On the profitability and welfare effects of downstream mergers *

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Abstract

We consider an upstream firm selling an input to several downstream firms through observable, non-discriminatory two-part tariff contracts. Downstream firms can alternatively buy the input from a less efficient source of supply. We show that downstream mergers lead to lower wholesale prices. They translate into lower final prices only when the alternative supply is inefficient enough. Concerning profitability of downstream mergers, we find that monopolization is the equilibrium outcome of a merger game even for very unconcentrated markets whenever the alternative supply is inefficient enough.

Key words: vertically separated industries, downstream mergers, wholesale price, two-part tariff contracts

JEL codes: L11, L13 and L14.

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1 Introduction

In the last few years, we have observed the rise of very large downstream firms in previously more fragmented industries such as retailing, farming, natural resource extraction or health. The effect of downstream mergers on consumer surplus and social welfare is far from being clear for industrial economists. The reason is that they may affect two different dimensions. On the one hand, they reduce competition downstream. On the other hand, they have an effect on the supply side of the market and may allow downstream firms to get better deals from suppliers. If this is the case, the key point to assess the welfare effect of downstream mergers is whether the lower wholesale prices obtained by downstream firms are passed on to consumers.

In order to address this question, we consider a model with an upstream firm selling an input to several downstream firms. They are engaged in Cournot competition in a homogeneous good final market. They can alternatively obtain the input from a less efficient source of supply. The upstream firm offers observable, non-discriminatory two-part tariff contracts to sell the input to downstream firms. In this setting, we show that downstream mergers reduce the optimal wholesale price offered by the upstream supplier. The intuition behind the result is as follows: the upstream firm chooses the wholesale price to balance two opposing incentives: an incentive to maximize the size of the "total pie" (total industry profits) and an incentive to increase the fraction of a "lower pie" it gets (by reducing the outside option of downstream firms). The former incentive calls for a high wholesale price. The latter one requires a low wholesale price. The optimal wholesale price arises from the balance of these two opposing effects. A downstream merger affects the two previous incentives; on the one hand, by reducing the level of competition

\footnote{For example, several reports of the European Commission and the OECD show that the grocery retail market of many states of the UE is now dominated by a small number of large retailers. Although market concentration in retailing is less extreme in the U.S., concern about buyer power is also increasing there (Inderst and Wey (2007)).}
in the downstream market, it supports the first incentive. On the other hand, it increases the
outside option of downstream firms, hurting the second incentive. Then, a downstream merger
makes the first incentive "less binding", leading the upstream firm to put more weight on the
second one, reducing the wholesale price in order to reduce the outside option of downstream
firms.

At this point, the question is when the lower input price induced by a downstream merger is
passed on to consumers. We find that if the alternative supply is inefficient enough (or, in other
words, if there is strong market power in the upstream sector), a downstream merger countervail
the market power of the dominant supplier, leading to a large reduction in the wholesale price,
that offsets the anticompetitive effect of the merger and leads to a drop in the equilibrium
final price. As a result, in this context, downstream mergers are pro-competitive. This result
supports the view that the existence of “symmetry” between upstream and downstream markets
increases welfare (Inderst and Shaffer (2008 (a)): the strong upstream market power should be
compensated with an increase in the buyer power of downstream firms. In other words, from the
point of view of competition policy, in our setting we should prescribe a lenient merger policy
downstream whenever there is strong market power upstream.

Observe that, in our model, downstream mergers increase the buyer power of downstream
firms not because they become larger (in our model all downstream firms are symmetric before
and after the merger), but because their outside options increase. In other words, the profits
any downstream firm gets if it buys the input from the alternative supplier increases after a
horizontal merger. It is this effect which allows downstream firms to get better deals after a
merger, countervailing the dominant position of the upstream firm.

On the other hand, let us emphasize the key role played by the assumption about the
existence of an alternative, less efficient source of supply. Under no alternative supply, the
upstream monopolist could always implement the monopoly outcome through two-part tariff contracts, regardless of the number of downstream competitors. But then, downstream mergers would have no effect on the final price paid by consumers. It is the fact that the existence of an alternative supply prevents the upstream firm from implementing the monopoly outcome, and its incentive to reduce the outside option of downstream firms, which explains that a downstream merger may lead to a reduction in the final price paid by consumers, increasing consumer surplus and social welfare.

Our paper is related to von Ungern-Sternberg (1996), Dobson and Waterson (1997), Chen (2003) and Symeonidis (2010). The key difference with our paper is that none of them consider the role played by the existence of an outside option. Von Ungern-Sternberg (1996) and Dobson and Waterson (1997) consider linear supply contracts and no alternative supply. They obtain that downstream mergers lead to lower final prices only when there exists enough competition in the downstream market. In Chen (2003), the role played by asymmetry in the retail market is explored. An exogenous increase in the relative bargaining power of a dominant retailer benefits consumers because it triggers a decrease in the wholesale price charged by the supplier to the fringe competitors (in an attempt to make up for lower profits earned from the dominant retailer), thereby leading to lower final prices. Finally, Symeonidis (2010) analyzes the effects of a downstream merger in a differentiated oligopoly when there is bargaining between downstream firms and upstream agents (firms or unions). When competition is in quantities, upstream agents are independent and bargaining is over a uniform input price, a merger between downstream firms may raise consumer surplus and overall welfare. However, when competition is in prices, or the upstream agents are not independent, or bargaining is over a two-part tariff, or bargaining covers both the input price and the level of output, the standard welfare results are restored: a downstream merger always reduces consumer surplus and overall welfare.
On the other hand, Caprice (2006) introduces the possibility of an alternative supplier in a setting with secret two-part tariff contracts, but he analyzes a different question, namely, the welfare effect of a ban on price discrimination. It is shown that when the supplier competes against a fringe of less efficient rivals, contrary to a previous result by Rey and Tirole (2007), banning price discrimination may cause per-unit prices to fall and welfare to increase. The dominant supplier can take advantage of a strategic bargaining effect: reducing the per-unit price makes the outside option of buying from the fringe less profitable, allowing the dominant supplier to extract more bargaining surplus through the fixed fee.

After the analysis of the welfare effects of downstream mergers, we turn our attention to their profitability. Again, the degree of competition upstream plays a key role. In particular, we show that when the alternative supply is inefficient enough, downstream mergers are very profitable because they induce a large reduction of the wholesale price offered by the dominant upstream firm. Indeed, in an endogenous merger formation game, we get that monopolization is the equilibrium outcome even for very unconcentrated industries whenever the alternative supply is inefficient enough. When the efficiency gap is not so large, however, merger to monopoly occurs in equilibrium only in concentrated markets. Our result contrasts with the lack of profitability of horizontal mergers found in Kamien and Zang (1990), where, in a standard Cournot setting, monopolization occurs in equilibrium only if the pre-merger market structure is a duopoly.

The question of profitability of downstream mergers in a vertical structure has been previously analyzed in the literature. For example, profitability of downstream mergers is also obtained in Lommerud et al. (2005, 2006). In the former paper, they consider three downstream firms, each of them contracting in exclusivity with an upstream firm. The supply contracts are linear. In this setting, the merger of two downstream firms is shown to be profitable because it generates competition between their suppliers, leading to a reduction in input prices. In
the latter paper, the same idea is applied to study the pattern of mergers in an international context. In Bru and Fauli-Oller (2008) profitability of downstream mergers is analyzed in a context of secret two-part tariff contracts and "passive beliefs". In Snyder (1996), downstream mergers allow to break collusion upstream. Chipty and Snyder (1999), Inderst and Wey (2003) and Raskovitch (2003) find that, if suppliers have increasing marginal costs, incremental surplus increases more than proportionally with buyer size, explaining why large buyers pay a lower per-unit price. In Katz (1987) and Inderst and Wey (2007), the possibility to share the costs of backward integration and producing the good itself, makes that merging firms get better deals from suppliers.

Our result on profitability of downstream mergers in a Cournot setting is, to the best of our knowledge, new in the literature because it is based neither on the opportunism generated by secret contracts (we consider observable contracts), nor on the fact that merged firms are larger (in our paper, there is always symmetry among downstream firms, before and after a merger takes place). And in contrast to Lommerud et. al. (2005) and (2006), we assume two-part tariff contracts. And still, we find that the existence of competition upstream shape the contracts offered to downstream firms such that downstream mergers are profitable.

The rest of the paper is organized as follows. In the next section, we analyze the effect of downstream mergers on consumers and social welfare. In Section 3, we solve an endogenous merger game to analyze the profitability of downstream mergers. Finally, Section 4 concludes. All proofs are relegated to the Appendix.

2 Model with an exogenous market structure

We consider an upstream firm that produces an input at cost $c_u$. A number $n$ of downstream firms transform this input into a final homogenous good on a one-to-one basis, without additional
costs. Downstream firms may alternatively obtain the input from a competitive supply at cost $c < a$. The competitive supply is less efficient than the upstream firm such that we have $c_a < c$.

Inverse demand for the final good is given by $P = a - Q$, where $Q$ is the total amount produced.

The upstream firm sets observable vertical contracts that establish the terms under which inputs are transferred. After contracts are set, competition downstream is à la Cournot. More specifically, the game is modelled according to the following timing: first, the supplier offers a two-part tariff contract $(F, w)$ to downstream firms, where $F$ specifies a fixed fee and $w$ a linear wholesale price. Second, downstream firms decide whether or not to accept the contract. The ones that accept, pay $F$ to the upstream firm. Finally, they compete à la Cournot, with the marginal costs inherited from the second stage. In particular, the firms that accept the contract have a marginal cost $w$ and the firms that do not accept the contract buy the input from the alternative supply and have a marginal cost $c$.

Assume that $k$ firms have accepted a supply contract $(F, w)$. Firms that have not accepted the contract produce in equilibrium:

$$q_N(k, w) = \begin{cases} \frac{a-c(k+1)+wk}{n+1} & \text{if } w > \frac{-a+c(k+1)}{k} \\ 0 & \text{otherwise.} \end{cases}$$

On the other hand, the firms that accept the contract produce in equilibrium:

$$q(k, w) = \begin{cases} \frac{a+c(n-k)-w(n-k+1)}{n+1} & \text{if } w > \frac{-a+c(k+1)}{k} \\ \frac{a-w}{k+1} & \text{otherwise.} \end{cases}$$

Observe that, if $w$ is sufficiently low, the firms that do not accept the contract are driven out of the market. In that case, the firms that accept the contract produce the Cournot output when there are only $k$ active firms in the market. Profits of non-accepting and accepting firms are given, respectively, by $\Pi_N(k, w) = (q_N(k, w))^2$ and $\Pi(k, w) = (q(k, w))^2$.

In the second stage, downstream firms accept the contract offered by the upstream firm
whenever $F \leq \Pi(k, w) - \Pi_N(k - 1, w)$. Obviously, as the upstream firm maximizes profits, in order for $k$ firms to accept the contract,\(^2\) it will choose $F$ to bind their participation constraint, that is, such that $F = \Pi(k, w) - \Pi_N(k - 1, w)$. But this implies that the problem of choosing the optimal contract $(F, w)$ is equivalent to that of choosing $(k, w)$. Then, in the first stage, the upstream solves the following problem:

$$
Max_{k,w} \left( \Pi(k, w) - \Pi_N(k - 1, w) + (w - c_u)q(k, w) \right)
$$

s.t. $1 \leq k \leq n$ and $w \leq c$.

This problem has been already solved in the literature. Erutku and Richelle (2007) solve an equivalent problem for the case of a research laboratory licensing a cost-reducing innovation to a $n$-firms homogeneous goods Cournot oligopoly through observable two-part tariff licensing contracts. Making use of this previously existing result, we know first, that regardless of the number of downstream firms, the upstream firm finds profitable to sell the input to all of them.\(^3\) Second, if we replace $k$ by $n$ and plug the corresponding profit expressions in the maximization problem of the upstream firm we get:

$$
Max_w \begin{cases} 
\left( \frac{a-w}{n+1} \right)^2 - \left( \frac{a-c(w(n-1))}{n+1} \right)^2 + (w - c_u) \left( \frac{a-w}{n+1} \right) \quad \text{if} \quad c \geq w \geq -\frac{a+c}{n-1} \\
\left( \frac{a-w}{n+1} \right)^2 + (w - c_u) \left( \frac{a-w}{n+1} \right) \quad \text{if} \quad w < -\frac{a+c}{n-1}.
\end{cases}
$$

s.t. $w \leq c$.

Direct resolution of this problem leads to the following optimal wholesale price:

$$
w^*(n) = \frac{(n-1)(2cn+c_u-n)+2cn}{2(1-\frac{1}{n})} \quad \text{if} \quad c < \frac{a-c_u+(a+c_u)n^2}{2n^2} \quad \text{and} \quad w^M(n) = \frac{-a+c_u+(a+c_u)n}{2n} \quad \text{otherwise}.
$$

The intuition for this result is as follows: concerning the optimality of selling to all firms, we know that with a fixed fee contract, the input would be sold to only a subset of firms in order to

\(^2\)As $\frac{d(\Pi(k,w)-\Pi_N(k-1,w))}{dk} < 0$, this is the only equilibrium in the acceptance stage.

\(^3\)See the proof of this result in the Appendix.
protec industry prof from competition (Kamien and Tauman (1986)). With a two-part tariff contract however, the upstream firm can always sell the input to more firms without affecting the level of competition, by choosing an appropriate (higher) wholesale price. In other words, the upstream firm can always use the wholesale price to control for the level of competition downstream.\footnote{This argument is also used in Sen and Tauman (2007) to prove that with an auction plus royalty contract, a cost reducing innovation would be sold to all firms by an outsider patentee, and also by Faulf-Oller and Sandonis (2012) to show that the same result holds for the case of differentiated goods and for both an outsider and an insider patentee.}

Concerning the equilibrium contract, the optimal wholesale price trade-offs two conflicting incentives. On the one hand, maximizing industry profits requires a high wholesale price; on the other hand, reducing the outside option of downstream firms asks for a low wholesale price. Observe that whenever \( c \geq \frac{a-c_n+(a+c_n)\alpha^2}{2\alpha^2} \), the outside option becomes zero and thus the upstream firm obtains the full monopoly profits. In this case, as \( n \) increases the wholesale price is adjusted upwards in order to implement the monopoly price in the final market. On the other hand, it can be checked that \( w^* \) is an increasing function of \( n \) \( \left( \frac{dw^*(n)}{dn} > 0 \right) \) and tends to \( c \) as \( n \) tends to infinity.\footnote{This holds for any \( n \geq 2 \). Observe that, if \( c < \frac{a + 3c_n}{4} \), \( w^*(1) = c_n > w^*(2) \). Notice also that the restriction that the wholesale price can not be higher than \( c \) is never binding in equilibrium.} In other words, a downstream merger, by reducing the number of downstream firms, leads to a drop in the optimal wholesale price charged by the upstream firm, which is a necessary condition in order for downstream mergers to be welfare improving. The intuition behind this result is as follows: a downstream merger, by reducing the level of competition in the downstream market, helps to increase total industry profits; on the other hand, the incentive to reduce the outside option of downstream firms becomes more binding because a merger increases these outside options. Therefore, a downstream merger leads the upstream firm to put
more weight on the second incentive, reducing the wholesale price in order to reduce the outside option of downstream firms.

It is interesting also to emphasize the key role played by parameter $c$. It affects the way in which the upstream firm adjusts the wholesale price as $n$ changes. This can be seen formally by inspecting:

$$
\frac{\partial^2 w^*(n)}{\partial n \partial c} = \frac{2n - 1}{(1 + n(n - 1))^2} > 0.
$$

This expression makes clear that as the alternative supply becomes more inefficient (or, in other words, as there is more market power upstream), the upstream firm reduces the wholesale price faster as $n$ decreases. The intuition is as follows: a higher value of $c$ allows the upstream firm to charge a higher wholesale price, implying that its margin over marginal cost is larger. This implies that after a horizontal merger downstream, the upstream firm has more room to reduce the wholesale price in order to reduce the outside option of downstream firms. In other words, the countervailing effect of a horizontal merger is larger when the alternative supply is more inefficient. This is very important because only when the wholesale price adjusts sufficiently fast to changes in $n$, it may be the case that a reduction in $n$ after a merger leads to a reduction in the final price paid by consumers. And this happens for high values of $c$.

The next step in the analysis is then to check under what circumstances the lower wholesale price obtained by downstream firms after a horizontal merger will be passed on to consumers. This may be the case whenever the anticompetitive effect produced by a horizontal merger is more than compensated by the drop in the wholesale price. Let us first compute the equilibrium final price. From the previous results, it is direct to compute that price, which is given by:

$$
P^*(n) = \left\{ \begin{array}{ll}
\frac{2c(n-1)n^2 + a(2+n(n-1)) + c_u n(n+1)}{2(1+n^3)} & \text{if } c \leq \frac{a+c_u}{2} \text{ or } c > \frac{a+c_u}{2} \text{ and } n < \sqrt[3]{\frac{a-c_u}{2c-a-c_u}} \\
\frac{a+c_u}{2} & \text{otherwise.}
\end{array} \right.
$$

(2)
Next, we have to analyze the evolution of the equilibrium price with respect to \( n \). For large enough values of \( c \), the upstream firm gets the full monopoly profits and then the final price does not depend on \( n \). Otherwise, it is useful to write the equilibrium price as a function of the input price, namely, \( P^*(w^*(n)) = \frac{a + nw^*(n)}{n+1} \). Then,

\[
\frac{\partial P^*}{\partial n} = \frac{n(n+1)\frac{\partial w^*}{\partial n} - (a - w^*)}{(n+1)^2}.
\]  

(3)

As we can see in expression (3), the effect of a downstream merger on the final price crucially depends on the effect that the merger has on the equilibrium wholesale price. In particular, only when a horizontal merger leads to a large reduction in the wholesale we may have that \( \frac{\partial P^*}{\partial n} > 0 \). It is direct to compute that this is the case whenever \( c > c'(n) \), where \( c'(n) = \frac{c_n(n-1)(n+1)^3 + a(1-2n+6n^2-2n^3+n^4)}{2n(-2+3n+n^2)} \) and \( c'(n) < \frac{a+c_n}{2} \). Therefore, downstream mergers lead to a decrease in the final price paid by consumers whenever the level of competition upstream is sufficiently low (\( c \) is high enough).\(^6\) Observe that, in this model, given that all downstream firms buy the input from the efficient supplier, social welfare (and consumer surplus) is a decreasing function of the final price. This implies that the welfare effect of downstream mergers depends on their effect on the equilibrium final price. This effect depends on \( c \), that parametrizes the level of competition upstream, and \( n \), the number of downstream firms. We summarize the previous result in the following proposition, which is the central result of the paper:

**Proposition 1** If \( n \geq 2 \), downstream mergers increase social welfare whenever \( c > c'(n) \), where

\[
c'(n) = \frac{c_n(n-1)(n+1)^3 + a(1-2n+6n^2-2n^3+n^4)}{2n(-2+3n+n^2)}.\]

For illustrative purposes, Figure 1 plots \( c'(n) \) for the particular case \( c_n = 0 \).

\(^6\)Notice that this applies to the case \( n \geq 2 \) because we have that \( P^*(n = 1) > P^*(n = 2) \) regardless of \( c \). In other words, moving from a duopoly to a monopoly is never welfare improving in our model.
Figure 1: Welfare effects of downstream mergers
As we can see in Figure 1, first, for large enough values of \( c \), the upstream firm monopolizes the market. In this region, downstream mergers do not affect the final price. Second, below the monopoly region but above \( c'(n) \), \( \frac{\partial P^*}{\partial n} > 0 \). This implies that horizontal mergers downstream countervail the dominant position of the upstream firm, leading to a final price reduction. Third, below \( c'(n) \), there is little market power upstream and then, downstream mergers have the main effect of reducing competition, leading to a final price increase.

We can observe also in Figure 1 that, if we fix a value of \( c \) (above 0.36a, which is the minimum of the \( c'(n) \) function), downstream mergers are welfare improving only for low enough values of \( n \), that is, whenever the level of competition downstream was already low before the merger. The intuition could be the following: if there are many downstream firms, a two-firm merger would reduce the level of downstream competition very little. When there are fewer firms however, a two-firm merge increases significantly market profits (imagine for example, going from 3 to 2 firms). Therefore, when the level of competition downstream is already low before the merger, any downstream merger forces the upstream firm to put more weight on the reduction of the outside options, reducing more the wholesale price, and, as a result, leading to a reduction in the final price paid by consumers.

A direct policy implication of Proposition 1 is that we should prescribe a lenient merger policy in the downstream market when there is a low level of competition in the upstream level. In other words, downstream mergers up to duopoly should be allowed in order to countervail a strong market power upstream. This supports the view that "symmetry" between the downstream and upstream sectors is good for welfare (Inderst and Shaffer (2008 (a)).

We next compute the equilibrium profits of upstream and downstream firms. They are given, respectively, by:

\[
\Pi^U(n) = \begin{cases} 
\frac{n((a-c_u)(a-c_u)(1+n^2)-2(a-2c+c_u))+4(a-c)(c-c_u)n^3)}{4(1+n+n^2+n^4)} & \text{if } c \leq \frac{a+c_u}{2} \text{ or } c > \frac{a+c_u}{2} \text{ and } n < \sqrt[2]{\frac{a-c_u}{2c-a-c_u}} \\
\left(\frac{a-c_u}{2}\right)^2 & \text{otherwise.}
\end{cases}
\]
\[ \Pi^D(n) = \begin{cases} \left( \frac{a-c_u+(a-2c+c_u)n^2}{2(n^2+1)} \right)^2 & \text{if } c \leq \frac{a+c_u}{2} \text{ or } c > \frac{a+c_u}{2} \text{ and } n < \sqrt{\frac{a-c_u}{2c-a-c_u}}. \\ 0 & \text{otherwise.} \end{cases} \quad (4) \]

Concerning the upstream profits, they are increasing (decreasing) in \( n \) for \( c > (<) c^\prime(n) \), where \( c^\prime(n) = \frac{a_u(1+n)^3+a_u(n-1)(1+(-4+n)n)}{2n(4+(n-1)n)} \) and \( c^\prime(n) < c'(n) < \frac{a+c_u}{2} \). Combining this result with the one on welfare, it is easy to see that any merger that increases the upstream profits reduces social welfare (see Figure 1, where we have also plotted \( c''(n) \)). This result is very intuitive because horizontal mergers increase welfare only when they counteract the market power of the upstream firm. Observe that we find that more competition downstream may be good for the upstream firm. This is due to the negative effect that the level of competition downstream has on the outside option of downstream firms.\(^\text{7}\)

Concerning joint downstream profits, we have that they are decreasing in \( n \). In other words, downstream mergers increase joint downstream profits. However, this result does not imply that there will be private incentives to merge, due to their public good nature. This is what we analyze in the next section, designing an endogenous merger formation game. But before, let us discuss how merger profitability depends on parameter \( c \). A merger of \( k+1 \) downstream firms is profitable if the profits of the merged entity are higher than the sum of the pre-merger profits of the \( k+1 \) firms, that is, if

\[ \Pi^D(n) - (k+1)\Pi^D(n) \geq 0. \quad (5) \]

It is useful to study profitability rewriting (5) in the following way:

\[ \frac{\Pi^D(n) - (k+1)\Pi^D(n)}{\Pi^D(n)} \geq (k+1). \]

It is direct to see that the left hand side of the inequality is increasing in \( c \). This means that mergers become more likely as \( c \) increases, that is, as the market power of the upstream firm

\(^\text{7}\) Caprice (2005) obtains a similar result for the case of secret contracts.
increases. Bru and Fauli-Oller (2008) obtain the same result but considering secret supply contracts. Let us now introduce a merger formation game.

3 An endogenous merger game

Some of the the most widely accepted merger games are the ones developed by Kamien and Zang (1990, 1991, 1993). For example, in Kamien and Zang (1990) each firm simultaneously chooses a bid for each competitor and an asking price. A firm is sold to the highest bidder whose bid exceeds the firm’s asking price. They get that, under linear demand and Cournot competition, monopolization does not occur when we have three or more firms. Buying firms is expensive because, by not accepting a bid, a firm free-rides on the reduction in competition induced by the remaining acquisitions.

In this section we propose a very simple merger game, inspired in the previous papers, in order to endogenize the market structure. We want to illustrate how profitable downstream mergers are in the presence of endogenous input prices. For simplicity, we restrict attention to a game where there is only one acquiring firm.\(^8\)

In order to be able to explicitly solve the merger game, we fix a value for parameter \(c\) and assume \(c_u = 0\). Given that we know that merger profitability increases with \(c\), we are going to solve the game for a high value of \(c\) (\(c = \frac{\alpha}{\beta}\)) and for a low value of \(c\) (\(c = \frac{\alpha}{10\beta}\)). In the latter case, we are in the region where downstream mergers are anticompetitive. In the former case, they always reduce the final price up to duopoly (in a monopoly the price takes its highest value).

\(^8\)In Kamien and Zang (1990) there is multiplicity of equilibria. In particular, no merger is always an equilibrium. When we obtain that monopolization is an equilibrium in our model, it would also be an equilibrium in Kamien and Zang’s model. In this equilibrium, we would have one firm asking infinity and bidding the duopoly profits for the rivals, and the remaining firms asking for the duopoly profits to sell their firms and bidding zero for the rivals.
We expect more mergers to take place when parameter $c$ is high. As we will see below, this is exactly the result.

The timing of the game is the following: we assume that there are, initially, $N$ symmetric downstream firms in the industry. One of them, say firm 1, can make simultaneous bids to acquire rival firms.

In the first stage, firm 1 offers bids $b_i$ to buy firm $i$ ($i = 2, \ldots, n$). In the second stage, these firms decide simultaneously whether to accept the bid or not. If firm $i$ accepts the offer, it sells the firm to firm 1 at the price $b_i$. Given the equilibrium market structure that results at the end of stage two, the contract game of the previous section is played.

We solve by backward induction starting at stage two. Suppose that at the end of stage 2, there are $n$ independent downstream firms. They would obtain the following profits in the market stage:

$$\Pi^D(n) = \frac{a^2}{4(n+1)^2} \text{ if } c = \frac{a}{2} \text{ and } \Pi^D(n) = \left(\frac{5a + 4an^2}{10(n+1)^2}\right)^2 \text{ if } c = \frac{a}{10}.$$  

These expressions are obtained just by plugging $c = \frac{a}{2}$ or $c = \frac{a}{10}$ into expression (4).9

Any firm $i$ ($i = 2, \ldots, n$) will accept a bid of firm 1 whenever the bid is not lower than its outside option, which of course depends on the acceptance decisions of the other firms. If, for example, $k - 1$ firms (other than firm j) accepted, the outside option of firm j would be $\Pi^D(N - k + 1)$. At the first stage, firm 1 has to decide the number of firms to acquire, taking into account that in order to buy $k$ firms it has to make a bid of $\Pi^D(N - k + 1)$. Then, the payoff of firm 1 as a

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9By looking at the above expressions, it is easy to see that downstream mergers are very profitable in this setting. For example, the monopoly profits would be almost 21 times the duopoly profits in the case where $c = a/2$ and almost 4 times the duopoly profits when $c = a/10$, whereas in a standard Cournot model, they would be only 2.25 times the duopoly profits.
function of the number of acquisitions $k$ is given by:

$$\Pi^D(N - k) - k\Pi^D(N - k + 1)$$  \hspace{1cm} (6)

The maximizer of the previous expression is summarized in the following proposition:

**Proposition 2** (a) If $c = \frac{a}{2}$, then, if $N \leq 21$, monopolization takes place. Otherwise, no merger occurs.

(b) If $c = \frac{a}{10}$, then, if $N \leq 4$, monopolization takes place. Otherwise, no merger occurs.

**Proof.** See Appendix □

Proposition 2 shows that monopolization is the equilibrium outcome even for very unconcentrated industries whenever there is strong market power upstream ($c$ is high). When the upstream sector is more competitive, however, merger to monopoly occurs in equilibrium only in concentrated markets. Our results contrasts with the lack of profitability of horizontal mergers found in Kamien and Zang (1990), where, in a standard Cournot setting, monopolization occurs in equilibrium only if the pre-merger market structure is a duopoly.

A natural question to address at this point is what is the optimal merger policy in this setting. If $c$ is low, we know that downstream mergers increase the final price and they should be forbidden. Instead, when $c$ is high, downstream mergers up to duopoly reduce the final price. Therefore, in the latter case, the optimal merger policy should allow all mergers except the one leading to monopolization. Similar calculations as in Proposition 2 show that, under the optimal merger policy, mergers up to duopoly would take place in equilibrium whenever $N < 13$ if $c = \frac{a}{2}$.

### 4 Conclusions

We have analyzed how a process of market concentration in a downstream sector affects the final price paid by consumers through its effect on the supply contracts offered by an upstream
dominant supplier. With this aim, we have considered a model with an upstream firm selling an input to n downstream firms through observable two-part tariff contracts and with the presence of a less efficient alternative supply, where downstream firms can buy the input if they do not reach an agreement with the dominant supplier. In equilibrium, downstream firms do not purchase from this fringe but its presence puts competitive pressure on the low-cost dominant supplier. We show that downstream mergers induce the upstream firm to offer lower wholesale prices with the aim to reduce their outside option. This reduction offsets the anticompetitive effect of downstream mergers whenever the alternative supplier is sufficiently inefficient, that is, only when the upstream firm enjoys a strong dominant position. In this case, downstream mergers countervail the market power of the dominant supplier, leading to an increase in consumer surplus and social welfare.

A natural question is then to ask about profitability of downstream mergers in this setting. We find that profitability increases with the marginal cost of the alternative supply. Indeed, in an endogenous merger formation game we obtain that, in contrast to what happens when input prices are exogenous, monopolization occurs even for very unconcentrated industries, whenever the upstream supplier has strong market power. In that case, our results would call for a lenient merger policy towards downstream mergers.

For tractability, our analysis leaves out several features of real markets. For example, we focus on the case of symmetric downstream firms and non-discriminatory two-part tariff contracts. The effect of price discrimination among downstream firms that differ either in marginal costs or in the quality of their goods is analyzed in Inderst and Shaffer (2008(b)), in a setting with observable two-part tariff contracts. They get that the differences among downstream firms are amplified through the optimal contracts because more efficient firms are offered lower wholesale prices than less efficient ones. This increases allocative efficiency. They also find that forbidding
price discrimination may lead to an increase of all wholesale prices, leading to a reduction in consumer surplus and social welfare.

Another limitation in our model is assuming that the upstream firm offers "take it or leave it" contracts to downstream firms. This assumption is not as restrictive as it could seem. It is well known that under the so called "outside-option principle" the outcome from bilateral Nash bargaining is pinned down by the binding outside option of one party if it is sufficiently attractive. In our model, the Nash bargaining outcome could be implemented through the "take it or leave it" mechanism just by lowering the fixed part of the contract up to the point where downstream firms profits reach the bargaining solution. Whenever this can be done without changing the wholesale price (this would be the case if the bargaining power of downstream firms is not too large), we would get in our model exactly the same result as under a Nash bargaining game.

To conclude, we want to discuss more carefully the role played by $c$, the price of the alternative supply. This parameter can be interpreted as a measure of the degree of competition upstream. The larger $c$ the higher the monopolistic power of the dominant upstream firm. It would be interesting to study settings where parameter $c$ is endogenously determined. One possible application would be to consider that the alternative supply is an international market for the input and the upstream supplier is a national firm. In this setting, it would be of interest the analysis of the optimal tariff. The effect of this trade policy on social welfare is not straightforward though. On the one hand, a tariff would increase the wholesale price and the final price for a given number of firms, which hurts consumers and welfare. On the other hand, the imposition of a tariff would increase the monopolistic power of the upstream firm, which induces more mergers downstream. But in our model, downstream mergers may be welfare enhancing. The final effect of a tariff would depend on the balance of these two effects. This and some other
possible applications of our model are left for future research.

5 Appendix

Proof of the result that the upstream firm sells the input to all firms:

Let \( \pi(k, w) \) represent the upstream firm profits if it sells the input to \( k \) firms and sets a wholesale price \( w \leq c \).

\[
\pi(k, w) = (P - c_a) ((n - k)q_N(k, w) + q(k, w)) - k(q_N(k - 1, w))^2 - (n - k)(q_N(k, w))^2 (7)
\]

\[-(c - c_a)(n - k)q_N(k, w).\]

We define the wholesale price \( w_1 \) that solves \( nq(n, w_1) = (n - k)q_N(k, w) + kq(k, w) \). Observe that if the upstream sells to \( n \) firms with the wholesale price \( w_1 \), the first term in the expression (7) will also appear in \( \pi(n, w_1) \). Then the difference in profits is given by:

\[
\pi(n, w_1) - \pi(k, w) = k(q_N(k - 1, w))^2 + (n - k)(q_N(k, w))^2 +
\]

\[+(c - c_a)(n - k)q_N(k, w) - n(q_N(n - 1, w_1))^2.\]

In order to prove the result we have to check that the previous expression is non-negative in the following three different regions:

- when \( c \geq w > c + \frac{-a + c}{k} \), where \( q_N(k, w) > 0 \) and \( q_N(k - 1, w) > 0 \),

- when \( \frac{a + c}{1 + k} < w \leq c + \frac{-a + c}{k} \), where \( q_N(k, w) = 0 \) and \( q_N(k - 1, w) > 0 \) and

- when \( w \leq \frac{-a + c}{1 + k} \), where \( q_N(k, w) = 0 \) and \( q_N(k - 1, w) = 0 \).

If \( c \geq w > c + \frac{-a + c}{k} \), we have that \( w \leq w_1 = \frac{c(n-k)+kw}{n} \leq c \) and

\[
\pi(n, w_1) - \pi(k, w) > k(q_N(k - 1, w))^2 + (n - k)(q_N(k, w))^2 - n(q_N(n - 1, w_1))^2 = (8)
\]

\[= \frac{(n - k)(c - w)^2}{n(1 + n)} \geq 0.\]
If $\frac{-a+ck}{1+k} < w \leq c + \frac{-a+c}{k}$, we have that $w < w_1 = \frac{a(n-k)+k(n+1)w}{(k+1)n} < c$ and $q_N(k, w) = 0$.

We have to distinguish two cases:

If $\frac{c(1+k)n^2 - a(k+n^2)}{k(n^2-1)} < w \leq c + \frac{-a+c}{k}$, we have that $q_N(n-1, w_1) > 0$. To sign the difference in profits we obtain that

$$kq_N(k-1, w) - nq_N(n-1, w_1) \geq 0.$$ 

This implies that

$$\pi(n, w_1) - \pi(k, w) = k(q_N(k-1, w))^2 - n(q_N(n-1, w_1))^2 > 0.$$ 

If $\frac{-a+ck}{1+k} < w \leq \frac{c(1+k)n^2 - a(k+n^2)}{k(n^2-1)}$, then $w_1 \leq \frac{-a+c}{-1+n}$ and, therefore, $q_N(n-1, w_1) = 0$. Then,

$$\pi(n, w_1) - \pi(k, w) = k(q_N(k-1, w))^2 > 0.$$ 

If $w \leq \frac{-a+ck}{1+k}$, we have that $w_1 = \frac{a(n-k)+k(n+1)w}{(k+1)n} \leq \frac{-a+c}{-1+n}$ and, therefore, $q_N(n-1, w_1) = 0$. As we have also that $q_N(k-1, w) = 0$, then

$$\pi(n, w_1) - \pi(k, w) = 0.$$ 

**Proof of Proposition 2**

The objective of firm 1 is given by expression (6):

$$F(N, k) = \Pi^D(N - k) - k\Pi^D(N - k + 1)$$

Consider the case $c = a/2$. Simple computations show that whenever $N < 25$, the result in the text holds. For $N \geq 25$, we proceed as follows. We check that for $m \geq 9$

$$\frac{\Pi^D(m)}{\Pi^D(m+1)} < 2 \quad (9)$$

This implies that for $N - 9 \geq k \geq 2$, we have that $\frac{\Pi^D(N - k)}{\Pi^D(N - k + 1)} < 2$. This implies that $F(N, k) < 0$. For $N - 1 \geq k \geq N - 8$, simple computations show that $F(N, k) < 0$. Finally,
$k = 1$ yields less profits than $k = 0$, because of (9). A similar analysis yields the second part of the proposition, that is, the case $c = a/10$.

6 References


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