Contracts and Competition in the Pay-TV Market*

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Abstract

This paper analyses how contractual arrangements for the sale and resale of premium programming affect competition in the pay-TV market. Competition is less effective when resale contracts specify per-subscriber fees rather than lump-sum payments. When premium programming is sold at terms similar to those observed in the UK, consumers can be made worse off than in the absence of premium programming. A number of potential remedies are considered. A ban on exclusive vertical contracts would intensify downstream competition and transfer the benefits of premium programming to consumers.

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1. Introduction

This paper is inspired by recent developments in the UK market for pay television. The Office of Fair Trading (OFT) is currently conducting a Competition Act inquiry into the wholesale pricing and other practices of British Sky Broadcasting (BSkyB) to determine whether the company's position is having a damaging effect on competition in the UK pay-TV market. This calls for an economic analysis of the contractual arrangements used to sell and resell broadcasting rights to determine whether they are anticompetitive. We use a simple model to investigate how different types of contracts affect downstream competition, the distribution of rents between upstream rights owners and downstream pay-TV companies, and overall economic welfare.

Pay-TV companies in Britain compete by purchasing the rights to broadcast programmes and then selling subscriptions to viewers.[1] There are currently three types of network: the direct to home (DTH) satellite network operated by BSkyB with approximately 53% of subscribers, local cable networks operated mostly by NTL and Telewest with 37% of subscribers, and a digital terrestrial network (DTT) operated by the most recent entrant ONdigital with the remaining 10% of the market.

The companies' products are differentiated both in the means of delivery and in the content of the programming packages offered. The three delivery systems cover different but partially overlapping segments of the population.[2] Each company offers its own packages of "basic" programming which must be taken by all subscribers, who can then purchase "premium" programming, typically major sports events and Hollywood movies, for the payment of additional monthly fees.[3]

Access to premium programming is widely viewed as being crucial for attracting customers.[4] As the first entrant in the market, BSkyB early on acquired the exclusive broadcasting rights to practically all of the Hollywood studios' first run films, and to most of the major sports events available to pay TV. For example, the UK's Premier League has sold the exclusive rights to broadcast live football matches to pay-TV companies in periodic auctions since 1992.[5] BSkyB has so far always acquired these rights under exclusive

[1] See Armstrong (1999) for a more detailed overview of the UK pay-TV industry.

[2] DTH satellite network coverage is limited by planning and technological restrictions, with roughly 80% of the population being covered. Currently, cable covers roughly 50% of the population, mainly in urban areas. At the moment, the coverage of DTT is around 70%, with ONdigital using three of the six existing terrestrial muliplexes. The other three multiplexes are reserved for free-to-air television. DTT's coverage can be increased by upping the power (which depends on the multiplex) to around 95%.

[3] For example, BSkyB offers a choice between three basic packages with increasing number of channels (value, popular and family) and offers two premium film channels (Moviemax and Sky Premiere) and two premium sport channels (Sky Sport 1 and 2).

[4] As Armstrong (1999) notes: "premium programming, where BSkyB currently holds an extremely strong position, is the major driver of subscriptions." Monopolies and Mergers Commission (1999) and Harbord, Hernando and von Graevenitz (2000) find evidence that the acquisition of premium programming rights confers monopoly power on broadcasters.

[5] Payments for the rights to broadcast live soccer games have grown drastically over time. Until 1992 BBC and ITV acted collusively, obtaining the rights for a yearly payment of roughly 3 million pounds. BSkyB obtained the rights for a yearly payment of roughly 37 million pounds in 1992, 167 million per year in 1997, and 366.6 million per year in 2000. See Cave and Crandall (2001) for a recent account of

vertical contracts and has been selling the resulting premium programming directly to its subscribers. BSkyB has also been selling premium programmes indirectly to the subscribers of the competing pay-TV companies in exchange for payments of per-subscriber monthly fees. The implications of these contractual reselling arrangements for downstream competition and economic welfare are not yet well understood.

When supplying under complete information to a monopolist who sells in an independent market, it is better to use fixed rather than variable fees in order to avoid the reduction in profits associated with double marginalisation (Spengler (1950)). The observation of reselling at variable fees in the UK pay-TV market is then indirect evidence of interdependence between the markets of the different pay-TV providers. In our model the demand for the programming of different pay-TV providers are interdependent.

Our point of departure is Armstrong's (1999) recent analysis of these issues in the context of Hotelling's model with asymmetries in the products' values and costs.[6] Although this simple model is special and abstracts from a number of potentially relevant features of the industry, it is quite well suited to illustrate the effects of horizontal and vertical contracts and to address possible remedies. We adopt his same model and discuss the robustness of our findings throughout the paper.

Firms initially compete in prices to sell differentiated products (basic programming) to customers. One firm (the industry leader) is assumed to be more efficient than its rival or equivalently to have previously acquired a more attractive package of basic programming. Acquisition of premium programming symmetrically increases the attractiveness of each firm's programming to subscribers. The outcome of the sale of the premium programming rights in the upstream market has an impact on the competitive balance in the downstream pay-TV market. A downstream firm which acquires the *exclusive* rights to premium programming obtains a competitive advantage over its rival firm which suffers a loss (a negative externality). Competition to purchase the rights can therefore be modelled as an auction with externalities in which downstream competition is affected by the outcome of the auction, as in Jehiel and Moldovanu (2000). In the absence of resale, the industry leader will outbid the rival in the auction.

Armstrong (1999) considers the case of the industry leader reselling the programming to its downstream competitor for a *lump-sum* (i.e. fixed) *payment*. As a result, the competitive advantage of the industry leader is reduced and the additional surplus from premium programming is captured by the consumers. Although the smaller downstream firm benefits from having access to the premium product, this gain is less than the industry leader's loss in competitive advantage from reselling. Reselling always increases consumer surplus and typically increases social welfare, but is not privately profitable for fixed fees.[7]

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the role of sport rights in the broadcast industry.

[6] Extensions of Hotelling's model have been widely used in a variety of similar contexts. See e.g. Laffont, Rey and Tirole's (1998) analysis of reciprocal network access pricing.

[7] Armstrong also considers alternative mechanisms (i.e. different vertical contracts) the upstream rights seller might adopt for selling premium programming rights, and concludes that the seller will prefer exclusive contracting when programming is sold for either lump sum or per subscriber fees. Essentially, exclusive contracting allows the upstream rights seller to exploit the negative externality suffered by a downstream firm which fails to acquire the rights, and hence increases its payoff. See also Armstrong

Very different conclusions obtain when downstream firms are allowed to resell premium programming through their competitors for *per-subscriber* (i.e. variable) *fees.* By reselling premium programming for per-subscriber fees, the downstream firm which acquires the exclusive rights *raises* the *rival's* marginal *cost* and simultaneously increases the *opportunity cost* of serving its own customers.[8,9] Downstream competition is less effective and equilibrium retail prices are higher when resale contracts specify a per-subscriber fee rather than a lump-sum payment. The model predicts that reselling takes place and that the upstream rights' seller prefers exclusive to nonexclusive vertical contracts, as observed.

With reselling for per-subscriber fees, premium programming becomes available to all consumers and this in itself increases social welfare. The per-subscriber resale price acts as an effective mechanism for relaxing downstream price competition and extracting consumer surplus from the premium product. It is as if the premium programming market were monopolized by a single firm. As a result of these vertical and horizontal contracts some consumers are worse off than in the case of no resale, when some of them are deprived of premium programming. In aggregate, consumers would prefer a ban on resale contracts, even though this would typically reduce social welfare.

Premium programming is the essential facility of a vertically integrated supplier to which downstream competitors would like to gain access. Departing from most of the access pricing literature, in our setting the vertically integrated firm sets its own downstream price with no intervention by the regulator. Our analysis in Section 3.3.2 explicitly accounts for the strategic effect resulting from the dependence of the access price on the downstream price. According to the so-called "DTH linkage" scheme, the variable resale price for premium programming is set in advance by BSkyB as a fixed percentage of its own corresponding retail price. We show that this pricing scheme is likely to induce even higher retail prices, so that consumer surplus can actually be lower than in the absence of premium programming.

Finally, we discuss a number of possible competition policy measures, some of which have already been implemented by the UK authorities. In our simple model neither a price-squeeze test nor forced rights splitting (equivalent to forced rights divestiture) have any effect on pricing, profits or consumer welfare. A ban on exclusive vertical contracts, however, would intensify downstream competition and transfer the social benefits of premium programming from firms to consumers.

The paper proceeds as follows: Section 2 introduces the basic model; Section 3 analyses the strategic effect of resale contracts on downstream competition; Section 4 compares different selling strategies of the upstream rights' seller; Section 5 discusses various remedies; Section 6 discusses the connection with the licensing literature; and Section 7 concludes.

(2000) for a simple example of this effect.

[8] Salop and Scheffman (1983), (1987) and Krattenmaker and Salop (1986) are standard references on raising rivals' cost via the sale of an essential input.

[9] In the competitive regime of the Hotelling model, an increase in the per subscriber resale fee shifts the reaction functions of both firms outwards by the same amount, inducing both firms to increase their retail prices. As discussed in the paper, the opportunity cost effect of resale on the selling firm's competitive incentives is present more generally in models of price competition.

2. Model

Timing. We consider a three stage game. First, the upstream monopolist sells the premium rights to one or both of the downstream firms. Second, if a downstream firm acquired the premium rights it resells them to the competing firm according to some contractual terms. Third, downstream firms compete to attract final customers.

Downstream competition. Two downstream television broadcasters (or firms) A and B compete to sell horizontally differentiated "basic" programming to consumers. Firm i's marginal cost of serving a consumer is c_i. The firms post prices simultaneously. Product differentiation may stem either from the difference in the basic programming packages offered by the firms or in the means of delivery (satellite, cable, digital terrestrial). Some buyers prefer the programming of one firm to that of the other. Consumers are indexed by their location on the unit interval $x \in [0, 1]$ and distributed uniformly. The two firms are located at the end points of the interval, firm A at 0 and firm B at 1, so that consumer x receives utility $u_A - tx - p_A$ from purchasing firm A's product at price p_A and utility $u_B - t(1 - x) - p_B$ from purchasing firm B's product at price p_B.[10] Let $s_i \equiv u_i - c_i \geq 0$ denote the utility of the consumer with highest valuation for good i net of the production cost of that good. We allow for asymmetries between the firms by assuming without loss of generality that firm A has a competitive advantage, $s_A \geq s_B$.[11,12]

Premium programming. Premium programming is modelled as in Armstrong (1999). If firm i acquires the programming and makes it available, the gross utility it offers increases from u_i to $u_i + \alpha$. All consumers are assumed to value the content of premium programming equally, being prepared to pay up to $\alpha > 0$ for it.[13] Since in this model all consumers wish to purchase the premium product, the premium and basic products are offered only as bundles. For simplicity, a firm's marginal cost of supplying the premium programming once they already serve a customer is assumed to be zero.

Equilibrium in the competitive regime. The qualitative features of the equilibrium in the Hotelling model depend on the parameters t, s_A and s_B. We focus on the "competitive" regime, where both firms are active and the market is covered, so that the marginal

[10] Since very few consumers subscribe to more than one pay TV provider, we exclude this possibility in the model.

[11] This competitive advantage may derive from a first-mover advantage, which has allowed firm A to acquire a more attractive package of basic programming rights. Alternatively, firm A could have a technological advantage. For example, since a satellite broadcaster is less capacity constrained than a digital terrestrial provider, it can offer a larger programming package.

[12] Asymmetries in market shares could also be due to different installed bases in the presence of consumer switching costs. This model can be extended to incorporate these dynamic considerations along the lines of Beggs and Klemperer (1992).

[13] A companion paper analyses resale contracts in a richer model which allows for both horizontal and vertical differentiation in the tastes of consumers.

consumer of each firm derives positive utility (net of the price paid and the transportation cost incurred), being indifferent between buying from either firm. The demand for one firm then increases in the competitor's price. The competitive regime results when there is enough, but not too much, product differentiation: $t \in [(s_A - s_B)/3, (s_A + s_B)/3]$. Equilibrium prices are

$$p_i = t + \frac{1}{3}\left(u_i - u_j + c_j + 2c_i\right). \tag{2.1}$$

with corresponding market shares

$$x_i\left(s_i, s_j\right) = \frac{1}{2} + \frac{s_i - s_j}{6t}. \tag{2.2}$$

In equilibrium, firm i's profits are

$$\pi_i\left(s_i, s_j\right) = \frac{1}{2t}\left(t + \frac{s_i - s_j}{3}\right)^2 \tag{2.3}$$

for $i = A, B$. Note that a uniform increase in the gross surpluses of both firms is competed away, so that profits depend on gross surpluses only through their difference $s_i - s_j$. In addition, profits are convex in $s_i - s_j$ because competitive pressure is reduced in more asymmetric situations.[14] An increase in the asymmetry increases profits of the superior firm more than it decreases profits of the inferior one. The sum of the firms' equilibrium profits

$$\Pi = \pi_A + \pi_B = t + \frac{\left(s_A - s_B\right)^2}{9t}$$

is then increasing in the absolute value of the difference in gross surpluses. Equilibrium consumer surplus is

$$V = \frac{s_A + s_B}{2} + \frac{\left(s_A - s_B\right)^2}{36t} - \frac{5t}{4},$$

so that total welfare is

$$W = V + \Pi = \frac{s_A + s_B}{2} + \frac{5\left(s_A - s_B\right)^2}{36t} - \frac{t}{4}.$$

3. Contracting with Rivals

We now analyse how the equilibrium in the downstream retail market is affected by the presence of the premium programming and the contractual terms used to sell and resell it. For simplicity we assume that the firms remain in the competitive regime when one firm acquires the premium programming rights

$$t \geq \frac{s_A + \alpha - s_B}{3}, \tag{3.1}$$

[14] More generally, Bester and Petrakis (1993) note this convexity property in a model of differentiated duopoly with linear demand under Bertrand and Cournot competition.

so that both firms remain active.[15] The rights owner can choose to sell the premium programming rights either exclusively to one downstream firm or nonexclusively to both broadcasters. It can also choose between selling for a lump-sum fee, on a per-subscriber basis, or using a two-part tariff. The downstream firm which acquires the exclusive rights can also choose to resell the programming to its rival for a lump-sum fee, a per-subscriber fee, or under a two-part tariff. For now we assume that the upstream rights owner sells the rights exclusively for a lump-sum payment and focus here on the downstream firms' resale decisions. More general upstream contracts are considered in Section 4.

3.1. No reselling

How much are the downstream firms are willing to pay for the exclusive broadcasting rights to α in the absence of reselling? If firm i acquires the rights, its downstream profits increase by $b_i = \pi_i(s_i + \alpha, s_j) - \pi_i(s_i, s_j) > 0$. If instead firm i fails to acquire the exclusive rights when firm j succeeds, its downstream profits *decrease* by $l_i = \pi_i(s_i, s_j) - \pi_i(s_i, s_j + \alpha) > 0$, where l_i is the *negative externality* imposed on firm i from the acquisition of exclusive rights by its competitor in the absence of reselling.

A firm's total willingness to pay for the exclusive rights which cannot be resold is $\Gamma_i = b_i + l_i$. Note that $\Gamma_A \geq \Gamma_B$ if and only if $\Pi(s_A + \alpha, s_B) > \Pi(s_A, s_B + \alpha)$. Since $\Pi(s_A, s_B)$ is increasing in the absolute value of the difference in gross surpluses $|s_A - s_B|$ and $s_A \geq s_B$, A's willingness to pay for the rights exceeds B's. Firm A has an advantage in acquiring the rights under any selling procedure.

The revenue R_S obtained by the upstream rights' seller from the rights depends on the bargaining power vis à vis the downstream firms.[16] If the upstream rights' seller holds an ascending-bid (second price) auction with no reserve price, firm A wins the auction for a price of Γ_B. Using the symbol δ to denote the change in a variable with respect to the equilibrium in the absence of the premium programming, we have $\delta\pi_A = b_A - \Gamma_B$, $\delta\pi_B = -l_B$ and $R_S = b_B + l_B$. Alternatively, if the upstream rights' seller has all the bargaining power, it could make a take-it-or-leave-it offer to the downstream broadcasters. This is equivalent to the rights' seller holding an ascending-bid auction with an optimal reserve price of Γ_A, so that firm A acquires the rights for a price of Γ_A. In this case, we have $\delta\pi_i = -l_i$ and $R_S = b_A + l_A$. Both downstream broadcasters are made worse off by the availability of the premium programming. In either of these cases:

$$\begin{aligned} \delta\Pi &= \frac{\alpha}{9t}(2(s_A - s_B) + \alpha) - R_S \\ \delta V &= \frac{\alpha}{2} + \frac{\alpha(2(s_A - s_B) + \alpha)}{36t} > 0 \end{aligned}$$

[15] This assumption is made to simplify the exposition. When it is violated, acquisition of the rights can lead to one firm becoming a monopolist (in the "limit pricing" regime). It is easy to show that, also in such a case, reselling of premium programming for fixed fees never occurs and reselling for per-subscriber fees always occurs.

[16] When the rights are sold nonexclusively the upstream seller cannot implement a standard auction procedure. In this case we assume that the seller can either make a take-it-or-leave-it offer, or that the outcome is the symmetric Nash bargaining solution

$$\delta W = \frac{\alpha}{2} + \frac{5\alpha\left(2\left(s_A - s_B\right) + \alpha\right)}{36t} > 0.$$

When only firm A has access to the premium programming, the benefits are shared between firm A and its customers who receive a utility increment of α while A's price increases by $\alpha/3$. In addition, firm B's customers benefit from the reduction in firm B's price induced by firm A's acquisition of the exclusive rights. Hence, aggregate consumer surplus increases as do downstream profits (gross of R_S) and total welfare. The total welfare gain may exceed α if the initial asymmetry $s_A - s_B$ is large enough (see Armstrong (1999) page 276).

3.2. Reselling for lump-sum payment

As remarked above, when contracting with an independent monopolist it is best to sell premium programming for a lump-sum payment. It is then natural to consider what happens when downstream broadcasters with interdependent demands are able to resell the premium programming to their competitors for a lump-sum payment. If the rights are resold in this way, downstream profits are the same as they would be in the absence of the premium programming, $\pi_i\left(s_i + \alpha, s_j + \alpha\right) = \pi_i\left(s_i, s_j\right)$. The additional value available from the provision of premium programming cannot be appropriated by the competitors. From equations (2.1) it is easy to check that equilibrium prices are unchanged, even though all consumers now receive the utility increment α. Total downstream profits are unchanged, while both consumer surplus and total welfare increase by the benefits α from premium programming.

Completing Armstrong's (1999) analysis, we show that reselling of premium programming for lump-sum fees only takes place when it results in an increase in asymmetry:[17]

Proposition 1 *Reselling for lump-sum payment is never profitable for firm A, and it is profitable for firm B whenever $\alpha \leq 2(s_A - s_B)$. The firms' willingness to pay for the rights are $\Gamma_A = b_A + l_A$ and $\Gamma_B = \max\langle l_A, b_B\rangle + l_B$.*

Firm A is willing to pay more than B since $l_A \geq l_B$ and $b_A > \max\langle l_A, b_B\rangle$. When the upstream rights' seller has all the bargaining power, firm A will win the auction for a payment of Γ_A. Hence $\delta\pi_A = -l_A$, $\delta\pi_B = -l_B$ and $R_S = b_A + l_A$. If the rights' seller holds an ascending bid auction for the rights with no reserve price, A will win the auction for a payment of Γ_B, so $\delta\pi_A = b_A - \Gamma_B$, $\delta\pi_B = -l_B$, and $R_S = l_A + l_B$. Downstream profits, consumer surplus and total welfare are all the same as they would be under no reselling. However, since $\Gamma_B = l_B + \max\langle l_A, b_B\rangle$ in this case, A pays weakly more for the rights in an ascending bid auction with no reserve price than in the case of no reselling. The

[17] We assume the reselling firm retains the right to broadcast premium programming to its subscribers. If instead firm B could resell to firm A by granting A the exclusive rights to the premium programming (so that firm B no longer retains the rights for itself), then B could obtain $b_A + l_A$ from A for the rights by making a take-or-leave-it offer. Clearly B would then always choose to resell, since $b_A + l_A > b_B + l_B$, and the value of the rights would be the same to both downstream firms. This form of resale is typically not allowed under rights contracts in the UK pay-TV market.

effect of allowing reselling for lump-sum payment is to increase weakly the revenues to the upstream rights' seller, with no change to the allocation. But the restriction to lump-sum payment is not innocuous.

3.3. Reselling for per-subscriber fee

In reality, BSkyB has been acquiring premium rights and then reselling them to the competitors for per-subscriber fees. The analysis in this section rationalises this. Reselling for a per-subscriber fee of q increases the marginal cost of the firm purchasing the programming by q, while at the same time increasing the marginal opportunity cost of the reselling firm. The reselling firm, however, receives additional revenue of qx_j where x_j is the market share of the purchasing firm. This makes reselling more profitable for the firm which acquires the rights, and hence more likely to occur. When firm i acquires the rights and resells for a per-subscriber fee of q to firm j, i's profits are

$$\pi_i = (p_i - c_i)\, x_i + qx_j = (p_i - c_i - q)\, x_i + qX \tag{3.2}$$

where the total demand served is denoted by $X = x_i + x_j$, and j's profits are

$$\pi_j = (p_j - c_j - q)\, x_j. \tag{3.3}$$

When the market is covered, as in the competitive regime, total demand is fixed at $X = 1$. Firms therefore compete as if both their marginal costs had increased by q, while the firm reselling the rights receives additional revenues equal to q.

When the per-subscriber charge q exceeds α, the buying firm has a profitable deviation:

Lemma 1 *The per-subscriber resale charge cannot be larger than the value of the premium programming to consumers, i.e. $q \leq \alpha$.*

Proof. See the Appendix.

Note that for $q \leq \alpha$ we are guaranteed to remain in the competitive regime where (2.3) holds, so that profits are $\pi_i = \pi_i(s_i, s_j) + q$ and $\pi_j = \pi_j(s_j, s_i)$. Firm j's equilibrium profits are invariant with respect to q while firm i's profits are strictly increasing in q. When firm i resells to j it will then want to set the value of q as high as possible. Since firm j is indifferent over all values of q, higher values of q correspond to Pareto improvements in welfare of the two firms. One implication of this is that determination of the value of q does not depend upon the relative bargaining positions of firms i and j. The firms will then agree to set $q = \alpha$, the highest value consistent with equilibrium.[18]

Firm i will therefore be willing to resell the rights for a variable charge of q if and only if $q \geq b_i$ where $b_i < \alpha$ by assumption (3.1) guaranteeing that we remain in the competitive regime once firm i acquires the premium programming rights. Once either firm A or firm B acquires the rights, it resells them to its rival for a per-subscriber fee

[18] The analysis can be easily extended differentiated Bertrand competition with linear demand system. In this case the buying firm's payoff is decreasing in q.

$q = \alpha$. This leaves the rival firm in precisely the same position it would have been if the premium programming rights were not available. The profits of the firm which acquires the exclusive rights from the upstream rights' seller are also the same as they would have been if the premium programming rights had not been made available, except that it now receives the per-subscriber charge α. We conclude:

Proposition 2 *The firm i which acquires the exclusive rights to the premium programming always resells to the competitor j at a variable fee $q^* = \alpha$. The payoffs are $\pi_i(s_i, s_j) + \alpha$ and $\pi_j(s_j, s_i)$.*

When rights are resold for a per-subscriber fee of α, each firm's willingness to pay for the rights is then $\Gamma_i = \pi_i(s_i, s_j) + \alpha - \pi_i(s_i, s_j) = \alpha = \Gamma_j$. Resale for per-subscriber fees equalizes the value of the rights to each firm. The upstream rights' seller will now obtain $R_S = \alpha$ for the rights under either a take-it-or-leave-it offer or in a second price auction with no reserve price. Hence, although consumers in aggregate receive an additional gross utility of α, all of this surplus is captured by the firm which acquires the rights via the per-subscriber charge $q = \alpha$, which is then passed on to the upstream rights' seller. Since both firms' equilibrium prices increase by exactly α, aggregate consumer surplus is the same as in the case when the premium programming is not available. In summary, we have

$$\begin{aligned} \delta\Pi &= 0 \\ R_S &= \alpha \\ \delta V &= 0 \\ \delta W &= \alpha. \end{aligned}$$

Resale for a per-subscriber fee of α means that consumers receive no benefit from the availability of the premium programming, and the upstream rights' seller captures the entire social surplus created by its product.

Resale of premium programming for per-subscriber fees thus unequivocally reduces consumer welfare compared to the case of no resale. It does, however, have an ambiguous effect on total welfare due to the different allocations of the premium and basic programming in the two cases. When programming rights are resold for a per-subscriber fee, all consumers in the market will efficiently purchase the premium product. In the absence of resale, on the other hand, some consumers are excluded from consuming the premium product, but a larger fraction of consumers will purchase from firm A. Because the *ex ante* market share of firm A is inefficiently low (due to the usual monopoly distortion), the latter effect tends to increase total welfare. Resale will then be welfare improving if the net utilities from the two basic products are not too asymmetric. More precisely, a necessary condition for reselling to reduce total welfare it is that the *ex ante* market share of firm A be at least 60%; if α is small then firm A's market share must be at least 80%. When this occurs, resale for a per-subscriber fee will be privately profitable, but not socially optimal.

3.3.1. The strategy of reselling.

Reselling for per-subscriber fees allows the downstream firm to prevent the dissipation of downstream premium programming profits by *raising its rival's costs,* while simultaneously increasing the *opportunity cost* of serving its own customers. The opportunity cost effect reflects the fact that when the market is covered any revenues earned by the reselling firm from reducing its price and serving additional customers are at the expense of resale revenue that would otherwise have been received from the rival. This reduction in resale revenue has exactly the same effect as an increase in the reselling firm's marginal costs, giving both firms an incentive to increase their retail prices in equilibrium.

When firm A acquires the rights and resells to firm B at a resale price of q, the firms' profits may be written as

$$\begin{aligned}\pi_A &= (p_A - c'_A)\, x_A + qX \\ \pi_B &= (p_B - c'_B)\, x_B\end{aligned}$$

where the new cost is $c'_i = c_i + q$. The reselling firm A chooses strategically the variable q taking into account the impact on the outcome of competition. Following the analysis of Bulow, Geanakoplos and Klemperer (1985) and Fudenberg and Tirole (1984), the effect of an increase in the reselling price on the selling firm's profits is

$$\begin{aligned}\frac{d\pi_A}{dq} &= \left(x_A + (p_A - c'_A)\frac{\partial x_A}{\partial p_A}\right)\frac{dp_A}{dq} + (p_A - c'_A)\frac{\partial x_A}{\partial p_B}\frac{dp_B}{dq} - x_A\frac{\partial c'_A}{\partial q} \\ &\quad + q\left(\left(\frac{\partial x_A}{\partial p_A} + \frac{\partial x_B}{\partial p_A}\right)\frac{dp_A}{\partial q} + \left(\frac{\partial x_A}{\partial p_B} + \frac{\partial x_B}{\partial p_B}\right)\frac{dp_B}{dq}\right) + X\end{aligned}$$

After substitution of the first order condition (or by the envelope theorem)

$$\frac{\partial \pi_A}{\partial p_A} = x_A + \frac{\partial x_A}{\partial p_A}(p_A - c'_A) + q\left(\frac{\partial x_A}{\partial p_A} + \frac{\partial x_B}{\partial p_A}\right) = 0$$

and the decomposition

$$\frac{dp_B}{dq} = \frac{\partial p_B}{\partial c'_B}\frac{\partial c'_B}{\partial q} + \frac{\partial p_B}{\partial c'_A}\frac{\partial c'_A}{\partial q} + \frac{\partial p_B}{\partial q}$$

we have

$$\frac{d\pi_A}{dq} = (p_A - c'_A)\frac{\partial x_A}{\partial p_B}\frac{dp_B}{dq} - x_A\frac{\partial c'_A}{\partial q} + q\left(\frac{\partial x_A}{\partial p_B} + \frac{\partial x_B}{\partial p_B}\right)\frac{dp_B}{dq} + X.$$

In addition $\frac{\partial c'_A}{\partial q} = \frac{\partial c'_B}{\partial q} = 1$, so we may write

$$\begin{aligned}\frac{d\pi_A}{dq} &= \underbrace{(p_A - c'_A)\frac{\partial x_A}{\partial p_B}\frac{\partial p_B}{\partial c'_B}}_{\text{strategic raising rival's cost effect}} + \underbrace{(p_A - c'_A)\frac{\partial x_A}{\partial p_B}\left(\frac{\partial p_B}{\partial c'_A} + \frac{\partial p_B}{\partial q}\right)}_{\text{strategic opportunity cost effect}} \\ &\quad + \underbrace{x_A}_{\text{direct opportunity cost effect}} + \underbrace{q\left(\frac{\partial x_A}{\partial p_B} + \frac{\partial x_B}{\partial p_B}\right)\left(\frac{\partial p_B}{\partial c'_A} + \frac{\partial p_B}{\partial c'_B} + \frac{\partial p_B}{\partial q}\right) + X}_{\text{resale revenue effect}}\end{aligned} \tag{3.4}$$

The first addend is the *strategic raising rivals' cost effect* on A's profits through a change in B's price, brought about by a change in B's costs. The second addend is the *strategic opportunity cost effect* on A's profits through a change in B's price, brought about by a change in A's opportunity costs. The third addend is the *direct opportunity cost effect*. The fourth addend is the *resale revenue effect,* reflecting the increase in the reselling firm's revenues from sales of the premium product to its own customers, and to those of its rival.

Equation (3.4) is generally valid for Bertrand price competition. In the competitive regime of the Hotelling model the total output is fixed ($\frac{\partial x_A}{\partial p_B} = -\frac{\partial x_B}{\partial p_B}$),

$$\frac{dp_A}{dq} = \frac{2}{3} + \frac{1}{3} = 1 = \frac{dp_B}{dq}$$

from (2.1) and

$$\frac{\partial x_A}{\partial p_B}(p_A - c'_A) = x_A.$$

The sum of the two strategic effects exactly offsets the opportunity cost effect, so that the total effect of a marginal increase in the per-subscriber fee is an increase in the selling firm's profits equal to total output:

$$\frac{d\pi_A}{dq} = X.$$

Similar analysis shows that the buyer's profits are unaffected: $\frac{d\pi_B}{dq} = 0$. It can be shown that the strategic effects are weaker under Bertrand price competition with differentiated products than in the Hotelling model, so that the total effect on the seller's profits is then $\frac{d\pi_A}{dq} \leq X$ and on the buyer $\frac{d\pi_B}{dq} \leq 0$.

In the Cournot model the reselling firm's profits are $\pi_A = (p_A(x_A, x_B) - c'_A)\, x_A + qX$ for a given resale price q, where again $X = x_A + x_B$ and $c'_i = c_i + q$. After application of the envelope theorem we have

$$\frac{d\pi_A}{dq} = \underbrace{x_A \frac{\partial p_A}{\partial x_B}\frac{dx_B}{dq}}_{\text{strategic raising rival's cost effect}} + \underbrace{q\frac{dx_B}{dq} + x_B}_{\text{resale revenue effect}}.$$

The first addend is the *strategic raising rivals' cost effect* on A's profits from a decrease in B's output due to an increase in B's costs; the last addend is the *resale revenue effect*. Note that there is no strategic opportunity cost effect nor a direct opportunity cost effect. The resale price q appears as an addition to marginal cost for firm B only in the Cournot model, and does not affect the reaction function of firm A.

The Hotelling and Cournot models are both special cases in which the reselling firm's opportunity costs from serving an additional customer (unit of demand) are equal to q and zero respectively. In models of Bertrand competition with differentiated products this opportunity cost always exceeds zero, but is less than q. The effect of setting $q = \alpha$ on equilibrium prices and profits is thus greatest in the Hotelling model (where equilibrium prices increase by α compared to no reselling) and smallest in the Cournot model (where the equilibrium price is unchanged).

3.3.2. Proportional resale pricing: DTH linkage

The terms on which BSkyB resells programming to its competitors is subject to informal regulatory oversight by the Office of Fair Trading, under what is known as the "rate card." According to the so-called DTH linkage scheme, the rate card makes BSkyB's wholesale prices equal to a percentage of its retail prices to consumers. Currently, BSkyB charges its downstream competitors 57% or 59% of the retail price for direct subscription to the premium channel involved. For example, the wholesale price per-subscriber for a single premium channel is 57% of BSkyB's retail price for the BSkyB package which includes its largest basic package and that premium channel.[19]

The problem of access pricing when the firm giving access is a price setter has been considered by Laffont and Tirole (1994, Section 7) and Armstrong and Vickers (1998). Realising that the downstream price is an increasing function of the access price, the regulator lowers the access price relative to the full regulation case (which results in same cases in the Baumol-Willig efficient component pricing rule). However, these papers do not consider the strategic effect resulting from the fact that the access price is often set to depend on the downstream price, as in the case of the efficient component pricing rule and DTH linkage. This strategic effect is the focus of our analysis in this section and is more generally present in other situations where the access price depends on unregulated retail prices.

The Office of Fair Trading (1996) reviewed the linkage between the wholesale price at which BSkyB sold to cable companies and its DTH retail price. As reported at page 15, DTH linkage was found not to be per se anticompetitive: "We conceded that tying the wholesale price to the retail price, might have the effect of limiting potential price competition between DTH and cable. However, this effect could be obtained without linkage. Were BSkyB to abandon the DTH linkage and set its wholesale price independently the same effect could be achieved. It could set both the wholesale and retail prices at the levels it believed the market would bear. The two prices would thus be related. If BSkyB were to raise its retail price, there would be some substitution from DTH to cable. The return to BSkyB from its wholesale price would be lower than from DTH, so BSkyB would have an incentive to raise wholesale prices for cable. The effects would be similar to the direct linkage. No clear evidence of adverse effects arising solely from DTH linkage had been produced and we concluded that no action was necessary in respect of this issue."

We challenge the view that DTH linkage does not affect downstream competition. Consider the Hotelling model where firm i resells premium programming to the competitor j at a variable fee equal to a fixed proportion $0 \leq \mu \leq 1$ of its own downstream price, i.e. $q = \mu p_i$. With proportional resale price, a small reduction in the reselling firm's retail

[19] Various discounts on these wholesale prices are offered and these determine whether the 59% or the 57% figure apply. Even if the cost of the largest basic ("family") package is imputed in the base for computing the wholesale price for the premium channels, none of the basic channels become available to the subscriber. See footnote 3 on the different packages and premium channels offered. An important feature of DTH linkage scheme is that the resale price for a premium channel depends on BSkyB's retail total price for the basic package plus premium, rather than on the marginal price for premium for a customer who has already subscribed to BSkyB.

price results in a reduction not only in the resale revenues from the rival firm's marginal customers, but also in the resale price, and hence in the resale revenue received from all of its rival's inframarginal customers. This makes a reduction in price to attract the rival's customers even less profitable, and allows the firms to sustain higher equilibrium prices.

Consider downstream competition among the firms when firm i resells to firm j for a per-subscriber fee of μp_i for given μ. Assuming that firm j purchases, downstream profits in the competitive regime are

$$\begin{aligned}\pi_i &= (p_i - c_i)x_i + \mu p_i(1 - x_i) = ((1-\mu)p_i - c_i)x_i + \mu p_i \\ \pi_j &= (p_j - c_j - \mu p_i)x_j.\end{aligned}$$

An increase in μ shifts upward the best replies of both firms, so higher values of μ result in higher equilibrium prices. The equilibrium prices are then

$$\begin{aligned}p_i^{\mu} &= \frac{(3+\mu)\,t + (s_i - s_j)\,(1-\mu) + (3-\mu)c_i}{(1-\mu)\,(3-\mu)} \qquad (3.5)\\ p_j^{\mu} &= \frac{(3+\mu^2)t - (1-\mu)^2(s_i - s_j) + (3-\mu)\,(c_i\mu + c_j\,(1-\mu))}{(1-\mu)\,(3-\mu)}.\end{aligned}$$

In order to remain in the competitive regime it is necessary that $p_i^{\mu} + p_j^{\mu} \leq u_i + u_j - t$, which is always satisfied at $\mu = 0$ and violated at $\mu = 1$. We assume that $u_i + u_j$ is always sufficiently large to guarantee that we remain in the competitive regime for values of μ not exceeding $\overline{\mu}$ such that $\overline{\mu}p^{\overline{\mu}} = \alpha$.[20]

Comparison of proportional with variable resale price. We show that any given level of the resale price $q \leq \alpha$ can be implemented under the proportional pricing scheme by choosing the appropriate value of μ, and that this results in both downstream firms charging higher prices and earning greater profits than they would if q were set independently.

Proposition 3 *The reselling firm A can implement more profitably any value of the* variable fee q *with a* proportional resale price. *The resulting equilibrium prices are higher.*

Proof. See the Appendix.

Independent resale pricing is dominated by proportional resale pricing. Prices and profits for both firms are higher under proportional resale pricing when $\mu p_A = q \leq \alpha$. The argument in the proof also shows that these higher retail prices could not be sustained without linkage. Intuitively, less competitive prices are supported in equilibrium because by reducing the downstream price the selling firm also reduces automatically its resale price to the competitor. Charging the competitor a price proportional to the downstream price is an effective way for the selling firm to credibly commit not to undercut its price. Given strategic complementarity, the prices of both firms end up being higher than under unconditional variable fee.

[20] Gilbert and Matutes (1993) and Laffont, Rey and Tirole (1998) make similar assumptions.

Consumer welfare is thus further reduced by proportional resale pricing. When $q = \mu p_i$ consumers end up worse off than they would be if the premium product were not available. The resale of premium programming becomes a mechanism for altering the pricing incentives of the competing firms so as to achieve even more collusive outcomes at the expense of consumers.

The optimal value of μ. It is natural to ask what is the optimal level μ that the selling firm will set. Unfortunately, we are not able to give a definite answer to this question. It can be shown that in the competitive regime the selling firm's profits (A.1) are increasing in μ, but this expression is valid only if the buying firm does not wish to deviate. Lemma 1 guarantees that for values of μ such that $\mu p_i^{\mu} > \alpha$, there is no pure strategy equilibrium, so the buyer must mix between purchasing and not purchasing the premium content. Under the assumption that the expected payoff of the seller in the resulting mixed-strategy equilibrium will not exceed the most profitable pure-strategy equilibrium payoff for the reselling firm, the reselling firm will wish to set $\overline{\mu}$ such that $\overline{\mu} p_i^{\overline{\mu}} = \alpha$ as in the previous analysis.[21] Retail prices increase by more than α compared to the basic product equilibrium, and hence consumers suffer a reduction in consumer surplus. The resale of premium programming becomes a device for extracting more consumer surplus from sales of the basic product.

Willingness to pay for fixed μ. Which firm is willing to pay more for the premium rights when the wholesale price is proportional to the retail price, with fixed factor μ? The difference between A's and B's willingness to pay is then

$$\left(\pi_{i=A}^{\mu} - \pi_{j=A}^{\mu}\right) - \left(\pi_{i=B}^{\mu} - \pi_{j=B}^{\mu}\right) = -\mu \frac{(3-\mu)^2 (c_A - c_B) + 2(1-\mu)(s_A - s_B)}{(3-\mu)^2 (1-\mu)}.$$

Because of the proportional wholesale price, the selling firm ends up reducing its market share and the buying firm increasing it. For given μ, joint profits are then higher when the selling firm is the inferior firm B ($s_B < s_A$), provided that it also has lower costs ($c_B < c_A$). In this case, firm B is willing to pay more than A.

A simple remedy. A simple regulatory remedy to the proportional resale problem identified in this section would be to forbid the reselling price from being proportional to the

[21] When instead $\mu > \overline{\mu}$, by Lemma 1, firm j can profitably deviate to offering the basic product at a price of $p_j^{\mu} - \alpha$, so none of firm j's subscribers will purchase the premium product, and resale revenues are reduced to zero. Hence firm j purchasing at a price $\mu p_i^{\mu} > \alpha$ cannot be a pure strategy equilibrium. However both firms offering prices contingent upon firm j not purchasing cannot be a pure strategy equilibrium either, at least for values of μ not too much larger than $\overline{\mu}$, since in such an equilibrium the reseller will offer a price strictly less than p_i^{μ} resulting in $\mu p_i^{noresale} \leq \alpha$. Given this, the buyer will wish to purchase, and the seller wish to increase its price to p_i^{μ}. The only equilibrium for $\mu \in [\overline{\mu}, \widehat{\mu}]$ is then a mixed strategy equilibrium in which the buying firm randomizes over purchasing and not purchasing. For $\mu > \widehat{\mu}$ there is a unique pure strategy equilibrium in which the buyer does not purchase, where $\widehat{\mu}$ is defined by $\widehat{\mu} p_i^{noresale} = \alpha$.

current price, while still allowing it to depend on the historic price. With this modification the variable fee charged to the competitor is independent of the seller's downstream price. From now on, we return to the case where the resale price does not depend on the retail price.

3.4. More general resale contracts

Reselling for two-part tariffs. Consider now reselling of premium programming under a two-part tariff $\langle q_i, Q_i \rangle$, where q_i is the variable or per-subscriber fee and Q_i is the fixed payment from the buying firm j to the reselling firm i. The deviation argument of Lemma 1 continues to remain valid, so that we must still have $q_i \leq \alpha$. This implies that the equilibrium market shares and prices of each firm are unchanged. A two-part tariff of this form merely redistributes rent between the two firms, without affecting the outcome in the downstream market.

When firm i can make a take-it-or-leave-it offer, we have $\langle q_i, Q_i \rangle = \langle \alpha, l_j \rangle$. The fixed component of the two-part tariff serves the purpose of extracting the buying firm's rent $l_j = \pi_j(s_j, s_i) - \pi_j(s_j, s_i + \alpha)$, equal to the difference in the profits achieved by j when i alone sells the premium product to that achieved when i resells to j. Firm i's willingness to pay for the rights to the premium programming is then $\Gamma_i = \alpha + l_j + l_i$, so that the value of the rights is again the same to both firms and the upstream rights' seller obtains $R_S = l_i + l_j + \alpha$, under either a take-it-or-leave-it offer or in a second price auction with no reserve price.

It is puzzling that the reselling contract used by BSkyB does not involve a fixed component. This could be due to a situation of bilateral monopoly in reselling. If the reselling firm does not have all of the bargaining power, all resale contracts of the form $\langle q_i, Q_i \rangle$ resulting from efficient bargaining will still have $q_i = \alpha$, but they might involve $Q_i < 0$. For example, j's payoff under Nash bargaining

$$\pi_j (s_j, s_i + \alpha) + \frac{1}{2} (\pi_i (s_i, s_j) + \pi_j (s_j, s_i) + \alpha - \pi_i (s_i + \alpha, s_j) - \pi_j (s_j, s_i + \alpha))$$

can be written as $\pi_j (s_j, s_i) + \alpha/6$, so that to achieve the Nash bargaining payoffs the fixed payment from the buying firm to the selling firm is negative, $Q_i = -\alpha/6 < 0$. But such a fixed payment from the seller to the buyer could raise suspicion of collusion. We conclude that in the presence of bilateral monopoly and a non-negativity constraint on the transfers from the buyer to the seller, the fixed component of the two part tariff is equal to zero.

Contingent contracts and quantity discounts. The selling firm could further increase profits by using contingent contracts which specify transfers conditional on prices or quantities. Clearly, the joint monopoly outcome can be achieved if the competing firms sign fully contingent contracts with penalties for deviations by either firm. However, such contracts would typically be deemed illegal due to violation of competition laws, and would therefore be unenforceable.

The resale of premium programming can become a mechanism for altering the pricing incentives of firms so as to achieve more collusive outcomes at the expense of consumers.

The contractual terms for selling the premium programming could be chosen so as to maximise the seller's profits. For instance, the selling firm could easily impose penalties, bonuses and discounts dependent upon the quantity of the premium programming sold by the buying firm. Nevertheless, the possible deviation by the selling firm typically imposes constraints on the outcome which can be implemented in equilibrium.

4. Incentives of the Upstream Rights' Seller

We now consider the choice of the upstream rights' seller between selling the rights exclusively or nonexclusively for lump-sum fees, per-subscriber fees, or under a two-part tariff.[22] Armstrong (1999) considered the first two of these alternatives in the absence of resale, and concluded that the rights' seller would prefer exclusive contracting when the programming is sold for either lump-sum or per-subscriber fees. In this section we show that:

Proposition 4 *With reselling for a fixed payment, variable fee, or two-part tariff with non-negative fixed component, selling exclusively for a fixed payment is optimal for the upstream monopolist.*

4.1. Selling for lump-sum payments

The upstream rights' seller could sell the rights for a lump-sum payment either exclusively to one firm or nonexclusively to both firms. Under *exclusive sale with reselling at variable fee* allowed, the downstream firm which acquires the rights ends up reselling to the rival for a per-subscriber fee of $q = \alpha$. Either firm is willing to pay α for the exclusive rights, so the upstream rights' seller obtains the same payment of α for the rights under either a take-it-or-leave-it offer or an ascending-bid auction.[23]

If the rights are sold *nonexclusively* for a lump-sum fee, the benefit to either firm from acquiring the nonexclusive rights is zero, given that the rival firm also obtains the rights. The upstream seller's promise not to also sell to the other firm is not credible under non-exclusive sale. Once a firm i has purchased, the seller will want to also sell to j for a payment up to l_j, which j would accept. Given this, each firm i will not pay more than l_i. The rights' seller's maximum payoff is then $l_A + l_B = \frac{2\alpha}{3}\left(1 - \frac{\alpha}{6t}\right) < \alpha$.

In conclusion, the upstream rights' seller prefers to sell the rights exclusively rather than non-exclusively. Note that when the rights are sold nonexclusively $\delta\Pi = -(l_i + l_j)$ and $\delta V = \delta W = \alpha$, whereas under exclusive selling $\delta\Pi = \delta V = 0$ and $\delta W = \alpha$. The downstream firms prefer exclusive selling, while consumers prefer nonexclusive selling.

[22] While in this environment with externalities other mechanisms could possibly result in higher revenue for the upstream seller, we focus on a comparison between these simple and commonly used mechanisms.

[23] Under *exclusive sale with reselling at fixed fee*, firm A will outbid firm B for the rights and pay $l_A + b_A$ under a take-it-or-leave-it offer or $l_B + \max\langle l_A, b_B\rangle$ in an ascending-bid auction with no reserve price. Since $l_A + b_A$ can exceed α when the intial asymmetry between the firms is large enough, i.e. when the industry leader's initial market share exceeds 75%, the upstream rights seller might wish to sell the rights exclusively but prohibit resale. We assume that this case does not apply. Note that this can only occur if the upstream rights seller can commit itself to a take-it-or-leave-it offer, as $l_B + \max\langle l_A, b_B\rangle < \alpha$ always.

4.2. Selling for per-subscriber fees

Suppose next that the upstream rights' seller makes the premium programming available to the downstream firms for a per-subscriber fee rather than for a fixed payment. If the rights are sold *exclusively* to one firm for a per-subscriber fee of r_i when firm i acquires the rights and resells to firm j at a price of q, firms' profits are

$$\begin{aligned} \pi_i &= \pi_i(s_i, s_j) + q - r_i \\ \pi_j &= \pi_j(s_j, s_i). \end{aligned}$$

The reselling firm sets $q = \alpha$ regardless of r_i. If $r_i \leq \alpha$ then resale will take place and the rights' seller will receive $R_S = r_i$ for the rights. Hence $r_i = \alpha$ is optimal for the rights' seller, and both firms will be willing to pay up to this price.[24,25]

If the rights are sold *nonexclusively* for a per-subscriber fee, both firms will purchase the premium programming if and only if $r_i \leq \alpha$. In a take-it-or-leave-it offer the upstream rights' seller will set $r_A = r_B = \alpha$ and earn revenues of $R_S = \alpha$. When selling for per-subscriber fees, exclusive or non-exclusive selling yield the same revenue to the upstream rights' seller.

4.3. Selling for two-part tariffs

We now consider what happens when the programming rights are first sold for two-part tariff $\langle r_i, R_i \rangle$ and then resold for two-part tariffs $\langle q_i, Q_i \rangle$.

Lemma 2 *With reselling for two-part tariffs with fixed components Q_A and Q_B, the upstream seller obtains $\alpha + Q_A + Q_B$ when selling exclusively for a fixed payment and α when selling non-exclusively.*

Proof. See the Appendix.

Selling rights exclusively for a lump-sum fee weakly dominates other selling schemes for the rights' seller. Under exclusive selling for a lump-sum fee the rights' seller will obtain α for the rights when they are resold for a per-subscriber fee, whether or not it is able

[24] Reselling will always occur since we may define $\alpha_i' = \alpha - r_i$. Then the reselling condition is $2t \geq \frac{s_i - s_j}{3} + \frac{\alpha_i'}{6}$. Since this is satisfied for α by assumption (3.1), it is also true for α_i'.

[25] Armstrong (1999) notes that in the absence of resale the willingness of each downstream firm to pay for the rights will depend upon the terms offered to its competitor should it reject any given offer from the rights seller. If the upstream seller can commit itself to making a favourable offer to the rival firm in the event of a rejection, it can extract a high payment from either firm by exploiting the negative externality suffered when the rival acquires the rights for a low per-subscriber charge. Hence, the sale of rights for per subscriber fees in the absence of resale raises some difficult issues of credibility which are not easily resolved, at least when the seller has the ability to make take-it-or-leave-it offers. Armstrong argues that under credible selling procedures the upstream seller will obtain at most α for the rights. This would also be the outcome when the seller holds an auction with no reserve price. When the rights can instead be resold for a per-subscriber fee, the value of the rights to either firm is independent of the offer made to its competitor, and simply equal to α. Thus resale for per-subscriber fees allows us to sidestep the credibility issue.

to commit itself to making a take it or leave it offer to downstream firms. Selling rights for per-subscriber fees also earns revenues of α for the upstream rights' seller. The rights' seller obtains up to $R = R_S = \alpha + l_j + l_i$ when rights are sold exclusively for a lump-sum fee and resold under a two-part tariff.

As remarked above, when the selling firm does not have all the bargaining power, the fixed component Q_i of the two-part tariff in the reselling contract can be negative. In this case, reselling under simple two-part tariffs may end up reducing the upstream rights' seller's profits, since the willingness to pay of each firm would then be $\Gamma_A = \Gamma_B = \alpha + Q_A + Q_B < \alpha$.[26] Note that in this case, it might be better for the upstream seller to forbid fixed components in the reselling contracts, or alternatively to sell non-exclusively at α.

5. Remedies

The Office of Fair Trading already informally regulates BSkyB's resale prices and it has intervened in the pay-TV market on an number of occasions. During the most recent auction for Premier League broadcasting rights in June 2000, for instance, the OFT intervened to ensure that the rights were split into a package of pay per view rights and non pay per view rights, with no company permitted to win the auctions for both packages. It also (unsuccessfully) challenged the Premier League's collective selling practices in the Restrictive Trade Practices Court in 1999 (see Cave and Crandall (2001)). If the OFT's current Competition Act inquiry finds that BSkyB is engaging in anticompetitive conduct designed to damage its competitors or exploit consumers, additional and more effective remedies will need to be found.

The key competition problem identified in our analysis is that resale contracts specifying per-subscriber fees allow the downstream firms which acquire the exclusive rights to premium content to relaxes downstream price competition. Dissipation of monopoly rents is avoided and consumers are deprived of the benefits of competition. Exclusive vertical contracts then permit upstream rights owners to transfer their monopoly power downstream, resulting in higher prices and lower consumer welfare. Effective remedies should therefore focus on regulating the way in which rights are sold and resold.[27] Below we consider three such remedies: forced divestiture of premium programming rights or forced rights splitting; forced rights sharing or reselling for lump-sum fees; and a ban on exclusive vertical contracts.

[26] Note that this implies that if the firms could commit themselves *ex ante* to paying a negative fixed fee Q, they would end up paying less for the rights to the upstream seller, and each firm's profit would increase by Q.

[27] We focus here on remedies designed to increase market competitiveness rather than regulate monopoly behaviour. In our model a price-squeeze test amounts to a requirement that the reselling firm should earn positive profits on the bundle of basic and premium programming at price q, i.e. $p_i - c_i - q > 0$. This condition is always satisfied in equilibrium, however, so imposes no additional constraint upon resale prices. An alternative might be to regulate the resale price q directly. As q is lowered from α, surplus is transferred on a one for one basis from firms to consumers. Hence, not surprisingly, direct price regulation is a more effective, albeit more heavy-handed, regulatory measure than a price squeeze test.

5.1. Forced rights splitting or rights divestiture

As noted above, the OFT recently intervened in the pay-TV market to ensure that Premier League broadcasting rights were split into a package of pay per view rights and a package of non pay per view rights, with no pay-TV company permitted to win the auctions for both packages. Cave and Crandall (2001) also suggest that the rationale behind the OFT's challenge of Premier League collective selling practices in the Restrictive Trade Practices Court, was that the Premier League should make more rights packages available: "In his argument before the Court, the Director General made it plain that he had no objection per se to collective sale of matches by the Premier League. Indeed he suggested that two or more packages of rights could be sold to separate broadcasters, each granting exclusivity over the matches in question."

It is unclear, however, whether the splitting of broadcasting rights into separate exclusive packages can be expected to have any significant procompetitive effect. To address this issue we consider two alternative ways in which rights could be separated into packages. First, forced rights splitting prescribes that the rights' seller is required to split the rights and sell them to different firms. Second, forced rights divestiture prescribes that the downstream firm which has acquired the exclusive rights is asked to divest itself of a fraction of the rights by selling them for a lump-sum fee to a competitor.

Forced rights splitting. Suppose first that the upstream rights' seller splits the rights into two packages α_A and α_B such that $\alpha_A + \alpha_B = \alpha$. Without loss of generality, assume that firm A acquires the rights to α_A and firm B acquires the rights to α_A. Each will then resell the rights for a per-subscriber charge of $q_i \leq \alpha_i$ so that $\pi_i = (p_i - c_i - q_j)x_i + q_i(1 - x_i) = (p_i - c_i - q_j - q_i)x_i + q_i = \pi_i(s_i, s_j) + q_i$. The firms will then agree on resale prices $q_i = \alpha_i$. The total surplus extracted from selling the premium programming is therefore $\alpha_A + \alpha_B = \alpha$.

How much will downstream firms be willing to pay for the split rights? Suppose that the rights to α_A are sold first. In the second stage, each firm's willingness to pay for the rights to α_B, given that the other firm has acquired the rights to α_A, is then just $\Gamma_i^{\alpha_B} = \alpha_B$. If this is the price paid for α_B at the second stage under a take-it-or-leave-it offer, the willingness to pay for α_A is then $\Gamma_i^{\alpha_A} = \alpha_A$. Hence, when the rights' seller can make take it or leave it offers, we obtain

$$\begin{aligned} \delta\Pi &= \alpha - R_S \\ R_S &= \alpha \\ \delta V &= 0 \\ \delta W &= \alpha. \end{aligned}$$

Forced rights splitting simply creates two downstream monopolies and does not differ from the case in which the exclusive rights are all sold to a single firm.[28]

[28] When the rights seller does not have all the bargaining power, and we impose the symmetric Nash bargaining solution we find that forced rights splitting still has no effect on competition, consumer surplus or total welfare, but may effect how much the upstream rights seller receives for the rights.

Forced rights divestiture. By forced rights divestiture we mean a requirement on the firm which holds the exclusive rights to give up a fraction of them to its rival in exchange for a fixed payment. This could be implemented, for instance, by requiring firm i to divest itself of α_j to firm j, while retaining α_i. It is natural to assume that $\alpha_i \geq \alpha_j$ and $\alpha_i + \alpha_j = \alpha$. Again, firms will resell the rights for per-subscriber fee $q_i = \alpha_i$, so that the total surplus extracted from selling the premium programming is $\alpha_A + \alpha_B = \alpha$. The willingness to pay to acquire the rights depends upon the transfer price for α_j which we denote by z_{ji}. When firm i acquires the rights its net gain is $\alpha_i + z_{jj}$ and when it does not acquire them its net gain is $\alpha_j - z_{ji}$. Hence $\Gamma_i = (\alpha_i - \alpha_j) + z_{jj} + z_{ji}$. The maximum transfer either firm would pay is α_j and the maximum value of Γ_i is α. Under take-it-or-leave-it offers the same payoffs as under forced rights splitting result. In conclusion, forced rights divestiture has again no effect on competition, consumer surplus or welfare.[29]

5.2. Forced rights sharing

Resale of exclusive rights for per-subscriber fees results in both firms charging a price increment of $\delta P_i = \alpha$ for the premium good and consumers receiving no benefit from the availability of the premium product. If instead the rights are acquired by both firms for a lump-sum fee, each downstream firms' price increment is $\delta P_i = 0$. Hence downstream firms make no additional profits from the premium good, and consumer surplus increases by α. This suggests that a remedy for the monopolistic pricing of the premium product would be to force firms to resell programming rights to each other for lump-sum fees.

Assume then that firm A has acquired the exclusive rights and is forced to sell to firm B for a lump-sum fee. Firm B will accept any transfer price z_B less than l_B. Similarly, if firm B acquires the rights, A will accept any transfer price z_A less than l_A. If the regulatory authority knows l_A and l_B, then it can impose transfer prices z_A and z_B satisfying these restrictions ($z_i \leq l_i$) upon the firms. Each firm's *maximum* willingness to pay for the rights is then $\Gamma_i(z_i, z_j)$ where $\Gamma_i = z_i + z_j$. To see this, suppose first that the seller can make a take it or leave it offer to either firm. Table 1 represents a game in which firms simultaneously decide to accept or reject a given offer R from the seller. Either firm will accept any offer $R \leq z_A + z_B$ assuming that the other firm will acquire the rights if it does not. Firm i will reject the seller's offer, on the other hand, if $R > z_j$ and it assumes that firm j will also reject the offer. For $\max(z_A, z_B) < R \leq z_A + z_B$ there are therefore two pure strategy equilibria, $\langle$Accept,Accept$\rangle$ and $\langle$Reject,Reject$\rangle$. If $R < \max(z_A, z_B)$ then $\langle$Accept,Accept$\rangle$ is the unique dominant strategy equilibrium.

Table 1

	Firm B accepts	Firm B rejects
Firm A accepts	$\pi_A + \frac{1}{2}[z_B - R - z_A], \pi_B + \frac{1}{2}[z_A - R - z_B]$	$\pi_A + z_B - R$, $\pi_B - z_B$
Firm A rejects	$\pi_A - z_A$, $\pi_B + z_A - R$	π_A, π_B

[29] Allowing for bargaining between the downstream firms does not affect this result.

Alternatively, if the seller holds an ascending bid auction with no reserve price, either firm will bid up to $z_B + z_A$ before dropping out. To see this note that firm i's payoff is $\pi_i - z_i$ when dropping out and it is $\pi_i + z_j - R$ when wining the auction at price R. Firm i is therefore willing to stay in so long as $R \leq z_i + z_j$. The result of an ascending-bid auction with no reserve price is:

$$\begin{aligned} \delta\Pi &= -(z_A + z_B) \\ R_S &= (z_A + z_B) \\ \delta V &= \alpha \\ \delta W &= \alpha \end{aligned}$$

So long as the regulatory authority can implement resale prices $z_i \leq l_i$, this remedy transfers α to consumers and allows the upstream rights' seller to obtain revenues equal to the sum of those resale prices.[30]

5.3. Regulatory rights-sharing rule

The regulators are unlikely to know the values of l_A and l_B, and so could base a rights sharing formula on observable market variables. For instance, each firm could be asked to pay a fraction of the cost of the rights in proportion to its market shares. If firm i has paid R_i to acquire the exclusive rights from the upstream rights' seller, firm j would pay a lump-sum of $x_j R_i$ to acquire the rights from firm i. Then

$$\begin{aligned} \Gamma_A(R_A, R_B) &= R_A x_B(s_A, s_B) + R_B x_A(s_A, s_B) \\ \Gamma_B(R_A, R_B) &= R_A x_B(s_A, s_B) + R_B x_A(s_A, s_B), \end{aligned}$$

with $R_A x_B(s_A, s_B) \leq l_B$ and $R_B x_A(s_A, s_B) \leq l_A$, which implies that $R_A = R_B = R$, so the value of the rights are equalized. It is easy to see that the maximum value of R consistent with incentive compatibility is $l_B / x_B(s_A, s_B)$.

If the upstream rights' seller makes a take-it-or-leave-it offer of R , then assuming that firm i will accept, firm j can do no better than to accept. ⟨Accept,Accept⟩ is an equilibrium in weakly dominated strategies and results in zero revenue for the seller. ⟨Reject,Reject⟩ is a more reasonable equilibrium (see Table 2).

Table 2

	Firm B accepts	Firm B rejects
Firm A accepts	$\pi_A - Rx_A$, $\pi_B - Rx_B$	$\pi_A - Rx_A$, $\pi_B - Rx_B$
Firm A rejects	$\pi_A - Rx_A$, $\pi_B - Rx_B$	π_A, π_B

Consider an ascending bid auction for the rights. When will A or B drop out? Suppose the current bid is R and it is B's turn to either improve on R or drop out immediately. If

[30] The regulatory authority could simply impose $z_i = 0, i = A, B$ to guarantee incentive compatibility, but in this case the upstream rights seller would obtain no revenues for the rights.

B drops out then his payoff will be $\pi_B(s_A, s_B) - Rx_B(s_A, s_B)$, so long as $Rx_B \leq l_B$. If B stays in his payoff is at most $\pi_B(s_A, s_B) + Rx_A(s_A, s_B) - R = \pi_B(s_A, s_B) - Rx_B(s_A, s_B)$. Hence B's payoff from dropping out immediately always (weakly) exceeds the payoff from staying in.[31] It is therefore a (weakly) dominant strategy for B to drop out at $R = 0$ (i.e. not to enter the auction). Likewise it is optimal for A not to enter the auction, so the seller again obtains nothing for the rights.

A rights sharing formula based on the market share results in neither firm bidding a price above zero for the rights and so probably cannot be used without modification. One solution is to interpret this remedy as an interim measure to be applied to rights held by downstream firms, while existing vertical contracts with upstream rights' sellers remain in place. As such contracts expire, remedies could then be imposed upon the form of future vertical contacts, as described below. An alternative would be to adapt the rule to make the transfer prices proportionate to (e.g. historic) market shares, plus a regulatory mark-up. Any mark-up larger than the bid increment in an ascending-bid auction would mean that it is no longer a dominant strategy to drop out of the auction immediately.

5.4. Nonexclusive rights selling

The final alternative we consider is to force the upstream rights' seller to sell the rights nonexclusively for lump-sum fees. When the rights are sold to both firms, firm i is willing to purchase the rights so long as the price does not exceed l_i. The maximum the seller can get under take it or leave it offers is $l_A + l_B$, so that

$$\begin{aligned} \delta\Pi &= -(l_B + l_A) \\ R_S &= (l_B + l_A) \\ \delta V &= \alpha \\ \delta W &= \alpha. \end{aligned}$$

From the seller's point of view a rule which enforces nonexclusive selling upstream for lump-sum fees may be preferable to a rule which imposes downstream reselling for lump-sum fees under a regulatory market-share rule.[32]

6. Relation to the Licensing Literature

The conclusions derived in the specific model adopted in this paper are not entirely novel. Similar results have been shown in the literature on patent licensing of an innovation which reduces the marginal cost of production. While in most of the licensing literature

[31] B's payoff from dropping out is strictly higher for any postive bid increment.

[32] Following the Premier League's auctions in June 2000, the cable company ntl returned the exclusive pay-per-view rights, which it had won for a bid of £328 million. The Premier League has subsequently resold these rights nonexclusively to each downstream pay-TV company for a single fixed payment. The total paid for the rights is not known, but it widely perceived to be much less than NTL's original bid for the exclusive rights.

the patent holder is an outsider to the industry (cf. Kamien's (1992) survey), Katz and Shapiro (1985) consider the case of licensing to a competitor. They focus mostly on licensing for a fixed fee, but also briefly discuss licensing for a per-unit charge (or royalty) and a two-part tariff. Licensor and licensee then compete à la Cournot in a homogeneous product market.

Licensing for a fixed fee to a rival is not always in the interest of the licensor, for the same reason that reselling for a lump-sum fee is not always optimal in the basic Hotelling model.[33] Katz and Shapiro (1985) also consider variable-fee licensing contracts and find that there is always a licensing agreement which is preferred by both firms to no licensing. Under Cournot competition, the licensor can always choose a royalty rate such that the reaction function of the licensee is identical to the one without licensing. This licensing agreement does not change the pattern of industry output, but results in cost savings which are then appropriated by the licensing firm via the royalty rate and possibly a fixed fee.

The crucial difference with licensing is that in our model the buying firm does not need to pay the per-subscriber fee if it induces its customers not to purchase the premium programming. When distributing a competitor's premium programming the buying firm can reduce the demand for this good from its customers by making it relatively more expensive. This possible ex-post deviation imposes a limit on how high the per-subscriber fee can be. A licensee of a cost-reducing innovation must instead pay the agreed royalty on the output in any case, without the option of avoiding the payment by not incorporating the innovation. The only constraint on the level of the royalty is the licensee's ex-ante willingness to accept the licence agreement.

Shapiro (1985) explains that, more generally, firms can use licensing agreements to facilitate collusion. Essentially, the licensor can induce the rival to reduce its output to zero by imposing a high enough per unit royalty rate. The fixed fee can then be used as a "bribe" to induce the licensee to accept the output reduction, thus implementing the collusive market outcome.[34]

When the fixed component of the fee is restricted to being non-negative in the Cournot model of Katz and Shapiro, the per-subscriber fee induces the firms to produce exactly the same output as was produced in the *absence of the licensing (resale) agreement*, thus enabling them to share some of the benefits of the cost reducing innovation with consumers.[35] A payment from the licensor to the licensee is then required to compensate the

[33] In particular, large innovations which result in monopolization will not be licensed by either firm. Small innovations will not be licensed by the industry leader but may be licensed by the smaller rival firm. In both these cases, the industry leader outbids the rival in an auction to acquire the innovation, because it has higher preemption incentives. These conclusions thus parallel exactly the conclusions reached in the Hotelling model of this paper.

[34] Shapiro (1985) points out that even a "sham" innovation can be used to implement the collusive market outcome by choosing a royalty rate and a negative fixed fee, and notes that, "such a side payment, in exchange for which the licensee would reduce its output, is likely to be illegal under the antitrust laws, and for a good reason!"

[35] In the Cournot model with licensing at variable fee, the licensor faces a lower effective cost than the licensee. As a result, the licensor's output increases by more than the reduction in the licensee's output,

rival for reducing its output further and increasing market price to the collusive level. If negative transfers are not allowed, the consumers are not harmed by licensing.

In our Hotelling model instead, the per-subscriber resale fee shifts the reaction functions of both firms outwards in exactly the same way, inducing both firms to increase their retail prices. The resale contract results in both firms producing the same outputs as in the *absence of the premium programming (or innovation)*, while the retail prices increase by an amount equal to the consumers' willingness to pay for it. Per-subscriber resale fees therefore extract all the rents from the availability of premium programming, and consumers would be better off in the absence of resale contracts.

7. Conclusion

Our analysis implies that premium programming rights will be sold originally under exclusive contracts for a lump-sum payment, and then resold for per-subscriber fees. Resale of premium programming for per-subscriber fees relaxes downstream price competition and provides incentives for both downstream firms to increase their prices. The profits created are initially captured by the reselling firm, and then transferred upstream to the rights monopolist. The model thus predicts a number of the key features of competition in the UK pay-TV market, and in particular the form of the rights selling and resale contracts.

Both the licensing literature and our analysis stress the anticompetitive effects which may arise from licensing or resale contracts which specify per-subscriber charges. Such contracts dampen downstream price competition and allow the reselling firm to avoid the rent dissipating effects that licensing for a fixed fee would induce. Monopoly power is thus extended downstream and consumers may receive little or no benefit from the innovation or premium programming.[36] In our setting, consumers are in the aggregate better off in the absence of reselling, even if some are deprived of premium programming.

In the version of the Hotelling model adopted in this paper, rights splitting and forced rights divestiture have no effect on prices, total profits or welfare. Forced rights reselling for lump-sum fees (or under a market share based formula) reallocates the gains from the premium programming to consumers, as does nonexclusive sale of rights for lump-sum fees. Remedies which alter the way in which rights are sold or resold can affect both competition and consumer welfare by transferring surplus from producers to consumers. In more realistic versions of the model they would also increase social welfare.[37]

so that the total equilibrium quantity increases and the market price decreases.

[36] As Shapiro (2001) writes in his recent survey paper: "The traditional concern with cross-licenses among competitors is that running royalties will be used as a device to elevate prices and effectuate a cartel.... Clearly, such concerns do not apply to licenses that involve small or no running royalties, but rather have fixed up-front payments."

[37] A companion paper formulates a model of competitive price discrimination with both horizontal and vertical differentiation in the tastes of consumers and the products offered by the firms, along the lines of Gilbert and Matutes (1993) and Rochet and Stole (2001).

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Appendix A: Proofs

Proof of Proposition 1. If firm A acquires the rights, it will only resell to firm B for a payment of at least b_A, firm A's benefit from retaining the rights exclusively. Firm B's maximum willingness to pay is l_B, firm B's loss from not having access to the rights given that firm A does. Since $b_A > l_B$, A never resells to B.

When firm B acquires the rights, reselling for a fixed fee is mutually advantageous when it results in an *increase* in asymmetry and total profits compared to no reselling. When B resells to A for a lump-sum fee, B's loss is b_A and A's gain is l_A. Reselling therefore occurs if and only if $l_A \geq b_B$ which requires that $2(s_A - s_B) \geq \alpha$ so that the asymmetry after reselling $s_A - s_B$ is greater than before reselling $|s_A - s_B - \alpha|$. If $2(s_A - s_B) \leq \alpha$ reselling by firm B does not take place because it results instead in a *decrease* in asymmetry.

Proof of Lemma 1. Consider any putative equilibrium in which firm i resells to firm j for a per-subscriber charge of $q > \alpha$. It is not required that the equilibrium be in the competitive regime.[38] In any such equilibrium, firm j's profits are $\pi_j = (p_j - c_j - q)\, x_j$ while firm j's marginal consumer receives a net utility of $u_j + \alpha - p_j - tx_j$. Now consider a deviation by firm j in which it offers to sell the basic product alone for a price equal to $p_j - \alpha$ and the premium product for a price of $p_j + \varepsilon$. Firm j's marginal consumer now receives a net utility of $u_j - (p_j - \alpha) - tx_j$ from the basic product, and $u_j + \alpha - p_j - \varepsilon - tx_j$ from the premium product. Hence, all of firm j's customers will switch to consuming the basic product alone, yielding firm j profits $(p_j - \alpha - c_j)\, x_j > (p_j - c_j - q)\, x_j$ for $q > \alpha$. Firm j has a profitable deviation.

Proof of Proposition 3. Substitution of the prices into the firms' profit functions gives

$$\begin{aligned} \pi_i^{\mu} &= \frac{1}{2t}\left(\frac{(3+\mu)t + (1-\mu)(s_i - s_j)}{(3-\mu)}\right)\left(\frac{(3-2\mu)t + (s_i - s_j)}{(3-\mu)}\right) \\ &\quad + \mu\frac{(3+\mu)t + (1-\mu)(s_i - s_j) + (3-\mu)c_i}{(3-\mu)(1-\mu)} \\ \pi_j^{\mu} &= \frac{1}{2t}\left(\frac{3t + s_j - s_i}{(3-\mu)}\right)^2, \end{aligned} \tag{A.1}$$

and equilibrium market shares are

$$x_i^{\mu} = \frac{1}{2t}\left(t + \frac{s_i - s_j - \mu t}{3-\mu}\right), x_j^{\mu} = \frac{1}{2t}\left(t + \frac{s_j - s_i + \mu t}{3-\mu}\right).$$

Denote the firms' second stage equilibrium profits under independent resale pricing for a per-subscriber fee of q as $\pi_i^q\,(s_i, s_j) = \pi_i\,(s_i, s_j) + q$ and $\pi_j^q\,(s_j, s_i) = \pi_j\,(s_j, s_i)$ given in

[38] Analysis of the Hotelling model is complicated by the existence of a kinked demand curve at the point where the marginal consumer is indifferent between consuming and not consuming. Typically this issue is avoided by making appropriate assumptions on parameters (see e.g. Laffont, Rey and Tirole (1998) and Gilbert and Matutes (1993)). We cannot do so here because the reselling firm may wish to set q so as to implement an equilibrium at the kink. According to this lemma however this cannot occur.

(2.3). Similarly, the market shares are $x_i^q = x_i(s_i, s_j)$ and $x_j^q = x_j(s_j, s_i)$, as given in (2.2). Compared to the independent resale pricing scheme, the market share of the selling firm is reduced and that of the buying firm increased: $x_i^\mu < x_i^q$ and $x_j^\mu > x_j^q$ for all $\mu \in [0, 1]$ under the competitive regime condition $3t > \alpha + s_i - s_j$. The buying firm's profits are higher under proportional resale pricing, since $\pi_j^{\mu=0} = \pi_j^q$ and π_j^μ is strictly increasing in μ. We now compare the selling firm's profits for equivalent resale prices $q = \mu p_i$:

$$\pi_i^\mu \geq \pi_i^{q=\mu p_i} \Leftrightarrow 27t^2\mu(1-\mu) + 12t(s_i - s_j)\mu^2 - \mu(3+\mu)(s_i - s_j)^2 \geq 0. \quad \text{(A.2)}$$

The right hand side of (A.2) is increasing in t, and so if it is satisfied for $3t = s_i - s_j$, it is also satisfied for higher values of t. Making this substitution yields $\pi_i^\mu = \pi_i^q$, implying that $\pi_i^\mu > \pi_i^q$ for all values of t such that $3t > s_i - s_j$.

It follows that when reselling, the superior firm A would always do better by using proportional rather than independent variable resale price. For a given value of the resale price q at which firm B purchases, the equilibrium profits of both firms are higher under proportional resale pricing. Since $\pi_{i=A}^\mu > \pi_{i=A}^q$ for $q = \mu p_i$, we have $p_A^\mu > p_A^q$ since $x_A^\mu < x_A^q$. From the expression of the best reply of firm B this in turn is seen to imply that $p_B^\mu > p_B^q$ in equilibrium since $p_A^\mu > p_A^q$ and $\mu p_A^\mu = q$.

Proof of Lemma 2. Consider the *resale subgame* downstream when the rights are purchased originally under a two-part tariff. As seen above, once firm i has acquired the exclusive rights for a lump-sum fee of R_i (i.e. $r_i = 0$), it resells to firm j for a tariff $\langle q, Q\rangle = \langle \alpha, l_j\rangle$ under a take-it-or-leave-it offer. Firm i's willingness to pay for the rights is $\Gamma_i = \alpha + l_i + l_j$. Once firm i has acquired the exclusive rights under a two-part tariff $\langle r_i, R_i\rangle$ and resells them for $\langle q, Q\rangle$, profits are

$$\begin{aligned} \pi_i &= \pi_i(s_i, s_j) + (q - r_i) + (Q - R_i) \\ \pi_j &= \pi_j(s_j, s_i) - Q. \end{aligned}$$

Firm i makes a take-it-or-leave-it offer to firm j for $\langle q = \alpha, Q = l_j(r_i)\rangle$, where $l_j(r_i) = \pi_j(s_j, s_i) - \pi_j(s_j, s_i + \alpha - r_i)$ is the loss suffered by j when it does not acquire the rights given that i acquires them for a per-subscriber fee of r_i. The two firms' payoffs can then be written as

$$\begin{aligned} \pi_i &= \pi_i(s_i, s_j) + (\alpha - r_i) + l_j(r_i) - R_i \\ \pi_j &= \pi_j(s_j, s_i) - l_j(r_i). \end{aligned}$$

For given variable fees r_i, r_j offered by the upstream rights' seller, firm i is willing to pay a fixed fee of $R_i \leq (\alpha - r_i) + l_j(r_i) + l_i(r_j)$ for the exclusive rights. If $r_i = r_j = \alpha$ then the maximum $R_i = l_j(\alpha) + l_i(\alpha) = 0$ and the upstream seller can obtain at most α for the rights. If $r_i = r_j = 0$, the upstream seller can obtain up to $R_S = \alpha + l_j + l_i$.

When the upstream rights' seller chooses to sell the rights *exclusively* to one downstream firm, firm i is willing to pay up to $r_i \leq \alpha$ and $R_i = (\alpha - r_i) + l_j(r_i) + l_i(r_j)$ for the rights, which depends upon the per-subscriber price offered to firm j. For any value of r_j

firm i's willingness to pay is maximized by setting $r_i = 0$. Similarly, for any value of r_i firm i's willingness to pay is maximized by setting $r_j = 0$. Hence setting $r_i = r_j = 0$ and $R_i = R_j = \alpha + l_A + l_B$ is optimal for the rights' seller. Since the value of the rights is the same to both firms, the upstream seller obtains $\alpha + l_A + l_B$ with either take-it-or-leave-it offers or in an ascending-bid auction.

When the rights are sold *nonexclusively* we assume that the upstream seller offers tariffs $\langle r_i, R_i \rangle$ to the two downstream firms $i = A, B$. If firm i purchases then firm j is willing to pay $r_j \leq \alpha$ and $R_j = b_j(r_j, r_i) + l_j(r_i)$ to purchase the rights from the upstream seller, where $b_j(r_j, r_i) = \pi_j(s_j + \alpha - r_j, s_i + \alpha - r_i) - \pi_j(s_j, s_i)$ and $l_j(r_i)$ is as defined above, so that $b_j(r_j, r_i) + l_j(r_i) = \pi_j(s_j + \alpha - r_j, s_i + \alpha - r_i) - \pi_j(s_j, s_i + \alpha - r_i)$. We now show that setting $r_i = r_j = \alpha$ and $R_i = R_j = 0$ thereby obtaining $R_S = \alpha$ is the rights' seller's optimal policy under nonexclusive sale. Note that $R_S^j = r_j + \pi_j(s_j + \alpha - r_j, s_i + \alpha - r_i) - \pi_j(s_j, s_i + \alpha - r_i)$ is increasing in r_j, so that $r_j = \alpha$. Similarly, R_S^i is increasing in r_i, so that $r_i = \alpha$. Hence $r_i = r_j = \alpha$ maximizes the seller's profits. Given this, we must have $R_i = R_j = 0$. Exclusive upstream sale for a fixed fee of $\alpha + l_j + l_i$ is optimal for the rights' seller when resale occurs under take-it-or-leave-it offers.