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Abstract

Often, we observe that some TV channels are distributed on several platforms, and by several distributors on the same platform, while others are distributed exclusively by one distributor. In this paper, we analyse a TV channel's incentives for choosing exclusive distribution versus full distribution. We then proceed by studying if bidding for premium content (e.g., broadcasting rights to football) influences the incentives for choosing exclusive distribution. We show that absent of premium content, the channel has incentives to choose exclusive distribution, but the existence of premium content dramatically reduces these incentives, and full distribution is the likely outcome.

Keywords: Exclusive dealing, auctions, football, media.

JEL codes: D44, L13, L42, L82

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1 Introduction

Often, we observe that some TV channels are distributed on several platforms, and by several distributors on the same platform, while others are distributed exclusively by one distributor. There may be several explanations for this. One possibility, which we pursue in this paper, is the fact that different TV channels may have different objective functions; some TV channels are profit maximizing, while others may be viewer maximizing.

Competition between TV channels is often driven by their exclusive premium content. The most typical example is sport, although TV series, Hollywood films, and in-house productions can also be important for attracting viewers. Just as TV channels use premium content in competition, distributors use TV channels as a form of premium content when competing. In recent years, we have also seen a growing interest from distributors to acquire premium content such as sport. For instance, the Norwegian distributor Canal Digital held the Norwegian rights to broadcast the 2002 World Cup in football.[1]

The prices for such content, and especially for sport, have increased substantially in recent decades (Cave and Crandall (2001), Hoehn and Lancefield (2003)), and when both 'upstream' TV channels and 'downstream' distributors want to acquire premium content, this may lead to both competition and/or cooperation. Distributors and TV channels, or competing TV channels, may therefore seek to collaborate in acquiring and airing these rights—i.e., both vertical and horizontal bidding consortia may arise. One explanation for such collaboration, apart from financial constraints, may be that single TV channels typically do not have the capacity to air large packages of premium content, e.g., sports broadcasting rights. Another explanation is that airing a part of the premium content on a major TV channel may serve to promote the distributors' part of the exclusive content aired on premium TV channels.[2] One example is the broadcasting of football:

[1]The discussion of exclusivity, auctions, and football as premium content is not new. In the UK, this was a central issue when BSkyB tried to acquire Manchester United, but was sanctioned by the Department of Trade & Industry (see Binmore and Harbord (2000) and Klemperer (2002)).

[2]For instance, the Norwegian TV channel TV2 bought the rights to broadcast the Norwegian premier football league jointly with the abovementioned Canal Digital for the period 2006–2008.

"It's a mix. Even though several matches are aired on premium TV channels, we need [to air some of the matches on] basic channels to promote the premium TV part of it." (H-H Albrecht, CEO Modern Times Group, cited in www.kampanje.com)

Questions arise as to a) how the incentives for competing distributors, and competing TV channels with different objectives, are affected by the introduction of premium content auctions, and b) which bidding consortia will arise in equilibrium. In this paper, we investigate a TV channel's incentive to offer exclusive distribution to a distributor, and which alliances might be formed when bidding for premium content.

The paper starts out with a simple model of two competing TV channels and two symmetrical distributors. There is one commercial (profit maximizing) TV channel, channel 1, and one publicly funded (viewer maximizing) free-to-air TV channel, channel 2. While the publicly funded TV channel always chooses full distribution by assumption, the commercial channel has an option to choose between full or exclusive distribution. If there is premium content present, the TV channel can obtain the premium content alone, by joint bidding with another TV channel (horizontal joint bidding), or by collaborating with a distributor (vertical joint bidding). The key finding is that in equilibrium a vertical bidding consortium will be formed between a TV channel and a distributor, and we show that both exclusive distribution and full distribution may occur, depending on the value of the premium content. Exclusive distribution and vertical joint bidding gives the consortium, where channel 1 is a member, an advantage in a premium content auction, and enables the channel to win the auction with some surplus remaining. Yet, we find that when the value of the premium content is small, the channel seeks exclusive distribution, but as the value of premium content increases, full distribution is more likely. There are two countervailing effects driving this result. First, the total industry profit is maximized when channel 1 is exclusively distributed, which contributes positively

At the time of bidding, TV2 was distributed exclusively on Canal Digital in the DTH satellite market. It was also available free-to-air in the terrestrial network and available on Cable TV. Hence, it was only on the DTH satellite platform that TV2 had exclusive distribution.

to channel 1's profit. Second, when channel 1 is distributed exclusively by one of the distributors, the two vertical consortia will compete harder to obtain the premium content, which drives the price for the premium content up.[3] This contributes negatively to channel 1's profit. Hence, when the value of the premium content is below a certain threshold value, the former effect dominates, and channel 1 chooses to be exclusively distributed. When the value of the premium content is above the threshold value, channel 1 always prefers full distribution. Hence, increasing the value of the premium content makes exclusive distribution less likely.

The paper is organized as follows. Section 2 outlines the model for the distributor market and the competition between TV channels. Sections 3 and 4 analyse the equilibrium outcome under exclusive and full distribution, respectively. Section 5 shows how the equilibrium outcome of whether to choose exclusive or full distribution is affected by premium content. Section 6 concludes.

2 The model

Consider the following simple model. A market consists of two major TV channels, $k = 1, 2$, where channel 1 is profit maximizing and channel 2 is a non-strategic viewer maximizing must-carry channel. In the following, one may only think of channel 2 as a must-carry channel in which each distributor airs at no costs.[4]

There are two profit maximizing distributors, $i = A, B$, distributing TV channels, and it is assumed that over the relevant period each viewer subscribes only to one distributor (single homing), and watches only one of the two major TV channels.[5] In addition, the viewers may spend some time watching a premium TV channel, established by one of the distributors to broadcast premium content. In the model, we explore only pure bundling equilibria, i.e., the viewers are forced to subscribe to

[3] This result resembles that of Jehiel and Moldovanu (2000) where they study downstream interaction between bidders in auctions.

[4] This means that channel 2's income is equal to zero. One may think of this as competition between a commercial channel and a public service broadcaster.

[5] Armstrong (1999) provides a similar setup for the distributor market when studying the incentives for signing exclusive contracts for premium programming. However, he does not discuss the possibility for cooperation between channels and distributors when obtaining these rights.

all the TV channels aired by the distributor.[6]

The channels and distributors have zero marginal cost. Channels 1 and 2 do not charge any subscription fees to viewers, and are assumed to be funded publicly or by advertising. Endogenous advertising is beyond the scope of this model, hence we normalize advertising revenues to zero.[7]

A consumer's gross utility from watching TV is $v_{k,i}(\beta)$, where $\beta = \beta_k + \beta_i$ is the premium content offered by the major TV channel k and distributor i's premium channel. Let $\beta_k = \delta_k \beta$ and $\beta_i = \delta_i \beta$, where $\delta_k, \delta_i \in [0,1]$ and $\delta_1 + \delta_2 + \delta_A + \delta_B = 1$.

Apart from the premium content, the quality of both TV channels and distributors is equal to $v_{k,i}(0) = v$. Assume that $v_{k,i}(\beta)$ has the following form:

$$v_{k,i} = v + \delta_k \beta + [\gamma \delta_k + \varepsilon] \delta_i \beta, \tag{1}$$

where $\gamma \in [0,1]$ and $\varepsilon \in [0,1]$. The term $\gamma \delta_k \delta_i \beta$ is the promotion effect of distributing some of the premium content on the TV channel k, and $\varepsilon \delta_i \beta$ is the direct effect for a distributor of airing premium content. The promotion effect captures the fact that distributor i may gain some viewers to its premium channel when airing (promoting) some of the content on a major channel k. In this setup, $\delta_i = 1$ is equivalent to the situation where distributor i buys all of the premium content by themselves and airs everything on their own premium TV channel.[8]

Distributors (and channels) compete in a Hotelling fashion with unit demand. In an x, y diagram, distributor A and channel 1 are located at $x_A = y_1 = 0$, and

[6] It would be interesting to investigate the effects of à la carte pricing and mixed bundling. For example, a distributor may want to set a lower subscription fee on channels that are fully distributed, and a higher subscription fee on channels that are exclusively distributed. Furthermore, a distributor obtaining premium content may want to make it a premium channel, in which a share of the premium content is aired, available to the viewers in return for a higher subscription fee. This is outside the scope of this model, but would be an interesting question for further research.

[7] We could introduce an exogenous advertising parameter, like Weeds (2007). However, this would be of no consequence to our results, as the per-viewer advertising revenue would enter as a negative marginal cost in the TV channels' profit functions, and hence would simply result in lower prices. As we normalize marginal costs to zero, we also normalize advertising revenues to zero.

[8] There are no capacity constraints, such that channel k, or distributor i, is able to distribute all of the premium content by itself. However, we show that this is optimal only for certain values of ε and γ.

distributor B and channel 2 at $x_B = y_2 = 1$.

The utility for a consumer watching channel k with distributor i, and with their most preferred point at (a^*, b^*) in the two-dimensional space, is:

$$U_{k,i} = v_{k,i} - t\,|x_i - a^*| - z\,|y_k - b^*| - p_i, \tag{2}$$

where t and z are the distributor and TV channel mismatch costs, respectively, and p_i is the subscription fee set by distributor i. In the situations we are going to study, it is assumed that t and z are such that there exists an interior equilibrium in which all consumers are served and both distributors are active.[9]

Channel 1 has to choose between full and exclusive distribution, while channel 2, because it is a viewer maximizer and a must-carry channel, always is fully distributed.

The timing of the game is as follows: At stage 1, channel 1 offers a take-it-or-leave-it contract to one distributor (exclusive distribution) or to both distributors (full distribution), in return for fixed fees F_i. The distribution contract offered to i may include an obligation to form a bidding consortium at stage 4, and if so, channel 1 proposes a share $\delta_i \in [0, 1]$ of the premium content that will be distributed by i's premium channel if they win the auction.[10] If none of the contracts include an obligation to form a bidding consortium, channel 1 may approach channel 2 with a contract proposal to form a horizontal bidding consortium at stage 4, or it may choose to compete alone in the auction. In the latter case, channel 1 airs all of the premium content by itself if it wins the auction, i.e., $\delta_A = \delta_B = \delta_2 = 0$.

All contracts and fixed fees are contingent on the outcome of the premium content auction, and they are never observable.[11]

[9] With fierce competition between distributors ($t \approx 0$) and sufficient differentiation between TV channels ($z \gg 0$), a distributor obtaining exclusive rights to one of the two TV channels could be able to corner and monopolize the entire market. To exclude such possibilities, we assume t to be high enough compared with z.

[10] Channel 1 may offer $0 < \delta_i^* < 1$ to distributor i in equilibrium. This may be achieved either by letting channel 1 create its own premium channel, and assign the distributor exclusivity to this premium channel, or by letting the distributor create a premium channel. These two scenarios are equivalent, and we classify both as 'vertical joint bidding'.

[11] That the contracts are unobservable, means that the prices and conditions negotiated between a distributor i and a channel k are observable only to i and k. To assume that contracts are

At stage 2, the parties may accept or reject the offers. If distributor i rejects the contract at stage 1, renegotiations between channel 1 and distributor j are allowed at stage 3. If everybody accepts (rejects) the offers at stage 1, the game jumps directly to stage 4, where the channels and the distributors may form bidding consortia and bid for premium content. The value of the premium content, determined by β, is known to all parties, and we assume that the rights holder sells the premium content using an English auction.

The parties that are not tied-up in a bidding consortium with channel 1 may compete for the premium content alone or together with some other party. For example, if distributor i at stage 2 accepts a contract including an obligation to form a vertical bidding consortium with channel 1, then distributor j may offer channel 2 a contract $\delta_j = [0, 1]$ and form a bidding consortium to compete for premium content at stage 4. At stage 5, the distributors set prices (subscription fees) $p = (p_A, p_B)$ and compete for viewers. The timing of the game is illustrated in Figure 1.

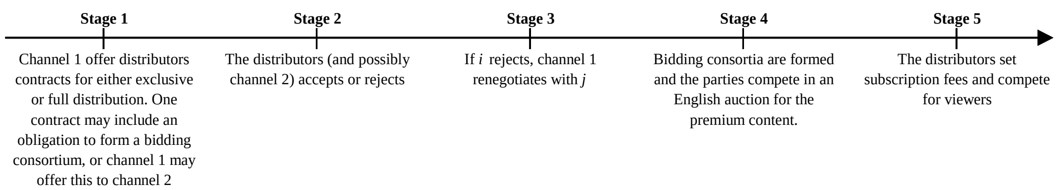

Figure 1: Time-line

In the following two sections, we focus on a vertical bidding consortium between a channel and a distributor and leave the discussion of horizontal bidding consortia to Section 5. To make the analysis tractable, we make the following assumptions:

Assumption 1 *The channel mismatch cost, z, is normalized to one.*

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unobservable, is both realistic and standard in the vertical contracting literature. Observable contracts would make it possible for a channel to dampen competition in the distributor market, e.g., by signing contracts that include a per-viewer cost for the distributors. The latter would result in higher subscription fees and increased industry profit.

Assumption 2 *γ and ε are discrete variables; specifically, we assume that $\gamma \in \{0, 1\}$ and $\varepsilon \in \{0, 1\}$.*

We now proceed to analyse the situation where channel 1 offers an exclusive contract to one of the distributors.

3 Exclusive distribution

Assume first that channel 1 decides to offer itself exclusively to distributor $i = A, B$ at stage 1, and that the offer includes an obligation to form a vertical bidding consortium at stage 4, $\delta_i \in [0, 1]$. Such a market configuration is illustrated in Figure 2. Note that in this scenario, if the distributor accepts, for some consumers, the decision of which channel to patronize will not be separable from the decision of which distributor to subscribe to.

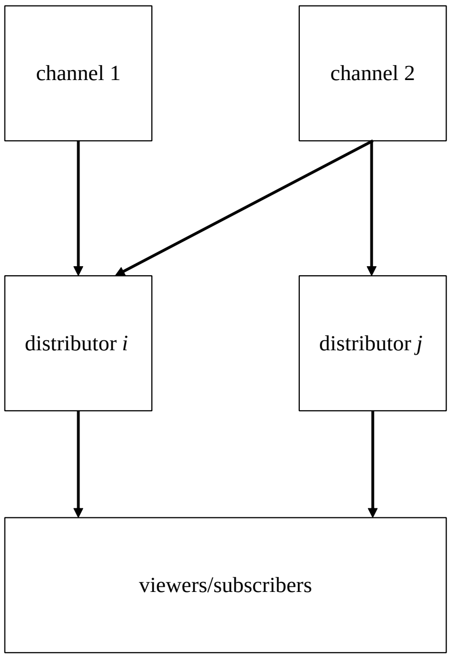

Figure 2: The market setup when channel 1 is exclusive on distributor i.

Before we proceed, we define the following notation. First, we denote any situation with exclusive distribution with superscript "+" for the parties involved in the agreement, and superscript "$-$" for the party without an exclusive distribution agreement. Situations with full distribution are denoted without superscripts. Second, we denote a variable with subscript w for the parties winning the premium content auction at stage 4, and l for the parties losing the auction.

Let $q_{i,w}(\delta_i)$ be the number of viewers of distributor i when all channels are fully distributed, and when distributor i wins the premium content auction either by themselves or as part of a vertical consortium, i.e., $\beta_i > 0$. Let $q_{i,l}$ be the number of viewers of distributor i if i is part of a losing consortium, i.e., if $\beta_j > 0$. Finally, let q_i be the number of viewers of distributor i if neither i nor distributor j airs any premium content, i.e., $\beta_i = \beta_j = 0$.

For the scenario where channel 1 is distributed exclusively by either distributor i or j, let $q_{i,w}^{+}$ be the number of viewers of distributor i if $\beta_j = \beta_2 = 0$ and channel 1 is distributed exclusively by i, and let $q_{i,w}^{-}$ be the number of viewers if $\beta_j = \beta_1 = 0$ and channel 1 is distributed exclusively by distributor j. Likewise, let $q_{i,l}^{+}$ be the number of viewers of distributor i if $\beta_j > 0$ and/or $\beta_2 > 0$ and channel 1 is distributed exclusively by i, and let $q_{i,l}^{-}$ be the number of viewers if $\beta_j > 0$ and/or $\beta_1 > 0$ and channel 1 is distributed exclusively by distributor j

We start out by deriving the market shares of the TV channels and the demand functions of the distributors as functions of the subscription fees. The number of viewers subscribing to distributor i is equal to:

$$q_i^{+} = \begin{cases} a_w + \int_{a_w}^{b_w} \tilde{y}_w(x)\,dx = q_{i,w}^{+} & \text{if} \quad \beta_j = \beta_2 = 0 \\ a_l + \int_{a_l}^{b_l} \tilde{y}_l(x)\,dx = q_{i,l}^{+} & \text{if} \quad \beta_j > 0 \text{ and/ or } \beta_2 > 0, \end{cases} \tag{3}$$

where a_w and a_l are the loci of viewers indifferent between watching channel 2 with distributor i and channel 2 with distributor j when channel 1 and distributor i win and lose the premium content auction, respectively. Similarly, $\tilde{y}_w$ and $\tilde{y}_l$ are the loci of viewers indifferent between watching channel 1 with distributor i and channel 2 with distributor j. b_w and b_l are the points where $\tilde{y}_w = 0$ and $\tilde{y}_l = 0$.

The total number of viewers of distributor j is simply:

$$q_j^{-} = 1 - q_i^{+}. \tag{4}$$

These demands are illustrated in Figure 3, and (3) and (4) are the correct demand functions as long as $\tilde{y}_w(p^* | \, x = 1) < 0$, or equivalently $b_w(p^*) < 1$, where p^* are the equilibrium subscription fees when distributor demand is equal to (3) and (4). In Figure 3, this is illustrated by the diagonal lines, $\tilde{y}_w$ and $\tilde{y}_l$, intercepting the x-axis for $x < 1$.

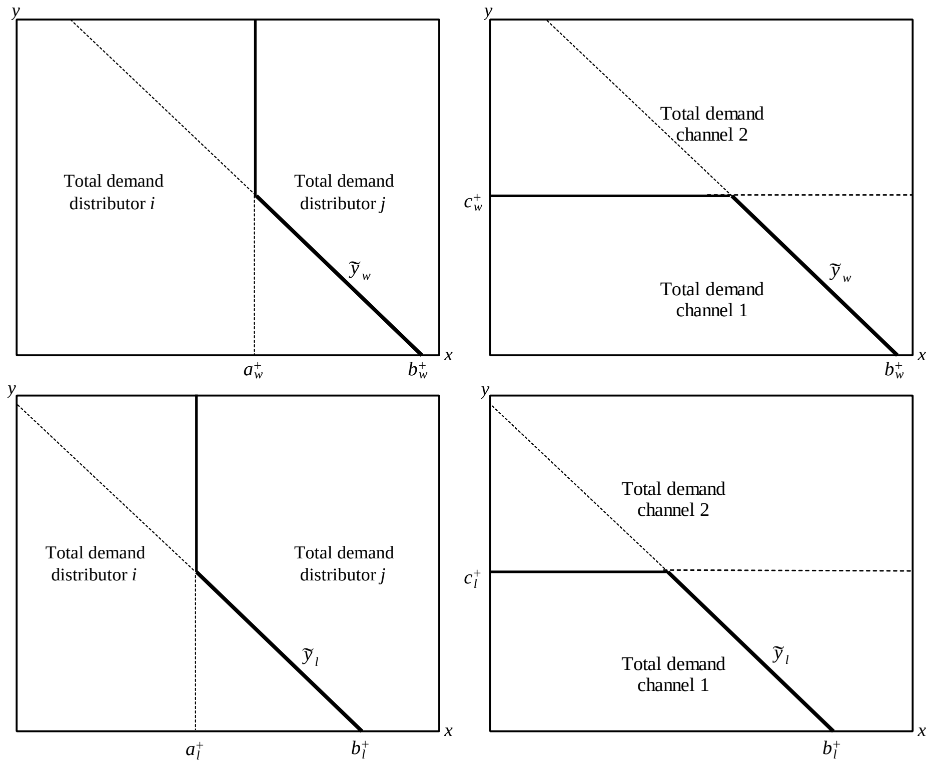

Figure 3: The upper left pane shows demand for distributors i and j while the upper right pane highlights demand for channels 1 and 2 when the consortium $i+1$ holds the premium content and channel 1 is exclusively distributed by i. c_w^+ is the locus of viewers indifferent between watching channel 1 and channel 2 with distributor i in this case. The bottom figures illustrates the case when $j+2$ holds the premium content.

We can see that obtaining an exclusive agreement will increase distributor i's demand from a to $a + \int_a^b \tilde{y}(x)\,dx$, ceteris paribus. Specifically, q_i^+ is equal to:

$$q_i^+ = \begin{cases} \frac{1}{2} - \frac{p_i - p_j}{2t} + \rho_i + \upsilon_i + \omega_i = q_{i,w}^+ & \text{if} \quad \beta_j = \beta_2 = 0 \\ \frac{1}{2} - \frac{p_i - p_j}{2t} - \upsilon_j + \omega_j = q_{i,l}^+ & \text{if} \quad \beta_j > 0 \text{ and/ or } \beta_2 > 0 \end{cases}, \tag{5}$$

where $\rho_i = \frac{(1-\delta_i)\beta}{2t}$, $\upsilon_i = \frac{(\gamma(1-\delta_i)+\varepsilon)\delta_i\beta}{2t}$, and $\omega_i = \frac{(1-(1-\delta_i)\beta)^2}{8t}$, $\upsilon_j = \frac{(\gamma(1-\delta_j)+\varepsilon)\delta_j\beta}{2t}$, and $\omega_j = \frac{(1-(1-\delta_j)\beta)^2}{8t}$. Let a bidding consortium consisting of channel 1 and distributor i be denoted by C_{i1}, and if this consortium wins the premium content auction, δ_i is the share of the premium content distributed by distributor i, and $1-\delta_i$ is the share distributed by channel 1. Equivalently, if the consortium consisting of channel 2 and distributor j (C_{j2}) wins the premium content auction, δ_j is the share of the premium content distributed by distributor j, and $1-\delta_j$ is the share distributed by channel 2.

At stage 5, the maximization problems and gross profits of the distributors are simply:

$$R_i^+ = \max_{p_i} p_i q_i^+, \text{ and} \tag{6}$$

$$R_j^- = \max_{p_j} p_j \left(1 - q_i^+\right), \tag{7}$$

which, if C_{i1} wins the premium content auction, results in subscription fees equal to:

$$p_{i,w}^+ = t + \frac{2}{3}t\upsilon_i + \frac{2}{3}t\omega_i + \frac{2}{3}t\rho_i, \tag{8}$$

$$p_{j,l}^- = t - \frac{2}{3}t\upsilon_i - \frac{2}{3}t\omega_i - \frac{2}{3}t\rho_i, \tag{9}$$

or, if C_{j2} wins:

$$p_{i,l}^+ = t - \frac{2}{3}t\upsilon_j + \frac{2}{3}t\omega_j, \tag{10}$$

$$p_{j,w}^- = t + \frac{2}{3}t\upsilon_j - \frac{2}{3}t\omega_j. \tag{11}$$

At stage 4, C_{i1} competes against C_{j2} in the premium content auction.

The prices p^* ((8) and (9) or (10) and (11)) set at stage 5 result in distributor profits as functions of δ_i (δ_j):

$$\pi_i^+ = \begin{cases} R_{i,w}^+(\delta_i) - F_i^+ - B_i^+ = \pi_{i,w}^+ & \text{if } B_i^+ \geq B_j^- \\ R_{i,l}^+(\delta_j) - F_i^+ = \pi_{i,l}^+ & \text{if } B_i^+ < B_j^- \end{cases}, \text{ and} \tag{12}$$

$$\pi_j^- = \begin{cases} R_{i,w}^-(\delta_j) - B_j^- = \pi_{j,w}^- & \text{if } B_i^+ < B_j^- \\ R_{j,l}^-(\delta_i) = \pi_{j,l}^- & \text{if } B_i^+ \geq B_j^- \end{cases}, \tag{13}$$

where B_j^- and B_i^+ are distributor j's (or C_{j2}, more strictly) and C_{i1}'s bid for the premium content at stage 4, and F_i^+ is the fixed fee paid by distributor i to channel 1 to obtain exclusive distribution of channel 1.

At stage 4, distributor j offers channel 2 a contract δ_j^- such that C_{j2}'s joint profit in the case they win the premium content auction, and hence their willingness to pay for the premium content, is maximized. This is the case when:

$$\frac{\partial R_{j,w}^-}{\partial \delta_j} = 0, \text{ for } \delta_j \in [0,1], \tag{14}$$

or, in the case of corner solutions, by setting:

$$\delta_j = 0 \text{ if } \frac{\partial R_{j,w}^-}{\partial \delta_j} < 0 \text{ for all } \delta_j \in [0,1], \text{ or} \tag{15}$$

$$\delta_j = 1 \text{ if } \frac{\partial R_{j,w}^-}{\partial \delta_j} > 0 \text{ for all } \delta_j \in [0,1]. \tag{16}$$

Because of symmetry, and where appropriate, we drop the subscripts i and j in the following. We derive the following result:

Lemma 1 *If channel 1 offers distributor $i = A, B$ an exclusive distribution contract at stage 1, including an obligation to form a vertical bidding consortium at stage 4, and if i accepts, j maximizes its profit R_w^-, in the case C_{j2} wins the auction, by* *offering channel 2 a contract* δ^- *at stage 4 such that:*

$$\begin{array}{llll} (I) & \delta^- = 0 & \textit{if} & \varepsilon = 0 \wedge \gamma = 0, \\ (II) & \delta^- = \frac{1+\beta}{4+\beta} & \textit{if} & \varepsilon = 0 \wedge \gamma = 1, \\ (III) & \delta^- = \frac{3+\beta}{4+\beta} & \textit{if} & \varepsilon = 1 \wedge \gamma = 1, \\ (IV) & \delta^- = 1 & \textit{if} & \varepsilon = 1 \wedge \gamma = 0. \end{array} \tag{17}$$

Channel 2 always accepts such an offer.

Proof. See appendix ■

Because channel 2 is aired by both distributors, distributor j would like to air as little premium content on channel 2 as possible. This is because any premium content aired by channel 2 benefits distributor i as well. Yet, if the 'promotion effect', γ, is positive, distributor j's profit if it wins the premium content auction is maximized when channel 2 airs some of the content. This is because channel 2 then serves to promote the distributor's share of the premium content, and hence the distributor captures more viewers by letting channel 2 air some of the content. For different values of the 'direct effect' ε and the 'promotion effect' γ, we can see that distributor j weakly prefers a vertical consortium with channel 2 to bidding alone.

We have now established how channel 2 and distributor j airs the premium content in the case they win the auction, and we can turn to the competing consortium. At stage 1, channel 1 offers distributor i an exclusive contract $\left(\delta^+, F^+\right)$ such that C_{i1}'s joint profit, in case they win the premium content auction, is maximized, and such that distributor i is indifferent between accepting and rejecting.

C_{i1}'s profit is maximized by setting:

$$\frac{\partial R_w^+}{\partial \delta_i} = 0, \text{ for } \delta_i \in [0, 1], \tag{18}$$

or, in the case of corner solutions, by setting:

$$\delta_i = 0 \text{ if } \frac{\partial R_w^+}{\partial \delta_i} < 0 \text{ for all } \delta_i \in [0,1], \text{ or} \tag{19}$$

$$\delta_i = 1 \text{ if } \frac{\partial R_w^+}{\partial \delta_i} > 0 \text{ for all } \delta_i \in [0,1]. \tag{20}$$

Before we proceed, we may then state the following results:

Lemma 2 *In every exclusive distribution equilibrium, channel 1 offers a contract* (δ^+, F^+) *to distributor* $i = A, B$ *at stage 1, where:*

$$\begin{array}{llll} (I) & \delta^+ = 0 & \text{if} & \varepsilon = 0 \wedge \gamma = 0, \\ (II) & \delta^+ = \frac{1-\beta}{4-\beta} & \text{if} & \varepsilon = 0 \wedge \gamma = 1, \\ (III) & \delta^+ = \frac{3-\beta}{4-\beta} & \text{if} & \varepsilon = 1 \wedge \gamma = 1, \\ (IV) & \delta^+ = 1 & \text{if} & \varepsilon = 1 \wedge \gamma = 0. \end{array} \tag{21}$$

Proof. See appendix ■

Lemma 3 *In the case where channel 1 is distributed exclusively by* $i = A, B$*, because* $q^+ > q^-$ *for* $\beta = 0$*, we have that when* $\beta > 0$*,* C_{i1} *wins the premium content auction in equilibrium.*

Proof. See appendix ■

The intuition for Lemma 2 is the same as for Lemma 1. Yet, note that because channel 1 is exclusively distributed by distributor i, this consortium will be in equilibrium when the 'promotion effect', γ, is positive, and broadcast a higher share of the premium content on the major channel. This is because there is no spillover effect from doing so, contrary to the case for C_{j2}.[12] We can see that channel 1 airs all of the premium content as long as the 'direct effect' and the 'promotion effect' are zero, and airs none of the premium content as long as the 'direct effect' is high compared with the 'promotion effect', i.e., as long as $\varepsilon = 1$ and $\gamma = 0$.

[12] The spillover effect for the consortium C_{j2} occurs because channel 2 is distributed by both distributors. Hence, in the case of exclusive distribution of channel 1 by distributor i, it is less attractive for distributor j to air PC on channel 2 than it is for distributor i to air PC on channel 1.

Lemma 3 follows from the simple fact that, when a distributor wins the premium content auction and $\beta > 0$, the distributor is able to increase its subscription fee. However, because the market share for distributor i, which has an exclusive distribution contract with channel 1, is higher than for distributor j ($q^+ > q^-$ for $\beta = 0$), distributor i's price increase (or price decrease if it loses the auction) applies to a larger number of viewers than for distributor j. Hence, in the case of exclusive distribution, consortium C_{i1}'s willingness to pay for the premium content, $W^+ \equiv R_w^+\left(\delta^+\right) - R_l^+\left(\delta^-\right)$, is always higher than C_{j2}'s willingness to pay, $W^- \equiv R_w^-\left(\delta^-\right) - R_l^-\left(\delta^+\right)$. The consortia's willingness to pay for the premium content is given by the gain in profit they get if they win the auction and the profit they lose if the other consortium obtains the premium content. So, the willingness to pay is given by:

$$\begin{aligned} W^+ &\equiv \left(R_w^+\left(\delta^+\right) - R^+|_{\beta=0}\right) + \left(R^+|_{\beta=0} - R_l^+\left(\delta^-\right)\right) = R_w^+\left(\delta^+\right) - R_l^+\left(\delta^-\right) \text{ and} \\ W^- &\equiv \left(R_w^-\left(\delta^-\right) - R^-|_{\beta=0}\right) + \left(R^-|_{\beta=0} - R_l^-\left(\delta^+\right)\right) = R_w^-\left(\delta^-\right) - R_l^-\left(\delta^+\right). \end{aligned}$$

We have now found how the two consortia air the premium content in case they win the auction, and their willingness to pay for this premium content. From Lemmas 1, 2, and 3, we then have that, for distributor i to accept the exclusive distribution contract offer at stage 2, channel 1 may offer a contract $\left(\delta^+, F^+\right)$ at stage 1, where:

$$F^+ = R_w^+\left(\delta^+\right) - R_l^-\left(\delta^+\right) - B^+, \tag{22}$$

where $B^+ = W^-$ is C_{i1}'s equilibrium bid in the premium content auction at stage 4.[13]

We can then state the following proposition:

Proposition 1 *In every exclusive distribution equilibrium, channel 1 offers a contract $\left(\delta^+, F^+\right)$ to distributor $i = A, B$ at stage 1, which distributor i accepts at stage*

[13] We could require the fixed fee paid by distributor i to be contingent on the outcome of the premium content auction. Yet, because C_{i1} always wins the auction in equilibrium when channel 1 is exclusively distributed by distributor $i = A, B$, it is superfluous to make F_i^+ contingent.

2. At stage 4, C_{i1} *obtains the premium content at a price:*

$$B^{+} = B^{-} = R_w^{-}\left(\delta^{-}\right) - R_l^{-}\left(\delta^{+}\right) \equiv W^{-} > 0 \textit{ for } \beta > 0.$$

At stage 5, distributors set prices $p^{*} = \left(p_w^{+}, p_l^{-}\right)$*, where* $p_w^{+} > p_l^{-}$*, and distributor* i*,* j*, and channel 1 earn:*

$$\begin{aligned}
\pi^{+} &= R_w^{+}\left(\delta^{+}\right) - F^{+} - B^{+} = R_l^{-}\left(\delta^{+}\right) = \pi^{-}, \textit{ and} \\
\Pi_1^{+} &= R_w^{+}\left(\delta^{+}\right) - R_w^{-}\left(\delta^{-}\right).
\end{aligned}$$

Proof. See appendix ■

The intuition for Proposition 1 is the following. If distributor i rejects the contract offer at stage 1, channel 1 offers an exclusive distribution contract to distributor j at stage 2, which distributor j accepts in equilibrium, because channel 1's incremental contribution to distributor j's profit is positive. Hence, in the subgame in which distributor i rejects the contract, we have it that a consortium consisting of distributor j and channel 1 is willing to pay more for the premium content than a consortium of distributor i and channel 2, $W^{+} > W^{-}$, from Lemma 3, and distributor j and channel 1 wins the premium content auction at stage 4. Distributor i then earns $R_l^{-}\left(\delta^{+}\right)$, which constitutes their outside option. Distributor i is therefore indifferent between accepting and rejecting as long as the contract offer implies $\pi_i^{+} = R_l^{-}\left(\delta^{+}\right)$. Having established that channel 1 and distributor i wins the premium content auction in the case of exclusive distribution, we now turn to the case where channel 1 offers full distribution to the distributors.

4 Full distribution

Assume now that channel 1 decides to offer full distribution contracts to both distributors at stage 1, and that the offer to one of the distributors, i, includes an obligation to form a vertical bidding consortium at stage 4, (δ_i, F_i).

Again, if distributor i enters into a vertical bidding consortium with channel 1 at stage 2, distributor j may offer a contract δ_j to channel 2 at stage 4.

In this scenario, if both distributors accept, for all consumers, the decision of which channel to patronize is completely separable from the decision of which distributor to subscribe to. Hence, the number of viewers is simply:

$$q_i = \begin{cases} \frac{1}{2} - \frac{p_i - p_j}{2t} + \upsilon_i = q_{i,w} & \text{if } \beta_j = \beta_2 = 0 \\ \frac{1}{2} - \frac{p_i - p_j}{2t} - \upsilon_j = q_{i,l} & \text{if } \beta_j > 0 \text{ and/ or } \beta_2 > 0 \end{cases}, \tag{23}$$

for distributor i, and:

$$q_j = 1 - q_i, \tag{24}$$

for distributor j.

Maximization at stage 5 results in subscription fees equal to:

$$p_{i,w} = t + \frac{2}{3} t \upsilon_i, \tag{25}$$

$$p_{j,l} = t - \frac{2}{3} t \upsilon_i, \tag{26}$$

if C_{i1} wins the premium content auction, and vice versa if C_{j2} wins.

At stage 1, in the same way as before, channel 1 maximizes:

$$\pi_i + F_i = \begin{cases} R_{i,w}(\delta_i) - B_i & \text{if } B_i \geq B_j \\ R_{i,l}(\delta_j) & \text{if } B_i < B_j, \end{cases} \tag{27}$$

with respect to δ_i, which gives the following first order condition:

$$\frac{\partial R_{i,w}}{\partial \delta_i} = 0, \text{ for } \delta_i \in [0,1], \tag{28}$$

or in the case of a corner solution:

$$\delta_i^* = 1, \text{ if } \frac{\partial R_{i,w}}{\partial \delta_i} > 0 \text{ for all } \delta_i \in [0,1]. \tag{29}$$

Because of symmetry, since both channels 1 and 2 are distributed by both distributors, distributor j offers channel 2 a contract $\delta_j^* = \delta_i^* = \delta^*$ at stage 4. We can state the following results:

Lemma 4 *With vertical joint bidding, in every full distribution equilibrium, channel 1 offers a contract* (δ^*, F_i) *to distributor* i *and* F_j *to distributor* $j \neq i$ *at stage 1, and distributor* j *offers a contract* δ^* *to channel 2 at stage 4, where:*

$$\begin{array}{lll} (I) & \delta^* = 0 & \text{if } \varepsilon = 0 \wedge \gamma = 0, \\ (II) & \delta^* = \frac{1}{2} & \text{if } \varepsilon = 0 \wedge \gamma = 1, \\ (III) & \delta^* = 1 & \text{if } \varepsilon = 1 \wedge \gamma = 1, \\ (IV) & \delta^* = 1 & \text{if } \varepsilon = 1 \wedge \gamma = 0. \end{array}$$

Proof. See appendix. ■

Lemma 5 *In the case where channel 1 is fully distributed and bids jointly with distributor* i*, because* $q_i = q_j$ *for* $\beta = 0$*, we have that for all* $\beta \geq 0$*,* C_{i1}*'s willingness to pay for the premium content is equal to* C_{j2}*'s willingness to pay,* $W_i = W_j$*. Hence, any of the consortia may win the premium content auction at stage 4.*

Proof. See appendix. ■

Because both channels have full distribution, there is a spillover effect from one distributor to the other when airing premium content on a major TV channel. Therefore, if either the 'promotion effect',γ, or the 'direct' effect, ε, is positive, it is never optimal for a vertical consortium to air more than half of the premium content on the major channel. In addition, if the 'direct effect' is larger than the 'promotion effect' ($\varepsilon > \gamma$), because of spillover effects, the winning consortium broadcasts the entire premium content on the distributor's premium channel. We can state the following corollary:

Corollary 1 *In any full distribution equilibrium, for* $\gamma > 0$ *and/or* $\varepsilon > 0$*, channel 1 never bids alone for premium content.*

Corollary 1 is straightforward from the fact that when the 'direct effect', $\varepsilon > 0$, and/or the 'promotion effect', $\gamma > 0$, the total chain profit of C_{i1}, and also the total industry profit, is maximized when $\delta_i > \frac{1}{2}$, as shown in Lemma 4.

The intuition for Lemma 5 follows from the fact that with full distribution of channel 1, there is full symmetry between the consortia C_{i1} and C_{j2}. We have now shown how the consortia's air the content if they win the premium content auction, and we now proceed to analyse which contracts channel 1 offers the distributors.

It follows from Lemmas 4 and 5, and from the results in the previous section, that distributors i and j are indifferent between accepting and rejecting at stage 2 as long as the fixed fees, F_i and F_j, are contingent on the outcome of the premium content auction at stage 4; specifically, as long as:

$$F_i = \begin{cases} R_w(\delta^*) - R_l^-\left(\delta^+\right) - B_i & \text{if } B_j \leq B_i \\ R_l(\delta^*) - R_l^-\left(\delta^+\right) & \text{if } B_j > B_i \end{cases}, \text{ and} \tag{30}$$

$$F_j = \begin{cases} R_w(\delta^*) - R_l^-\left(\delta^+\right) - B_j & \text{if } B_j > B_i \\ R_l(\delta_i^*) - R_l^-\left(\delta^+\right) & \text{if } B_j \leq B_i \end{cases}. \tag{31}$$

We can state the following proposition:

Proposition 2 *With vertical joint bidding, in every full distribution equilibrium, channel 1 offers a contract (δ^*, F) to distributor i and F to distributor j at stage 1. Both distributors accept at stage 2, and at stage 4, either C_{i1} or C_{j2} obtains the premium content at a price:*

$$B = 0.$$

At stage 5, distributors set prices $p^* = (p_w, p_l)$, where $p_w > p_l$, and distributors i and j earn:

$$\pi = R_l^-\left(\delta^+\right).$$

Channel 1 earns:

$$\Pi_1 = R_w(\delta^*) + R_l(\delta^*) - 2R_l^-\left(\delta^+\right).$$

Proof. See appendix ■

The intuition for Proposition 2 is the following. If distributor $i = A, B$ rejects the contract offer at stage 1, channel 1 proposes an exclusive contract to distributor j at stage 2, which it accepts in equilibrium. Then, from Lemma 3, we have that distributor j and channel 1 wins the premium content auction in equilibrium. Hence, the distributors are indifferent between accepting and rejecting the full distribution offers from channel 1 as long as the contracts secure them a profit equal to $R_l^-\left(\delta^+\right)$. Channel 1 can then set the fixed fees such that it captures all of the distributors' incremental profits from winning the premium content auction, irrespective of the outcome of the auction. The willingness to pay for the premium content at stage 4 therefore drops to zero.

We have now found the equilibrium outcome in the subgames in which channel 1 offers exclusive or full distribution. The next section analyses what constitutes the equilibrium for the whole game, i.e., whether channel 1 offers full or exclusive distribution.

5 Full distribution or exclusivity?

As stated in Section 2, we have delayed the discussion of horizontal joint bidding until now. As it turns out, horizontal joint bidding contributes nothing to channel 1's and the distributors' profits, and may be seen as equivalent to single bidding. Hence, we choose to ignore horizontal consortia in the analysis.

Lemma 6 *In both exclusive and full distribution equilibria, horizontal bidding consortia contributes nothing to channel 1's and the distributors' profits when* $\varepsilon = \gamma = 0$*. For* $\gamma > 0$ *and/or* $\varepsilon > 0$*, horizontal joint bidding is never optimal.*

Proof. See appendix ■

The intuition for Lemma 6 follows directly from the intuition for Lemmas 1, 2, and 4. First of all, under horizontal joint bidding, asymmetric splits between the cooperating parties are optimal, as this increases the differentiation in the distributor market, and increases the total industry profit. However, this is equivalent to one party (a channel or distributor) buying all of the premium content by itself. Yet, there is one reason why horizontal bidding consortia may be considered. Think of the situation where $\gamma > 0$. When channel 1 is distributed exclusively by distributor i, channel 1 may form a horizontal bidding consortium with channel 2—even though it is inefficient ex post—to reduce distributor j's gain from winning the premium content auction, and hence reduce distributor j's equilibrium bid. This is not a viable strategy, however, as distributor j, if it wins the premium content auction, may just resell (or give away) a share of the premium content to channel 2. As channel 2 is unable and unwilling to commit not to air any premium content if distributor j wins the auction, horizontal joint bidding between channels 1 and 2 should not affect j's equilibrium bid. Hence, horizontal joint bidding cannot be an equilibrium strategy for channel 1.

Now, what remains is to investigate channel 1's choice of exclusive or full distribution at stage 1. It turns out that the decision of whether to offer exclusive or full distribution at stage 1 depends critically on the value of the premium content, β, and the degree of competition between the distributors, t. We derive the following proposition:

Proposition 3 *There exists a function* $\widehat{t}\,(\beta, \varepsilon, \gamma)$ *, where* $\lim_{\beta \to 0} \widehat{t} = \infty$ *and* $\widehat{t}\,(1, \varepsilon, \gamma) \leq \frac{1}{2}$*, such that for* $t > \widehat{t}$*, channel 1 always prefers full to exclusive distribution. In addition, because we have required that the degree of differentiation in the distributor market is sufficiently high compared with the differentiation between the TV channels,* t *must be above a certain threshold value* $\underline{t}\,(\beta, \varepsilon, \gamma, z)$*. Hence, in equilibrium, when* $\underline{t} > \widehat{t}$*, channel 1 will always choose full distribution. When* $\widehat{t} > \underline{t}$*, channel 1 will always choose exclusive distribution if* $\widehat{t} > t > \underline{t}$*.*

Proof. See appendix ■

If channel 1 offers an exclusive distribution (and vertical joint bidding) contract to distributor i at stage 1, from Lemma 3 we have that C_{i1} has an advantage in the premium content auction, because the consortium's willingness to pay for the premium content is then always higher than C_{j2}'s willingness to pay. Hence, in that case, the exclusively distributed channel is left with some surplus from winning the auction. This could lead us to believe that introducing a premium content auction should increase the channel's incentives for exclusive distribution, because exclusivity makes the channel able to win the auction with some surplus remaining. This turns out not to be the case. There are two countervailing effects from exclusive distribution on channel 1's profit. First, exclusive distribution of channel 1 maximizes the total industry profit, which contributes positively to channel 1's profit, ceteris paribus. Second, when channel 1 is distributed exclusively by distributor i, the consortia C_{i1} and C_{j2} compete hard to obtain the premium content at stage 4, which drives the price for the premium content up. This contributes negatively to channel 1's profit, ceteris paribus. When β is small, $\widehat{t}$ is high, and the former effect dominates— making it optimal for channel 1 to offer an exclusive distribution contract to one of the distributors at stage 1. Hence, there is a threshold value $\underline{\beta}(t, \varepsilon, \gamma)$ above which channel 1 always prefers full to exclusive distribution, so we may conclude that increasing the value of the premium content makes exclusive distribution less likely.

6 Conclusion

In this paper, we analysed a TV channel's incentives to choose exclusive distribution. We show that absent of premium content, the channel has incentives to choose exclusive distribution, but the existence of premium content dramatically reduces these incentives, and full distribution is the likely outcome.

The model involves no uncertainty, and one could image that uncertainty about the true value of premium content could influence the results, because a consortium consisting of an exclusive channel and its distributor would have a private value advantage in such an auction, similar to the findings in Bulow and Klemperer (2002). However, this does not alter our results in any significant way because the reduction in auction price under exclusive distribution is not enough to outweigh the effect of a low price for the premium content under full distribution.

We do not discuss how exclusivity may affect the quality of the premium content, which we assume is exogenously given. See Stennek (2007) for a discussion where the broadcaster may influence the quality of premium content. Neither do we explicitly discuss competition between different platforms in this paper, but we would argue that the results are applicable also to such a setting (see Goolsbee and Petrin (2004) and Wise and Duwadi (2005) for empirical studies of such competition).

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Appendix

Proof of Lemma 1: Because the profit is maximized when the prices are maximized in a Hotelling setting, δ_j^- that maximizes $R_{j,w}^-$ is found by maximizing (11) with respect to δ_j^- ■

Proof of Lemma 2: Analogous to the proof of Lemma 1, δ_i^+ is found by maximizing (8) with respect to δ_i^+ ■

Proof of Lemma 3: From (3), (4), and (8) – (11), we find the following demand and prices given the winner of the auction:

$$\begin{aligned}
q_{i,w}^+ &= \frac{1}{2} + \frac{1}{24t} + \frac{\beta}{24t}\left(\left(1-\delta_i\right)\left(2+\beta\left(1-\delta_i\right)+4\delta_i\gamma\right)+4\varepsilon\delta_i\right), \\
q_{i,l}^+ &= \frac{1}{2} + \frac{1}{24t} - \frac{\beta}{24t}\left(\left(1-\delta_j\right)\left(2-\beta\left(1-\delta_j\right)+4\delta_j\gamma\right)+4\varepsilon\delta_j\right), \\
q_{j,w}^- &= \frac{1}{2} - \frac{1}{24t} + \frac{\beta}{24t}\left(\left(1-\delta_j\right)\left(2-\beta\left(1-\delta_j\right)+4\delta_j\gamma\right)+4\varepsilon\delta_j\right), \\
q_{j,l}^- &= \frac{1}{2} - \frac{1}{24t} - \frac{\beta}{24t}\left(\left(1-\delta_i\right)\left(2+\beta\left(1-\delta_i\right)+4\delta_i\gamma\right)+4\varepsilon\delta_i\right), \\
p_{i,w}^+ &= t + \frac{1}{12} + \frac{\beta}{12}\left(\left(1-\delta_i\right)\left(2+\beta\left(1-\delta_i\right)+4\delta_i\gamma\right)+4\varepsilon\delta_i\right), \\
p_{i,l}^+ &= t + \frac{1}{12} - \frac{\beta}{12}\left(\left(1-\delta_j\right)\left(2-\beta\left(1-\delta_j\right)+4\gamma\delta_j\right)+4\varepsilon\delta_j\right), \\
p_{j,w}^- &= t - \frac{1}{12} + \frac{\beta}{12}\left(\left(1-\delta_j\right)\left(2-\beta\left(1-\delta_j\right)+4\gamma\delta_j\right)+4\varepsilon\delta_j\right), \\
p_{j,l}^- &= t - \frac{1}{12} - \frac{\beta}{12}\left(\left(1-\delta_i\right)\left(2+\beta\left(1-\delta_i\right)+4\delta_i\gamma\right)+4\varepsilon\delta_i\right).
\end{aligned}$$

Note that when $\beta = 0$, $q_{i,w}^+ = q_{i,l}^+$, $q_{j,w}^- = q_{j,l}^-$, $p_{i,w}^+ = p_{i,l}^+$, and $p_{j,w}^- = p_{j,l}^-$. Further, we have when $\beta = 0$ that $q_i^+ > q_j^-$ and $p_i^+ > p_j^-$. Also note that because prices are given as $2tq$ the derivative of quantity and prices with respect to β is analogous.

The lemma is then proved if:

$$\begin{aligned}
\frac{dq_{i,w}^+}{d\beta} &> \frac{dq_{j,w}^-}{d\beta} \\
&\Downarrow \\
\beta &> \frac{\left(1-2\gamma\left(1-\delta_i-\delta_j\right)-2\varepsilon\right)\left(\delta_i-\delta_j\right)}{\left(2-\delta_i\left(2-\delta_i\right)-\delta_j\left(2-\delta_j\right)\right)}. \qquad (32)
\end{aligned}$$

From (17) and (21), we then have four cases to consider:

$$\begin{array}{ll} \delta^{+}=\delta_{j}^{-}=0 & \text{if } \varepsilon=0\wedge\gamma=0, \\ \delta^{+}=\frac{1-\beta}{4-\beta}<\frac{1+\beta}{4+\beta}=\delta_{j}^{-} & \text{if } \varepsilon=0\wedge\gamma=1, \\ \delta^{+}=\frac{3-\beta}{4-\beta}<\frac{3+\beta}{4+\beta}=\delta_{j}^{-} & \text{if } \varepsilon=1\wedge\gamma=1, \\ \delta^{+}=\delta_{j}^{-}=1 & \text{if } \varepsilon=1\wedge\gamma=0. \end{array}$$

Insertion of these four cases in (32) confirms that this inequality always holds for $\beta>0$, and completes the proof ■

Proof of Proposition 1: At stage 5, in equilibrium, distributors i, j earn the same profit; hence, distributor i is indifferent between accepting and rejecting at stage 2. We also assume in the case of indifference that he signs, because channel 1, in the case that i rejects, offers j a contract at stage 3 that j signs.

In Lemma 3, we have established that C_{i1} always has a higher willingness to pay for premium content, and the price will therefore be given by C_{j2}'s willingness to pay. Precisely, C_{j2}'s willingness to pay is given as the sum of its incremental gain in case it wins $\left(R_w^-\left(\delta^-\right)-R_w^-\left(\beta=0\right)\right)$ and the incremental loss if it loses $\left(R_w^-\left(\beta=0\right)-R_l^-\left(\delta^+\right)\right)$. Summation of these yields the willingness to pay:

$$\begin{aligned} w^{-} &= R_w^-\left(\delta^-\right)-R_w^-\left(\beta=0\right)+R_w^-\left(\beta=0\right)-R_l^-\left(\delta^+\right) \\ &= R_w^-\left(\delta^-\right)-R_l^-\left(\delta^+\right). \end{aligned}$$

$p_w^+>p_l^-$ follows from the proof of Lemma 3. At stage 1, we have from (22) that channel 1 offers the following contract:

$$F^{+}=R_w^+\left(\delta^+\right)-R_l^-\left(\delta^+\right)-B^{+}.$$

Insertion of:

$$B^{+}=R_w^-\left(\delta^-\right)-R_l^-\left(\delta^+\right),$$

yields the fixed fee, which is channel 1's profit:

$$\Pi_1^+ = F^+ = R_w^+ \left(\delta^+\right) - R_w^- \left(\delta^-\right).$$

Distributor i's profit is then found to be:

$$\begin{aligned}
\pi^+ &= R_w^+ \left(\delta^+\right) - F^+ - B^+ \\
&= R_w^+ \left(\delta^+\right) - \left(R_w^+ \left(\delta^+\right) - R_w^- \left(\delta^-\right)\right) - \left(R_w^- \left(\delta^-\right) - R_l^- \left(\delta^+\right)\right) \\
&= R_l^- \left(\delta^+\right),
\end{aligned}$$

which competes the proof ■

Proof of Lemma 4: Because of symmetry, both consortia set the same δ^* in equilibrium, and δ^* is simply found by maximizing $R_{h,w}$, $h = i, j$ with respect to δ^*.

Proof of Lemma 5: This follows directly from the fact that because both channels have full distribution and there is no difference in spillover effects, there is complete symmetry between the two consortiums at the time of bidding; hence, their willingness to pay is equal ■

Proof of Proposition 2: That $p_w^+ > p_l^-$ follows directly from the prices under full distribution, (25), (26), and that $\upsilon_i > 0$ and $\upsilon_j > 0$.

In the case that one of the distributors does not sign at stage 2, channel 1 renegotiates with the other distributor at stage 3 and offers an exclusive distribution contract. In that case, C_{i1} wins, and distributor j earns $R_l^- \left(\delta^+\right)$. This is then the distributors' outside option when deciding to sign the full distribution agreement.

Depending on who wins the premium content auction, the fixed fees are given by (30) and (31).

C_{j2}'s willingness to pay for the premium content is:

$$B_j = \pi_{j,w} - \pi_{j,l},$$

where:

$$\begin{aligned}
\pi_{j,w} &= R_w(\delta^*) - F_{j,w} = R_w(\delta^*) - \left(R_w(\delta^*) - R_l^-\left(\delta^+\right)\right) = R_l^-\left(\delta^+\right) \text{ and} \\
\pi_{j,l} &= R_l(\delta_i^*) - F_{j,l} = R_l(\delta^*) - \left(R_l(\delta^*) - R_l^-\left(\delta^+\right)\right) = R_l^-\left(\delta^+\right).
\end{aligned}$$

Hence, $B_j = 0$. C_{i1}'s willingness to pay is given by:

$$B_i = \pi_{i,w} - \pi_{i,l} + \pi_{1,w} - \pi_{1,l},$$

where:

$$\begin{aligned}
\pi_{i,w} &= R_w(\delta^*) - F_{wi} = R_l^-\left(\delta^+\right), \\
\pi_{i.l} &= R_l(\delta^*) - F_{wi} = R_l^-\left(\delta^+\right), \\
\pi_{1,w} &= R_w(\delta^*) - R_l^-\left(\delta^+\right) + R_l(\delta^*) - R_l^-\left(\delta^+\right) = R_w(\delta^*) + R_l(\delta^*) - 2R_l^-\left(\delta^+\right), \\
\pi_{1,l} &= R_w(\delta^*) - R_l^-\left(\delta^+\right) + R_l(\delta_i^*) - R_l^-\left(\delta^+\right) = R_w(\delta^*) + R_l(\delta^*) - 2R_l^-\left(\delta^+\right).
\end{aligned}$$

Hence, this consortium also has $B_1 = 0$.

From these computations, it is also easy to find the distributors' profit:

$$\pi = R_w(\delta^*) - \left(R_w(\delta^*) - R_l^-\left(\delta^+\right)\right) = R_l^-\left(\delta^+\right),$$

and the channel's profit:

$$\Pi_1 = R_w(\delta^*) + R_l(\delta^*) - 2R_l^-\left(\delta^+\right) \blacksquare$$

Proof of Lemma 6: First, think of the situation where channel 1 opts for an exclusive distribution contract at stage 1. There exists a fixed value π^0 that distributor i must earn to accept the contract offer from channel 1. π^0 is what i earns in the subgame equilibrium after which i rejects the offer from channel 1. For now, it is not important to know what π^0 actually is, only that it is a fixed value and that it is possible to write a contract such that distributor i earns π^0 in every possible subgame that follows distributor i's acceptance of the contract. In addition, we know that in every equilibrium, channel 2 earns nothing. Hence, when choosing to be exclusively distributed, channel 1 earns:

$$\Pi_1^+ = R_i^+(\delta, \beta) - \pi^0 - W_j^-(\delta),$$

if it wins the premium content auction, where $W_j^-(\delta)$ is the willingness to pay (or equilibrium bid) for the consortium of which channel 1 is not a part, which consists of either distributor $j \neq i$ and channel 2 together, or distributor j alone. $\delta = (\delta_1, \delta_2, \delta_A, \delta_B)$ is the premium content shares aired by the channels and the distributors.

First, because $\frac{\partial}{\partial \delta_j} R_i^+ \leq 0$ and $\frac{\partial}{\partial \delta_2} R_i^+ < 0$, it is never optimal ex post for channel 1 to collaborate with either distributor j or channel 2. As shown in Lemma 2, $R_i^+(\delta, \beta)$ is maximized by setting:

$$\begin{array}{rcl} (I) & \delta_i^+ = 0, \delta_1^+ = 1, \delta_j = \delta_2 = 0 & \text{if } \varepsilon = 0 \wedge \gamma = 0, \\ (II) & \delta_i^+ = \frac{1-\beta}{4-\beta}, \delta_1^+ = \frac{3}{4-\beta}, \delta_j = \delta_2 = 0 & \text{if } \varepsilon = 0 \wedge \gamma = 1, \\ (III) & \delta_i^+ = \frac{3-\beta}{4-\beta}, \delta_1^+ = \frac{1}{4-\beta}, \delta_j = \delta_2 = 0 & \text{if } \varepsilon = 1 \wedge \gamma = 1, \\ (IV) & \delta_i^+ = 1, \delta_1^+ = 0, \delta_j = \delta_2 = 0 & \text{if } \varepsilon = 1 \wedge \gamma = 0. \end{array}$$

This implies that channel 1 prefers ex post to share some of the premium content with distributor i (cases II and III), to let distributor i air everything (case IV), or to air everything themselves (case I).

In addition, channel 1 would like to minimize $B(\delta)$, which is the opposite of maximizing $R_j^-(\delta, \beta)$ with respect to δ, where $R_j^-(\delta, \beta)$ is j's revenue if it wins the auction. Again, because $\frac{\partial}{\partial \delta_i} R_j^- < 0$ and $\frac{\partial}{\partial \delta_1} R_j^- < 0$, it is never optimal ex post for distributor j to collaborate with either distributor i or channel 2. As shown in Lemma 1, R_j^- is maximized for:

$$\begin{array}{rcl} (I) & \delta_j^- = 0, \delta_2^- = 1, \delta_i = \delta_1 = 0 & \text{if } \varepsilon = 0 \wedge \gamma = 0, \\ (II) & \delta_j^- = \frac{1+\beta}{4+\beta}, \delta_2^- = \frac{3}{4+\beta}, \delta_i = \delta_1 = 0 & \text{if } \varepsilon = 0 \wedge \gamma = 1, \\ (III) & \delta_j^- = \frac{3+\beta}{4+\beta}, \delta_2^- = \frac{1}{4+\beta}, \delta_i = \delta_1 = 0 & \text{if } \varepsilon = 1 \wedge \gamma = 1, \\ (IV) & \delta_j^- = 1, \delta_2^- = 0, \delta_i = \delta_1 = 0 & \text{if } \varepsilon = 1 \wedge \gamma = 0. \end{array}$$

Now, think of the following deviation by channel 1, which offers channel 2 a horizontal joint bidding contract (δ_1', δ_2') at stage 1, where $0 < \delta_2' \rightarrow 0$. From Lemma 3, we know that if channel 2 rejects the offer and forms a consortium with distributor j, it loses the auction at stage 4. Hence, it is optimal for channel 2 to accept. However, we know that $R_i^+ \left(\delta_i^+, \delta_1^+\right) > R_i^+ \left(\delta_1', \delta_2'\right)$, so the contract offer does not maximize channel 1's gross profits. In addition, the deviation by channel 1 does not affect distributor j's willingness to pay, as j knows that if it wins the auction, it may just "resell" a share $\delta_2^- \geq 0$ of the premium content to channel 2 at a price $P = 0$. Channel 2, because it is viewer maximizing, always accepts such an offer ex post. Hence, distributor j should bid as if it has joined a vertical consortium with channel 2. Because the equilibrium bid for the premium content is unaffected, the deviation by channel 1 cannot be profitable.

Finally, think of the situation where channel 1 opts for full distribution at stage 1. Let $V(\delta, \beta) = R_A(\delta, \beta) + R_B(\delta, \beta) - B$ be the total industry profit as a function of $\delta = (\delta_1, \delta_2, \delta_A, \delta_B)$ and β, where B is the winning bid in equilibrium. Again, there exists a fixed value π^0 that each distributor $i = A, B$ must earn to accept the contract offer from channel 1. Again, we know that channel 2 earns nothing. Hence, in this scenario, channel 1 earns:

$$\Pi_1 = V(\delta, \beta) - 2\pi^0 - B,$$

if it wins the premium content auction, and:

$$\Pi_1 = V(\delta, \beta) - 2\pi^0,$$

if it loses. Gross of the price on the premium content, each distributor earns π^0, and channel 1 earns $V(\delta, \beta) - 2\pi^0$, irrespective of which consortium wins the premium content auction at stage 4. Hence, their willingness to pay for the premium content is zero, as shown in Proposition 2. The problem for channel 1 at stage 1 is then to maximize $V(\delta, \beta)$ with respect to δ. It is easy to show that $V(\delta^*, \beta) \geq V(\delta, \beta)$ for all δ, where:

$$\delta^* = \begin{cases} \delta_i^* = 0, \delta_k^* = 1, \delta_j^* = \delta_h^* = 0 & \text{if} \quad \varepsilon = 0 \wedge \gamma = 0 \\ \delta_i^* = \frac{1}{2}, \delta_k^* = \frac{1}{2}, \delta_j^* = \delta_h^* = 0 & \text{if} \quad \varepsilon = 0 \wedge \gamma = 1 \\ \delta_i^* = 1, \delta_k^* = 0, \delta_j^* = \delta_h^* = 0 & \text{if} \quad \varepsilon = 1 \wedge \gamma = 1 \\ \delta_i^* = 1, \delta_k^* = 0, \delta_j^* = \delta_h^* = 0 & \text{if} \quad \varepsilon = 1 \wedge \gamma = 0 \end{cases},$$

as shown in Lemma 4, where $i, j = A, B$, $i \neq j$, and $k, h = 1, 2$, $k \neq h$. And this completes the proof ■

Proof of Proposition 3: From Lemmas 2 and 4 and Propositions 1 and 2, we have the following profit for channel 1 in the case of exclusive distribution and full distribution, respectively:

$$\Pi_1^+ = \begin{cases} \frac{(6t+\beta)\left(\beta^2+1\right)}{36t} & \text{if} \quad \varepsilon = 0 \wedge \gamma = 0 \\ \frac{4\left(16t+3\beta-t\beta^2\right)\left(\beta^2+2\right)}{3t(4+\beta)^2(4-\beta)^2} & \text{if} \quad \varepsilon = 0 \wedge \gamma = 1 \\ \frac{3t+\beta}{18t} & \text{if} \quad \varepsilon = 1 \wedge \gamma = 0 \\ \frac{8\left(48t+17\beta-\beta^3-3t\beta^2\right)}{9t(4+\beta)^2(4-\beta)^2} & \text{if} \quad \varepsilon = 1 \wedge \gamma = 1, \end{cases}$$

$$\Pi_1 = \begin{cases} \frac{\left(24t-2\beta-\beta^2-1\right)(\beta+1)^2}{144t} & \text{if} \quad \varepsilon = 0 \wedge \gamma = 0 \\ \frac{144t^2+\beta^2}{144t} - \frac{(12t-2\beta-3t\beta-1)^2}{9t(4-\beta)^2} & \text{if} \quad \varepsilon = 0 \wedge \gamma = 1 \\ \frac{24t-8\beta+96t\beta-1}{144t} & \text{if} \quad \varepsilon = 1 \wedge \gamma = 0 \\ \frac{24t+90t\beta+2\beta^2+6t\beta^3-8\beta-48t\beta^2-1}{9t(4-\beta)^2} & \text{if} \quad \varepsilon = 1 \wedge \gamma = 1. \end{cases}$$

We then need to compare the incentive to choose exclusive distribution in each of these cases. To ensure that channel 1 does not corner the market on distributor i in the case of exclusive distribution, we have that $\beta \in [0, 1]$. Note that we impose the condition that t must be such that $\tilde{y}_w^+ (p^* | x = 1) < 0$ under exclusive distribution. Let this value be denoted by $\underline{t}$ in each case. We now proceed to study each case.

Case 1: $\varepsilon = \gamma = 0$

$$\begin{aligned} \Pi_1^+ &> \Pi_1 \\ &\Downarrow \\ t &< \frac{8\beta + 6\beta^2 + 8\beta^3 + \beta^4 + 1}{48\beta} \equiv \widehat{t}_1. \end{aligned}$$

In addition, we have that:

$$t > \frac{\beta(4-\beta)}{6} + \frac{5}{6} \equiv \underline{t}_1,$$

for $\tilde{y}_w(p^*|\, x = 1) < 0$. For $\widehat{t}_1 > \underline{t}_1$, we then have that:

$$\frac{\left(16\beta^3 - 26\beta^2 - 32\beta + \beta^4 + 1\right)}{48\beta} > 0. \tag{33}$$

Because the denominator is non-negative, we focus on the numerator to see when this inequality holds. Let the numerator be given as $F(\beta)$.

$F(0) = 1$, so the inequality holds. $F'(\beta)$ is negative for $\beta \in [0, 1]$ and $F(1) = -40$, so there is a cut-off where channel 1 prefers exclusive distribution to full distribution as the value of the premium content increases.

Graphic inspection of the inequality (33) is given in Figure 4, and we see that the incentives for exclusive distribution vanish quickly as $\beta > 0$.

Case 2: $\varepsilon = 0 \wedge \gamma = 1$

$$\begin{aligned} \Pi_1^+ &> \Pi_1 \\ &\Downarrow \\ t &< \frac{2304\beta + 1296\beta^2 + 1152\beta^3 + 96\beta^4 - \beta^6 + 256}{864(\beta+4)(4-\beta)\beta} \equiv \widehat{t}_2. \end{aligned}$$

In addition, we have that:

$$t > \frac{7\beta - 11\beta^2 + 40}{3(4-\beta)^2} \equiv \underline{t}_2,$$

for $\tilde{y}_w\left(p^*\middle|\, x=1\right) < 0$. For $\widehat{t}_2 > \underline{t}_2$, we then have that:

$$\frac{1024 - 37\,120\beta + 13\,968\beta^3 - 16\,704\beta^2 + 2400\beta^4 - 96\beta^5 - 4\beta^6 + \beta^7}{864\left(\beta+4\right)\left(4-\beta\right)^2\beta} > 0. \tag{34}$$

In the same way as in case 1, the denominator is always non-negative for $\beta \in [0,1]$ and $F(0) = 1024$, so in that case the inequality holds. $F'(\beta) < 0$ and $F(1) = -36\,531 < 0$, so the same reasoning as under case 1 applies. Graphic illustration of inequality (34) is given in Figure 5, and we see that the incentives for exclusive distribution quickly diminishes as β grows larger.

Case 3: $\varepsilon = 1 \wedge \gamma = 0$

$$\begin{aligned} \Pi_1^+ &> \Pi_1 \\ &\Downarrow \\ t &< \frac{(1+16\beta)}{96\beta} \equiv \widehat{t}_3 \end{aligned}$$

.In addition, we have that:

$$t > \frac{1}{3}\beta + \frac{5}{6} \equiv \underline{t}_3,$$

for $\tilde{y}_w\left(p^*\middle|\, x=1\right) < 0$ to hold. For $\widehat{t}_3 > \underline{t}_3$, we then have that:

$$\frac{\left(1 - 32\beta^2 - 64\beta\right)}{96\beta} > 0. \tag{35}$$

This holds for $\beta = 0$. This case can also be solved explicitly, and for the inequality to hold, $\beta < \frac{31}{2000}$. For completeness, the graph is given in Figure 6.

Case 4: $\varepsilon = 1 \wedge \gamma = 1$

$$\begin{aligned} \Pi_1^+ &> \Pi_1 \\ &\Downarrow \\ t &< \frac{\left(272\beta + 33\beta^2 - 16\beta^3 - 2\beta^4 + 16\right)}{6\left(17-\beta^2\right)\left(\beta+4\right)\left(4-\beta\right)\beta} \equiv \widehat{t}_4. \end{aligned}$$

In addition, we have that:

$$t > \frac{\left(3\beta - 8\beta^2 + \beta^3 + 40\right)}{3\left(4-\beta\right)^2} \equiv \underline{t}_4,$$

for $\tilde{y}_w\left(p^* \middle| x = 1\right) < 0$ to hold. For $\widehat{t_4} > \underline{t}_4$, we then have that:

$$\frac{\left(1209\beta^3 - 1908\beta^2 - 4368\beta + 248\beta^4 - 90\beta^5 - 8\beta^6 + 2\beta^7 + 64\right)}{6\left(17-\beta^2\right)\left(4-\beta\right)^2\left(\beta+4\right)\beta} > 0. \tag{36}$$

In the same way as in cases 1 and 2, the denominator is always non-negative for $\beta \in [0,1]$ and $F(0) = 64$, so in that case the inequality holds. $F'(\beta) < 0$ and $F(1) = -4851 < 0$, so the same reasoning as under cases 1 and 2 applies. The graph of inequality (36) is given in 7, and again it is shown that the incentives for exclusive distribution quickly vanish as β grows larger.

Hence, in all cases, the incentives for exclusive distribution are reduced as β increases, and for β larger than some (low) threshold value, channel 1 chooses full distribution. ■

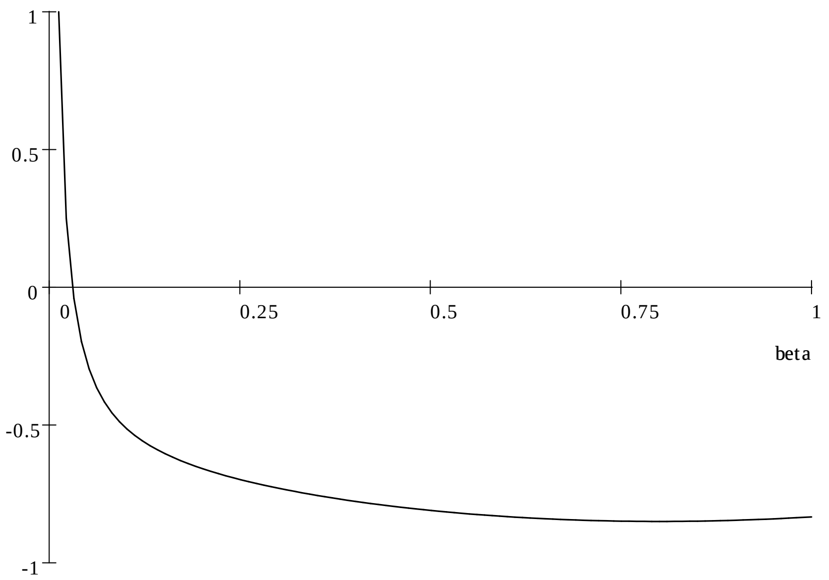

Figure 4: *Case 1:* $\varepsilon = 0 \wedge \gamma = 0$

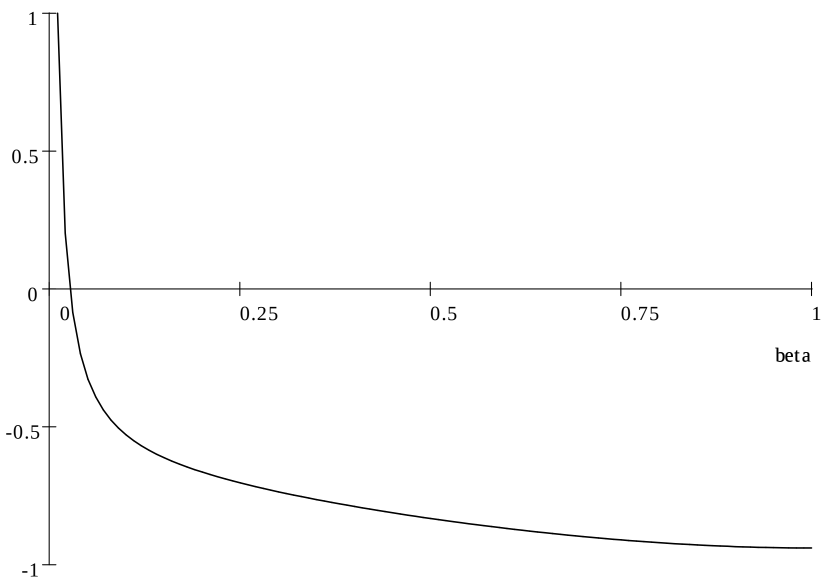

Figure 5: *Case 2:* $\varepsilon = 0 \wedge \gamma = 1$

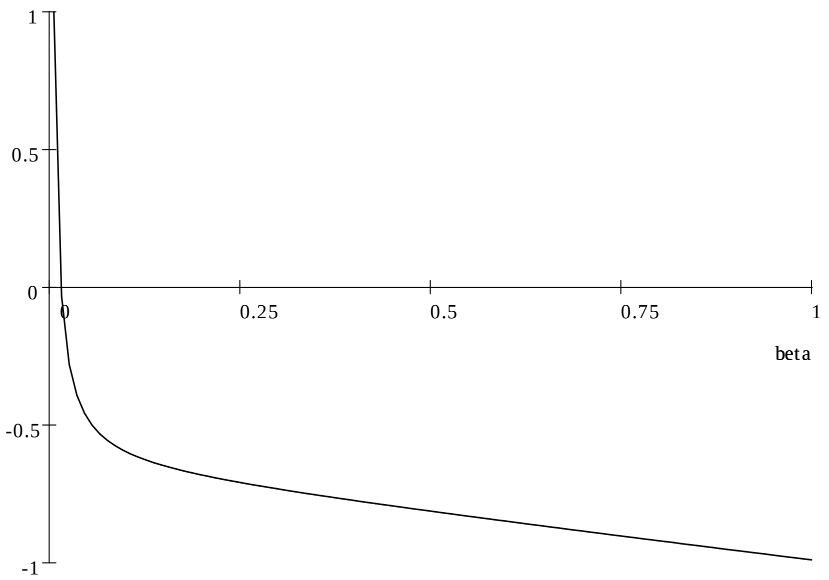

Figure 6: *Case 3:* $\varepsilon = 1 \wedge \gamma = 0$

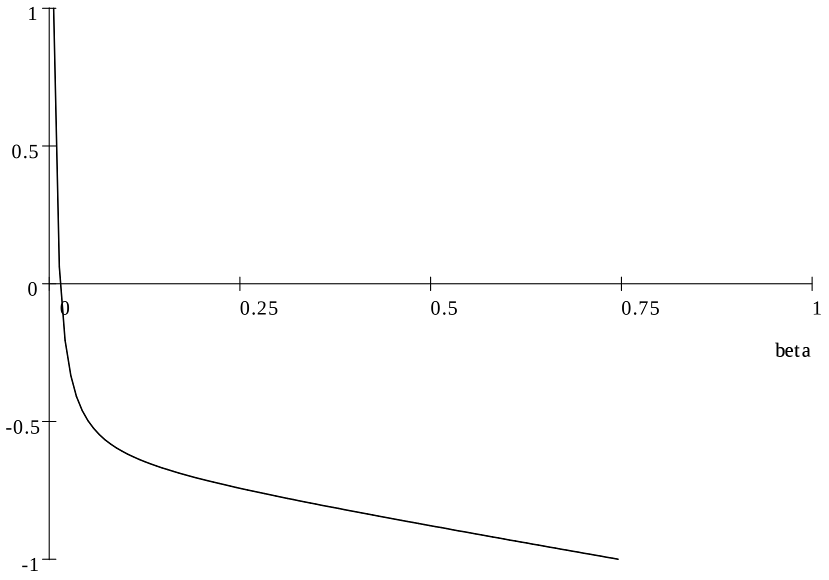

Figure 7: *Case 4:* $\varepsilon = 1 \wedge \gamma = 1$

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