On the profitability and welfare effects of downstream mergers *

Ramon Fauli-Oller[†] and Joel Sandonis[‡]

August 2010

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: *downstream mergers, wholesale price, two-part tariff contracts*

JEL codes: L11, L13 and L14.

*We are grateful to Mariano Tappata and seminar and conference participants at Tromso, Grenoble, Bilbao, Berlin, Vigo, Toulouse, Reus, Málaga, 34th EARIE Meeting (Valencia), XXVII ASSET Meeting (Padova), XXXII Simposio de Análisis Económico (Granada), 43th CEA Meeting (Toronto), 2010 EAEFEASA Conference (Beijing) and RCEF (Rimini). Financial support from SEJ 2004-02172, Ministerio de Ciencia e Innovación and FEDER funds under project SEJ 2007-62656 and the IVIE is also gratefully acknowledged.

[†]Corresponding author. University of Alicante. Economics Department, Campus de SanT Vicent del Raspeig, E-03071, Alicante, Spain. E-mail address: fauli@merlin.fae.ua.es.

[‡]University of Alicante. Economics Department, Campus de Sant Vicent del Raspeig, E-03071, Alicante, Spain. E-mail address: sandonis@merlin.fae.ua.es.

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.[1] 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, first, 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

[1] For example, several reports of the European Comission 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)).

the level of competition 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 incentive, 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), downstream mergers countervail the market power of the dominant supplier leading to a reduction in the final price. As a result, in this context, downstream mergers are pro-competitive. This result supports the view that "symmetry" between upstream and downstream markets increases welfare. (Inderst and Shaffer (2008(a)).

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 option increases. In other words, the profits any downstream firm gets if it rejects the contract offered by the dominant supplier and 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.

The assumption about the existence of an alternative, less efficient source of supply plays a key role in this paper. If there was no alternative supply, the upstream monopolist could always implement the monopoly outcome with the use of (observable) two-part tariff contracts, regardless of the number of downstream competitors. But then, downstream mergers would not affect the final price paid by consumers for the good. It is the fact that the existence of an alternative supply prevents the upstream firm from implementing the monopoly outcome, and also 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) and Dobson and Waterson (1997). The key difference with our paper is that they 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. There is a paper (Inderst (2008) that uses a framework similar to ours (observable two-part tariff contracts and a more inefficient alternative supply of the input). It analyzes the effect of the degree of product differentiation on the final prices in a Bertrand model with a Shubik-Levintahl demand function. He finds that prices decrease and consumer surplus increases when the level of product differentiation in the downstream market increases.

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 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.

The question of profitability of downstream mergers in a vertical structure has been analyzed in several papers. 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, 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.

Another key assumption in our model is that the upstream firm offers observable contracts. A different approach in the literature assumes secret contracts and the so-called "passive beliefs".[2]

[2] See, for example, Caprice (2005, 2006). In Caprice (2005), it is shown that an upstream firm may be better-off the higher the level of competition downstream. The reason is that competition reduces the outside option of firms. On the other hand, Caprice (2006) shows that banning price discrimination may be welfare improving in

In this alternative setting, a severe problem of opportunism arises that leads the upstream firm to set the wholesale price equal to the marginal cost of producing the input. Therefore, downstream mergers would have no effect on the equilibrium wholesale price. But it is precisely the effect that downstream mergers have on the wholesale price what explains that downstream mergers can be profitable and welfare improving in our setting. Then, our framework proves to be a flexible enough model that allows to capture the existing relationship between downstream and upstream market structure (the number of downstream firms and the degree of competition upstream) and market outcomes (intermediate and final prices). This flexibility is particularly important for the analysis of issues that are relevant for competition policy.

The rest of the paper is organized as follows. In the next section, we analyze the optimal supply contracts taken market structure as given. 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 $c < a$. 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

the presence of an alternative supply.

a two-part tariff contract (F, w) to downstream firms, where F specifies a non-negative fixed amount and w a 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:

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

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

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

Observe that, if w is very 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,[3] it will choose F such that $F = \Pi(k, w) - \Pi_N(k-1, w)$. This implies that the problem of choosing the optimal contract (F, w) is equivalent to that of

[3] As $\frac{\partial(\Pi(k,w)-\Pi_N(k-1,w))}{\partial k} < 0$, this is the only equilibrium in the acceptance stage.

choosing (k, w). Then, in the first stage, the upstream solves the following problem:

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

$$s.t.\quad 1 \quad \leq \quad k \leq n \text{ and } w \leq c.$$

We proceed as follows. First of all, we prove that the upstream firm finds profitable to sell the input to all firms in the downstream sector. Then, we calculate the optimal wholesale price once we replace k by n in expression (1). As far as the first result is concerned, we know that with a fixed fee contract, the input would be sold to only a subset of firms in order to protect industry profits from competition (Kamien and Tauman (1986)). With a two-part tariff contract, however, we show that the upstream firm can always sell to more firms without affecting the level of competition, by choosing an appropriate (higher) wholesale price. Assume that the upstream firm sells to k firms with a wholesale price $w < c$. It is direct to see that he can always sell to all firms with a $w < w_1 < c$ such that the final price remains constant.[4] In other words, the upstream firm may always use the wholesale price to control for competition.[5] Next lemma shows that this particular contract increases the profits of the upstream firm.

Lemma 1 *Let $\pi(k, w)$ represent the upstream firm profits if it sells the input to k firms and sets a wholesale price $w \leq c$. Then $\pi(n, w_1) \geq \pi(k, w)$ where w_1 solves $nq(n, w_1) = (n-k)q_N(k, w) + kq(k, w)$.*

Proof. *See Appendix* ■

We show in the above result that it is always feasible (and profitable) for the upstream firm to sell the input to all firms and increase the wholesale price accordingly so that the final

[4] Observe that selling to all firms with a wholesale price w would decrease the final price and that selling to all firms with a wholesale price equal to c would increase the final price.

[5] This argument is 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.

price (and total output) remains constant. Let us provide an intuition for the above result. First, the reason why this strategy is always feasible (regardless of n) has to do with the way in which the level of competition downstream increases as the upstream firm sells the input to more firms. Selling to one more downstream firm increases less the level of competition when there are already many firms buying the input than when only a few of them are buying. This implies that, as more firms buy the input, the upstream firm needs to increase less and less the wholesale price in order to keep the level of competition constant. Second, the intuition for why selling to all firms with a (higher) wholesale price that keeps the final price constant is profitable for the upstream firm is the following: its problem can be seen as that of maximizing total market profits minus the outside option of downstream firms. Selling to all firms leads, on the one hand, to an increase of total market profits due to an efficiency effect (all firms buy the input from the efficient dominant supplier). On the other hand, the effect with respect to the outside option is ambiguous: selling the input to more firms for a given wholesale price reduces the outside option; but increasing the wholesale price leads to an increase of the outside option. As we show in the proof, the final effect is negative, so that it is in the interest of the upstream firm to sell the input to all firms.

This result is central to the paper and, therefore, it seems interesting to know whether it holds for more general demand functions. In the Appendix, we show that it holds for concave demands satisfying a technical restriction concerning the third derivative of the inverse demand. We show that it also holds for the class of demands $P = A - X^b$, where $b \geq 1$.

Next, we derive the optimal two-part tariff contract to sell the input to n firms.

Proposition 1 *The upstream firm optimally sells the input to all firms with a wholesale price* $w^*(n) = \frac{(n-1)(2cn+c_u-a)+2c_u}{2(1-n+n^2)}$ *if* $c < \frac{a-c_u+(a+c_u)n^2}{2n^2}$ *and* $w^M(n) = \frac{-a+c_u+(a+c_u)n}{2n}$ *otherwise.*

Proof. *See Appendix* ■

This result has been independently obtained in Erutku and Richelle (2007) for the case of a research laboratory licensing a cost-reducing innovation to a n-firms Cournot oligopoly through observable two-part tariff licensing contracts. However, Lemma 1 allows for a simpler and more intuitive proof and we are able to generalize the result for the case of non-linear demands.

The equilibrium wholesale price optimally 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 $c \geq \frac{a-c_u+(a+c_u)n^2}{2n^2}$, the alternative supply is irrelevant and 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, if $c < \frac{a-c_u+(a+c_u)n^2}{2n^2}$, $w^*(n)$ is an increasing function of n and tends to c as n tends to infinity.[6] This result is key to explain the effect of downstream mergers on social welfare. It implies that downstream mergers, by reducing the number of firms in the downstream sector, lead to a reduction 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 the 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

[6] This holds for any $n \geq 2$. Observe that, if $c < \dfrac{a+3c_u}{4}$, $w^*(1) = c_u > w^*(2)$. Notice also that the restriction that the wholesale price can not be higher than c is never binding in equilibrium.

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, the upstream firm adjusts the wholesale price faster as n changes. A higher value of c, reduces the outside option of downstream firms for a given n. This implies that a downstream merger produces a proportionally larger increase of the outside option, that must be compensated by the upstream firm with a larger reduction of the wholesale price. 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 leads to a reduction in the final price paid by consumers. And this happens for high values of c. In other words, when there is strong market power upstream, the optimal merger policy should prescribe a lenient merger policy in the downstream sector in order to balance the situation. This result supports the view that "symmetry" between the upstream and downstream markets increases social welfare (Inderst and Shaffer, (2008(a))).

>From the previous proposition, it is direct to compute the equilibrium price, which is given by:

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

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

$$\frac{\partial P^*}{\partial n} = \frac{n(n+1)\frac{\partial w^*}{\partial n} - (a + nw^*)}{(n+1)^2}. \tag{3}$$

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 $c'(n) = \frac{c_u(n-1)(n+1)^3 + a(1-2n+6n^2-2n^3+n^4)}{2n(-2+3n+n^3)}$ and $c'(n) < \frac{a+c_u}{2}$. Note that this refers to the case $n \geq 2$. We have that $P^*(1) > P^*(2)$ regardless of c. Therefore, downstream mergers lead to a decrease of the final price whenever the level of competition upstream is sufficiently low (c is high enough). 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 price. Then, we have 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:

Proposition 2 *If $n \geq 2$, downstream mergers increase social welfare whenever $c > c'(n)$, where $c'(n) = \frac{c_u(n-1)(n+1)^3 + a(1-2n+6n^2-2n^3+n^4)}{2n(-2+3n+n^3)}$.*

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

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 $c'(n)$, the derivative of price with respect to n is positive. 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 to countervail and then, downstream mergers have the main effect of reducing competition, leading to a price increase.

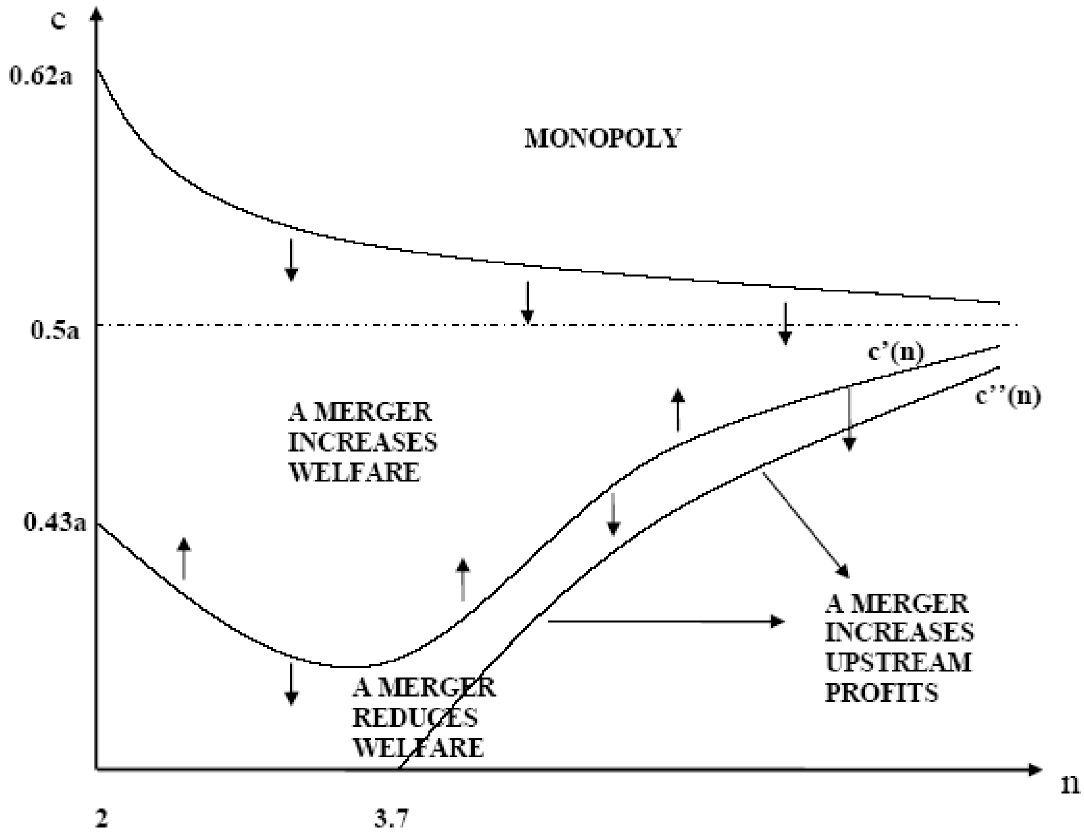

Figure 1: Welfare effects of downstream mergers

We can observe also in Figure 1 that, for a given value of c (above 0.36a), downstream mergers are welfare improving only for low 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 merge for example, would change both competition and the outside option of downstream firms very little. When there are fewer firms however, a two-firm merge increases significantly both market profits and outside options (imagine for example, going from 3 to 2 firms). Then, when the level of competition downstream is already low, any downstream merger forces the upstream firm to put more emphasis 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 implication in terms of merger policy is that we should prescribe a lenient merger policy in the downstream market when there is a low level of competition in the upstream sector. In this case, downstream mergers should be allowed in order to countervail the strong market power upstream. This supports the view that "symmetry" between the downstream and upstream sectors is good for welfare (Inderst and Shaffer (2008a).

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

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

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

Concerning the upstream profits, they are increasing (decreasing) in n for $c > (<)\ c"(n)$, where $c"(n) = \frac{c_u(1+n)^3+a(n-1)(1+(-4+n)n)}{2n(4+(n-1)n)}$, and $c"(n) < c'(n) < \dfrac{a+c_u}{2}$. 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 countervail the buyer 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.[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 just emphasize how merger profitability depends on c. A merger of $k+1$ firms is profitable if

$$\Pi^D(n-k) - (k+1)\Pi^D(n) \geq 0. \tag{5}$$

This condition holds if $c \geq \dfrac{a - c_u + (a + c_u)n^2}{2n^2}$ because, in this case, $\Pi^D(n) = 0$. Otherwise, it is useful to study profitability rewriting (5) in the following way:

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

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 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

The most widely accepted merger game is the one 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

[7] Caprice (2005) obtains the same result for the case of secret contracts.

asking price. They get that, with 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 design a merger game, inspired in the previous papers, in order to endogenize the market structure. We want to analyze how profitable downstream mergers are in the presence of endogenous input prices. For simplicity, we restrict attention to a simple 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 ($c = \frac{a}{2}$) and for a low value of c ($c = \frac{a}{10}$). In the latter case, downstream mergers always lead to an increase in the final price. In the former case, they always reduce the final price up to duopoly (in a monopoly the price takes its highest value). We expect more mergers to take place when parameter c is high. As we will see below, this is exactly what happens.

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 ($i = 2, ..n$). 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

[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 equlibrium in Kamien and Zang's model. In this equilibrium, we would have one firm asking infinity and bidding the duopoly profits for the other firms, and the remaining firms asking for the duopoly profits to sell their firms and bidding zero for the other firms.

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:

$$\Pi^D(n) = \frac{a^2}{4(1+n^3)^2} \text{ if } c = \frac{a}{2} \text{ and } \Pi^D(n) = \left(\frac{5a+4an^2}{10(1+n^3)}\right)^2 \text{ if } c = \frac{a}{10}.$$

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

Firms will accept the offers of firm 1 whenever the bid is not lower than their 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 function of the number of acquisitions k is given by:

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

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

Proposition 3 *(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 ■

[9] By 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.

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 how competition authorities should perform in this market. 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 $N < 13$.

Finally, observe that from Proposition 2, it is easy to check that whenever $4 < n \leq 21$, an increase in the value of parameter c from $a/10$ to $a/2$ would trigger a monopolization of the downstream sector. Suppose, for example, that we have 3 firms in the upstream sector: firm U and two competitive firms (A and B) that produce the input respectively with marginal costs a/10 and a/2. In this setting, a merger between firms U and A would increase parameter c from a/10 to a/2 and would therefore trigger a takeover wave in the downstream sector, whenever $4 < n \leq 21$. This observation could help to explain the parallel processes of consolidation of upstream and downstream sectors observed in several industries (see for example, Sexton (2000) for the food market, or Lockshin (2002) for the wine market).

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. This setting is very useful to analyze the interaction between the market structure and the market outcomes. 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 that we assume that the upstream firm offers "take it or leave it" contracts to downstream firms. Analyzing a Nash bargaining setting would require additional simplifying assumptions. For example, Symeonidis (2008) considers a game between two downstream firms and two upstream firms, and simplifies by assuming that each downstream firm bargains only with one of the two upstream firms. It gets that regardless of whether the bargaining units bargain over a linear tariff or over a two-part tariff, less competition downstream leads to a lower wholesale price in the negotiation process, that might lead to a higher level of consumer surplus and social welfare. On the other hand, however, as Inderst and Valletti (2008(b)) state: "That the supplier can make a *take it or leave it* offer is not as restrictive as it seems. 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 this 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. Then, it would be interesting to study settings where the 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 Lemma 1

We have that

$$\begin{aligned}\pi(k,w) &= (P-c_u)\left((n-k)q_N(k,w)+kq(k,w)\right)-k\left(q_N(k-1,w)\right)^2-(n-k)\left(q_N(k,w)\right)^2- \\ &\quad -(c-c_u)(n-k)q_N(k,w).\end{aligned}$$

Observe that if the upstream sells to n firms with the wholesale price w_1, the first term in the above expression will also appear in $\pi(n,w_1)$. Then the difference in profits is given by:

$$\begin{aligned}\pi(n,w_1)-\pi(k,w) &= k\left(q_N(k-1,w)\right)^2+(n-k)\left(q_N(k,w)\right)^2+ \\ &\quad +(c-c_u)(n-k)q_N(k,w)-n\left(q_N(n-1,w_1)\right)^2.\end{aligned}$$

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

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

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

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

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

$$\begin{aligned} \pi(n,w_1) - \pi(k,w) &> k\left(q_N(k-1,w)\right)^2 + (n-k)\left(q_N(k,w)\right)^2 - n\left(q_N(n-1,w_1)\right)^2 = \\ &= \frac{(n-k)k(c-w)^2}{n(1+n)} \geq 0. \end{aligned} \tag{7}$$

If $\frac{-a+ck}{-1+k} < w \leq c + \dfrac{-a+c}{k}$, 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 $\frac{c(1+k)n^2 - a(k+n^2)}{k(n^2-1)} < w \leq c + \dfrac{-a+c}{k}$, 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

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

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

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

If $w \leq \frac{-a+ck}{-1+k}$, we have that $w_1 = \frac{a(n-k)+k(n+1)w}{(k+1)n} \leq \frac{-a+cn}{-1+n}$ 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 Lemma 1 with a general demand

Assume we have n firms and market demand is given by $P(X)$, where $P'(X) < 0$ and $P"(X) \leq 0$. Firms have constant marginal costs. Denote by C the sum of marginal costs. Then in an interior equilibrium we have that:

$$nP(X) - C + P'(X)X = 0 \tag{8}$$

The profits of a firm with cost c is given by:

$$\pi(C) = \frac{(P(X(C) - c)^2}{-P'(X(c))}$$

where $X(C)$ is implicitly defined in (8). Then condition (7) in the proof of Lemma1 can be written as

$$k\left(\pi(C^*) - \pi(\overline{C})\right) - (n-k)\left(\pi(\overline{C}) - \pi(\underline{C})\right) \geq 0 \tag{9}$$

where $C^* = (n-k+1)c + (k-1)w$, $\overline{C} = (n-1)w_1 + c$ and $\underline{C} = (n-k)c + kw$. We have also that $C^* - \overline{C} = \frac{(n-k)(c-w)}{n}$ and $\overline{C} - \underline{C} = \frac{k(c-w)}{n}$. (9) can be rewritten as:

$$\frac{\pi(C^*) - \pi(\overline{C})}{\pi(\overline{C}) - \pi(\underline{C})} = \frac{\int_{\overline{C}}^{C^*} \pi'(C)dC}{\int_{\underline{C}}^{\overline{C}} \pi'(C)dC} \geq \frac{n-k}{k}$$

A sufficient condition for this to hold is that $\pi"(C) > 0$. Then

$$\frac{\int_{\overline{C}}^{C^*} \pi'(C)dC}{\int_{\underline{C}}^{\overline{C}} \pi'(C)dC} > \frac{(C^* - \overline{C})\pi'(\overline{C})}{(\overline{C} - \underline{C})\pi'(\overline{C})} = \frac{n-k}{k}$$

It is tedious but direct to show that $\pi"(C) > 0$ if $-P'(X)$ is log-convex and $P'''(X) \leq 0$. We show that it also holds for the class of demands $P = A - X^b$, where $b \geq 1$.

Proof of Proposition 1

We have to find the maximizer of this expression:

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

$$s.t.w \leq c.$$

Direct resolution of this problem leads to the result in Proposition 1.

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 $m\geq 9$

$$\frac{\Pi^D(m)}{\Pi^D(m+1)}<2 \tag{10}$$

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 that $k=0$, because of (10). A similar analysis yields the second part of the proposition, that is, the case $c=a/10$.

6 References

Bru, L. and R. Faulí-Oller,., 2008, "Horizontal Mergers for Buyer Power", Economics Bulletin 12 (3), pp. 1-7.

Caprice, S., 2005, “Incentive to encourage downstream competition under bilateral oligopoly”, Economics Bulletin, 12. 9. pp.1-5.

Caprice, S., 2006, "Multilateral vertical contracting with an alternative supply: the welfare effects of a ban on price discrimination", Review of Industrial Organization, 28, 63-80.

Chipty, T. and C. Snyder, 1999, "The Role of Buyer Size in Bilateral Bargaining: A Study of the Cable Television Industry", Review of Economics and Statistics, 81(2), 326-340.

Dobson, P.W and M. Waterson, 1997, "Countervailing Power and Consumer Prices" The Economic Journal 107, 418-30.

Erutku, C. and Y. Richelle, 2007, "Optimal licensing contrcat and the value of a patent", Journal of Economics and Management Strategy, 16(2), 407-436.

Inderst, R., 2008, "Wholesale price determination under the threat of demand-side substitution", mimeo.

Inderst, R. ans G. Shaffer, 2008(a), "Buyer power in merger control", chapter XX in ABA Antitrust Section Handbook, Issues in Competition, Law and Policy, W. D. Collins, ed.

Inderst, R. and G. Shaffer, 2008(b), Input price discrimination with nonlinear contracts", mimeo.

Inderst, R. and C. Wey, 2003, "Bargaining, mergers and technology choice", RAND Journal of Economics, 34 (1), 1-19

Inderst, R. and C. Wey, 2007, "Buyer power and supplier incentives", European Economic Review 51 (3), 647-667.

Kamien, M. and Y. Tauman,1986, "Fees versus royalties and the private value of a patent". The Quarterly Journal of Economics 101, 471-491.

Kamien, M. and I. Zang,1990, "The limits of monopolization through acquisition", The Quarterly Journal of Economics, 105, 465-499.

Kamien, M. and I. Zang, 1991, "Competitively cost advantageous mergers and monopolization" Games and Economic Behavior, 3, 323-338.

Kamien, M. and I. Zang,1993, "Monopolization by sequential acquistion" The Journal of Law, Economics and Organization 9(2), 205-229.

Katz, M. L., 1987, "The welfare effects of third degree price discrimination in intermediate goods markets", American Economic Review 77, 154-167.

Lockshin, L., 2002, "Globalization and wine branding", Economies et Societés, 25, 1573-1590.

Lommerud, K., O. Straume and L. Sorgard, 2005, "Downstream merger with upstream market power", European Economic Review 49, 717-743.

Lommerud, K., O. Straume and L. Sorgard, 2006, "National versus international mergers in unionized oligopoly" RAND Journal of Economics 37(1), 212-233.

Raskovich, A., 2003, "Pivotal buyers and bargaining position", Journal of Industrial Economics 51, 405-426.

Salant, S.W., S. Switzer and R.J. Reynolds, 1983, "Losses from horizontal mergers: The effects of an exogenous change in industry structure on a Cournot-Nash Equilibrium", The Quarterly Journal of Economics, 98 (2), 185-199.

Sen, D. and Tauman, Y., 2007, "General licensing schemes for a cost-reducing innovation", Games and Economic Behavior, 59,1, 163-186.

Sexton, R.J., 2000, "Industrialization and consolidation in the US food sector. Implications for competition and welfare", American Journal of Agricultural Economics, 82, 1087-1104.

Snyder, C. M., 1996, "A dynamic theory of countervailing power", RAND Journal of Economics 27 (4), 747-769.

Symeonidis, G., 2008, "Downstream competition, bargaining and welfare", Journal of Economics and Management Strategy, 17 (1), pp. 247-270.

von Ungern-Sternberg, T.,1996, “Countervailing Power Revisited", International Journal of Industrial Organization 14, 507-520.