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ABSTRACT

Downstream Competition, Foreclosure and Vertical Integration*

This Paper analyses the impact of competition among downstream firms on an upstream firm's pay-off and on its incentive to vertically integrate when firms on both segments negotiate optimal contracts. We argue that tougher competition decreases the downstream industry profit, but improves the upstream firm's negotiation position. In particular, the upstream firm is better off encouraging competition when the downstream firms have high bargaining power. We derive implications on the interplay between vertical integration and competition among the downstream firms. The mere possibility of vertical integration may constitute a barrier to entry and may trigger strategic horizontal spin-offs or mergers. We discuss the impact of upstream competition on our results.

JEL Classification: D40, L10, L42
Keywords: bargaining, competition, contracts, foreclosure, vertical integration

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NON-TECHNICAL SUMMARY

In many competition policy cases, a dominant firm, say an upstream firm, is suspected to restrict access to an essential input to some downstream firms in order to extend its monopoly power to the downstream industry. In particular, the tendency by the upstream firm to engage in so-called market foreclosure would provide an important rationale for government intervention. This intervention can be as dramatic as the break-up of a large company, as advocated by many in the ongoing Microsoft case.

The present Paper aims to provide a caveat to the view that dominant firms necessarily want to extend their monopoly power to vertically related markets. An important intuition behind the market foreclosure argument is that the use of vertical restraints such as (price) discrimination, non-linear tariffs and/or vertical integration may allow the upstream firm to increase the downstream industry profit and appropriate it (Rey and Tirole, 1999). This effect is typically modelled through optimal take-it-or-leave-it contract offers made by a monopolistic upstream firm to downstream firms that compete for both input and output. In this Paper, we observe that a monopolistic upstream firm need not have all the bargaining power as, for instance, the mere threat of the appearance of an alternative source of supply would increase the downstream firms' bargaining power. We thus allow the upstream firm and downstream firms to bargain over optimal tariffs. We argue that a monopolistic upstream firm that can use vertical restraints may then be willing to favour downstream competition.

When the tariffs are negotiated, the use of vertical restraints allows the upstream firm to appropriate only part of the downstream industry profit. When a downstream firm makes a contract offer, it sees itself as the incremental downstream firm. Then, when the cost to the upstream firm of servicing an additional downstream firm is convex, the contract offer made by each firm increases with the number of downstream firms. Thus, downstream competition improves the upstream firm's negotiation position. Therefore, when downstream firms have high bargaining power, the upstream firm is better off with more downstream competition. Therefore, the foreclosure result relies heavily on the extreme assumption that the upstream firm has all the bargaining power.

This negotiation effect may actually be so strong that the upstream firm's incentive to favour downstream competition is sometimes higher than that of a social planner. When the downstream firms make contract offers, the upstream firm ignores both the positive effect of an increase in competition (and production) to consumers and the negative effect to downstream firms. The additional cost of servicing one more firm is borne by the downstream firms and it benefits the upstream firm even though this cost is higher than the positive effect on consumers of increasing production.

This approach allows us to derive predictions on the interactions between vertical integration and the competitive environment. Vertical integration allows the upstream firm to increase her leverage on the downstream industry. When she appropriates (a share of) the downstream industry surplus and when the supplier's bargaining power is low (or high), the benefit from vertical integration increases (or decreases) with downstream competition. *Ex ante*, the possibility of vertical integration has important consequences on market structure. Entry in the downstream industry may be restricted by the mere threat of vertical integration. Strategic horizontal mergers or spin-offs may be observed in order to prevent vertical integration. The case where two upstream firms compete to supply downstream firms is discussed.

1 Introduction

This paper analyzes a monopolistic upstream firm's incentive to promote competition between downstream firms and to vertically integrate one downstream firm. The downstream firms compete both to buy input from the upstream firm and to sell output to consumers. For each transaction, optimal tariffs contingent on the quantity exchanged are considered so that double marginalization is irrelevant. Hence, more fierce competition among downstream firms has two opposite effects on the payoff to the upstream firm: it erodes the downstream industry profit, but it improves the upstream firm's negotiation position, i.e. it gets a larger share of a lower industry profit. In a world of incomplete contracts, ceteris paribus, the upstream firm's surplus increases with both the industry surplus and the share of the industry surplus that it captures. As a result, more downstream competition increases (resp. decreases) the payoff to the upstream firm when the upstream firm has low (resp. high) bargaining power. Building on these results, we analyze the case where the upstream firm vertically integrates one downstream firm. Since this affects the total quantity supplied and the number of active downstream firms, the incentive to vertically integrate depends on the market environment. We further analyze the impact of upstream competition on these results.

Consider an industry where a monopolistic upstream firm sells an input to downstream firms competing both for the input and on the output market. We assume that contracts are incomplete in the sense that the trade contract between the upstream firm and each downstream firm is not observable to the other parties and cannot be made contingent on outputs. Hence, competition as measured by the number of downstream firms has two effects: on the one hand, the transfer is contingent on the total industry profit which is reduced by more competition in the output market, i.e. there is a rent reduction effect[1]. On

[1]An example for this argument is provided by the case of the European telecommunications upstream firms which used to enjoy a close relationship with state monopolies. The

the other hand, more fierce competition between downstream firms improves the negotiation position of the upstream firm. It leads the downstream firms to make higher bids for the upstream firm's input. This negotiation effect alone makes competition desirable to the upstream firm as it receives a larger share of the surplus[2]. Thus, competition has an ambiguous effect on the payoff to the upstream firm. In particular, in situations where the upstream firm has low bargaining power, it is better off with a more competitive downstream industry.

We then investigate the interaction between the competitive environment and the incentive to vertically integrate: since the firms have no alternative source of supply, vertical integration leads to total foreclosure and monopolization of the downstream market. The reason is that the upstream firm knows about its transactions with other downstream firms and it internalizes the negative externality to its subsidiary if it supplies them. Thus, the payoff to the upstream firm under integration does not depend on the number of downstream firms while the upstream firm's payoff under non-integration is subject to the effects explained above. When the rent reduction (resp. negotiation) effect dominates, vertical integration is most valuable when there is a high (resp. low) level of competition.

Suppose that downstream firms may initially enter the market at a cost and that vertical integration makes this integrated firm bear some agency (Crémer (1994)), legal, or informational cost. The mere possibility of vertical integration may act as a barrier to entry: potential entrants into the downstream market can be deterred if they anticipate that their entry would trigger vertical integration which would in turn imply market foreclosure. When there

prospect of deregulation eventually leading to some competition between national telecom companies is widely believed to constitute a pressure on upstream firms as well.

[2]Rajan (1992) develops a theory of arm's-length debt somewhat related to our negotiation effect where arm's-length debt reduces the creditors' bargaining power. However, in his paper, the lower bargaining position of creditors is due to their inability to acquire information about the borrower rather than competition.

is no possible entry, but when the downstream firms may separate or merge, horizontal mergers or spin-offs may take place in order to prevent vertical integration. From the upstream firm's viewpoint, the mere threat of vertical integration may act as a disciplinary device for downstream firms.

The present paper is closely related to the literature on vertical relationships and market foreclosure in which an upstream firm can appropriate (some of) the downstream industry profit via exclusivity contracts, (price) discrimination, and/or vertical integration (see Rey and Tirole's (1999) survey, hereafter RT). In this literature, the upstream firm can appropriate the downstream industry profit by using vertical restraints. It is thus better off reducing competition in the downstream industry. While this argument also appears in this paper, we further argue that downstream competition may be desirable to the upstream firm because it enables it to increase its share of the downstream industry profit. Papers particularly close in spirit to ours are Bolton and Whinston (1991, 1993) (hereafter BW) and especially Hart and Tirole (1990) (hereafter HT) who consider a framework where one or two upstream firms supply two downstream firms competing both for input and in the output market[3]. They analyze conditions under which vertical integration takes place, when it leads to market foreclosure, and when it is socially desirable. These papers, however, find that firms have an incentive to restrict competition in the vertically related market and that they have too high an incentive for vertical integration. In this paper we point out that their results depend on specific assumptions about their bargaining game or about the upstream firms' cost structure[4].

[3]The reader can also refer to McLaren (1997) for an analysis of the asset specificity problem in vertically related markets.

[4]Formally, our paper is also a modest contribution to the literature on competition in contracts. In our setup, the secrecy of transactions between the upstream firm and each downstream firm, the increasing cost of supplying the incremental downstream firm and the independence of the marginal costs of production make sure that each downstream firm only considers its *bilateral* relationship with the upstream firm. As a result, the upstream firm cannot commit not to supply other downstream firms. This ensures the uniqueness of the equilibrium, which is to be contrasted with the result obtained by Bernheim and Whinston (1986). Biais, Martimort and Rochet's (1999) paper, which was developed independently, also finds, but for different reasons, that competition is limited in their general analysis of

Although it has often been overlooked in IO theory, the analysis of private and public incentives to promote competition in vertically related markets is of practical importance for both firms and regulators. For instance, following a change in the regulatory environment in 1995, AT&T decided to divest its supplier AT&T Technology so as to promote competition among downstream firms (RT). Under integration, AT&T Technology could not have committed not to discriminate against AT&T's rivals. The rivals would then have turned to alternative suppliers. The short-term gains from monopolization would have been more than offset by the long-term costs of the subsequent new relationships and competition. In this paper, increasing downstream competition aims at improving the negotiation position, but it may take place because of a supply assurance motive as well[5]. A good understanding of how these incentives depend on technology, demand or the competitive environment may guide contract design and decisions about vertical integration and spin-offs as well as competition policy.

The paper proceeds as follows. Section 2 presents the model. Section 3 describes the negotiation and rent reduction effects and derives costs and benefits of competition. The interplay between vertical integration and competition between downstream firms is examined in section 4. Section 5 examines the impact of upstream competition on these results. Section 6 concludes.

2 The Model

An upstream firm U produces an input that it can sell to $n \leq N$ potential downstream firms D_1, ..., D_n competing in an output market. The inverse

strategic risk-neutral market makers competing in contracts to supply a risk-averse agent who is privately informed about both his valuation and his hedging needs. Indeed, their result is driven by the information revealed by the trades which makes sure that unit prices increase with the quantities traded, and thus that the elasticity of the residual demand curve is finite.

[5]Although vertical integration may take place for a supply assurance motive (BW (1993), Emons (1996)), this motive may also lead a firm to promote competition upstream to insure against a potential inability of one of its suppliers to supply the good.

demand function in the output $Q \to P(Q)$ is assumed decreasing and concave: $P' < 0$ and $P'' < 0$. The downstream firms need one unit of the input to produce one unit of the homogeneous output. Downstream firm D_i has a zero transformation cost and no alternative supply source.

To produce a good for downstream firm D_i, the upstream firm needs to bear the cost $f(i)$ of opening a specific line of production. For instance, this line of production can be thought of as a necessary step to produce an input which is compatible with D_i's technology. We denote $F(n) = \sum_{i=1}^{n} f(i)$ and we assume that $f(\cdot)$ increases with the number of lines of production which are open. The fact that this cost increases may reflect growing agency costs within the upstream firm when it expands. Once the line of production is open, U can produce a number of units at a constant marginal cost c. Hence, producing a quantity q_i for firm D_i costs $C(i, q_i) = f(i) + cq_i$. We assume $F(n) \leq [P(Q^C) - c]Q^C(n)$, where $Q^C(n)$ is the total Cournot quantity, is satisfied for each $n \leq N$.

Our contractual assumptions are similar to those in HT and RT.

Assumption 1 *Downstream firms' production is not contractible.*

Assumption 2 *Contracts and transactions between the upstream firm and any of the downstream firms are not observable by the other downstream firms.*

HT thoroughly justify these assumptions. In particular, they stress the difficulty for a downstream firm to "monitor or control shipments made by $[U]$ to other parties without having residual rights of control over the assets of $[U]$, including buildings, trucks and inventories." Given this assumption, contracts conditional on other contracts (in particular exclusive dealing contracts) are not feasible: When it negotiates with one downstream firm, the upstream firm cannot commit not to supply inputs to other downstream firms[6]. Since

[6]Any other motive for the upstream firm to not be willing or able to commit to supply only a limited amount to the industry would do the trick. For instance, allowing for several production periods might induce the upstream firm to keep competition to play the downstream firms against one another in a "once out always out" setup.

contracts are unobservable, there is no possible precommitment via a contract (see Katz (1991)). More specifically, U cannot induce the downstream firms to undertake ex post inefficient actions in the output market.

Furthermore, we assume that there is no trade between the downstream firms. This may be the case, for instance, when only the upstream firm has the technology to design the input for the use of each downstream firm or the ability to transport the input.

The surplus generated is divided through bargaining over tariffs between the upstream firm and the downstream firms. The bargaining game between U and D_i is as follows: with probability α, U simultaneously makes each D_i a take-it-or-leave-it offer of a tariff transfer $T_{U,i}(\cdot)$ Then, each D_i either accepts or rejects the offer it was made. With probability $1-\alpha$, all downstream firms simultaneously make take-it-or-leave-it offers $T_{i,U}(\cdot)\}$, $i = 1, ..., n$ to U. Then, U either accepts or rejects each offer. The parameter α can be thought of as the upstream firm's bargaining power[7].

The timing of the game is as follows:

- In stage 1, the upstream firm chooses the number $n \leq N$ of downstream firms which will be potentially active in further stages. This may be done by specifying technical characteristics which are necessary for compatibility reasons or by communicating a particular technology. Without knowing these characteristics or this technology, a downstream firm starts development too late to be able to produce in later stages.

- In stage 2, U bargains with each downstream firm over a tariff $T_i(\cdot)$. D_i then orders a quantity of input q_i and pays $T_i(q_i)$[8].

[7] There are a number of reasons for which an upstream monopolist may not have all the bargaining power. For example, the upstream firm may be more eager to reach an agreement if the value of its input decreases over time or if there is some probability that a competing upstream firm will enter the market. The results in section 5 indicate that our qualitative results would obtain if we assumed that the upstream firm had all bargaining power if it remained alone in the industry (which would occur with probability α), but that a competing upstream firm could enter the industry with probability $1-\alpha$.

[8] Our results would not be affected if firms bargained over the pair $\{q_i, T_i\}$.

- In stage 3, the downstream firms transform the input into an output, observe others' production and choose their prices at which the consumers buy this output.

We assume that an (out-of-equilibrium) offer by U to a downstream firm cannot affect this firm's beliefs about U's offer to another downstream firm. This is natural because the offers are secret and U tries to extract as much rent as it can from each downstream firm. This assumption rules out any manipulation of beliefs and will guarantee the uniqueness of the pure strategy Perfect Bayesian Equilibria we shall derive. This assumption is discussed at length in HT and RT who call it "market-by-market bargaining" or "passive conjectures".

When the quantity q_i is exchanged against a transfer $T_i(q_i)$, we denote:

- $\pi_i = P(Q)q_i - T_i(q_i)$ downstream firm D_i's profit,
- $\pi_U = \sum_{i=1}^{n} T_i(q_i) - cQ - F(n)$ the payoff to the upstream firm (its reservation utility is normalized to 0),
- $CS = \int_0^Q P(x)dx - P(Q)Q$ the consumer surplus,
- $SW = \pi_U + \sum_{i=1}^{n} \pi_i + CS = \int_0^Q P(x)dx - cQ - F(n)$ the social welfare.

As a benchmark, we first turn to the case where the upstream firm's offers are publicly observable. These tariff offers would satisfy[9]:

$$\begin{aligned} \max_{(T_{U,i}(\cdot))} \quad & \sum_{i=1}^{n} [T_{U,i}(q_i) - cq_i - f(i)] \\ s.t. \quad & q_i \in \arg\max P(q_{-i} + q_i)q_i - T_{U,i}(q_i) \\ & P(q_{-i} + q_i)q_i - T_{U,i}(q_i) \geq 0, \ \forall i \in \{1, ..., n\} \end{aligned} \tag{1}$$

[9]Given that transformation costs are low relative to the upstream firm's production cost, it is well-established that the downstream firms will transform all the units of input that they bought and market all the corresponding units of output (see Tirole (1988), ch. 5).

In this case, the offers can perfectly manipulate the quantities q_i keeping the downstream firms' participation constraints binding. Under complete information, U can commit to sell a given amount of input to the industry and appropriate the whole industry surplus, which is maximized under the monopoly quantity[10]. In equilibrium, the total quantity produced is (not surprisingly) the monopoly quantity $Q^m = \arg\max P(Q)Q - cQ$. Any allocation of the monopoly quantity among downstream firms is an equilibrium. Thus, the industry production and the consumer's surplus do not depend on n, while the payoff to the upstream firm and social welfare decrease with the number of downstream firms supplied by a correspondingly higher number of lines of production.

If, instead, the downstream firms were to make take-it-or-leave-it offers to the upstream firm and were able to coordinate, they would choose the monopoly quantity ex post. Here, the firms cannot coordinate. Given the simultaneity assumption, whether the offers are secret or not is irrelevant. The case where the downstream firms make the offers is studied in the next section.

3 The Incentive to Favor Downstream Competition

In this section, we show that the effect of downstream competition on the upstream firm's surplus and social welfare crucially depends on the distribution of bargaining powers. We identify the rent reduction (or output) and negotiation effects. We shall see that when its bargaining power is low enough, the upstream firm may be better off with a competitive downstream industry.

From now on, we assume that the transactions between the upstream firm and a downstream firm are not observable to other downstream firms. In this setup, we shall see that the upstream firm is unable to credibly commit to sell the monopoly quantity or not to supply some firms.

[10]For more on this, see Mathewson and Winter (1984).

3.1 The Equilibrium Quantities and Transfers

Proposition 1 *In equilibrium, the upstream firm supplies each downstream firm the Cournot quantity independently of the distribution of bargaining power. The expected transfer from each downstream firm to the upstream firm is:*

$$T^{\alpha}(q^C) = \alpha P(nq^C)q^C + (1-\alpha)[cq^C + f(n)] \tag{2}$$

Proof: See Appendix. □

The total (Cournot) quantity increases with the number of downstream firms, but it is *independent* of bargaining power. The reason for this is simply that each party making an offer to its trading partner seeks to maximize the surplus from their *bilateral* relationship, regardless of the relationships between the upstream firm and the other downstream firms. Whatever the distribution of bargaining power, U cannot commit in any way to restrain the quantity competition between the downstream firms[11].

When the upstream firm makes the take-it-or-leave-it offers, it appropriates the whole downstream industry Cournot profit. This makes it clear that the upstream firm suffers from the inability to commit to supply less than the Cournot quantity. More interestingly, when the downstream firms make the take-it-or-leave-it offers, they cannot prevent the upstream firm from opening another line of production and selling inputs to other downstream firms. This leads them to leave the upstream firm with a rent which increases with the number of firms.

In this simple environment, bargaining power does not affect production. It simply determines the distribution of the rents obtained for given output

[11]Suppose that all downstream firms but D_i had agreed that $D_j, j \neq i$ would buy Q^m/n. Then, whatever α (the reader can refer to the appendix on this), U and D_i would agree on a quantity $q_i = \arg\max[P(\frac{n-1}{n}Q^m + q) - c]q = R^C(\frac{n-1}{n}Q^m) > Q^m/n$, where the Cournot reaction function satisfies $-1 < (R^C)' < 0$ ($(R^C)' = -(P' + QP'')/2P' + qP'' \in (-1, 0)$ since $P' < 0$ and $P'' < 0$). This commitment problem is analogous to the Coasian durable good pricing problem in many respects, with the number of firms playing the same role as the number of periods in the durable good monopoly case.

between upstream and downstream firms. These two features allow us to focus on the tradeoff between the redistribution of rents and the size of the rents.

3.2 The Rent Reduction Effect

When $\alpha = 1$, the upstream firm appropriates the entire industry surplus. If there are more than one firms in the downstream market then more output is produced than in a monopoly and increasing total output by increasing the number of downstream firms leads to a rent reduction. We refer to this as the rent reduction effect of competition. When n increases, total output and consumer surplus increase, but the payoff to the upstream firm $P(Q(n))Q(n) - cQ(n) - F(n)$ decreases (since $Q > Q^m$, $P' < 0$ and $P'' < 0$, $[P(Q(n)) - c + P'(Q(n))Q(n)]Q'(n) - F'(n) < 0$). U appropriates the whole industry surplus which is maximized under monopoly. Therefore, when it has all the bargaining power, the upstream firm chooses $n = 1$ potentially active downstream firms in stage 1, i.e. it forecloses the market, although this is undesirable from a social viewpoint.

The rent reduction effect is actually a natural extension of the (Coasian) commitment problem when focusing on the effect of downstream competition on the payoff to the upstream firm. Here, we start from the observation that when there are less downstream firms, the upstream firm suffers less from its inability to supply them all[12].

3.3 The Negotiation Effect

When $\alpha = 0$, the bargaining game is reduced to simultaneous contract offers from the downstream firms to the upstream firm. When making an offer, each D_i expects that $n-1$ other downstream firms will be supplied, and that it will

[12]Our approach in this section could also be seen as a principal-agent relationship in the style of Maskin and Tirole (1992) where the principal performs hidden actions (the sale to other downstream firms). Given the degree of competition in the downstream market, the upstream firm's hidden action enters the downstream firms' objective function. Here, as soon as $n \geq 2$, the upstream firm is strictly worse off than if the downstream firms could observe its action.

cost $cq_i + f(n)$ to the supplier to produce q_i units of input. Hence, each D_i's offer and the number of units both increase with n. The key ingredient for the former result is U's increasing cost of opening additional lines of production. This makes sure that the payoff to the upstream firm, $\pi_U(n) = cQ + nf(n) - cQ - \sum_{i=1}^{n} f(i) = \sum_{i=1}^{n}[f(n) - f(i)]$, increases with n. We call this latter effect the negotiation effect[13].

The intuition behind the negotiation effect can also be understood by assuming fixed total output equally shared between the downstream firms, each of them getting Q/n. Then, increasing n and keeping Q constant does not affect the offers made by U. However, each D_i has to offer the upstream firm $cQ/n + f(n)$, which is the incremental cost of dealing with the marginal firm. Clearly, the payoff to U, $nf(n) - F(n)$, is increasing in n. As the number of downstream firms grows the upstream firm retains all the inframarginal benefits of supplying them all. This is the negotiation effect. While a downstream monopolist would only have to pay the upstream firm the average cost of producing Q, negotiation with n firms producing Q brings payments of each of them closer to the incremental cost of producing Q/n for each of them. If the upstream firm makes the offer, the output effect of increased competition leads to a reduction in rents and therefore to a reduction in extracted surplus. If the downstream firms make the offers, increased competition makes U benefit from the negotiation effect, increasing the average price for a given level of output.

Hence, in stage 1, the upstream firm publicly picks $n = N$ potentially active downstream firms. Since the upstream firm has no bargaining power, it favors competition (rather than foreclose the market) between the downstream firms to induce them to make higher offers. Thus, the upstream firm's choice of downstream competition crucially depends on its bargaining power.

[13]This result is qualitatively close to that in Stole and Zwiebel (1996a, 1996b), where the authors develop a non-cooperative multilateral dynamic bargaining game applied to intrafirm bargaining. Our approach is very different, though, because we analyze bargaining over optimal contracts and competition, but with a more stylized bargaining game.

The negotiation effect leads downstream firms to make offers to U which increase with the degree of competition as measured by the number of downstream firms. While it is modeled through an increasing cost of opening lines of production, such an effect is robust to a number of alternative specifications of the market environment and of the bargaining procedure[14]. This effect is absent in BW because they assumed no cost for the upstream firm. In HT, the offers are always made by the upstream firms and this effect is ignored.

3.4 The choice between foreclosure and downstream competition

Analyzing the two polar cases ($\alpha = 0$ and $\alpha = 1$) enable us to identify two antagonistic effects of competition. Now, we address the trade-off between these effects. More competition between downstream firms improves the upstream firm's negotiation position, but decreases the industry profit. For $\alpha \in [0, 1]$, the payoff to the upstream firm can be written

$$\pi_U(n) = \alpha\Big[[P(Q(n)) - c]Q(n) - F(n)\Big] + (1 - \alpha)[nf(n) - F(n)]. \qquad (3)$$

The following proposition follows from the previous discussion.

Proposition 2 *The effect of downstream competition on the payoff to the upstream firm depends on the distribution of bargaining power. In particular, there exist* $\{\alpha_1, \alpha_2 \geq \alpha_1\}$ *such that* π_U *strictly increases with* n *when* $\alpha < \alpha_1$

[14]Our cost structure is particularly convenient in that it captures the higher cost of servicing a larger number of firms while leaving the upstream firm with the commitment problem mentioned above. With an increasing marginal cost of *total* production, instead of an increasing cost of opening an additional line of production, downstream firms' offers would be more complicated to describe. *Ceteris paribus*, the competition effect would be more radical than in our paper. If we leave the structure of our model unchanged apart from this different cost structure, downstream firms might be tempted to buy the total industry quantity and to produce the monopoly quantity. The increasing marginal cost of production would, under some circumstances, allow the upstream firm to commit not to supply more units of input when this becomes too costly. The intuitive outcome that each firm offers the supplier's incremental cost of production (which increases with other firms' production because the marginal cost increases) would require different specifications of the game, such as capacity constraints or infinitely repeated contract offers.

and strictly decreases with n when $\alpha > \alpha_2$. In stage 1, U picks N downstream firms when $\alpha < \alpha_1$ and 1 downstream firm when $\alpha > \alpha_2$.

Proof: See Appendix. □

When it has high bargaining power, the upstream firm appropriates a large share of the downstream industry profit while the effect of competition on the downstream firms' offers is not very important. It is thus better off facing a non competitive downstream industry. In contrast, when its bargaining power is low, it appropriates a small share of the industry profit in the absence of competition. Favoring competition allows the upstream firm to increase its share of the industry profit by enhancing its bargaining power. It has an incentive to enhance bargaining power at the cost of total rent.

This motive is, however, unrelated to social concerns. From a social viewpoint, the welfare-improving effect of an increase in competition clearly decreases in n since the positive effect of increasing n on consumer surplus decreases with n and the cost of opening additional lines increases with n, More importantly from a policy viewpoint, we should wonder whether U's incentive to promote competition is too low from a social viewpoint. This can be done easily by comparing (3) and SW. When U makes the offers, given that $\pi_i = 0$ for any n, and that U bears all the cost of opening additional lines of production, the only difference with the objective of a social planner is that U does not internalize the positive effect of more competition on CS. Hence, U has too low an incentive to favor competition from a social viewpoint. When D_i makes the offers, it ignores both the positive effect of an increase in competition (and production) to consumers and the negative effect to downstream firms. The additional fixed cost of servicing one more firm is borne by the downstream firms, and it benefits U even though the associated cost of opening an additional line of production is higher than the positive effect on consumers of increasing production to $Q(n+1)$.

Corollary 1 *The upstream firm's incentive to favor competition is lower than that of a social planner when* $\alpha > \alpha_2$ *and can be either lower or higher when* $\alpha < \alpha_1$.

This result is to be contrasted with the analysis of market foreclosure in BW and HT. In these papers, the upstream firm's incentive to promote competition in vertically related markets is too low from a social viewpoint. Here, this need not be the case, which, of course, potentially has strong implications from a competition policy viewpoint.

4 Vertical Integration

A hotly debated issue in antitrust policy concerns the response to vertical integration. Vertical integration is widely thought of as a somewhat radical way of imposing vertical restraints on vertically related firms. In this section, as in HT and RT, we view vertical integration as an opportunity for the upstream firm to overcome the (Coasian) commitment problem described in section **3** by restricting production[15]. We focus on the effect of downstream competition on the incentive for the upstream firm to vertically integrate one downstream firm.

We assume that the owner of a production unit's assets is entitled to all the returns generated by this unit (although profit sharing would be enough) and all the decision rights concerning production and trade involving this unit. Ownership will matter because of contract incompleteness. We followed the literature in assuming that no contract can be signed before the bargaining stage. Like Grossman and Hart (1986), BW and HT (where this assumption is discussed at length), the characteristics of the input may be difficult to write in

[15] A number of examples can be used to document this argument. See, for instance, Brandenburger and Nalebuff's (1996) description of how Nintendo could build its success on voluntary shortages of video games and video game systems after the mid-1980s because of a dominating position on the segement of video game systems and of its ownership of game-developing subsidaries (pp. 111-118).

a contract in advance. It will become clear shortly that we can abstract from modeling the acquisition cost as Bertrand competition between downstream firms to sell their assets would lead to a zero cost of acquiring a downstream firm.

For simplicity, we assume that U merges with either 0 or 1 downstream firms. This may be either because a vertical structure with more than one downstream firm has to bear a prohibitively high agency cost or, as we shall now see, because monopolization and total foreclosure in equilibrium make only the integration of one firm profitable. Indeed, we first consider how vertical integration affects bargaining and production.

Lemma 1 *Under vertical integration, the upstream firm only supplies its subsidiary. It supplies the monopoly quantity* Q^m.

Proof: See Appendix. □

Since it can observe both its transactions with the other downstream firms and it obtains all the returns of the vertical structure (having a share β would not affect the result), the upstream firm internalizes the negative externality of supplying other downstream firms on its subsidiary. Given this informational advantage, nothing prevents it from supplying the monopoly quantity. The upstream firm can appropriate the whole industry surplus by supplying only the firm that it owns. This surplus is maximized under the monopoly quantity. If it supplies another downstream firm, it will supply more than the monopoly quantity in equilibrium. Thus, the only equilibrium that can exist is that U supplies the monopoly quantity to its downstream firm and does not supply any other firm. There is monopolization and total foreclosure (here, the absence of an outside option for downstream firms is crucial). The payoff to the integrated structure does not depend on the number of firms in the market.

We now study the effect of downstream competition on the upstream firm's incentive to vertically integrate one downstream firm. If $\alpha = 0$, $U^{vi} - U^{ni}$

decreases with n since U^{ni} increases with n. When many firms are in the downstream market, the upstream firm's surplus is already quite high under non-integration and the profit increase under vertical integration is not so high. In contrast, when there are few downstream firms, the payoff under non integration may be so low that vertical integration is worthwhile. Conversely, if $\alpha = 1$, $U^{vi} - U^{ni}$ increases with n since U^{ni} decreases with n. For $\alpha \in [0, 1]$, it follows immediately that

Proposition 3 *The upstream firm's incentive to integrate a downstream firm may either increase or decrease with the number of downstream firms. In particular, when $\alpha < \alpha_1$ (resp. $\alpha > \alpha_2$), the incentive for vertical integration strictly decreases (resp. increases) with the number of downstream firms.*

In this model, vertical integration is always desirable to the upstream firm since it solves its commitment problem. However, vertical integration often comes with costs in practice. Following BW and HT, we could have assumed that a vertically integrated structure must bear some agency cost A that a non integrated structure does not have to bear. Then, vertical integration would take place when the downstream industry is competitive (resp. concentrated) enough if the upstream firm's bargaining power is high (resp. low).

Assume now that downstream firms can enter at stage 0 at cost f and that vertical integration comes at cost A. Hence, entry affects the incentive to integrate. The number of downstream firms in equilibrium is sensitive to the possibility of vertical integration. When α is low, a sufficiently low entry cost induces enough entry to prevent vertical integration. But a high entry cost constrains the downstream industry to a level of concentration sufficient to trigger vertical integration, which implies that only one downstream firm actually enters the market. When α is high, a high entry cost leads to non-integration. But the possibility of vertical integration may reduce the number of entrants enticed by a low entry cost: a potential entrant which would have

made a positive profit in the absence of vertical integration may realize that entry would trigger vertical integration and would thus prefer to stay out.Thus, the mere possibility of vertical integration can be a barrier to entry and can sustain profits in an industry.

Corollary 2 *Assume that entry in the downstream industry and vertical integration are subject to fixed costs. Then, when $\alpha > \alpha_2$, there are ranges of these fixed costs such that the mere possibility of vertical integration can be a barrier to entry.*

Horizontal mergers and spin-offs may also constitute an important decentralized way to prevent vertical integration and market foreclosure. Assume that there is no entry but that horizontal mergers and spin-offs are allowed. The downstream firms may strategically merge or separate in order to prevent vertical integration and market foreclosure. They may be better off either separating and weakening their bargaining position (and maybe duplicating fixed costs) or merging and reducing their market share. This result holds, for instance, when the owners of two merging downstream firms share the profit equally and when two downstream firms resulting from a horizontal spin-off compete in quantities.

Corollary 3 *Horizontal integrations (when $\alpha > \alpha_2$) or spin-offs (when $\alpha < \alpha_1$) may take place in order to prevent vertical integration.*

Finally, vertical integration is not necessarily socially harmful, since a social planner would have to weigh the cost of monopolization with the benefits of saving on additional costs of opening lines of production. It follows from corollary 1 and the analysis of this section that

Corollary 4 *When $\alpha > \alpha_2$, the upstream firm's incentive to vertically integrate is too high from a social viewpoint. When $\alpha < \alpha_1$, the upstream firm may have either too high or too low an incentive for vertical integration. In*

particular, some socially desirable vertical integrations may not take place, i.e. they may not be privately profitable, when $\alpha < \alpha_1$.

This result is to be contrasted with BW and HT who find that downstream competition results in an excessive tendency towards vertical integration. Non desirable integration may appear in their model because the benefits from the vertical merger go to the merging parties, while the consumers are either worse off or unaffected[16]. Here, when downstream firms have high bargaining power, vertical integration and monopolization lead to savings on costs of opening lines of production which would have been costly from a social viewpoint if they were higher than the increase in consumer's surplus[17].

5 The Effect of Upstream Competition

Assume now that there are two upstream firms U_p, $p \in \{1, 2\}$, both of them with a marginal cost of production c and a cost of opening lines of production $f(\cdot)$. With probability α (resp. $1 - \alpha$), both upstream (resp. downstream) firms make take-it-or-leave-it offers. Then, our competition effect pertains for any distribution of bargaining power, while the rent reduction effect vanishes. Upstream firms' payoff increases with the number of downstream firms.

Proposition 4 *The transfer functions, which are of the form* $T_{p,i}(q_{p,i}) = cq_{p,i} + f(n/2)$ *if* n *is even and* $T_{p,i}(q_{p,i}) = cq_{p,i} + f((n+1)/2)$ *if* n *is odd, and the payoff to the upstream firms are unaffected by the distribution of bargaining*

[16] Kühn and Vives (1999) study a model with product variety and with upstream monopoly and downstream monopolistic competition. They identify conditions on consumer preferences under which vertical mergers are welfare improving or welfare reducing.

[17] Slightly modified setups would have led us to the result that some socially desirable vertical integrations may not take place when α is high as well. For instance, when U invests in design (the inverse demand curve $P(e, Q)$ satisfying $P_e > 0, P_{e,Q} > 0$), the consumer appropriates part of the surplus created by the upstream firm's investment, and the incentive to vertically integrate can be too low relative to the social optimum. When α is high, monopolization after vertical integration may increase investment. Consumer surplus may be either higher or lower since consumers get a smaller share of a larger pie. Since U ignores the positive effect of higher investment on consumer surplus, the incentive for monopolization/vertical integration may be either too high or too low from a social viewpoint.

power. Upstream firms are better off facing a more competitive downstream industry.

Proof: See Appendix. □

When the upstream firms make the offers, they compete in Bertrand with differentiated costs. The lower cost associated with having supplied fewer downstream firms confers a strategic advantage which allows the upstream firms to make positive profit on inframarginal downstream firms. The higher the number of dowsntream firms, the more downstream firms they supply and the higher the profit they make when supplying an inframarginal downstream firm. This implies that all the results we had in section 3 with $\alpha = 0$ now hold for any α. In particular, the incentive to encourage competition in the downstream market may be higher than that of a social planner.

The strategies of vertically integrated firms are more difficult to capture. First assume that one upstream firm, say U_1, owns one downstream firm and the other upstream firm, say U_2 does not. Given this "partially integrated" market structure, U_1 would be tempted to restrict production and to supply its downstream firm, say D_1, only. However, supplying only D_1 would leave U_2 with the possibility to supply the other downstream firms, including those for which U_1 has a lower cost of opening another line of production. Given that U_2 is always ready to supply other downstream firms, U_1 is better off supplying them if it has a cost advantage over U_2. Depending on the differentials between the costs of opening lines of production, several strategies are possible regarding the supply of the downstream firms for which U_1 has a cost advantage. For instance, U_1 may supply these downstream firms less than the Cournot quantity (since it internalizes the negative externality of supplying them to its own subsidiary) but a quantity that is high enough so that U_2 would lose money by supplying them with additional quantities (this strategy, in turn, would affect the quantities supplied to D_1 by U_1 and to the other downstream firms by U_2).

This indicates that the total quantity supplied would actually depend on the shape of the function $f(\cdot)$. Finally, an analysis similar to that of Lemma 1 would indicate that under vertical integration of one downstream firm by each upstream firm, total output would be the Cournot duopoly quantity[18].

6 Concluding Remarks

This paper analyzed a monopolist's choice of how many trading partners it would like to have when bargaining over optimal contracts. In contrast with the literature on market foreclosure, which describes how the use of vertical restraints both induce and allow a firm with significant market power to extend its market power to vertically related segments, we pointed out that such a firm may be tempted to favor competition among trading partners in order to improve its negotiation position. Its incentive to favor competition may actually be higher than that of a social planner. This incentive to promote competition may also hold when conditional contracts (and in particular exclusive dealing agreements) are allowed. For instance, in the case of several production periods, the upstream firm may still want to supply a number of downstream firms to make sure that there is enough downstream competition remaining in each period. In the presence of upstream competition, the form of the transfer function offered by the upstream firm is a two-part tariff whatever the distribution of bargaining power. Upstream firms are unambiguously better off with more downstream competition.

We believe that this paper would allow for a number of potential extensions. First, while we assumed that vertical integration is irreversible, vertical mergers and spin-offs may take place sequentially. This paper suggests that a shift in the demand curve or a change in the competitive environment may trigger

[18]This duopoly outcome, like the monopolization outcome subsequent to vertical integration in the previous section, would be sensitive to capacity constraints or an increasing marginal cost of transformation for downstream firms. Under these two variations, the incentives for foreclsoure would probably be reduced.

such mergers or spin-offs. This could be a starting point towards an analysis of the dynamics of integration. Second, most assumptions of our paper seem reasonable to analyze financial intermediation. The secrecy of transactions is an important factor of many financial contracts. Interbank loans suggest that banks' cost of capital is often a linear function of this capital, while fixed fees may be here to pay for labour and operating costs. Our results suggest that an investor with significant market power and high bargaining power would tend to offer more equity-like contracts, while the same investor with low bargaining power or competing investors would tend to offer loan or debt contracts with fixed fees. Fixed fees, as opposed to the linear part of the two-part tariffs (e.g. interest rates), would be an important determinant of upstream firms' profits and they should be looked at carefully when examining the effective level of competition.

Appendix

Proof of Proposition 1.

We first set $\alpha = 1$. The upstream firm makes simultaneous take-it-or-leave-it offers to all downstream firms which satisfy

$$\begin{aligned} \max_{T_{U,i}(\cdot))} \quad & [\sum_{i=1}^{n} T_{U,i}(q_i) - cq_i - f(i) && (4) \\ s.t. \quad & P(q^a_{-i} + q_i)q_i \geq T_{U,i}(q_i) && (5) \\ & 0 \leq q_i \in \arg\max P(q^a_{-i} + q_i)q_i - T_{U,i}(q_i). && (6) \end{aligned}$$

Clearly, each downstream firm's participation constraintis binding. Anticipating the choice of q_i, the upstream firm offers a tariff $T_{U,i}(\cdot)$ which is limited by the secrecy of its transactions with the other downstream firms. Therefore, the quantity chosen by each downstream firm is

$$\begin{aligned} q_i \quad &\in \quad \arg\max \sum_{i=1}^{n} P(q^a_{-i} + q_i)q_i - cq_i && (7) \\ &\equiv \quad R^C_i(q^a_{-i}), \end{aligned}$$

where R^C stands for the reaction function of a standard Cournot game. Hence, this quantity turns out to be the Cournot quantity. Then, U appropriates the full industry surplus and gets a total transfer $T(Q^C) = P(Q^C)Q^C$.

We now investigate the case $\alpha = 0$. Each downstream firm makes a take-it-or-leave-it offer (to the upstream firm) which satisfies

$$\begin{aligned} \max_{T_{i,U}(\cdot))} \quad & P(q^a_{-i} + q_i)q_i - T_{i,U}(q_i) && (8) \\ s.t. \quad & q_i \in \arg\max P(q^a_{-i} + q_i)q_i - T_{i,U}(q_i) && (9) \\ & T_{i,U}(q_i) - cq_i - f(l+1) + \sum_{j=1, j\neq i}^{l} [T_j(q^a_j) - cq_j - f(j)] \end{aligned}$$

$$\geq \sum_{k=1,k\neq i}^{m} [T_k(q_k^a) - cq_k - f(k)], \tag{10}$$

where l (resp m) holds for the number of other downstream firms supplied by the upstream firm if D_i's offer is accepted (resp. rejected). The latter constraint, which is binding, can be rewritten $T_{i,U}(q_i) = cq_i + A_i(n)$, where $A_i(n)$ is independent of q_i[19]. Hence, without loss of generality, we can restrict ourselves to transfer functions which are two-part tariffs. This implies that, here again, each downstream firm will buy and transform a quantity satisfying

$$q_i \in \arg\max \sum_{i=1}^{n} P(q_{-i}^a + q_i)q_i - cq_i - A_i(n) = R^C(q_{-i}^a), \tag{11}$$

which leads, once again, to the Cournot quantity q^C. Rewriting (**??**) leads to $T(q_i) = cq_i + f(n)$, which gives the result. □

Proof of Proposition 2.

$\forall n \in \{1, N-1\}$, $\pi_U(n+1) - \pi_U(n) = \alpha G(n) + (1-\alpha)H(n)$, where

$$\begin{aligned}
G^- &\equiv \min_{1\leq n\leq N-1} G(n) \\
&\leq G(n) \equiv [P(Q(n+1)) - c]Q(n+1) - [P(Q(n)) - c]Q(n) - f(n+1) \\
&\leq G^+ \equiv \max_{1\leq n\leq N-1} G(n) < 0 \\
0 < H^- &\equiv \min_{1\leq n\leq N-1} H(n) \leq H(n) \equiv n[f(n+1) - f(n)] \leq H^+ \equiv \max_{1\leq n\leq N-1} H(n).
\end{aligned}$$

This implies that

$$H^- - \alpha(H^- - G^-) \leq \pi_U(n+1) - \pi_U(n) \leq H^+ - \alpha(H^+ - G^+).$$

The left hand side is strictly positive for any $\alpha < \alpha_1 \equiv H^-/(H^- - G^-)$ and the right hand side is strictly negative for any $\alpha > \alpha_2 \equiv H^+/(H^+ - G^+) \geq \alpha_1$. □

[19] In our setup, all units bought by downstream firms will be used. This is why we did not have to formally distinguish between the number of units bought and the number of units sold by downstream firms.

Proof of Lemma 1.

The upstream firm supplies its downstream firm, say D_1, the quantity $q_1 = R^C(q_{-1})$. Therefore, the quantity decisions after U and D_i ($i \neq 1$) made the offers both satisfy

$$q_i = \arg\max_{q_i} \Big[P\Big[R^C\Big(\sum_{j=2}^{n} q_j \Big) + \sum_{j=2}^{n} q_j \Big] q_i - c q_i \tag{12}$$

which is maximized for $q_i = 0$ (note that this result does not depend on the cost of operating lines of production). □

Proof of Proposition 4.

Given that an upstream firm U_p must incur a fixed cost in order to supply a downstream firm, we can restrict the analysis to the case where each downstream firm buys inputs from only one upstream firm. If the downstream firms expect upstream firm U_p to have supplied $n_p - 1$ other downstream firms, an analysis similar to that of the proof of Proposition 1 indicates that (1) their offer will be $f(n_p) + cq_i$, (2) each downstream firm will produce the Cournot quantity, and (3) half of the downstream firms are supplied by each upstream firm if n is even, and that $(n-1)/2$ downstream firms will be supplied by each upstream firm while the n^{th} firm will randomize if n is odd.

Consider now the offers made by the upstream firms.

$$\begin{aligned} \max_{T_{p,i}(\cdot))} \quad & [\sum_{i=1}^{n} T_{p,i}(q_{p,i}) - c q_{p,i} - f(n_p) && (13) \\ s.t. \quad & T_{-p,i}(q_{-p,i}) \geq T_{p,i}(q_{p,i}) && (14) \\ & 0 \leq q_{p,i} \in \arg\max P(q^a_{-i} + q_{p,i} + q_{-p,i}) q_{p,i} - T_{p,i}(q_{p,i}). && (15) \end{aligned}$$

The firms compete in the Bertrand sense with differentiated costs. To supply downstream firm D_i, U_p must supply fewer downstream firms than (or as many as) U_{-p}. Hence, the offers satisfy $T_{p,i}(q_{p,i}) = cq_{p,i} + f(n/2)$ if n is even

and $T_{p,i}(q_{p,i}) = cq_{p,i} + f((n+1)/2)$ if n is odd. The equilibrium quantities are, here again, the Cournot quantities.

Note that, here again, the upstream firms make profits when they supply inframarginal downstream firms, but not on the incremental downstream firm. Their payoff $\sum_{i=1}^{(} n_p) f(n_p) - f(i)$ increases with n for any α. □

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