On intrabrand and interbrand competition: 
The strategic role of fees and royalties

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Abstract

We examine oligopolistic markets with both intrabrand and interbrand competition. We characterize equilibrium contracts involving a royalty (or wholesale price) and a fee when each upstream firm contracts with multiple downstream firms. Royalties control competition between own downstream firms at the expense of making them passive against rivals. When the number of downstream firms is endogenous, each upstream firm chooses to have only one downstream firm. This result is in sharp contrast to previous literature where competitors benefit by having a larger number of independent downstream firms under only fixed fee payments. We discuss why allowing upstream firms to charge per-unit payments in addition to fixed fees dramatically alters their strategic incentives. © 2002 Elsevier Science B.V. All rights reserved.

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1. Introduction

In a large number of market transactions, firms do not sell their products directly to final consumers but instead contract with independent downstream
firms who act as final sellers. Vertical market relations include franchising, retailing, licensing of technology, and supply of intermediate products. Since such relations are pervasive, it is important to understand the forces that govern vertical contracts. In this paper we explore how strategic considerations shape vertical contracts in oligopolistic markets. We focus on two key strategic decisions of ‘upstream’ firms: The number of independent ‘downstream’ firms and the terms of vertical contracts. We consider two-part tariffs, contracts that specify a fixed fee and a per-unit payment which we call royalty. The main result is that, when each upstream firm commits to its number of downstream firms prior to signing a fee-and-royalty contract with each of them, each upstream firm chooses to be represented by a single downstream firm.

We allow oligopolistic competition to be both intrabrand and interbrand. Specifically, we first characterize fee-and-royalty contracts when each upstream firm is associated with an arbitrary number of downstream firms. Past work has developed important insights for the case of a monopolist contracting with multiple downstream firms and for upstream oligopolists each contracting with a single downstream firm. Our analysis nests these two situations as special cases.

When choosing royalty rates, an upstream firm has to balance two opposing incentives. On the one hand, it prefers its downstream firms to be more passive against one another. On the other hand, it would like them to be committed to more aggressive behavior against rival downstream firms. In equilibrium, the larger the number of its own downstream firms relative to that of rival firms and the higher the degree of differentiation between products, the higher will be the royalty rate.

The central result of this paper is obtained by endogenizing the number of downstream firms. We consider a three-stage game with upstream firms choosing the number of their independent (i.e. maximizing own profit) downstream firms and then choosing their royalty rates (and fees). In the last stage, downstream firms compete in quantities. We find that each upstream firm prefers to minimize the number of its independent downstream firms so that, in equilibrium, each upstream firm chooses only one downstream firm. This result is in sharp contrast to previous work showing that upstream firms prefer to have a higher number of downstream firms for strategic reasons. In particular, Baye et al. (1996), Corchón (1991), and Polasky (1992) have shown that, in a two-stage game where the choice of the number of downstream divisions by upstream firms is followed by quantity competition in the product market, upstream firms have an incentive to increase the number of downstream divisions since this

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1 Such payment schemes are widely prevalent in vertical relations. In our framework, the per-unit payment can be also viewed as a wholesale price.

2 Bonanno and Vickers (1988, p. 264), refer to the first of these two cases as (1, n) and the second as (m, 1). Our analysis contributes to the understanding of the (m, n) case.

3 When taking the number of downstream firms as given, our analysis is related to Dixit (1984), who explores aspects of trade policy in oligopolistic markets.
practice represents a commitment to more aggressive downstream behavior, a ‘divide and conquer’ strategy. This insight is often offered as a rationale for ‘divisionalization’ policies of firms. However, we show that allowing upstream firms to charge both fees and per-unit payments, as opposed to only fees, dramatically alters their strategic incentives: A larger number of downstream firms implies that, for any royalty rate, the rival has a stronger incentive to behave strategically when selecting royalties. This change in strategic incentives completely overturns the existing result. Since per-unit payments are very often used in addition to fees, our analysis implies that the existing argument in support of the ‘divide and conquer’ strategy requires important qualifications.

Finally, we demonstrate how the equilibria that arise depend critically upon the order in which firms make decisions. In particular, if the number of downstream firms is chosen simultaneously with (or subsequently to) the terms of contracts, upstream firms may then have incentives to contract with many downstream firms, thereby reversing our main result. Similarly, the main result may not hold if only a single instrument (either a fee only or a royalty only) can be utilized in the contract.

2. The model

We consider two upstream firms, $A$ and $B$, each of which may contract with multiple downstream firms. The number of downstream firms associated with upstream firm $i$ is $n_i \geq 1$, $i = A, B$. We assume that production cost is zero, both at the upstream and the downstream stages. Market demand is given by

$$ p_i = a - Q_i - sQ_j, \quad i, j = A, B, $$

(1)

where $Q_i = \sum_{k=1}^{n_i} q_i^k$ denotes the aggregate output of all downstream firms selling product $i$, $i = A, B$; $q_i^k$, $k = 1, \ldots, n_i$, denotes the output of each downstream firm contracting with upstream firm $i$; and $p_i$ denotes the market price. The parameter $s \in [0, 1]$ measures the degree of substitution between the two

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4 This point is related to the idea that, for strategic reasons, horizontal mergers may be unprofitable (see e.g. Salant et al., 1983).

5 That it may be desirable for an upstream firm to restrict the number of its downstream is also a feature of some previous work including Kamien and Tauman (1986) and Katz and Shapiro (1986) on licencing an innovation. However, they consider a single upstream firm whereas upstream competition is critical for our results.

6 Rey and Stiglitz (1995) consider exclusive territories which, like picking a single downstream firm, eliminate downstream competition. However, unlike us they do not examine oligopolistic intrabranch competition and compare perfect competition and exclusive territories under price competition. In addition, they consider downstream price competition and the strategic incentives are different in their model. See also Gal-Or (1991) for downstream price competition (with each upstream firm contracting with one downstream).

7 As long as unit costs are constant, this assumption is without loss of generality.
products. Clearly, when \( s = 1 \) the two products are perfect substitutes whereas when \( s = 0 \) they are perfectly differentiated.

We study a three-stage game. In the first stage, the two upstream firms simultaneously choose the number of their own downstream firms, \( n_i \geq 1, \quad i = A, B \). Next, the two upstream firms (simultaneously) make a take-it-or-leave-it offer to each of their downstream firms that specifies a pair \((f_i, r_i)\), where \( f_i \) is a fixed fee and \( r_i \) is a royalty rate per unit sold.\(^8\) Thus, the total payment to an upstream firm from a downstream firm that produces \( q \) units equals \( f_i + r_i q \). The outside option of each downstream firm is normalized to zero. We assume that the same contract is offered to all downstream firms associated with a given upstream firm.\(^9\) Finally, in the third stage of the game, firms that accept the offer \((f_i, r_i)\) compete in quantities in the downstream market. We consider the subgame perfect equilibrium of this game.

Note that the timing adopted here (the choice of number of downstream firms precedes the choice of royalties) reflects a situation where it is costlier to change the number of downstream firms than to change royalties. Later in the paper we discuss the implications of alternative timing assumptions. Also note that we assume quantity competition in the downstream market.\(^10\) As known from the strategic contracting literature, it matters whether the strategic variables in the downstream market are prices or quantities, since the slopes of downstream reaction functions depend upon the strategic variable. In our framework, quantity competition is attractive because it allows us to capture the idea that a firm may want its downstream firms to be more passive against its own firms but more aggressive against rivals. Moreover, assuming quantity competition facilitates comparison of our results to previous work on the strategic choice of downstream divisions (discussed above) which also employs this assumption.

3. Analysis: Competition with given numbers of downstream firms

We first take the number of downstream firms \((n_A \text{ and } n_B)\) as given and analyze the choice of contracts and downstream quantity competition. This is, of course, a necessary first step before we can consider the choice of the number of downstream firms. Moreover, the analysis of competition with a given number of downstream firms is of independent interest.

\(^8\) Placing all the bargaining power in the hands of upstream firms corresponds to having a competitive supply of potential downstream firms. This assumption is standard in this class of models.

\(^9\) In reality, there is indeed uniformity regarding contracts of the same firm (see, for example, Lafontaine and Slade, 1997, pp. 15–16). Often, legal restrictions also contribute to this wholesale-price uniformity.

\(^10\) With respect to this modelling choice, both the usual criticism of quantity competition models (‘firms choose prices’) as well as its usual defences (including capacity precommitment) apply.
3.1. Equilibrium royalties and quantities

Suppose that downstream firms have accepted contracts that involve royalty rates \( r_i \). The fixed fees specified in the contracts clearly do not affect output decisions, as long as downstream firms have an incentive to operate. Profit (net of royalty payments) for a downstream firm \( m \) that accepts a contract involving a royalty rate \( r_i, i = A, B \), equals

\[
(a - Q_i - sQ_j - r_i)q_i^m, \quad i,j = A, B.
\]  

(2)

Taking the output levels of other firms as given, the reaction function of downstream firm \( m \) is \( q_i^m(Q_{i,-m}, Q_j; r_i) = (a - Q_{i,-m} - sQ_j - r_i)/2 \), where \( Q_{i,-m} = \sum q_i^k \) is the aggregate quantity produced by all other downstream firms contracting with firm \( i \) except firm \( m \). We then solve the system of downstream reaction functions for equilibrium output levels as functions of the number of firms and royalty rates:

\[
q_i = \frac{a - r_i - n_j(a(s - 1) + r_i - s r_j)}{1 + n_i + n_j + n_i n_j(1 - s^2)}. \quad \text{(3)}
\]

Next, we determine equilibrium royalty rates. Substituting the above output levels into (2), we obtain downstream profits. Since upstream firms have all the bargaining power, they extract the entire residual profit of downstream firms by choosing a fee equal to their after-royalty profit. Therefore, taking as given the royalty rate of firm \( j \), the objective of upstream firm \( i \) is to choose its royalty rate \( r_i \) to maximize the aggregate profit of its downstream firms \( \pi_i(r_i, r_j; n_i, n_j) = n_i p_i q_i \), where per-firm quantities are given by (3) and prices by (1). This optimization generates the royalty reaction functions of upstream firms:

\[
r_i(r_j; n_i, n_j) = \frac{[n_j((s^2 - 1)n_i + 1) - n_i + 1][n_j(a(s - 1) - s r_j) - a]}{2(n_j + 1)[(1 - s^2)n_j + 1]n_i}, \quad i,j = A, B.
\]  

(4)

Solving the system of the two royalty reaction functions we obtain:

**Proposition 1.** With two upstream firms, each contracting with \( n_i, i = A, B \), downstream firms, the equilibrium royalty rates are

\[
r^*_i = r(n_i, n_j) = \frac{a[2 - s + n_j(2 - s^2 - s)][n_i - 1 - n_j(s^2n_i - n_i + 1)]}{n_i[n_i n_j(s^4 - 5s^2 + 4) + (n_i + n_j)(4 - 3s^2) + 4 - s^2]}, \quad i,j = A, B.
\]  

(5)

This expression appears somewhat complicated – a discussion and intuition are provided below. The equilibrium royalty captures a central tension in our
analysis. From the viewpoint of an upstream firm, charging a positive royalty makes downstream firms more passive and has two conflicting effects. On the one hand, passive behavior is desirable in order to control competition with other downstream firms contracting with the same upstream firm. On the other hand, passive behavior is undesirable from the point of view of competing with firms contracting with a different upstream firm.\(^\text{11}\)

### 3.2. Analysis of the equilibrium contracts

There are three critical parameters that determine equilibrium royalty rates (5): \(n_A, n_B,\) and \(s.\) To isolate the role of each parameter, consider first the case where products of the two upstream firms are perfectly differentiated (\(s = 0\)). In this case of pure intrabrand competition, we have

\[
r_i^*(s = 0) = a(n_i - 1)/2n_i, \quad i = A, B. \tag{6}
\]

Thus, an upstream monopolist charges a positive royalty if and only if the number of downstream firms exceeds one. A positive royalty serves to effectively raise the downstream firms’ marginal cost and makes them internalize the horizontal externality that exists among them. It is easy to check that the optimal contract for the upstream firm drives the downstream market to the monopoly level (with price \(a/2\)) and allows the upstream firm to obtain exactly the monopoly profit \((a^2/4).\)\(^\text{12}\) It is also easy to see that the optimal royalty decreases in the number of downstream firms. In the extreme case with only one downstream firm, the upstream firm charges no royalties: Extracting a per-unit payment from a downstream monopolist simply leads to ‘double marginalization’.

In the other extreme case, pure interbrand competition, each upstream firm signs a contract with a single downstream firm: \(n_i = n_j = 1.\) To focus the discussion, assume no differentiation (\(s = 1\)). In this case, Eq. (5) yields\(^\text{13}\)

\[
r_i^*(n_i = n_j = 1; s = 1) = -a/5, \quad i = A, B. \tag{7}
\]

\(^{11}\)One could define the ‘aggregate’ or ‘brand’ reaction function of upstream firm \(i,\) indicating the aggregate output of all of firm \(i\)'s downstream firms given the output of all of firm \(j\)'s downstream firms. Then, when firm \(i\) chooses \(r_i,\) and taking \(r_j\) as given, firm \(i\) acts as a Stackelberg leader along firm \(j\)'s ‘brand’ reaction function. This reasoning delivers the expressions we have derived above (see Saggi and Vettas, 1999).

\(^{12}\)This intuition is central in Dixit (1983), Mathewson and Winter (1984), and other work that examines ‘minimally sufficient instruments’ to replicate vertical integration outcomes. See Katz (1989, pp. 678–679) for downstream price competition as a negative externality.

\(^{13}\)More generally, when \(n_i = n_j = 1\) and \(s \in [0,1]\), we have \(r_i = s^2a/(s^2 - 2s - 4).\)
This represents a standard result in the strategic contracting and delegation literature. In this case, the upstream firms subsidize their downstream firms per unit of output sold. Note that, since in this model there is an analogy between royalties and wholesale prices, a subsidy simply means charging wholesale prices below upstream cost. If negative royalties (that is, subsidies) are not possible, the equilibrium involves zero royalties (and fees equal to the per-firm Cournot profit). The basic intuition is that, by charging a lower royalty rate, an upstream firm reduces the unit cost of its own downstream firm, thereby allowing it to obtain a stronger strategic position against its rival.

Next consider how the number of downstream firms matters. In the case of homogenous products \((s = 1)\), we obtain

\[
r^*_i(s = 1) = a(n_i - n_j - 1)/n_i(n_A + n_B + 3), \quad i, j = A, B,
\]

so that firm \(A\) employs a positive royalty if and only if \(n_A > n_B + 1\). Further, when \(n_A > n_B + 1\) firm \(B\) does not employ a positive royalty. The intuition is that a positive royalty is used only when the incentive to soften downstream competition among own contracting firms is stronger than the incentive to give them a stronger strategic position against rival downstream firms.

Next, to isolate the role played by the degree of product differentiation \((s)\), suppose \(n_A = n_B = n\). Then, from (5) we obtain

\[
r^*(n_A = n_B = n) = a[n^2(1 - s^2) - 1]/n[n(2 + s - s^2) + (s + 2)].
\]

Thus \(r^* > 0\) if and only if \(n^2(1 - s^2) > 1\). As \(s\) increases, \(n\) must also increase for the royalty rate to be positive. In other words, more similar the downstream products (i.e., the higher is \(s\)), stronger must be the competitive externality between firms that contract with a single upstream firm for the latter to charge a positive royalty. In the limit when products become perfectly homogenous \((s \to 1)\), optimal royalties are never positive.

Finally, we note an important property of the optimal royalty rates:

**Remark 1.** The equilibrium royalty of firm \(i\) decreases as the number of rival downstream firms \((n_j)\) increases (regardless of the magnitude of \(s\)).

This relation underlies a key strategic incentive when we endogenize the number of downstream divisions in the following analysis. An upstream firm

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14 See, for example, Brander and Spencer (1985) in the context of international trade policy, and Bonanno and Vickers (1988), Fershtman and Judd (1987), McGuire and Staelin (1983), Sklivas (1987) and Vickers (1985) on delegation and managerial incentives. The central insight is that competing principals may have a (unilateral) incentive to make their agents commit to more aggressive behavior.

15 This analysis suggests an empirically testable implication: Dominant upstream firms (in the sense of having a higher number of downstream firms) are likely to charge relatively higher royalty rates and lower fixed fees than their smaller competitors.
recognizes that, if it chooses a larger number of downstream divisions, it induces its rival to become more aggressive in terms of royalties.\(^\text{16}\)

4. Equilibrium number of downstream firms

Firm \(i, i = A, B\), chooses its number of downstream firms to solve

\[
\max_{n_i} \{n_i p_i(r^*_i(n_i, n_j), r^*_j(n_i, n_j))q_i(r^*_i(n_i, n_j), r^*_j(n_i, n_j))\}.
\]

Substitution of the equilibrium royalty rates and differentiation with respect to \(n_i\) yields

\[
\frac{\partial \pi_i(n_i, n_j)}{\partial n_i} = -\frac{2s^2 a^2(n_j + 1)(2 - s^2 - s)n_j + 2 - s)[1 + (1 - s^2)n_j][(2 - s^2 - s)n_i + 2 - s]}{[n_i n_j(4 + s^2 - 5s^2) + (n_i + n_j)(4 - 3s^2) + 4 - s^2]^3} < 0
\]

for all \(0 < s \leq 1\).\(^\text{17}\) It follows that each upstream firm wants to minimize the number of its own downstream firms, regardless of the number of firms chosen by its rival. Thus, we have:

**Proposition 2.** If \(s > 0\), in equilibrium, \(n^*_A = n^*_B = 1\), so that each upstream firm chooses to have only one downstream firm. Moreover, it is strictly optimal for firm \(i\) to have only one downstream firm, regardless of the number of downstream firms chosen by firm \(j\).

The intuition is as follows. In our framework, a commitment to more aggressive behavior in the downstream market can be achieved by either having a higher number of downstream firms or choosing a lower royalty rate. So why is it preferable to choose low royalties instead of (also) choosing a larger number of firms? When choosing its number of downstream firms, while an upstream firm takes the rival number of downstream firms as given, it does consider the effect of its choice of number of firms on the rival’s royalty rate. In particular, a larger number of downstream firms implies that, for any royalty rate, an

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\(^\text{16}\) Differentiating \(r^*_i\) from (5) with respect to \(n_j\) delivers the result:

\[
\frac{\partial r^*_i}{\partial n_j} = \frac{-2as^2(n_i + 1)(s^2 + s - 2)n_i + s - 2)[(s^2 - 1)n_i - 1]}{n_i[(s^2 - 5s^2 + 4)n_i n_j - (3s^2 - 4)(n_i + n_j) - s^2 + 4]^2} < 0.
\]

\(^\text{17}\) Since \(0 < s \leq 1\), the following hold: (i) \(2 - s > 2 - s^2 - s \geq 0\); (ii) \(4 + s^2 - 5s^2 \geq 0\) and (iii) \(4 - s^2 > 4 - 3s^2 > 0\). It is easy to show that these inequalities imply that \(\partial \pi_i(n_i, n_j)/\partial n_i < 0\).
upstream firm’s brand reaction function becomes steeper and, as a result, the rival has a stronger incentive to behave strategically (by choosing a lower royalty rate). Since it is desirable to have higher rival royalty rates, each firm has an incentive to lower its number of downstream firms.\footnote{One may ask if upstream firms prefer to become vertically integrated. While both firms are better off under vertical integration, they do not have a \textit{unilateral} incentive to vertically integrate. In particular, it is a dominant strategy for each firm to choose delegation (and so this situation is a ‘prisoners’ dilemma’). Formally, we can enlarge the game so that firms first choose to either become vertically integrated (VI) or not (N). Assuming \( s = 1 \), for simplicity, we obtain the following profits. If both choose VI, firms’ profits are \( \pi(\text{VI}, \text{VI}) = a^2/9 \) (this expression follows from our analysis when royalties equal zero and is, of course, equal to Cournot profit with two firms). Further, \( \pi(\text{N}, \text{N}) = 2a^2/25 \) (this corresponds to the equilibrium where each firm contracts with only one downstream firm and sets royalties equal to \(-a/5\)). Finally, it is easy to check that \( \pi(\text{VI}, \text{N}) = a^2/8 \) (the firm that does not integrate vertically sets its royalty equal to \(-a/4\)). We see that \( \pi(\text{N}, \text{VI}) > \pi(\text{VI}, \text{VI}) \) and \( \pi(\text{N}, \text{N}) > \pi(\text{VI}, \text{N}) \), thus, vertical separation is a dominant strategy for each firm.}

Using the terminology of Fudenberg and Tirole (1984), the incentives of upstream firms to employ ‘top-dog’ strategies (be strong to look aggressive), as a result of the downstream quantity competition, are replaced by ‘puppy-dog’ behavior (be weak to look inoffensive) when the number of downstream firms is selected prior to the terms of contracts. The choice of royalties in the second stage corresponds to ‘top-dog’ behavior, while the prior commitment to the number of downstream firms corresponds to ‘puppy-dog’ behavior.

To illustrate the effect of increasing the number of downstream firms consider the following example. Suppose \( s = 1 \), \( n_B = 1 \), and that \( n_A \) increases from 1 to 2. It is easy to calculate the relevant royalties, quantities, prices, and profits from the expressions given above. As \( n_A \) increases, firm \( A \)’s royalty increases (from \(-a/5\) to zero) and \( B \)’s royalty decreases (from \(-a/5\) to \(-a/3\)). The total output of firm \( A \)’s downstream firms decreases from \( 2a/5 \) to \( a/3 \) and that of \( B \)’s increases from \( 2a/5 \) to \( a/2 \). The price decreases from \( a/5 \) to \( a/6 \). Finally, firm \( A \)’s profit decreases from \( 2a^2/25 \) to \( a^2/18 \) while that of \( B \) increases from \( 2a^2/25 \) to \( a^2/12 \). Thus (when \( n_B = 1 \)) firm \( A \) would not like to increase its number of firms.

\section*{5. Alternative formulations and comparison}

To further clarify the interaction between royalties and the number of downstream competitors, we consider a number of alternative structures below. We show that the equilibria depend critically on the sequence in which firms make decisions and on the type of contracts that upstream firms can utilize.

Consider first the \textit{fees-only} case. In the absence of royalties, the only strategic choice facing upstream firms is the number of downstream firms. As the literature (e.g. Baye et al., 1996; Corchón, 1991; Polasky, 1992) shows, when
contracts can specify only fees, each upstream firm has a strict incentive to have a higher number of downstream firms than its rival.\textsuperscript{19} If in the simple example discussed above (with $s = 1$ and $n_R = 1$) only fees can be used, increasing $n_A$ from 1 to 2 causes the total output of firm $A$'s downstream firms to increase from $a/3$ to $a/2$, whereas that produced by $B$'s downstream firms increases from $a/3$ to $a/4$. The price decreases from $a/3$ to $a/4$. Firm $A$'s profit increases from $a^2/9$ to $a^2/8$ and, thus, firm $A$ has an incentive to increase its number of firms from 1 to 2.

In the case of royalty-only contracts, each upstream firm prefers to increase its number of downstream firms, as long as the rival number of firms are not too large (see Saggi and Vettas, 1999). When fees are infeasible, the incentive to assume a more aggressive posture against the rival can be reinforced by the incentive to induce competitive behavior in the downstream market.\textsuperscript{20} If in the example above ($s = 1$, $n_R = 1$) fees are infeasible, both firms’ royalty rates decrease with an increase in $n_A$ from 1 to 2 (in contrast to the fee-and-royalty case). Firm $A$'s royalty decreases from $a/3$ to $7a/22$ and $B$'s from $a/3$ to $3a/11$. The total output of firm $A$’s downstream firms increases from $2a/9$ to $7a/22$ and that of $B$’s decreases from $2a/9$ to $9a/44$. Firm $A$’s profit increases from $2a^2/27$ to $49a^2/484$ and thus, in this case, firm $A$ would increase the number of its firms from 1 to 2.

Finally, the assumption that the number of downstream firms is chosen before the contracts is crucial for our main result. If the number of firms is chosen at the same time as (or after) the terms of the contracts, both firms have an incentive to increase the number of downstream firms. In particular, for given royalty rates that are not too low, each firm has an incentive to have a larger number of downstream firms than its rival.\textsuperscript{21} The intuition should be clear from the preceding analysis: The strategic incentive of a firm to decrease the number of its downstream divisions is present only if a choice of a rival’s royalty rate follows.

6. Conclusion

This paper examines strategic interactions in vertically related markets where both intrabrand and interbrand competition may be present. We focus on contracts that specify a fixed fee and a per-unit payment (royalty). We characterize equilibrium contracts when each upstream firm contracts with multiple

\textsuperscript{19} Our analysis provides one important qualification to this result; it holds only when $s = 1$. In Saggi and Vettas (1999), we show that for $0 < s < 1$ (i.e., when products are differentiated), each firm chooses to have $n^* > 1$ downstream firms, where $n^* = 1/\sqrt{1 - s^2}$.

\textsuperscript{20} For example, when $s = 1$, if one upstream firm were to choose a small number of downstream firms (say one), the other upstream firm’s best response is to have an infinite number of downstream firms.

\textsuperscript{21} See Saggi and Vettas (1999) for details.
downstream and show how strategic interactions affect the design of these contracts. The basic tension is that higher royalties help control competition among own downstream firms while making them less aggressive against rival downstream firms.

Our main contribution lies in using the analysis of contracts as a building block to endogenize the number of downstream firms. Thus, the present paper creates a link between the work on strategic contracting and the work exploring the choice of downstream divisions. In contrast to previous literature that has emphasized the strategic benefit of having a large number of downstream firms (when contracts specify only a fixed fee), we show that the strategic incentives are reversed when upstream firms can also choose per-unit payments. In particular, under such contracts, each firm prefers to minimize the number of its downstream firms.\(^{22}\) Our analysis is not purely of theoretical interest: contracts that specify both fees and royalties are frequently used in the real world.

Like most work in this area, our model assumes that upstream firms commit to their contracts and that these contracts are observable. Further, to highlight the strategic motives and to facilitate comparison with the literature, we have kept the model as simple as possible. Of course, we omit a number of factors that play an important role in vertical contracts, such as uncertainty. Encompassing such factors in our model could modify our results.

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References


\(^{22}\) Kühn (1997) considers fully nonlinear wholesale schedules and finds that, with constant marginal costs, the number of downstream firms is irrelevant for strategic contracting. His result differs from ours because with fully nonlinear contracts upstream firms control not only the position but also the slope of the downstream firms’ reaction functions. In general, the class of contracts that can be written should depend on the informational structure. See Rey and Tirole (1986) for informational assumptions underlying two-part tariffs.