high-quality games will multihome.[5] Indeed, given that institutional issues may prevent certain forms of pricing from being practical in certain situations,[6] 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 itself.

Related Literature

Our analysis parallels and extends work on a single manufacturer contracting for representation with 2 retailers (e.g., Hart and Tirole (1990), O'Brien and Shaffer (1992), McAfee and Schwartz (1994)), as one can interpret platforms as "retailers" and content providers as "manufacturers" of content. In addition to considering multiple content providers, we study a novel, platform setting, which differs in several important respects from the vertical contracting literature. First, platforms are not the final end-users of the content and instead compete in a "downstream" market for consumers.[7] Second, whereas in the standard verti-

[5]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.

[6]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.

[7]Although Fumagalli and Motta (2006) study the role of downstream product competition on exclusive dealing in standard vertical settings, they do not allow upstream firms (our content providers) to price

cal contracting literature the "upstream" firm typically has all the bargaining power, in our setting "downstream" platforms are the ones bidding and competing for content; we accommodate this using an adapted version of the bargaining game from Bernheim and Whinston (1998) between an upstream and two downstream firms. 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 under content affiliation.

Our paper is also related to the literature on " two-sided markets." Although this literature analyzes platform markets (c.f., Rochet and Tirole (2006)), its focus to date has mainly been on platform pricing, and on settings in which only platforms act strategically, while all other sides of the market are price-takers. In contrast, by focusing on the determinants of content exclusivity, we analyze a different issue; furthermore, not only do we allow for one side of the market (content providers) to also be strategic, but we also allow platforms to offer exclusivity-contingent contracts to content providers.

Finally, our distinction between outright sale versus affiliation is also made in Hagiu (2007). However, that paper focuses on the case of a monopoly platform and examines other tradeoffs between these two modes of intermediation from the perspective of the platform owner: outright sale ("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, affiliation ("two-sided platform" mode) is preferred when seller investment incentives are important or when there is asymmetric information regarding seller product quality.[8]

The remainder of the paper is organized as follows. The next section lays out the basic structure of our model, which will be constant throughout the paper. In section 3 we analyze the version of the model with two platforms and a continuum of N content providers. Section 4 focuses on the case with two platforms and a single content provider. Section 5 concludes.

2 Model

Throughout the paper we study a two-stage game in which two symmetric platforms A and B compete for access to content providers. In section 3 there is a continuum of atomless content providers with total mass N; in section 4 there is a single content provider. In both cases, each content provider may select to join only one platform exclusively, or can

directly to consumers.

[8]Stennek (2006) studies the relationship between content quality and exclusivity in a platform environment, but assumes the content provider never has control over any strategic variable.

multihome and join both platforms. Consumers may join at most one platform, and can purchase content from a particular content provider only if that content provider has joined the same platform.

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 pricing of its content as well as over any cash flows resulting from its sale to users in exchange for a fixed lump-sum payment from the platform provider(s). In this case, the setup is similar to Hart and Tirole (1990), whereby a content provider can be thought of as a manufacturer who can sell to both retailers (platforms) or just one; once the decision is made, the content provider no longer has any strategic decisions left to make. The second way in which a content provider may join a platform is through *affiliation*: the content provider retains control over content pricing and keeps revenues from selling content, but may also obtain (or pay) a fixed fee to the platform(s) it joins. The affiliation scenario is new and does not have a parallel in the existing literature on exclusive contracting. For the purposes of our analysis, we assume that whether content providers join platforms via outright sale or affiliation is exogenously given (e.g., it may determined by industry-specific institutional or technological conditions), and do not explicitly model its determination in this paper.

The overall timing of the game is broken down into two main stages:

I. Platforms A and B compete for access to content providers by making simultaneous monetary offers/demands (either for outright purchase or for affiliation); content providers then choose which platform(s) to join.

II. Under outright sale, platforms simultaneously set their access prices for consumers *and* for the content each has acquired in stage I. Under affiliation, platforms first simultaneously set their access prices for consumers; each content provider chooses its own price only *after* the platforms have announced theirs.[9] Finally, under either outright sale or affiliation, consumers choose which platform to join and whether or not to purchase content.

2.1 Stage II: Pricing Game

Working backwards, we begin by describing the nature of price competition and consumer demand in Stage II. We assume consumers are distributed uniformly along a unit interval Hotelling segment with linear transportation costs, which we normalize to 1. The two

[9] We assume content prices after platforms since in many of the industries we have in mind, the platform typically is the Stackelberg leader on pricing. See, e.g., Hagiu (2006) for a discussion of how this holds in the video game industry.

platforms are located at the two extreme points. The utilities for a consumer "located" at $\theta \in [0,1]$ from purchasing access to only platform A or B (but without consuming any content) are given by $u_A(\theta) = V - \theta - P_A$ or $u_B(\theta) = V - (1-\theta) - P_B$, where P_A and P_B are the access prices charged by the two platforms and V represents the stand alone utility generated from access to a platform (e.g., derived from the platform itself, and may include any pre-existing content).

For tractability, we assume content providers sell independent products so that there is no competition (substitutability) nor complementarities between different pieces of content on the same platform.[10] We denote by $s(p)$ the *net* surplus derived by a consumer from a piece of content priced at p: e.g., if consumer demand for content is elastic and equal to $d(p)$, then $s(p) \equiv \int_p d(\rho)\, d\rho$; if it is inelastic, then $s(p) = \max\{v - p, 0\}$, where v represents the surplus derived from a piece of content by all consumers. Also, let $\pi(p) \equiv pd(p)$ denote the profit per platform consumer obtained by a content provider pricing at p, and let $w(p) \equiv s(p) + \pi(p)$ the total *gross* consumer surplus created by one piece of content.

Respective demands for the two platforms are:

$$\begin{aligned} D_A &= \frac{1}{2} + \frac{N_A s(p_A^C) - N_B s(p_B^C) + P_B - P_A}{2} \\ D_B &= \frac{1}{2} + \frac{N_B s(p_B^C) - N_A s(p_A^C) + P_A - P_B}{2} \end{aligned}$$

where $\left(p_A^C, p_B^C\right)$ are the prices of content on platforms A and B,[11] and (N_A, N_B) represent the respective numbers (or masses) of content providers onboard each platform, with $N \leq N_A + N_B \leq 2N$. We assume platforms and content providers have 0 marginal costs.

In all versions of our model, Stage II profits for platforms and content providers will depend solely on the difference between the respective numbers of content providers on each platform, denoted ΔN. Let:

- $\Pi_P(\Delta N)$ denote the Stage II profits for a platform when it has ΔN more content providers than its rival (ΔN can be negative);
- $\Pi_C^e(\Delta N)$ denote the Stage II profits for a content provider when it is exclusive with a platform which has ΔN more content providers than its rival;
- $\Pi_C^m \equiv \Pi_C^e(\Delta N) + \Pi_C^e(-\Delta N)$ denote the Stage II profits for a content provider who

[10] In the online appendix, we prove that this paper's main insights and results carry over to a setting where platforms compete for two substitutable content providers.

[11] Under outright sale, each platform sets the same price for all the (identical) content pieces it has obtained in Stage I. Under affiliation, we will always focus on the symmetric equilibrium in which all content providers on the same platform set the same price.

multihomes (i.e. joins both platforms).[12]

We stress that these profits only represent payments collected from consumers in Stage II; to obtain total profits for each industry participant, payments made between platforms and content providers in Stage I must also be considered.

2.2 Stage I: Bargaining Game

To model the Stage I bargaining process, we use a " bidding game" which extends the one developed in Bernheim and Whinston (1998) and in which platforms make simultaneous take-it-or-leave-it offers consisting of lump-sum fixed transfers to content providers. The precise timing for Stage I is as follows:

I. 1. Platforms A and B make non-discriminatory offers (T_A^e, T_A^m) and (T_B^e, T_B^m) to all content providers, where $T_i^e, i \in \{A, B\}$ is a lump-sum payment from platform i to a content provider in exchange for exclusivity, and T_i^m is the transfer when a content provider multihomes.

I. 2. Content providers simultaneously choose which platform(s) to join. If a content provider joins platform i exclusively, it will receive a total payoff of $T_i^e + \Pi_C^e(N_i - N_j)$ once subsequent Stage II profits are accounted for; if the content provider joins both platforms, it receives $T_A^m + T_B^m + \Pi_C^m$. Each platform i receives $\Pi_P(N_i - N_j) - N_i^e T_i^e - N^m T_i^m$, where N_i^e is the number of content providers that join i exclusively, and N^m the number of content providers that multihome. (Note $N_i = N_i^e + N_i^m$).

We assume that if content providers are indifferent between platforms, they always join A. Furthermore, to deal with the potential multiplicity of Nash equilibria among content providers in Stage I.2., we will utilize the "strong equilibrium" refinement (Aumann, 1959), and consider only equilibria which are coalitionally stable among content providers. This implies that content providers can coordinate on the most efficient equilibrium (from their joint perspective) for any given set of transfers.[13]

As we will show in the following sections, this particular bargaining protocol ensures that the allocation of content which maximizes industry surplus *subject to Stage II price*

[12] We assume there are no multihoming costs for content providers.

[13] Lee (2008) analyzes a similar platform bilateral contracting game between 2 platforms and N symmetric firms, and uses similar reasoning to justify the use of Coalition Proof Nash Equilibrium (Bernheim, Peleg, and Whinston, 1987) as a refinement for content provider actions. Lee (2008) focuses on the role of contingent versus non-contingent contracts in sustaining inefficient "tipping" or interior equilibria; importantly, his analysis does not model the second stage pricing game, instead taking payoffs as primitives, and does not allow for firms to multihome.

competition between content providers and platforms is always an equilibrium outcome. Our objective is *not* to build a general model of multilateral bargaining with externalities (c.f. Segal (1999), Segal and Whinston (2003), de Fontenay and Gans (2007)). Instead, we wish to focus on how the (exogenous) allocation of control rights over Stage II content pricing affects the resulting industry structure after Stage I. Inefficiencies generated in the Stage I bargaining game are clearly sensitive to assumptions governing agent beliefs, the transfer space, and the extensive form of the game; we wish to abstract from such frictions in the analysis since they are not the focus of our results.[14]

3 N content providers and no strategic interactions

In this section we analyze the outcome of the game described above assuming there is a continuum of mass N content providers so that each provider is small (atomless) and does not internalize the effect of its individual pricing decision on consumer demand for platforms.[15]

3.1 Equilibrium Analysis

We begin by analyzing stage II and distinguish between the two alternative ways in which content providers can join platforms.

Content Sells Outright

Under outright sale, only the platforms make strategic decisions and derive non-zero payoffs in Stage II. Platforms solve simultaneously:

$$\max_{P_i, p_i^C} \left\{ \left(P_i + N_i p_i^C\right) \left(\frac{1}{2} + \frac{P_j - P_i + \left(s(p_i^C)N_i - s(p_j^C)N_j\right)}{2} \right) \right\} \qquad i \neq j \in \{A, B\}$$

[14] Other papers have provided conditions under which the industry efficient outcome will result in different bargaining games: e.g., Prat and Rustichini (2003) provide conditions on the underlying payoffs to principals and agents which ensure an efficient outcome is an equilibrium in a bilateral contracting setting without externalities across agents; Bloch and Jackson (2007) provide necessary conditions on the richness of the transfer space to ensure a network formation game yields the efficient outcome (where links can be interpreted as a content provider supporting a platform).

[15] The results of this section would still hold if we assumed there are N distinct content providers and the following alternative Stage II timing: II.1. platforms set access prices; II.2. consumers decide which platform to join; II.3. content providers set prices; II.4. consumers decide whether or not to purchase content. This timing would then also imply that content providers do not internalize the impact of their own pricing on platform demand.

which is equivalent to:

$$\max_{\widetilde{P}_i, p_i^C} \left\{ \widetilde{P}_i \left(\frac{1}{2} + \frac{\widetilde{P}_j - \widetilde{P}_i + \left(w(p_i^C) N_i - w(p_j^C) N_j \right)}{2} \right) \right\} \qquad i \neq j \in \{A, B\}$$

Since $w(p)$ is maximized at $p = 0$ (marginal costs are zero), in equilibrium both platforms set $p_A^C = p_B^C = 0$ and obtain Stage II profits of $\Pi_P(N_A - N_B)$ for platform A and $\Pi_P(N_B - N_A)$ for platform B, where $\Pi_P(\Delta N) \equiv ((1 + (w(0)\Delta N)/3)^2)/2$. Content providers make 0 revenues in Stage II, and thus $\Pi_C^e = \Pi_C^m = 0$.

Content Affiliates

If content providers maintain control rights in Stage II, the profits of a single content provider are $p_i^C d\left(p_i^C\right) D_i$ when it is exclusive with platform $i \in \{A, B\}$ and charges price p_i^C, or $p_A^C d\left(p_A^C\right) D_A + p_B^C d\left(p_B^C\right) D_B$ if it multihomes and charges p_A^C and p_B^C. Given that they do not internalize the effect of their prices on platform demands, all content providers charge the monopoly price corresponding to $d(p)$:

$$p^m = \arg\max_p pd(p) = \arg\max_p \pi(p)$$

Therefore, in Stage II the two platforms solve simultaneously:

$$\max_{P_i} \left\{ P_i \left(\frac{1}{2} + \frac{P_j - P_i + s(p^m)\left(N_i - N_j\right)}{2} \right) \right\} \qquad i \neq j \in \{A, B\}$$

and obtain Stage II profits $\Pi_P(N_i - N_j)$, where $\Pi_P(\Delta N) \equiv ((1 + (s(p^m)\Delta N)/3)^2)/2$.

Profits for content providers affiliated exclusively with platform A are $\Pi_C^e(N_A - N_B)$ and for those affiliated exclusively with B they are $\Pi_C^e(N_B - N_A)$, where $\Pi_C^e(\Delta N) \equiv (\pi(p^m)/2)(1 + (s(p^m)\Delta N)/3)$.

Content providers who multihome obtain $\Pi_C^m \equiv \Pi_C^e(N_A - N_B) + \Pi_C^e(N_B - N_A) = \pi(p^m)$.

Outcome of Stage I Bargaining

With the expressions of Stage II payoffs in hand, let us now move back to stage I and determine the outcome of the bargaining game. The following proposition characterizes Stage I equilibrium outcomes *for both* outright sale and affiliation cases.

Proposition 3.1. *An equilibrium in which all content providers join platform A exclusively ($N_A = N$; $N_B = 0$) always exists. An equilibrium in which all content providers multihome*

($N_A = N_B = N$) exists if and only if:

$$N\Pi_C^m + 2\Pi_P(0) \geq N\Pi_C^e(N) + \Pi_P(N) + \Pi_P(-N) \tag{3.1}$$

There are no other possible equilibria.

The fact that exclusivity may always occur is an artifact of the modelling setup in Stage I: A or B can unilaterally eliminate the ability of content providers to multihome by setting $T^m = -\infty$ (i.e., asking content providers to pay an arbitrarily high sum). However, a multihoming equilibria will also be sustainable if (3.1) holds. The key reason for which only all-exclusive or all-multihoming equilibria are possible (for any transfers offered by the platforms) is that content providers' profits from exclusivity $\Pi_C^e(\Delta N)$ are strictly increasing in ΔN whereas profits from multihoming Π_C^m do not depend on ΔN.[16] Indeed, this implies that given any set of transfers offered by the platforms, content providers collectively and individually prefer either all to be exclusive with one platform or all to multihome; the strong equilibrium refinement insures that these are the only equilibrium outcomes.

As the following proposition illustrates, the necessary and sufficient condition for multihoming to be an equilibrium given by (3.1) has a particular interpretation:

Proposition 3.2. *If condition (3.1) holds, then total stage II industry profits (the sum of platforms' and content providers' profits) are maximized when all content providers multihome. Otherwise, they are maximized when all content providers join one platform exclusively.*

In a sense, these two propositions extend the first efficiency principle in Bernheim and Whinston (1998) to our setting: multihoming by content providers arises as an equilibrium outcome if and only if it maximizes total industry profits *subject to the Stage II pricing game*. For our analysis, we will assume that the industry structure that emerges from stage I will indeed be the one that maximizes industry profits; propositions 3.1 and 3.2 ensure that this allocation of content providers is always an equilibrium of the Stage I bargaining game. As mentioned before, one could sustain "inefficient" allocations of content providers in Stage I by assuming different bargaining games; our focus however is not on the specific bargaining game played in Stage I, but on how the equilibrium outcome changes (keeping

[16] Of course, these are direct consequences of our assumptions that: (i) content providers offer independent products and therefore do not compete against each other on the same platform and (ii) there is no market expansion on the consumer side. Introducing competition among content providers would make it possible to obtain intermediate allocations in Stage I (i.e., some content providers choose to be exclusive while some multihoming). As mentioned earlier, however, our focus is not on the nature of the equilibrium allocations per se, but on how they are affected by changes in control rights over content pricing.

constant the structure of the bargaining game) when the allocation of control rights between content providers and platforms is changed.

3.2 Impact of Control Rights on Industry Structure

First, consider the case when content is sold outright:

Proposition 3.3. *Under outright sale, all content providers join platform A exclusively.*

Proof. Under outright sale, condition (3.1) becomes $0 \geq (w(0)^2 N^2)/9$, which is never true. By proposition 3.1, all content is exclusive with platform A. □

This result is not surprising: since total Stage II industry profits are just the sum of platform profits, they are maximized when the vertical differentiation between platforms induced by the presence of content is highest, i.e., when $\Delta N = N$. This is irrespective of the shape of $d(p)$. Indeed, if some content providers were to multihome, they would contribute no competitive advantage for either one of the platforms, and therefore their value to industry profits would be 0 (it would be competed away to consumers). In other words, neither platform would be willing to pay a positive price for non-exclusive content.

Results change when content providers only affiliate with platforms and maintain control rights over their own pricing. Now total industry profits in Stage II include both platforms' and content providers' profits from pricing and selling to consumers. While vertical differentiation through content provider exclusivity still increases the sum of platforms' profits, exclusivity results in lower content provider profits as they can no longer sell to consumers of the rival platform.

Proposition 3.4. *Under affiliation, all content providers multihome in equilibrium if and only if:*

$$\frac{N}{t} \leq \frac{9\pi(p^m)}{s(p^m)\,(3\pi(p^m) + 2s(p^m))} \tag{3.2}$$

Otherwise, all content providers join platform A exclusively.

This condition follows directly by substituting the expression of Stage II profits into (3.1). Note that exclusivity is *more* likely (i.e. the condition above is *less* likely to hold) when $s(p^m)$ *increases* and $\pi(p^m)$ *decreases*. This is to be understood in the following way: $s(p^m)$ increases the scope for vertical differentiation between platforms (from consumers' perspective) through content exclusivity, which makes exclusivity more likely; by contrast, $\pi(p^m)$ increases the opportunity costs of exclusivity (forgone content provider profits), which makes multi-homing more likely.

To further explore the meaning of condition 3.2, consider the following examples.

Example 3.1. *If* $d(p) = q\,(1-p)$ *or* $d(p) = 1-p/q$ *(where* q *can be interpreted as a measure of content quality) then* $\pi(p^m) = q/4$ *and* $s(p^m) = q/8$*, so that multihoming prevails if and only if* $q \leq 18t/N$*, i.e. for small enough* q*.*

Example 3.2. *Suppose a fraction* $\lambda > 1/2$ *of consumers have valuation* $v_H(q) = \sqrt{2+q}$ *for content and a fraction* $1-\lambda$ *have valuation* $v_L(q) = \sqrt{1+q}$ *(again,* q *can be interpreted as a measure of quality). Then* $\pi(p^m) = \sqrt{1+q}$ *(increasing in* q*) and* $s(p^m) = \lambda\left(\sqrt{2+q} - \sqrt{1+q}\right)$ *(decreasing in* q*). Therefore condition (3.2) can be written* $q \geq q_0$*, so that multihoming prevails for large* q *and exclusivity prevails for small* q *– the opposite of the previous example.*

Example 3.3. *Third and finally, suppose all consumers value content at* $v > 0$*, so that* $d(p) = 1$ *if* $p \leq v$ *and* 0 *otherwise. Then* $\pi(p^m) = v$*,* $s(p^m) = 0$*, and multi-homing prevails.*

Condition (3.2) and these three examples make it clear that when content providers maintain control rights, the likelihood of exclusivity and the impact of content quality on this likelihood are crucially determined by the amount of consumer surplus that content providers are able to extract in Stage II, *relative to* how much is left to consumers. The surplus left to consumers creates vertical differentiation among platforms under exclusivity (which results in greater platform profits), and therefore tends to make exclusivity *more* likely. However, the surplus extracted by content providers makes exclusivity *less* likely by increasing the opportunity cost from exclusivity (i.e., content not being able to sell to other platform users). In the extreme case of example 3, when content providers are able to extract all the surplus they create from consumers, multi-homing is always the equilibrium outcome that maximizes industry profits since the presence of content providers cannot create any vertical differentiation between platforms.

This tradeoff is novel and only holds in the case when content providers maintain control rights; the previous literature on exclusive dealing had focused solely on the case in which content providers give up all control rights. Furthermore, this tradeoff is clearly robust to the introduction of substitutability (i.e. competition) or complementarities between content providers on the same platform. The formal treatment of these cases is significantly more cumbersome while only adding the (not particularly surprising) results that competition among content providers on the same platform tends to make exclusivity more likely, whereas complementarities would make the multihoming outcome more likely. Similarly, allowing for market expansion (e.g., by introducing hinterlands on both sides of the Hotelling segment) would tend to make exclusivity less likely. These extensions are treated and discussed in the online appendix.

4 Single Strategic Content Provider

Control rights have further, subtler effects when content providers internalize the impact of their pricing decisions on overall demand for platforms. To investigate these effects in the most tractable setting, we focus in this section on the case of a single content provider. We also focus on the simplest possible specification of consumer demand for content, by assuming it is inelastic: $d(p) = 1_{\{p \leq v\}}$ and $s(p) = \max\{v - p, 0\}$, with $v \leq 3$ in order to avoid complete tipping to one platform under content exclusivity. In other words, consumers purchase 1 unit of content as long as its price p is below their willingness to pay v. Recall from example 3.3 that with non-strategic content providers and inelastic demand for content, content providers always multihome under affiliation. As we will see, this is no longer the case here when the content provider internalizes the impact of its own price on consumer demand for a platform.

We refer to the single content provider as C and we maintain the same notation for platform and content provider profits in Stage II (of course, the actual expressions will be different from the case with N content providers). It is straightforward to extend proposition 3.1 for the Stage I bargaining outcome to the single content provider case:

Corollary 4.1. *An exclusive equilibrium in which the content provider joins only one platform always exists. A multihoming equilibrium exists if and only if:*

$$2\Pi_P(0) + \Pi_C^m \geq \Pi_P(1) + \Pi_P(-1) + \Pi_C^e(1) \tag{4.1}$$

Again, we will assume that multihoming will be the equilibrium outcome if and only if (4.1) holds; i.e., if and only if multihoming maximizes industry profits.[17]

4.1 Impact of Control Rights on Exclusivity

If the content provider sells its content outright, then the outcome will be the same as in the case of N content providers:

Proposition 4.2. *Under outright sale, the only equilibrium outcome is exclusivity.*

Again, the intuition is straightforward: if C multihomes, the benefits of having the content are completely competed away in Stage II by the platforms. Thus, aggregate gains to industry participants under exclusivity are strictly greater when the platforms are vertically

[17] In the online appendix, we show how this same result – the Stage I outcome maximizes industry profits subject to Stage II price competition– also holds in a related "offer game," where C makes the initial offers to the platforms, as well as in a setting in which platforms can use both fixed transfers and royalties.

differentiated through content exclusivity.[18] This directly parallels results with a single manufacturer and two retailers (Hart and Tirole (1990)). Furthermore, it is also interesting to note 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. Nonetheless, since the content provider is assumed to exist, there is no equilibrium where both platforms refuse to contract with the content provider.

In the case of content affiliation, market outcomes will be different from both the case when C sells its content outright and from the case with content affiliation but a continuum of content providers (c.f., the previous section). Recall that content exclusivity results in vertical differentiation among platforms and therefore allows them to extract higher profits from consumers, but at the same time it also results in forgone profits to content providers, who no longer can sell to the entire consumer market. As shown in example 3.3 however, with inelastic consumer demand for content and a continuum of content providers, the possibility for platform vertical differentiation disappears because content providers extract all consumer surplus from content. As a result, multihoming always prevails.

With a single strategic content provider under content affiliation, a new effect arises as C now internalizes the impact of its own price on platform demand. To see this generally, let D_i denote consumer demand for platform i and assume platform A has exclusive access to C. Let platform A's Stage II profits be denoted by $\Pi_A = P_A D_A(P_A, P_B, p_C(P_A, P_B))$, 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 $p_C(P_A, P_B) = \arg\max_{p_C} \{p_C D_A(P_A, P_B, p_C)\}$. For a general class of functional forms for D_A (including any linear demand model such as the one used in this paper), p_C and P_A are *strategic substitutes*: $\frac{\partial p_C}{\partial P_A} < 0$ (which follows since A and C are complements). The first order condition for profit maximization in P_A can be written:

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

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 there was a continuum of non-strategic content providers.

As a result of this new effect, we find that even with inelastic consumer demand for content, *both* exclusive *and* multihoming equilibria exist, and the likelihood of exclusivity is non-monotonic in the quality of content v:

Proposition 4.3. *There exist values* $\{v', v'', v'''\}$, $0 < v' < v'' < v''' < 3$, *such that if:*

- $v \leq v'$, *C will multihome in equilibrium;*

[18] In the online appendix, we show that multihoming can exist under outright sale with sufficient market expansion effects.

- *$v \in [v'', v''']$, C will affiliate exclusively with one platform in equilibrium;*
- *$v \geq v'''$, C will multihome in equilibrium.*

For low quality content, C sets $p_C = v$ regardless of its affiliation decision (exclusivity or multihoming) and the prices set by A or B; in this case, content exclusivity does not provide any competitive advantage to the platform that obtains it exclusively, and hence C always multihomes. 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; thus, C will also always multihome. However, for "mid-quality" content, C will affiliate exclusively with one platform.

The result that C can *ever* end up exclusive in equilibrium under affiliation crucially relies on the strategic interaction created when A and B set prices before C. Under exclusivity, A internalizes C's pricing best-response and will set a higher P_A than it would have had A bought C outright (since p_C and P_A are *strategic substitutes*); furthermore, 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. This "softening" of competition between platforms as a result of independent pricing by an exclusive C is comparable to the results in Fudenberg and Tirole (1984) and Bulow, Geanakoplos, and Klemperer (1985), and increases platform profits enough to offset the potential reduction in industry profits incurred by C not extracting surplus from consumers on the excluded platform.

One final observation is that this analysis implies that exclusive arrangements in platform industries with affiliated content may still harm consumer welfare despite raising industry profits: not only are certain consumers on the excluded platform foreclosed from accessing the content, but platforms can also sustain higher prices to consumers. Consequently, fierce bidding competition between platforms for content exclusivity (via stage I transfers) does not imply – nor should be mistaken for – fierce price competition for consumers.

4.2 Industry vs. Individual Profits

Using the computed profits for platforms and the content provider derived in the proofs or Proposition 4.2 and 4.3, it can be shown that total industry profits in equilibrium are higher under affiliation than under outright sale. However, it is not true that both platforms and content providers prefer this outcome once Stage I transfers are accounted for. 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 providers would not wish to acquire them.

Corollary 4.4. *Under the bidding game, for all $v \geq \frac{10}{7}$, platforms earn higher total equilibrium profits and the content provider earns lower total equilibrium profits under content affiliation than under outright sale.*

Though the content provider makes no Stage II profits and loses all future cash flow rights under outright sale, it still prefers this structure since it extracts larger lump sum payments during the Stage I bargaining game when platforms bargain for exclusivity. Furthermore, for high quality content, the content provider does not keep all of its Stage II profits under affiliation: both platforms extract payment in Stage I from the content provider in exchange for the right to join (i.e., $T^m < 0$).[19]

Our assumption that the the economic relationship between content providers and the platforms (outright sale or affiliation) is exogenously given can be motivated in at least two ways. First, it may be simply determined by industry-specific characteristics, e.g. technological limitations or high transaction costs of charging users for the consumption of an individual piece of content. Second, the terms of the relationship might exhibit path-dependence: they could have been determined historically by the preferences of whomever (platforms or content providers) possessed more bargaining power at a certain point in time, and subsequent changes in the nature of the relationship may be prevented by transaction or coordination costs.[20] Corollary 4.4 shows that the two types of agents have conflicting interests ex-ante regarding the allocation of control rights.

4.3 Licensing of Content

Another important and counterintuitive implication of our analysis concerns the desirability of platform vertical integration into content. If 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 any revenue losses incurred.

Corollary 4.5. *There exists $v^* < 3$ such that for $v \in (\frac{10}{7}, v^*)$, a platform carrying the content exclusively makes higher profits in Stage II when the content provider maintains control over*

[19] See proof of Corollary 4.4.

[20] E.g., 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 potentially greater bargaining power (the NFL or the video game console manufacturers) may have been able to select the nature of the relationship most beneficial to its own interests.

pricing (and keeps the associated profits) relative to a platform who buys the content outright. The excluded platform always makes higher Stage II profits when the content provider only affiliates with the rival platform and keeps control over pricing.

Thus, it is in the interest of *both* the exclusive and excluded platform to have the content provider independent – each platform can extract greater consumer surplus by increasing its own prices. This competition-softening 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. Indeed, 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.[21]

5 Concluding Remarks

This paper has analyzed the relationship between the allocation of control rights over content pricing and the propensity of content to be exclusive. In particular, we have distinguished between two cases – outright sale (where control rights over and revenues from content pricing are transferred to platforms) and content affiliation (where control rights and revenues remain with content providers) – and highlighted how market outcomes (multihoming or exclusivity) under these scenarios may differ from each other.

Under affiliation, we have shown that that the market outcome is determined by two key factors. First, as illustrated with a continuum of content providers in Section 3, when content providers are able to extract a *larger* fraction of consumer surplus, the scope for vertical differentiation between platforms through content exclusivity is *reduced* and the opportunity costs for content providers of being exclusive with one platform are *increased*. Both of these effects make multihoming more likely. Secondly, as shown in Section 4, a subtler effect arises when content providers internalize the impact of their prices on consumer demands for platforms. Then content providers may end up exclusive even in cases in which they would multihome if they were non-strategic. An important – and novel – implication of this insight is that a platform having gained exclusive rights to content may prefer to spin it off as an independent content provider and relinquish control over pricing and associated revenues in order to relax price competition with the rival platform.

In turn, our results imply that the question of why exclusivity occurs in certain platform

[21] See, e.g., Tirole (1988), Chapter 4.

industries and not in others cannot be answered without also accounting for how control rights over certain variables, including pricing and associated content cash flows, are distributed between platforms and content providers. As suggested in the introduction, content distribution systems such as satellite television and radio may be more likely to have exclusive content than hardware-software platforms such as videogame consoles since such content is typically priced and controlled by the platform itself.

We conclude with two potential extensions of our analysis. Throughout the paper, we have taken the allocation of control rights between content providers and platforms as exogenous. Although this allocation is oftentimes determined by institutional features of a given industry, it may also be strategically bargained over by platforms and content providers. In this regard, the preferences of platforms and content providers are in conflict: in our model when platforms make take-it-or-leave-it offers, platforms prefer outright sale whereas content providers prefer affiliation. A natural follow-up to our results would be to enrich our Stage I game by allowing platforms and content providers to also bargain over the allocation of control rights, perhaps by allowing platforms to make transfers contingent on who controls the price and associated cash flows from content.

Finally, 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 or distribution channels, and so forth. A promising avenue of future research would be investigate conditions under which devolving control over a given strategic variable to the content provider raises or lowers the profits of a platform carrying the content exclusively.

A Proofs

Proof of Proposition 3.1. The proof is comprised of the following three lemmas:

Lemma A.1. *Given any transfers* $\{(T_A^m, T_A^e), (T_A^m, T_A^e)\}$*, only two equilibrium allocations of content providers are possible: either all multihome or all are exclusive to one platform.*

Proof. If content is sold outright, then Stage II profits for content providers are 0 and therefore they choose which platform(s) to join based solely on transfers. Thus, all content providers make the same choice: all exclusive or all multihome (since we have assumed content coordinates on the same action if indifferent).

If content providers maintain control rights over their prices, then profits are $\Pi_C^m + T_A^m + T_B^m$ for those who multihome, $\Pi_C^e(N_A - N_B) + T_A^e$ for those who are exclusive with platform A and $\Pi_C^e(N_B - N_A) + T_B^e$ for those who are exclusive with platform B. Consider changing to the following allocation:

- If $\Pi_C^m + T_A^m + T_B^m \geq \max\{\Pi_C^e(N) + T_A^e, \Pi_C^e(N) + T_B^e\}$ then make all content providers multihome (i.e. $N_A = N_B = N$);
- otherwise, make all content providers exclusive with the platform offering the highest T_i^e, $i \in \{A, B\}$ (if $T_A^e = T_B^e$ then all content providers choose A).

Since $\Pi_C^e(\Delta N)$ is increasing in ΔN, this ensures that all content providers end up with (weakly) higher profits, therefore these are the only possible equilibrium allocations given the platform transfers offered. □

Lemma A.2. *An exclusive equilibrium in which all content providers joins platform A always exists.*

Proof. Let $T_A^m = T_B^m = -\infty$ (note indeed that either platform can unilaterally rule out multihoming) and $T_A^e = T_B^e = \frac{\Pi_P(N) - \Pi_P(-N)}{N}$. The following necessary and sufficient conditions for equilibrium are satisfied:

- Content provider incentive compatibility – content providers do not want to (all) switch to be exclusive with platform B or to multihome:

$$\Pi_C^e(N) + T_A^e \geq \Pi_C^e(N) + T_B^e \qquad \text{and} \qquad \Pi_C^e(N) + T_A^e \geq \Pi_C^m + T_A^m + T_B^m.$$

- Platform incentive compatibility – platform B does not want to slightly raise transfers to capture *all* content providers[22], and platform A does not wish to lower transfers

[22] It can be verified that even if we allowed platform B to raise T_B^e but offer it only to a limited number $N_B \leq N$ content providers, it would still be in its best interest to make the offer available to all content providers. Indeed, the minimum transfer T_B^e has to satisfy:$\Pi_C^e(2N^B - N) + T_B^e \geq \Pi_C^e(N) + \frac{\Pi_P(N) - \Pi_P(-N)}{N}$. This means that the maximum payoffs that platform B can obtain as a function of N_B are $\Pi_P(2N_B - N) - N_B\left[\frac{\Pi_P(N) - \Pi_P(-N)}{N} + \Pi_C^e(N) - \Pi_C^e(2N^B - N)\right]$. When the content is sold outright this expression is:$\frac{1}{2}\left(t + \frac{w(2N_B - N)}{3}\right)^2 - \frac{2wN_B}{3}$. When content providers maintain control rights, it is: $\frac{1}{2}\left(t + \frac{s(2N_B - N)}{3}\right)^2 - N_B\left(\frac{2s}{3} + \frac{\pi(N - N_B)}{3}\right)$. In both cases it is easily seen that the optimum is at $N_B = N$ or $N_B = 0$, which yield the same payoff.

slightly and receive no content providers:

$$\Pi_P(-N) \geq \Pi_P(N) - NT_A^e \qquad \text{and} \qquad \Pi_P(N) - NT_A^e \geq \Pi_P(-N)$$

Note that this proof is valid both when content providers maintain control rights and when they sell their content outright to the platforms. □

Lemma A.3. *An equilibrium in which all content multihomes exists if and only if:*

$$2\Pi_P(0) + N\Pi_C^m \geq \Pi_P(N) + \Pi_P(-N) + N\Pi_C^e(N) \tag{A.1}$$

Proof. The following conditions are necessary and sufficient for equilibrium:

- Content provider incentive compatibility – content providers do not wish to all switch to be exclusive with a platform:

$$\Pi_C^m + T_A^m + T_B^m \geq \Pi_C^e(N) + T_A^e \tag{A.2}$$
$$\Pi_C^m + T_A^m + T_B^m \geq \Pi_C^e(N) + T_B^e \tag{A.3}$$

- Platform incentive compatibility (i) – neither platform wants to deviate and attract all content providers exclusively, which it can do by setting $T_i^m = -\infty$ and $T_i^e = T_{-i}^e + \epsilon$

$$\Pi_P(0) - NT_A^m \geq \Pi_P(N) - NT_B^e$$
$$\Pi_P(0) - NT_B^m \geq \Pi_P(N) - NT_A^e \tag{A.4}$$

- Platform incentive compatibility (ii) – neither platform wants to deviate and have no content providers:

$$\Pi_P(0) - NT_A^m \geq \Pi_P(-N) \tag{A.5}$$
$$\Pi_P(0) - NT_B^m \geq \Pi_P(-N)$$

- Platform incentive compatibility (iii) – neither platform can lower T_i^m and still induce all content providers to multihome, which is equivalent to requiring that conditions (A.2) and (A.3) are binding.

Combining (A.2) and (A.4), we obtain $T_A^m \geq \frac{\Pi_P(N)-\Pi_P(0)}{N} + \Pi_C^e(N) - \Pi_C^m$, and re-arranging (A.5) yields $T_A^m \leq \frac{\Pi_P(0)-\Pi_P(-N)}{N}$.

Both conditions can hold at the same time if and only if (A.1) holds. If that is the case, then we can construct an equilibrium in the following way: let $T_A^m = T_B^m$ take any value in the interval $\left[\frac{\Pi_P(0)-\Pi_P(-N)}{N}, \frac{\Pi_P(N)-\Pi_P(0)}{N} + \Pi_C^e(N) - \Pi_C^m\right]$ and let $T_A^e = T_B^e = T_A^m + T_B^m + \Pi_C^m - \Pi_C^e(N)$. □

This completes the proof of proposition 3.1. ■

Proof of Proposition 3.2. Let m be the number of content providers who multihome and n_A, n_B the numbers of content providers who are exclusive with either platform. Rewrite $N_B = n_B + m$ and $N_A = n_A + m$. Suppose without loss of generality $N_A \geq N_B$.

Total industry profits can be re-expressed as:

$$\Pi_T = \Pi_P(n_A - n_B) + \Pi_P(n_B - n_A) + m\Pi_C^m + n_A\Pi_C^e(n_A - n_B) + n_B\Pi_C^e(n_B - n_A) \quad \text{(A.6)}$$

When content providers relinquish control rights to platforms, we have $\Pi_C^m = \Pi_C^e = 0$, so that A.6 reduces to $\Pi_T = t + \frac{w(0)}{9t}(n_A - n_B)^2$ which is always maximized for $n_A = N$ and $n_B = 0$. At the same time, (3.1) is equivalent to $t \geq t + \frac{1}{9t}w(0)^2 N^2$ which never holds.

When content providers maintain control rights, (A.6) can be written as:

$$\Pi_T = t + \frac{1}{2}\left[t\pi(p^m)(n_A + n_B + 2m) + \frac{s(p^m)(3\pi(p^m) + 2s(p^m))}{9}(n_A - n_B)^2\right]$$

Clearly, maximizing Π_T requires setting $n_B = 0$ (if $n_B > 0$, one could increase Π_T by taking 1 content provider who is exclusive with B and making it exclusive with A or multihome).

Thus, we are left with solving:

$$\max_{\substack{0 \leq n_A, m \\ n_A + m = N}} \left\{t\pi(p^m)(n_A + 2m) + \frac{s(p^m)(3\pi(p^m) + 2s(p^m))}{9}n_A^2\right\}$$

i.e.:

$$\max_{0 \leq n_A \leq N} \left\{t\pi(p^m)(2N - n_A) + \frac{s(p^m)(3\pi(p^m) + 2s(p^m))}{9}n_A^2\right\}$$

The solution is therefore:

$$\begin{array}{cc} n_A = 0,\ m = N & \\ \text{(all content providers multihome)} & \text{iff} \quad \frac{N}{t} \leq \frac{9\pi(p^m)}{s(p^m)(3\pi(p^m)+2s(p^m))} \\ n_A = N,\ m = 0 & \\ \text{(all content providers are exclusive)} & \text{iff} \quad \frac{N}{t} \geq \frac{9\pi(p^m)}{s(p^m)(3\pi(p^m)+2s(p^m))} \end{array}$$

which yields the condition in the text. ∎

Proof of Proposition 4.1. We first show that an exclusive equilibrium always exists where C joins platform j exclusively. Clearly, if $T_j^m = -\infty$, then a best response for i is to set $T_i^m = -\infty$ as well: forcing exclusivity is a unilateral decision. Necessary conditions for T_j^e, $j = A, B$ to be an equilibrium are:

$$\begin{aligned} \Pi_C^e(1) + T_i^e &= \Pi_C^e(1) + T_j^e \geq 0 \\ \Pi_P(1) - T_j^e &\geq \Pi_P(-1) \geq \Pi_P(1) - T_i^e \end{aligned}$$

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 $T_i^e = T_j^e = \Pi_P(1) - \Pi_P(-1)$, and will exist.

Let us now turn to the existence of multihoming equilibria (T_A^m, T_A^e) and (T_B^m, T_B^e). The first set of necessary conditions for a multihoming equilibria to exist is $\Pi_C^m + T_A^m + T_B^m = \Pi_C^e(1) + T_j^e \geq 0$. If this 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^m without inducing C to change its action.

The second necessary condition is $\Pi_P(1) - T_j^e \leq \Pi_P(0) - T_j^m$ otherwise $T_j^e + \varepsilon$ is a profitable deviation for j given the first set of necessary conditions above. Finally, we must also have $\Pi_P(-1) \leq \Pi_P(0) - T_j^m$ otherwise $T_j^m = -\infty$ 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 $\Pi_P(1) - T_j^e = \Pi_P(0) - T_j^m$, which implies $T_j^m = \Pi_C^e(1) + \Pi_P(1) - \Pi_C^m - \Pi_P(0)$. Platform j's profits are$\Pi_C^m + 2\Pi_P(0) - \Pi_C^e(1) - \Pi_P(1)$ and the content provider's profits are $2\Pi_C^e(1) - \Pi_C^m + 2\left[\Pi_P(1) - \Pi_P(0)\right]$ which are always positive.

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.: $\Pi_C^m + 2\Pi_P(0) - \Pi_C^e(1) - \Pi_P(1) \geq \Pi_P(-1)$ which yields the condition in the text. ■

Proof of Proposition 4.2. It can be easily shown that stage II revenues are $\Pi_P(1) = \frac{1}{2}\left(1 + \frac{v}{3}\right)^2$, $\Pi_P(-1) = \frac{1}{2}\left(1 - \frac{v}{3}\right)^2$, $\Pi_P(0) = \frac{1}{2}$, and $\Pi_C^e(1) = \Pi_C^m = 0$. Since $\Pi_P(1) + \Pi_P(-1) \geq 2\Pi_P(0)$ when $v < 3$, by Proposition 4.1, exclusivity is the equilibrium outcome.

The equilibrium of the Stage I bargaining game will involve each content provider offering stage I transfers of (see proof of Proposition 4.1):

$$T_i^e = \Pi_P(1) - \Pi_P(-1) = \frac{1}{2}\left((1 + \frac{v}{3})^2 - (1 - \frac{v}{3})^2\right) = \frac{2}{3}v$$

for exclusivity, and the content provider will choose to be exclusive with either platform. Thus, each platform will obtain $\Pi_P(-1)$ and the content provider will receive T_i^e as final payoffs. ■

Proof of 4.3. Let $v' = 2(\sqrt{2} - 1)$, $v'' = 10/7$, and $v''' = 1/5(35 - 12\sqrt{5})$. The proof follows immediately from Proposition 4.1 and the following Lemma.

Lemma A.4. *When the content provider multihomes, stage II profits are always* $\Pi_P(0) = 1/2$ *and* $\Pi_C^m = v$. *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* $v \leq 2(\sqrt{2} - 1) \approx 0.825$, *there exists a unique pure strategy equilibrium with* $P_A = P_B = 1$ *and* $p_C = v$. *The equilibrium (stage II) profits are:* $\Pi_P(1) = \Pi_P(-1) = \frac{1}{2}$, *and* $\Pi_C^e(1) = \frac{v}{2}$.

- *For* $2(\sqrt{2}-1) < v < 5(3\sqrt{2}-4) \approx 1.213$*, there exists no equilibrium in pure strategies*

- *For* $5(3\sqrt{2}-4) \leq v$*, there exists a unique pure strategy equilibrium with* $P_A = \frac{5}{3} + \frac{v}{3}$*,* $P_B = \frac{7}{3} - \frac{v}{3}$ *and* $p_C = \frac{5}{6} + \frac{v}{6}$*. The equilibrium (stage II) profits are:* $\Pi_P(1) = \frac{1}{2}\left(\frac{5\sqrt{2}}{6} + \frac{v\sqrt{2}}{6}\right)^2$*,* $\Pi_P(-1) = \frac{1}{2}\left(\frac{7\sqrt{2}}{6} - \frac{v\sqrt{2}}{6}\right)^2$*, and* $\Pi_C^e(1) = \frac{1}{2}\left(\frac{5}{6} + \frac{v}{6}\right)^2$.

Furthermore, both pure strategy equilibria described above are stable.

Proof of Lemma A.4. 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 $p_C = v$.

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:

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

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

$$p_C(P_A, P_B) = \min\left(v, \frac{1+v+P_B-P_A}{2}\right) \tag{A.7}$$

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

$$P_A \frac{1}{2}\left(1 + P_B - P_A + v - \min\left(v, \frac{1+v+P_B-P_A}{2}\right)\right) \tag{A.8}$$

whereas B sets P_B to maximize:

$$P_B \frac{1}{2}\left(1 + P_A - P_B - v + \min\left(v, \frac{1+v+P_A-P_B}{2}\right)\right) \tag{A.9}$$

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 v 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:

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

Taking the derivatives of the two expressions ($\Pi_A^r(P_A)$ and $\Pi_A^l(P_A)$) and evaluating them at $P_A = 1 - v + P_B$, we have:

- if $P_B \leq 3v - 1$ then $\Pi_A^r(P_A)$ is maximized by $P_A = \frac{1+v+P_B}{2}$

- if $P_B \geq 3v - 1$ then $\Pi_A^r(P_A)$ is maximized by $P_A = 1 - v + P_B$
- if $P_B \leq 2v - 1$ then $\Pi_A^l(P_A)$ is maximized by $P_A = 1 - v + P_B$
- if $P_B \geq 2v - 1$ then $\Pi_A^l(P_A)$ is maximized by $P_A = \frac{1+P_B}{2}$

Thus:

- If $P_B \leq 2v - 1$ platform A profits $\Pi_A(P_A)$ are maximized by $P_A = \frac{1+v+P_B}{2}$
- If $P_B \geq 3v - 1$ platform A profits $\Pi_A(P_A)$ are maximized by $P_A = \frac{1+P_B}{2}$

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

We have therefore:

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

Similarly:

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

implying:

- if $P_A \leq 5 - 3v$ then $\Pi_B^l(P_B)$ is maximized by $P_B = v - 1 + P_A$
- if $P_A \geq 5 - 3v$ then $\Pi_B^l(P_B)$ is maximized by $P_B = \frac{3-v+P_A}{2}$
- if $P_A \leq 3 - 2v$ then $\Pi_B^r(P_B)$ is maximized by $P_B = \frac{1+P_A}{2}$
- if $P_A \geq 3 - 2v$ then $\Pi_A^l(P_A)$ is maximized by $P_B = v - 1 + P_A$

We have:

$$5 - 3v \geq 3 - 2v \Longleftrightarrow 2 \geq v$$

Assume first that $v \leq 2$. Then:

$$\arg\max_{P_B} \Pi_B(P_B) = \begin{cases} \frac{1+P_A}{2} & \text{if} \quad P_A \leq 3 - 2v \\ v - 1 + P_A & \text{if} \quad 3 - 2v < P_A < 5 - 3v \\ \frac{3-v+P_A}{2} & \text{if} \quad 5 - 3v \leq P_A \end{cases}$$

If on the other hand $v > 2$ then $5 - 3v < 0$ and $3 - 2v < 0$. Therefore, since $P_A \geq 0$ necessarily:

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

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

1) $P_A = \frac{1+P_B}{2}$ and $P_B = \frac{1+P_A}{2}$, which is equivalent to $P_A = P_B = 1$. This equilibrium exists if and only if $1 > (\sqrt{2}+1)v - 1$ and $1 \leq 3 - 2v$, which is equivalent to $v \leq 2(\sqrt{2}-1)$.

2) $P_A = \frac{1+P_B}{2}$ and $P_B = v - 1 + P_A$, leading to $P_A = v$ and $P_B = 2v - 1$. The existence of this equilibrium requires $2v - 1 > (\sqrt{2}+1)v - 1$, which is impossible.

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

4) $P_A = \frac{1+v+P_B}{2}$ and $P_B = \frac{1+P_A}{2}$, leading to $P_A = 1 + \frac{2v}{3}$ and $P_B = 1 + \frac{v}{3}$. This equilibrium exists if and only if $1 + \frac{v}{3} \leq (\sqrt{2}+1)v - 1$ and $1 + \frac{2v}{3} \leq 3 - 2v$, which is impossible.

5) $P_A = \frac{1+v+P_B}{2}$ and $P_B = v - 1 + P_A$, leading to $P_A = 2v$ and $P_B = 3v - 1$. The existence of this equilibrium requires $3v \leq (\sqrt{2}+1)v$, which is impossible.

6) $P_A = \frac{1+v+P_B}{2}$ and $P_B = \frac{3-v+P_A}{2}$, leading to $P_A = \frac{5}{3} + \frac{v}{3}$ and $P_B = \frac{7}{3} - \frac{v}{3}$. This equilibrium exists if and only if $\frac{7}{3} - \frac{v}{3} \leq (\sqrt{2}+1)v - 1$ and $\frac{5}{3} + \frac{v}{3} \geq 5 - 3v$ or if $\frac{7}{3} - \frac{v}{3} \leq (\sqrt{2}+1)v - 1$ and $v \geq 2$. The first pair of conditions is equivalent to $v \geq 5(3\sqrt{2}+4)$ and the second one to $v \geq 2$. Therefore this equilibrium exists if and only if $v \geq 5(3\sqrt{2}+4)$.

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 (A.7), we have $p_C = \min\left(v, \frac{v+1}{2}\right) = v$ when $v \leq 2(\sqrt{2}-1)$ (equilibrium 1)) and $p_C = \min\left(v, \frac{5+v}{6}\right) = \frac{5+v}{6}$ when $v \geq 5(3\sqrt{2}+4)$ (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 (A.8) and (A.9) above. ■

Proof of Corollary 4.4. When exclusivity is efficient and occurs under content affiliation (for values of $v \in \left[\frac{10}{7}t, \frac{1}{5}(35 - 12\sqrt{5})\right]$), the stage I equilibrium involves each platform offering a transfer:

$$T_A^e = \Pi_P(1) - \Pi_P(-1) = \frac{1}{2}\left(\left(\frac{5\sqrt{2}}{6} + \frac{v\sqrt{2}}{6}\right)^2 - \left(\frac{7\sqrt{2}}{6} - \frac{v\sqrt{2}}{6}\right)^2\right) = \frac{2}{3}(v-1)$$

and the content affiliates with one platform exclusively. Recall that when the content was purchased outright, the transfer necessary to induce exclusivity was $\frac{2}{3}v$ and exclusivity was always efficient. However, here content is acquired exclusively only for sufficiently low v and at lower transfer $\frac{2}{3}(v-1)$. Since $\Pi_P(-1)$ (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 $\frac{2}{3}v$ if it sells outright, and $\frac{2}{3}(v-1) + \Pi_C^e(1)$ if it maintains control rights. A content provider, thus, will prefer to affiliate than sell outright as long as $v \geq (4\sqrt{3}-5) \approx 1.93$. 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 $v \in \left[\frac{10}{7}t, \frac{1}{5}(35-12\sqrt{5})\right]$.

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

$$T^m = \Pi_C^e(1) + \Pi_P(1) - \Pi_C^m - \Pi_P(0) = \frac{1}{2}\left[\frac{13}{12} - \frac{14v}{12} + \frac{v^2}{12^2}\right]$$

Platform j's profits are:

$$\Pi_C^m + 2\Pi_P(0) - \Pi_C^e(1) - \Pi_P(1) = \frac{1}{2}\left[\frac{14v}{12} - \frac{1}{12} + \frac{v^2}{12^2}\right]$$

and the content provider's profits are:

$$2\Pi_C^e(1) - \Pi_C^m + 2\left(\Pi_P(1) - \Pi_P(0)\right) = \frac{1}{2}\left[\frac{13}{6} - \frac{v}{3} + \frac{v^2}{6^2}\right]$$

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

Proof of Corollary 4.5. Let $v^* = \left(3((5\sqrt{2})/6-1)\right) / \left(1-(\sqrt{2})/2\right)$. Corollary follows directly from comparison of profit functions in proof of Proposition 4.3. ■

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