Title: The welfare effects of upstream mergers in the presence of downstream entry barriers

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The welfare effects of upstream mergers in the presence of downstream entry barriers

Manel Antelo\textsuperscript{a} and Lluís Bru\textsuperscript{b}

Abstract

This paper examines the incentives for upstream firms to horizontally consolidate among themselves and the impact of such a process on industry performance, when the downstream side of the industry is highly concentrated and up- and downstream firms set bilateral agreements in the wholesale market. We demonstrate that, in the short-run, consumers are not worse off with horizontal upstream mergers, since they only imply a redistribution of rents in the industry from retailers to the merged producers leaving the quantities produced unaltered. In the long-run free entry equilibrium upstream, consumers are better off from upstream mergers, since they induce more entry in that segment. Besides, if industry profits are also taken into account to evaluate social welfare, private incentives to invest in upstream productive capacity may lead to under-investment relative to the second best. Hence, the model finds the rationale for competition policies that, after screening proposed horizontal upstream mergers, allow them under certain conditions.

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1 Introduction

In both 1999 and 2000, Spanish competition authorities\(^1\) approved in each year a merger in the brewing industry by imposing two basic conditions: In the first merger (the largest one), the involved firms were forced to get rid of some of their productive plants; and, in both mergers, firms were obligated to cancel exclusionary clauses in their distribution contracts for some brands, mainly imported beers and high quality beers, as well as in their contracts with the distribution network of hotels, restaurants and cafes (the so-called horeca or in-license trade channel).\(^2\) These mergers in the production sphere of the brewing industry followed a recent consolidation process in the retail sector, a trend that extends beyond the Spanish market and is observed in many EU countries.\(^3\) Indeed, a stylized fact of many intermediate goods industries is the observation that upstream firms want to horizontally merge\(^4\) in response to the consolidation process in retailing; and competition authorities, both in the EU and the US, seem to be prone to allow such mergers subject to certain restrictions in line with those imposed by the Spanish competition authority.

On the other hand, there is an informal claim that the presence of downstream entry barriers—through the difficulties it creates for upstream firms to find alternative channels for established retailers to sell their product—may lead to an excessive bargaining power of retailers over suppliers, and consequently to upstream under-investment in the long-run equilibrium (with free entry at the upstream market).

In this paper, we propose the so-called bilateral oligopoly model, which analyzes the realistic situation where several up- and downstream firms engage in bilateral negotiations over supply contracts to deliver a intermediate good, to address formally the above issues. In

\(^1\) In the EU, the European Competition Commission delegates to national regulatory authorities those policies that it estimates only have an effect on national markets. In particular, for mergers that exclusively affect the Spanish market, the antitrust authority is shared between the Ministerio de Economía and the Tribunal de Defensa de la Competencia.

\(^2\) See the Tribunal de Defensa de la Competencia’s (1999, 2000) reports for a detailed discussion.

\(^3\) See Dobson and Waterson (1999) for a nice overview of retail consolidation in Europe.

\(^4\) For an overview on the consolidation trend throughout the world’s brewing industry, see, for instance, The Economist Jan 20\(^{th}\) 2001, “The big pitcher”, pp. 65-66.
particular, three concerns are analyzed: The incentives of upstream firms to engage in horizontal mergers among themselves when the retailing sector is already highly concentrated, the consequences of upstream consolidation in the long-run, and the role that competition policies may play in such a setting.

Our model captures some stylized facts commonly present in many intermediate goods markets. First, there are barriers to entry in the downstream sector of the industry, and each retailer accounts for a large share of sales of any supplier.\(^5\) Second, the good produced by upstream firms is \textit{commoditized}, i.e., it is produced by standard techniques that can easily be replicated by many firms. Finally, up- and downstream firms engage in bilateral negotiations over supply contracts to deliver the intermediate good. In this setting, and given the existence of barriers to entry in retailing, the bargaining power of producers vis-à-vis retailers depends on, other things being equal, the possibility to sell the product through alternative distribution channels to that configured by retailers and their importance (e.g., the importance of alternative distribution channels could be higher in the case of beer\(^6\) than in oil or milk), the alternative uses of the product (e.g., they could be higher in milk\(^7\) than in oil or beer), and the existence of substitutes (e.g., olive oil can be replaced by soya or sunflower oil). Seller power may also reflect the presence of exclusionary contracts in the alternative commercial channels that guarantee some revenues for upstream firms, the existence of brand recognition, etc.

In this scenario, the current paper examines the impact of horizontal upstream mergers on the overall industry performance. At the same time, it sheds light on the efficacy of policies restricting horizontal mergers. In the short-run, where the level of upstream capacity is given, we show that the efficiency of the industry is determined by the level of investment upstream

\(^5\) Retailing is also characterized by the existence of local retailing power. In fact, barriers to entry in retailing are caused not only by technological reasons, but also by factors such as the shortage of land and sites suitable for development due to urban planning guidelines. For an evaluation of possible barriers to entry or expansion in retailing in the UK, see the Competition Commission’s report on supermarkets (Competition Commission 2000). Regulatory activities of local authorities over retailing markets constitute another important source of barriers to entry in some countries. For instance, in France (since the establishment in 1973 of the loi Royer) and Spain, regional authorities can restrict entry to the retailing sector. See Bertrand and Kramarz (2002) for an empirical analysis of the impact of entry restrictions on retailer concentration and employment growth in France, and the Tribunal de Defensa de la Competencia’s (2003) report for the discussion of regulatory entry barriers in Spain.

\(^6\) Beer is commonly commercialized through two separate channels, namely the horeca or in-license trade channel and the network of retail-stores, which is also called the take-home or off-license trade channel.

\(^7\) Milk, for instance, can be sold as fresh milk or in a second market (at a lower price) to produce butter.
and the level of competition downstream. Then, in addressing incentives of upstream firms to engage in horizontal mergers, we find that (i) a larger upstream firm, i.e., an entity that owns more productive plants as a result of a horizontal merger, countervails the bargaining power of retailers better than a little one, and (ii) upstream firms participating in a merger get higher profits than non-participants.

In the long-run free entry equilibrium upstream, we find that, in the presence of downstream entry barriers, allowing more consolidation upstream might drive to more entry. That is, upstream consolidation is a means to countervail downstream bargaining power; so, a more consolidated upstream industry obtains larger rents, for a given level of capacity, and, as a consequence, consolidation induces more entry upstream that translates into larger production (and hence consumer surplus increases). Consumers benefit from competition policies allowing more consolidation among producers, because the overall industry becomes more efficient as the level of production increases with total capacity.

Finally, when social welfare is taken into account, the presence of downstream entry barriers may result in upstream under-investment relative to the second-best socially optimal number of productive plants. This conclusion sharply contrasts with the standard finding in oligopoly models (Mankiw and Whinston, 1986), in which there is always excessive entry (upstream over-investment in our setting) when manufacturers sell their product to consumers either directly or through price-taking retailers. Compared to Mankiw and Whinston’s (1986) set-up, where the business-stealing effect results in excess entry, in our analysis there is a countervailing additional effect, which we shall call the rent-distribution effect: In a bilateral oligopoly, upstream firms do not retain the entire profit of the industry, but part of it goes to retailers; thus, as the intrinsic bargaining power of retailers increases (decreases), upstream

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8 This result was anticipated by Hart and Tirole (1990) but in a more stylized model than ours.
9 That firms inside the merger benefit from merger more than firms outside the merger is a result that, although implicit in contemporary papers to ours (see, e.g., Inderst and Wey, 2003), has not been emphasized previously. In any case, it is in stark contrast with the results obtained in standard oligopoly models that do not distinguish between producers and retailers (see Salant et al., 1983, and Kamien and Zang, 1990).
10 Even retailers might also benefit from upstream consolidation, since the (ex-post) countervailing effect of upstream consolidation on bilateral negotiations would be compensated by the (ex-ante) increase in entry. However, this result would partly depend on the intrinsic bargaining power of retailers, i.e., on their ability to appropriate the additional surplus created as a result of more entry upstream.
firms obtain a lower (higher) share of industry profits and hence their incentive to build productive capacity decreases (increases).

In summary, the current paper finds the rationale for competition policies that allow upstream consolidation, whenever the downstream market is already consolidated; namely, any relaxation of merger policy increases consumer surplus and may help to alleviate the insufficient entry in the upstream industry.

The current paper is closely related to the recent literature on bilateral oligopoly, that include Björnnerstedt and Stennek (2001), Inderst and Wey (2003) and de Fontenay and Gans (2004a, b) among others. Björnnerstedt and Stennek (2001) model a bilateral oligopoly as a set of simultaneous Rubinstein-Stähl bargainings over supply contracts that specify prices and traded quantities of the intermediate good. In some sense, their model can be seen as a non-cooperative foundation of the reduced form we use to model a bilateral oligopoly. We show, just like them, that bilateral negotiations do not cause additional distortions over those created from the existence of market power in the final market. To their results, however, we add that (i) upstream consolidation does not change this result, but only affects the distribution of total rents from trade, (ii) such a redistribution of rents favors large upstream firms, and, consequently, (iii) upstream firms have strong incentives to engage in horizontal merging processes.

In turn, Inderst and Wey (2003) study whether an excessive purchasing power of retailers can damage the viability of producers in the long-run. They analyze, for a given number of up- and downstream firms, the impact of horizontal up- and downstream mergers on technology choice of upstream firms and conclude that an upstream merger redistributes some bargaining power from retailers to producers, but it has an adverse effect on the incentives to reduce marginal costs. Such a conclusion runs against the wide view (and also against our result in the current paper) that an excessive bargaining power of retailers will result in a reduction of productive efficiency. However, while the analysis of these authors fits well (as they point out) in industries where innovative activities are important and upstream entry is limited, ours is better suited for industries where upstream entry is technically easy and scale economies are not relevant, i.e., industries with no technological entry barriers at the upstream segment.
The bilateral oligopoly theory origins can be traced back to Horn and Wolinsky (1988) and Hart and Tirole (1990). Horn and Wolinsky (1988) show, in a model in which two retailers and two suppliers bargain à la Nash the quantity of the input traded, that producers (to be interpreted as a union) have an incentive to horizontally merge among themselves since it increases their bargaining power. Their model, however, is not intended to discuss issues that are important in our setting and for this reason some of their assumptions are not well suited for the concerns we address.11

Other literature on vertical structures—the so-called theory of vertical foreclosure, which examines the incentives of a supplier to vertically integrate in order to foreclose its rivals—also suffered from its poor modeling of contractual (linear payments) relationships until Hart and Tirole (1990) developed a more rigorous contractual framework in which up- and downstream firms trade the intermediate good by means of bilateral negotiations rather than through a decentralized intermediate market. The insights in Hart and Tirole’s (1990) paper have spurred into a wide literature on vertical foreclosure, nicely surveyed in Rey and Tirole (2003), and whose latest developments compare the impact of vertical integration on industry performance for different levels of upstream competition.

The most relevant paper of this literature for the issues we discuss in this paper is de Fontenay and Gans (2004a). These authors show that vertical integration by a monopsonist reduces total capacity of production upstream and, as a consequence, reduces both total production and consumer surplus. A non-integrated monopsonist is vulnerable to hold-up by upstream firms; more entry upstream alleviates the hold-up problem; hence the monopsonist promotes entry when vertically separated. In consequence, the conventional wisdom that

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11 First at all, they only consider linear wholesale payments, which seem to be a very restrictive assumption for the analysis of bilateral oligopolies. Moreover, they only examine the creation of a monopoly from a duopoly, while in our case a merger does not directly involve the creation of a monopoly, i.e., we allow for partial monopolization. Finally, they are not concerned neither with the possibility that upstream mergers drive entry into the industry nor with the degree of upstream consolidation that antitrust authorities should allow. Along the same lines, Dobson and Waterson (1997) model an industry in which imperfectly competitive retailers negotiate intermediate prices with a supplier. Again, they only allow linear payments and concentrate on the impact on final prices provoked by a reduction in the number of retailers.
vertical integration by a monopsonist does not harm consumers may not hold, and hence a
merger policy that bans vertical integration may be welfare enhancing for consumers.

The rest of the article proceeds as follows. In Section 2, a model of simultaneous Nash
bargaining among many sellers and buyers (the up- and downstream firms) is built. Section 3
deals with upstream consolidation that arises in the short-run. Section 4 is the core of the paper
and is concerned with mergers among producers in the long-run free entry equilibrium
upstream, its consequences on social welfare, and the appropriate regulatory policy in this
setting. Some conclusions are contained in Section 5. Finally, an appendix collects the formal
proofs of the results.

2 The model

Consider an industrial structure with an up- and a downstream sector. Upstream, exist producers
of an intermediate good that is delivered to downstream or retail firms. Specifically, there are \( n \)
identical productive plants (factories) in the upstream side of the industry. Firms in the
downstream market transform the intermediate good into a final product and sell it to final
consumers.

Throughout we assume there are two firms, \( A \) and \( B \), in the retail side of the industry.\(^{12}\)
Upstream, we first assume that a fixed number of productive plants exists there, in order to
discuss the creation of coalitions of producers (through mergers of plants or just through
alliances of firms joining their plants). In particular, there are, in the short-run, \( n \) productive
plants. We allow each productive plant to belong to an independent upstream firm (uni-plant
firms) or several or even all of the plants to be of a coalition of firms or to pertain to a
consolidated firm (multi-plant firm). Later on, after determining the upstream coalitions that one
should expect to emerge, we discuss the upstream configuration in the long-run free entry

\( ^{12} \) Hence, we assume an exogenous degree of concentration downstream. However, our results immediately extend to
any exogenous number of firms \( m \geq 1 \) downstream.
equilibrium, for which we assume that the number of upstream plants is endogenous, given the
degree of consolidation permitted by the regulator in the production sphere.

The cost to produce \( Q \) units of the intermediate good by a coalition \( i \) of producers owning
\( k_i \) plants (in the sequel, the coalition \( i \) of producers), \( 1 \leq k_i \leq n \), is given by \( C(Q, k_i) \). Retailers need
one unit of the intermediate good to obtain one unit of the final good that is then sold to
consumers in the final market, they have zero marginal costs in the transformation process, and
there is no alternative source of the intermediate good. The final good is homogeneous and the
market demand is given by \( P(Q) \), where \( Q \) (also) denotes total sales achieved by both
downstream firms. (Table 1 summarizes the notation we use all along the paper.)

To guarantee that standard tools of oligopoly theory concerning the existence and
uniqueness of equilibrium can be used, we make the following assumptions on the properties for
cost and demand functions:

**A1.** The cost function of each productive plant, \( C\left( \frac{Q}{k_i} \right) = \frac{C(Q, k_i)}{k_i} \), is a twice continuously
differentiable, increasing and strictly convex function; namely, \( C'(\cdot) > 0 \) and \( C''(\cdot) > 0 \).

**A2.** The market demand function of the final good, \( P(Q) \), is twice continuously differentiable,
downward sloping, \( P'(Q) < 0 \), and satisfies the condition \( P'(Q) + P'(Q)Q_d < 0 \), \( d = A, B \).

Finally, given that the cost to produce the output \( Q \) by a coalition \( i \) of producers is
\( C(Q, k_i) = k_i C\left( \frac{Q}{k_i} \right) \), we assume that there are no synergies in production. In other words,
upstream mergers have no technological consequences.\(^{13} \) Hence, we concentrate solely on their
effects on the bargaining position of merged suppliers vis-à-vis retailers.

\(^{13} \) Similar assumptions on the cost function and the modeling way of bargaining to discuss subcontracting between
two vertically integrated duopolists are made by Spiegel (1993) and Björnnerstedt and Stenneck (2002).
2.1 Description of the game

The above-mentioned vertical oligopoly market is modeled as a three-stage game with the following sequence of events. In the first (coalition formation) stage, upstream firms decide about mergers among themselves. In the second (contracting) stage, producers and retailers determine, in bilateral negotiations, quantities of the intermediate good to be delivered from producers to retailers and the money transfer from retailers to producers. In the third (final market) stage, downstream firms sell the final good to consumers by competing in Cournot fashion. As usual, we look for a subgame-perfect equilibrium of this game.

2.1.1 Coalition formation stage

Given the \( n \) plants existing in the upstream industry, a coalition of upstream firms with \( k_i \) plants is a non-empty subset \( k_i \) of \( n \). Such a coalition can be thought of as a merger or an alliance among the involved plants. Each producer may pertain at most to one coalition, although it may also remain alone. In this stage, the only decision made by producers is whether to participate or not in a coalition with others. Finally, we ignore both the formation of vertical mergers\(^{14}\) and the possibility of horizontal mergers among retailers.

2.1.2 Contracting (bargaining) stage

Given the coalitional structure recorded upstream, each coalition \( i \) of upstream firms and each downstream firm \( d \) sign a supply contract \( \{Q_{di}, T_{di}\} \) that specifies the quantity \( Q_{di} \) of the intermediate good to be delivered from coalition \( i \) of producers to downstream firm \( d \) and the fixed payment\(^{15}\) \( T_{di} \) to be transferred from the latter to upstream coalition \( i \). Firms,\(^{14}\) This is the issue analyzed in the literature on vertical foreclosure (see a survey in Rey and Tirole, 2003) and in some papers of the bilateral oligopoly model (see, for instance, de Fontenay and Gans, 2004a, b).\(^{15}\) Instead of a linear payment.
independently and simultaneously, bargain over the terms of trade, i.e. the retailer $A$ vis-à-vis all given coalitions of producers, the retailer $B$ regarding all given coalitions of producers, and, finally, the coalitions of producers with every retailer. Hence, as was discussed in the introduction, we assume there is no spot market to deliver the intermediate good.

We assume that members of a coalition $i$ of producers share profits equally, all upstream firms may produce for both retailers, and each retailer may sell the product of all the producers. When an upstream coalition and a retailer bargain over a supply contract, they must hold a conjecture about which deals are reached in parallel negotiations. In this subject, we follow most of the literature on bargaining and assume that in each bilateral negotiation parties hold passive beliefs as to the prices and quantities arising in other negotiations; in other words, when a firm receives an unexpected offer, it does not revise its beliefs about offers made to rivals.\footnote{See Rey and Tirole (2003) and de Fontenay and Gans (2004a, b) for a fully account of the discussion in the literature about assumptions on beliefs. Nevertheless, the passive beliefs conjecture is not free of criticism (see Segal and Whinston, 2003, for a detailed discussion in this point).}

We also assume that the outcome of negotiations is given by the Nash bargaining solution. In each trade, and given the passive conjectures on the result of other trades, the involved upstream firm and the retailer agree on the quantity of the intermediate good that maximizes their joint surplus. They split the increase in the joint surplus generated by their trade in a proportion that reflects their respective bargaining power.

Finally, and according to the Nash bargaining solution, we assume that contracts are not renegotiated in case of disagreement, which is obviously an extreme assumption. In a more general set-up, we would expect some frictions in renegotiating contracts but anyway, unless the resulting transaction costs were enormous, at least some contracts would be rescheduled. In other words, the assumption of passive beliefs on prices and quantities contracted may be a sensible one, but it seems less palatable to assume that breakdown of contracts are not observed either. Anyway, de Fontenay and Gans (2004a, b) show, in an explicit non-cooperative bargaining model, where the quantities contracted may change after breakdowns, that bilateral efficiency still holds. Hence, we would expect that a more elaborate assumption on the
disagreement payoffs could change the precise distribution of payoffs in equilibrium, but that it wouldn’t alter our broad qualitative conclusions on the final profits of firms in the industry.

2.1.3 Market stage

In this stage, we assume that downstream firms, which do not have internal production, are Cournot competitors in the market of the final good.

2.2 The equilibrium in the second (contracting) stage

In the last stage of the game, it is immediate to see that retailers are interested in leaving to the final market the equilibrium quantities they traded in the previous contracting stage. In fact, retailers have strictly positive marginal revenues at the equilibrium quantities and hence they sell all the production stipulated in supply contracts at the second stage.

Regarding the second stage of the game, consider, without loss of further generality, the bargaining problem between coalition $i$ of producers and retailer $A$. Both of them anticipate that all other coalitions of upstream firms different to coalition $i$ will produce the total amount $Q_{A-i} = \sum_{j \neq i} Q_{Aj}$ of the intermediate good for downstream firm $A$ in exchange for money transfer $T_{A-i} = \sum_{j \neq i} T_{Aj}$, that production for retailer $B$ will be $Q_B^*$, etc.

Under passive conjectures, the retailer $A$ and the coalition $i$ of producers bargain over a supply contract $\{Q_{A}, T_{B_i}\}$ to maximize their joint profits under the expectation that (i) retailer $B$ will sell in the final market the candidate equilibrium quantity $Q_B^*$, (ii) retailer $A$ will reach the candidate equilibrium supply contract $\{Q_{A-i}^*, T_{A-i}^*\}$ in its bargaining with any upstream firm other than coalition $i$, and (iii) coalition $i$ of producers will reach the candidate equilibrium contract $\{Q_{B_i}^*, T_{B_i}^*\}$ in its bargaining with retailer $B$.

Hence, under passive beliefs the profit for retailer $A$ is expected to be
while the aggregate profit for coalition $i$ of producers is

\[
\Pi_i = T_{Ai} + T^*_{Bi} - k_i C \left( \frac{Q_{Ai} + Q^*_{Bi}}{k_i} \right),
\]

which is assumed to be shared among its members (plants) proportionally to the number of plants that integrate the coalition. On the other hand, disagreement profits for downstream firm $A$ are

\[
\Pi^\text{Dis}_A = P(Q^*_{A-i} + Q^*_B)Q^*_{A-i} - T^*_{A-i},
\]

where in (3) it is implicitly assumed that retailer $A$ has strictly positive marginal revenues at the level of production $Q^*_{A-i}$ and, consequently, (i) it sells all this production in case of disagreement with coalition $i$ of producers and, moreover, (ii) it is interested in reaching an arrangement with coalition $i$ of producers (we show below that both conditions are indeed satisfied in equilibrium). Finally, the profit of coalition $i$ of upstream firms in the disagreement point is

\[
\Pi^\text{Dis}_i = T^*_{Bi} - k_i C \left( \frac{Q^*_{Bi}}{k_i} \right).
\]

The coalition $i$ of producers and the retailer $A$ agree on the pair $\{Q_{di}, T_{di}\}$ that solves the problem
where parameter $\alpha$, $0 < \alpha < 1$, can be thought of as an exogenous measure of the intrinsic bargaining power of producers against downstream firms.\textsuperscript{17} Parameter $\alpha$ is the same in all partnerships, independently of the number of plants owned by coalitions of upstream firms that would arise. In other words, we do not prejudice that the number of plants works against or for a given coalition of producers in terms of relative bargaining power over retailers.\textsuperscript{18}

Once the behavior of players in the two last stages of the game has been summarized, the analysis of the behavior at the first stage, i.e., the process of horizontal upstream consolidation, is the purpose of the next section.

3 The bilateral oligopoly model in the short-run

In this section, we investigate to which extent the size of coalitions of upstream firms matters in our framework taking the number of upstream plants as given. What we will see indeed is that the number of plants possessed by the (coalitions of) upstream firms is valuable since it is the way to achieve more rents from retailers. Hence, upstream firms have a strong incentive to consolidate their plants as will be shown later on.

The problem defined in (5) is strictly concave in $\{Q_{A_i}, T_{A_i}\}$. By solving it, we afford the fixed payment from the downstream firm $A$ to the coalition $i$ of producers

$$ T_{A_i}^* = \alpha \left[ P(Q_{A_i} + Q_{A_i - 1}^* + Q_{A_i}^*) (Q_{A_i} + Q_{A_i - 1}) - P(Q_{A_i}^* + Q_{A_i}^*) Q_{A_i - 1} \right] $$(6)

\textsuperscript{17} All of our results obtain for any value of parameter $\alpha$ strictly positive. The purpose of allowing this range of values for $\alpha$ is that it allows us below (in Section 4) to discuss some polar cases that are illuminating to understand the basic forces driving our results in the long run, and also to compare them in an elegant way with standard results for oligopoly models.

\textsuperscript{18} The bargaining power of firms could be affected by reasons outside the model, such as whether producers may or may not sell their product through other distribution channels than the one explicitly defined by downstream firms, the existence of alternative uses for products (for instance, milk can be sold as fresh milk or can be used to produce butter, a less valuable alternative) and, in the case of differentiated products, the presence of brand recognition.
\[ +(1 - \alpha) \left[ k_i C \left( \frac{Q_{A_i} + Q_{B}}{k_i} \right) - k_i C \left( \frac{Q_{B_i}}{k_i} \right) \right]. \]

As usual, when (coalitions of) producers and retailers bargain à la Nash, payments allow them to share the surplus from the disagreement point with weights given by parameters \( \alpha \) and \( 1 - \alpha \).

Particularly, in the bargain between the coalition \( i \) of upstream firms and the downstream firm \( A \), bilateral joint profits are maximized given \( Q_{A_i}^* \) and \( Q_B^* \). Hence, the problem to be solved is

\[
\text{Max}_{Q_{A_i}} P(Q_{A_i} + Q_{A_{-i}}^* + Q_B^*)(Q_{A_i} + Q_{A_{-i}}^*) - k_i C \left( \frac{Q_{A_i} + Q_{B_i}}{k_i} \right),
\]

and the optimal quantity \( Q_{A_i}^* \) coming from the solution of (7) is the one that satisfies the first-order condition

\[
P'(Q_{A_i} + Q_{A_{-i}}^* + Q_B^*)(Q_{A_i} + Q_{A_{-i}}^*) + P(Q_{A_i} + Q_{A_{-i}}^* + Q_B^*) - C \left( \frac{Q_{A_i} + Q_{B_i}}{k_i} \right) = 0,
\]

where \( Q_{A_i}^* = k_i q^* \), \( Q_{A_{-i}}^* = (n - k_i) q^* \), \( Q_B^* = n q^* \), and \( Q_{B_i}^* = k_i q^* \).

The next lemma summarizes what happens in the upstream side of the industry in terms of production of the intermediate good.

**Lemma 1** In an equilibrium with passive beliefs, the following holds:

(a) The quantity \( q^* \) of the intermediate good produced per plant for a downstream firm is the same, regardless of the coalitional structure arising at the upstream market.

(b) Such a quantity, \( q^* \), is the one satisfying the condition

\[
P'(2nq^*)nq^* + P(2nq^*) - C(2q^*) = 0.
\]

**Proof.** See the Appendix.
The lemma says that upstream firms attain productive efficiency and the industry outcome is a Cournot duopoly outcome assuming that downstream firms face a perfectly competitive upstream supply and downstream firms are also competitive in the wholesale market. In other words, the presence of bilateral bargaining in the wholesale market does not add any inefficiency up to the one created by the existence of market power in the final market. What exclusively matters for the performance of the industry as a whole is the level of downstream competition (in our case, a duopoly) and the size of the upstream segment (the $n$ plants); beyond this, the way in which the upstream productive capacity is partitioned among coalitions is innocuous for actual quantities. Hence, upstream consolidation will merely affect the redistribution of rents in the industry leaving unchanged the quantities produced of the intermediate good (Lemma 2 below proves this claim and also shows in which direction rents are changed). Note furthermore that there are no externalities for producers outside any coalition. As production does not indeed depend on the upstream consolidation, it follows that for a given coalition $i$ of producers, the partition in coalitions of remaining productive plants $n-k_i$, i.e. the size of other coalitions, does not affect the actual production of coalition $i$.

That size of coalitions itself proves to be crucial to the payments received by such coalitions can be easily seen. A coalition $i$ of producers receives from each downstream firm $d$ the payment\[T^*_d = \alpha \left[ P \left( 2 n q^* \right) n q^* - P \left( (2n - k_i) q^* \right) (n - k_i) q^* \right] + (1 - \alpha) \left[ k_i C \left( 2 q^* \right) - k_i C \left( q^* \right) \right],\]from which the per plant profit of such a coalition is

19 The efficiency of bilateral bargaining is also shown in Björnerstedt and Stennek (2001) and de Fontenay and Gans (2004a, b).
20 Besides, this feature implies that we may use the standard tools from oligopoly theory (summarized, for example, in Vives, 2000, pp. 97-99) to prove the existence and uniqueness of the equilibrium.
21 Hart and Tirole (1990) anticipated this outcome although their model is very stylized relative to ours. De Fontenay and Gans (2004a, b) also derive this result.
In view of (10) it follows straightforwardly that a change in the number of plants of coalition $i$ only has an effect on the payment it obtains (the first term on the right-hand side of (10); not on costs per plant (the second right-hand side of (10), which is due to the fact that production per plant does not change by virtue of Lemma 1. Thus, the payment a coalition $i$ of upstream firms receives per plant is

$$
\pi_i = \frac{1}{k_i} \left[ T_{A_i}^* + T_{B_i}^* - k_i C(2q^*) \right]
$$

$$
= \frac{1}{k_i} (T_{A_i}^* + T_{B_i}^*) - C(2q^*).
$$

and it follows from (11) that such payment is composed of two terms. The first term on the right-hand side of (11) is related to the impact of a disagreement on revenues, and depends on the exogenous bargaining power of producers, $\alpha$, as well as on the size of the coalition $i$. The second term on the right-hand side of (11), instead, is dependent on $\alpha$, but not on the coalition’s size.

The following lemma summarizes the net effect caused by the size of upstream coalitions on money transfer received by them.

**Lemma 2** The payment a coalition $i$ of upstream firms receives per plant increases with the size of the coalition, namely $\frac{\partial t_{A_i}^*}{\partial k_i} > 0$, but it does not depend on the size of other coalitions.

**Proof.** See the Appendix.
The explanation of the lemma is quite simple. Given the fixed number of plants existing in the upstream industry, the production per plant of a coalition \( i \) of upstream firms does not change with the number of plants, but payments do. Hence, the process of upstream consolidation only implies, in the short-run, a redistribution of profits in the industry that favors the coalition of upstream firms to the detriment of downstream firms.\(^{22}\) Note in fact that revenues obtained by retailers from other upstream firms than coalition \( i \), \( P(Q_{A-i}^* + Q_B^*)Q_{A-i}^* \), are a decreasing function in the size of the coalition \( i \) as \( Q_{A-i}^* = (n - k_i) q^* \). Furthermore, it is immediate to verify that, since the production of a coalition \( i \) of upstream firms does not depend on the size of other coalitions, payments do not depend either.

It is also important to note that profits of a coalition of producers increase with its size only when parameter \( \alpha \) is strictly positive, that is, only when producers obtain rents related to their impact on retail prices charged to consumers (through their share of total production). Finally, for a given size of a coalition of producers, the payment it receives per plant increases with parameter \( \alpha \).

What happens when we compare the mechanism of bilateral negotiations over supply agreements with other trading institutions in the intermediate market? If the results raised from the assumption of bargaining in the wholesale market are compared with those emerging in a decentralized (competitive) intermediate market, we obtain that the per plant production of upstream firms for each retailer is the same in both trading mechanisms, since the Walrasian wholesale price \( w^M \) satisfies the condition

\[
(12) \quad w^M = P'(2nq^M)q^M + P(2nq^M)q^M = C'(2q^M),
\]

which is the same than (8). Thus, \( q^M = q^* \).

\(^{22}\) In Section 4, we will show that the redistribution of profits in the industry induces, in the long-run free entry equilibrium upstream, an upstream entry process that changes the number of productive plants.
However, the payment received by a coalition $i$ of producers in the bilateral trade, $T_{di}^*$, can be larger or smaller than that it would obtain in a Walrasian intermediate market, $w^M k_i q^*$, depending on both the size and the intrinsic bargaining power of the coalition. Thus, for a given size of the coalition, there is a value $\alpha^* \in (0,1)$ of the bargaining power of upstream firms such that $T_{di}^*$ is above (below) $w^M k_i q^*$ if and only if $\alpha$ is above (below) $\alpha^*$. To prove this assert, it suffices to note that in the Walrasian equilibrium, an upstream coalition $i$ produces for each retailer the quantity $k_i q_i^*$ in exchange for the payment $w^M k_i q^*$. In the bilateral negotiation, however, when producers have all the bargaining power, i.e., when $\alpha=1$, a coalition $i$ of producers receives the payment

$$T_{Ai}^{\alpha=1} = P(2nq^*) - P(2n-k)q^*(n-k)q^*$$

$$= k_i \int_0^{q^*} \left[ P\left( (2n-k_i)q^*+s \right) \left( nq^* + s \right) + P\left( (2n-k_i)q^*+s \right) \right] ds,$$

which is larger than $w^M k_i q^*$. The reverse is true when downstream firms have all the bargaining power, i.e., when $\alpha=0$. In this case, a coalition $i$ produces, in the bilateral trade, the same amount for each retailer, $k_i q_i^*$, but receives the payment

$$T_{Ai}^{\alpha=0} = k_i \left[ C(2q^*) - C(q^*) \right]$$

$$= k_i \int_0^{q^*} C'(q^*+s) ds,$$

which is lower than that of the Walrasian equilibrium, $w^M k_i q^*$. From (13) and (14), and considering that the payment $T_{Ai}^*$ received by the coalition $i$ of producers is a convex
combination of $T_{A_i}^{\alpha=1}$ and $T_{A_i}^{\alpha=0}$, $T_{A_i}^* = \alpha T_{A_i}^{\alpha=1} + (1-\alpha)T_{A_i}^{\alpha=0}$, it follows that a value $\alpha^* \in (0,1)$ of the bargaining power of producers exists such that $T_{A_i}^* = w^M k_i q^*$.

We are now in conditions of evaluating which are the effects produced by the presence of downstream entry barriers on the structure of the upstream market.

**Proposition 1** As long as $\alpha \in (0,1]$ upstream firms will benefit from constituting a coalition among them.

**Proof.** See the Appendix.

Given the duopolistic structure of the downstream market, for upstream firms it is beneficial to gain market share by acquiring productive plants. The result according to which producers will enter into a single coalition that includes all existing plants follows in two steps. First, the fact that producers inside a coalition are better off the bigger the coalition is implies that they are interested in adding new members to the coalition. Second, given that profits of producers outside a coalition are lower than profits of insiders, the former have incentives to enter into the coalition.

The intuition behind this result relies on the fact that the threatening point of a retailer and a producer in each partnership is related to the effect of a breach in the bilateral negotiation over supply agreements. If a retailer does not reach an agreement with a small upstream firm, the effect on final prices and retailer’s revenues is small—retailer’s revenues are in fact reduced from equilibrium revenues, $P(2nq^*) n q^*$, to $P((2n-1)q^*)(n-1) q^*$. However, when a retailer and a big producer do not reach an agreement, the effect on retail prices and retailer’s revenues is considerable—retailer’s revenues diminish from $P(2nq^*) n q^*$ to $P((2n-k_i)q^*)(n-k_i) q^*$. A downstream firm then has less strength when it negotiates in the wholesale market a deal with

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23 This seems to be the case in the Spanish brewing industry (see the newspaper El País Dec 18th 1999, p. 78).
24 In the extreme, when all upstream firms enter into a unique coalition, the disagreement point of a retailer reduces its profits to zero.
a big producer, and, as a consequence, a big producer obtains higher per plant rents than a small one. Put differently, as a coalition of upstream firms increases its size by adding new members, it does not restrict output, but just internalizes more and more the duopolistic structure of downstream market.

From the analysis above, we can evaluate which would be the effect of merger guidelines (including restrictions on mergers, strategic alliances of producers, etc.) that limit the size of upstream coalitions allowed by the regulator. Consider a legal framework in which the merger policy allows any given upstream coalition to have at most a share $\mu^R$ of total capacity in the industry; namely, the regulator imposes the condition $\frac{k_i}{n} \leq \mu_i \leq \mu^R$, with $\frac{1}{n} \leq \mu^R \leq 1$, to any coalition $i$ of upstream firms. The impact of this merger regulation is stated in the following lemma that extends the contents of Proposition 1 by considering a regulatory environment.

**Lemma 3** For a level of upstream productive capacity of $n$ plants, if every coalition $i$ of producers can have at most a number of plants $k_i$ satisfying $k_i \leq \mu^R n$, the number of plants owned by each one is $k_i^* = \mu^R n$.

The intuition of this result is quite simple. Given that profits per plant of a coalition increase with its size and firms inside the coalition always obtain higher profits than those outside the coalition, upstream firms will want to merge as far as allowed; up to regulatory constraints.

Lemma 3 will be useful in the next section, in which we move from the short- to the long-term in order to analyze the consequences of the presence of a non-competitive downstream sector both on the structure and performance of the overall industry in the long-run, and the impact of the merger regulatory policy.

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25 This analysis will prove very useful in the long run equilibrium analysis of the next section.
4 The long-run analysis

In this section, we examine the impact that downstream entry barriers have in the long-term structure of the industry. That is, we consider that the number of upstream productive plants is not exogenous as in Section 3, but that it arises endogenously from a free entry process of new plants. Along this section we explicitly take into account that the profits of a given coalition of producers depend both on the size of the coalition itself and on the level of total upstream capacity. Moreover, we analyze the impact that regulation on level of upstream consolidation may have on the free entry process and in welfare.

We model the conduct of the whole industry in the long-run as a four-stage game with the following sequence of moves. In the first stage, potential producers decide whether to enter in the upstream market. In the second stage, all productive plants are independent and decide whether to create coalitions among themselves. In the third stage of the game, coalitions bargain with retailers in the wholesale market. In the fourth stage, retailers produce for consumers.

Some remarks about this setup are in order. First at all, consolidation through coalitions upstream may include not only mergers, but also other forms of alliances among plants. Second, we assume that entry is by individual plants, that it occurs before coalitions among producers are formed, and that there is no incumbency upstream. In reality, when new capacity enters the industry, some upstream coalitions may already exist—created through previous upstream mergers or strategic alliances within already existing plants. Third, we consider regulations that limit the size of coalitions. It will be immediate from lemma 3 in the previous section that, in the absence of incumbency, firms will consolidate as much as the merger policy rule allows.

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26 This is a surprisingly strong result when compared with the literature on horizontal mergers based on oligopoly models where firms compete in Cournot fashion. See Salant et al. (1983) or Kamien and Zang (1990).
27 In this sense, our analysis is similar to the one developed in the literature on endogenous formation of coalitions and networks (see Bloch, 2003, for a survey). In the context of oligopolies, this literature models the formation of coalitions as a two-stage process, where initially firms form groups, and then compete in the market. In our set-up, instead of competing for consumers, the groups bargain with retailers.
28 This raises the important practical question of how to achieve that the entrants bargain on an equal foot with incumbents in the formation of coalitions, and one indeed could argue that this is the goal of some of the conditions imposed by competition authorities in approving merger processes (e.g., the cancellation of exclusivity contracts in hands of existing firms). In a more general set-up, it would be worthwhile to analyze an “entry game” by considering the history of the industry.
We begin by explicitly computing the per plant profits of each coalition of producers. We then proceed to calculate the free entry equilibrium. Later on, we examine the role of merger guidelines. To make the analysis tractable, we restrict ourselves to explicit forms of demand and cost functions. In particular, we consider the linear demand function

\[ \text{(15)} \quad P(Q) = A - Q, \]

for the final product, where \( A \) is a strictly positive parameter, and the quadratic cost function

\[ \text{(16)} \quad C(Q, k_i) = \frac{c}{k_i} Q^2, \]

with \( c > 0 \).

Given that the number \( n \) of upstream plants is now endogenous, it follows that total production of the intermediate good is dependent on \( n \). Under the demand and cost functions above specified in (15) and (16), each one of the \( n \) upstream plants produces the quantity

\[ \text{(17)} \quad Q_u^*(n) = \frac{2A}{3n + 4c}, \]

of the intermediate good and each downstream firm \( d \) sells in the final market the quantity

\[ \text{(18)} \quad Q_d^*(n) = \frac{A}{3n + 4c}. \]

In turn, the payment made by each downstream firm \( d \) to every coalition of upstream producers depends both on the size of the latter and on total capacity. For a coalition \( i \) of upstream producers with \( k_i \) plants, define \( \mu_i \) as its share of total capacity; namely, \( \mu_i = \frac{k_i}{n} \). Thus, the
payment made by each downstream firm \(d\) to a coalition of upstream producers whose share is given by \(\mu_i\) is

\[
T^*_d(k_i, n) = \mu_i \left( \frac{A}{3n+4c} \right)^2 \left[ (3 + \alpha) c + \alpha k_i \right],
\]

by which the per plant profits of the upstream coalition \(i\) are given by

\[
\pi_u(k_i, n) = 2 \left( \frac{A}{3n+4c} \right)^2 \left[ (1 + \alpha) c + \alpha k_i \right],
\]

and it is immediate from (20a) that per plant profits are decreasing in the level of total upstream capacity.

It is useful for our purposes to rewrite the profit of any upstream firm inside the coalition \(i\) as a function of parameter \(\mu_i\). Then the expression (20a) becomes

\[
\pi_u(\mu_i, n) = 2 \left( \frac{A}{3n+4c} \right)^2 \left[ (1 + \alpha) c + \alpha \mu_i n \right]
\]

On the other hand, if there are \(S\) coalitions of producers, \(1, \ldots, i, \ldots, S\), each one of them with the number of plants \(k_1, \ldots, k_i, \ldots, k_S\), respectively, and where \(\sum_{i=1}^{S} k_i = n\) (or, equivalently, each upstream coalition \(i\) owning a share of total capacity \(\mu_i\), with \(\sum_{i=1}^{S} \mu_i = 1\)), then the profit of each retailer \(d\) is

\[
\Pi_d(\mu_1, \ldots, \mu_i, \ldots, \mu_S, n) = n \left( \frac{A}{3n+4c} \right)^2 \left[ (1 - \alpha) c + \left( 1 - \alpha \sum_{i=1}^{S} \mu_i^2 \right) n \right].
\]
Regarding the second stage of the game, it is worthwhile to recall that upstream profits depend on the size of coalitions; so, regulatory policies have the potential to affect the free entry equilibrium through changes in the level of upstream consolidation allowed. To illustrate this, assume that antitrust laws restrict the process of consolidation in the upstream industry. For instance, it could be established that any consolidated producer cannot possess a share of plants above a given threshold $\mu^R$; namely, the value $\mu_i$ of every coalition $i$ must satisfy the condition $\mu_i \leq \mu^R$. Clearly, in the second stage of the game, parameter $\mu^R$ must take values in the interval $\left[\frac{1}{n}, 1\right]$, where the lower bound, $\frac{1}{n}$, will depend on the level of entry arising in the first stage.

How does the maximum capacity sharing authorized, $\mu^R$, affect the number of upstream plants in the long-term? To answer this question, let us assume that the set-up cost of each plant is given by $r$, $r > 0$, and that upstream consolidation leads to symmetric coalitions of producers, that is, coalitions with the same size. With respect to the assumption of symmetric coalitions, we argue that parameter $\mu^R$ is chosen in such a way that a natural number $S$ exists verifying the property $\mu^R = \frac{1}{S}$ or, if not, that any entrant comes into the coalitions with size $\mu^R$, i.e., those with the maximum size allowed. In any case, we assume that entering producers receive the per capita profits of members inside the larger coalitions.

From lemma 3, we know that firms consolidate as much as allowed by the regulatory rule, $\mu_t = \mu^R$. Hence, the entry of plants in the first stage of the game holds as long as each plant obtains a per capita profit verifying the condition

$$\pi_r(\mu^R, n) \geq r,$$

and the number of plants in the long-run free entry equilibrium upstream, $n^{FE} = n^{FE}(\mu^R)$ is the one that satisfies the condition

---

Evaluating the free entry condition (23) for the explicit profit of an upstream firm (20b) at 
\(\mu_i = \mu^R\), for all coalition \(i\), we can state the following lemma.

**Lemma 4** In the long-run free entry equilibrium upstream, the number of plants at the upstream market increases with the consolidation degree allowed there; namely, 
\[
\frac{\partial n^{FE}(\mu^R)}{\partial \mu^R} > 0.
\]

**Proof.** See the Appendix.

Allowing more consolidation leads to more investment in the upstream industry. The result is clear in light of lemma 2, that states that more consolidated upstream firms obtain higher rents. As a consequence, some entry that is unprofitable under a given level of consolidation becomes profitable once more concentration in the production sphere is allowed.

An immediate consequence of Lemma 4 is the beneficial effect that upstream consolidation (and hence, indirectly, regulatory policies that allow such a concentration) has on consumer surplus.

**Proposition 2** In the long-run free entry equilibrium upstream, consumer surplus is increasing in \(\mu^R\).

**Proof.** See the Appendix.

This proposition states the main message of the paper, namely, that consumers benefit in the long-run from relaxing merger constraints upstream. In a standard oligopoly model (or in a
vertically integrated industry), more entry is necessarily the result of an increase in industry profits, that must come at the expense of consumers. In a vertically separated industry, instead, we obtain that more consolidation upstream increases consumer surplus. To explain this result, recall that in the previous section we have established that industry performance basically depends on the level of competition in the downstream market, which we assume cannot be altered due to entry barriers. Then, more entry upstreams (induced by an expectation of increased profits due to a relaxation of the merger constraint that allows more consolidation upstream) does not come from a more collusive outcome in the industry, but from a redistribution of rents between retailers and producers. Indeed, consumers benefit from the relaxation of merger laws, since further entry reduces the marginal cost of production, which in oligopoly leads, under fairly general conditions of demand and cost functions,\(^{30}\) to lower retail prices being charged to consumers.

de Fontenay and Gans (2004a) also describe a capitalization effect that improves consumer surplus. They show that upstream entry is promoted by a merger policy that bans vertical integration. They do not allow, however, for horizontal upstream mergers. In analyzing the impact of horizontal up- and downstream mergers on technology choice for a given number of firms, Inderst and Wey (2003) conclude, like us, that an upstream merger redistributes some bargaining power from retailers to producers. They do not consider, however, free entry upstream, but a fixed vertical structure with two firms upstream and two firms downstream. In their set-up, the redistribution of rents has an adverse impact on the incentives to reduce marginal costs. Such a result runs against the widely held view (and also against Proposition 2) that if retailers are really too powerful this reduces productive efficiency. Nevertheless, as these authors point out, their analysis fits well in industries where innovative activities are very important and entry is limited, while ours is better suited for industries where upstream entry is technically easy and economies of scale are not relevant, i.e., industries in which there are no technological entry barriers in the upstream side. In any case, it is true that in a more general

\(^{30}\) See Vives (2000).
set-up our results might change if there were non-contractible investments undertaken by both suppliers and retailers.

Beyond the effect on final consumers, it is also relevant to assess the optimality of the level of entry from the social viewpoint. To this end, as is usual we evaluate the social welfare with

\[ W = CS + \Pi, \]

with \( CS \) denoting the consumer surplus and \( \Pi \) the profits of the whole industry. We are mostly interested in analyzing whether the level of consolidation allowed by the planner is a sufficient instrument to obtain the second best (defined as the level of welfare achieved when the regulator controls the number of plants but not pricing behavior)\(^{31}\). For that, we compare the number of upstream entrants in the long-run free-entry equilibrium, given the level of consolidation allowed, \( n^{FE}(\mu^R) \), with the welfare-maximizing number of plants, \( n^{SB} \).

The result in oligopolistic models (Mankiw and Whinston, 1986) is that there is excessive entry in the long-run free-entry equilibrium (in our terminology, over-investment in productive plants) when producers sell a homogenous product to final consumers. This excessive entry is driven by the so-called business-stealing effect: Any new entrant leads all existing firms to contract their output levels, but it does not take into account such a negative externality and hence excess entry occurs. We show below that in the bilateral oligopoly model, however, to the business stealing we must add a new effect, the rent distribution effect, by which upstream firms do not retain the entire profit of the industry, but share it with retailers. This rent distribution effect countervails business stealing to the point that insufficient entry may hold.

The problem of the ‘structural’ regulator is defined by

\[
\text{Max}_n \quad CS(Q(n)) + P(Q(n))Q(n) - n C \left( \frac{2Q(n)}{n} \right) - r n,
\]

\[
(24)
\]

\(^{31}\) This is sometimes called the second best structural regulation. For a discussion see Mankiw and Whinston (1986) and Vives (2000, pp. 107-109).
with \( Q(n) = \frac{2n}{3n+4c}A \) denoting total production, \( CS(Q(n)) = \frac{1}{2} \left( \frac{2n}{3n+4c}A \right)^2 \) the consumer surplus, \( P(Q(n)) = \frac{n+4c}{3n+4c}A \) the final price of the good, and \( nC \left( \frac{Q(n)}{n} \right) = nc \left( \frac{2}{3n+4c}A \right)^2 \) total costs of production.

The problem defined in (24) is concave in \( n \) and so has a unique solution, which is the socially optimal level of investment, \( n^{SB} \). When it is compared with the long-run free-entry level, \( n^{FE} = n^{FE}(\mu^R) \), —when social incentives are compared with private incentives to invest in the upstream industry—, then cases of both insufficient and excess entry may be observed. This is the spirit of the following proposition, which evaluates the consequences of the merger policy.

**Proposition 3** In the free entry long-run equilibrium with merger policies, three regions of parameters can be defined.

(i) In region 1, the merger policy is a sufficient instrument to achieve the second best; namely, a merger policy \( \mu^R \) exists such that \( n^{FE}(\mu^R) = n^{SB} \).

(ii) In region 2, insufficient entry holds even at \( \mu^R = 1 \).

(iii) In region 3, excessive entry occurs even at \( \mu^R = \frac{1}{n^{FE}} \).

**Proof.** See the Appendix.

The message of the proposition is that allowing upstream consolidation to encourage entry can be also welfare improving, but this may result in excess or insufficient entry from a social perspective. To a better understanding of both possibilities, we illustrate in Figure 1, the proposition for a particular set of parameter values. We show in the figure the three regions through intervals of parameter \( \alpha \). In such a figure, the inferior curve, \( \mu^R = \frac{1}{n^{FE}} \), stands for the merger policy that consists in forcing each upstream plant to negotiate separately with retailers.
(or, alternatively, that consists in each coalition \( i \) of upstream firms being formed by only one plant, \( k_i = 1 \)); and the superior curve is the locus of merger policy \( \mu^R \) that leads to the second best, \( n^{SB} = n^{FE}(\mu^R) \).

Proposition 3 implies that under-investment may hold if consolidation is banned. Since we know from lemma 4 that consolidation increases entry, a more tolerant merger policy may improve welfare. Figure 1 illustrates that, in some cases (region 1), a merger policy that allows some consolidation may even obtain the second best.\(^{32}\)

Sometimes, however, under-investment in upstream capacity may hold no matter the degree of consolidation allowed. Indeed, when \( \alpha = 0 \), i.e. when retailers offer take-it-or-leave-it contracts to producers, we know from Proposition 1 that consolidation has no effect whatsoever in the bargaining power of producers. Then, the proof of proposition 3 in the Appendix shows that, for this level of bargaining power, there is always under-investment, and, by continuity, that it holds for other combinations of bargaining power and consolidation.\(^{33}\)

This conclusion, that under-investment may hold, is in stark contrast with the standard result in oligopolistic models, namely that there is excessive entry in the long-run free-entry equilibrium (in our terminology, over-investment in productive plants). In an oligopolistic environment, the divergence between the socially optimal entry level and the free entry level, is due to the business stealing effect; in our model, however, to the business stealing we must add the rent distribution effect, by which upstream firms do not retain the entire profit of the industry, but share it with retailers. In this respect, since producers obtain only a share of

\(^{32}\) When producers split the surplus with retailers (\( \alpha = \frac{1}{2} \)), for parameters \( (A,r,c) = (100,50,5) \) the second best is obtained with a merger policy \( \mu^R = .221492 \).

\(^{33}\) For other constellations of parameters, it can be shown that region 2 may include situations where producers split the surplus with retailers (\( \alpha = \frac{1}{2} \)). For instance, region 2 includes parameters \( (A,r,c,\alpha) = (100,50,10,5) \).
industry profits, their incentives to build productive capacity decrease as compared with the standard oligopoly model, to the point that under-investment may hold.\textsuperscript{34}

In these circumstances, a merger policy that allows consolidation improves welfare but is not a sufficient instrument to achieve the second-best. Hence, only rules that favor entry either directly (e.g., subsidies on investment) or indirectly (e.g. that favor upstream against downstream firms), in addition to the merging policy, may allow the regulator to achieve it.

In turn, part (iii) of the proposition shows that for other parameter values, over-investment may persist even if producers are forced to deal with retailers on an individual basis. In order to clear the intuition behind this possibility, consider the values \((\alpha, \mu^R) = (1, 1)\), that amount to a scenario where producers offer take-it-or-leave-contracts to retailers, and the policy rule consents the emergence of an upstream monopoly. In such a case, over-investment upstream holds for sure, i.e., for general demand and cost functions, as an immediate implication of the Mankiw and Whinston’s (1986) analysis, since the rent distribution effect disappears. By continuity, region 2 may include lower levels of bargaining power and consolidation. Proposition 2 shows that overinvestment may hold even if consolidation is completely banned.\textsuperscript{35}

In these cases, direct restrictions on entry make sense.

Propositions 2 and 3 have shown that a tolerant merger policy benefit consumers for sure, whereas it may increase total welfare (if there is under-investment otherwise).\textsuperscript{36} Surprisingly, retailers may also benefit with a merger policy that allows some consolidation upstream, even if consolidation increases entry due to a redistribution effect. Specifically, it is easy to see that retailers profits increase if \(\mu^R\) satisfies \(\mu^R < \frac{c}{n} \left( \frac{4c - n\mu^R}{4c + 3n\mu^R} \right) \alpha - 1 \). The result rests on the presence of a hold-up problem: The investment cost \(r\) is sunk when up- and downstream firms

\textsuperscript{34} Note that an insufficient entry occurs despite the fact that our set-up assumes the most favorable situation for entrants; namely, that there is no incumbency and hence all entrants negotiate on an equal foot the creation of coalitions.

\textsuperscript{35} For other constellations of parameters, it can be shown that region 3 may include situations where producers split the surplus with retailers (\(\alpha = \frac{1}{2}\)). For instance, region 3 includes parameters \((A, r, c, \alpha) = (100, 50, 2, 5)\).

\textsuperscript{36} Obviously, the positive assessment of upstream mergers depends of (i) productive efficiency of the bilateral bargaining, and (ii) the fixed number of downstream firms. Such a positive assessment may be no longer under other conditions (e.g., if the consolidation upstream would change the downstream structure)
bargain the exchange of the intermediate good. Since more entry upstream allows retailers to appropriate a larger amount of the additional surplus, ex-ante producers may refrain from entering into the industry if ex-post (i.e., at the bargaining phase) they are not guaranteed a sufficiently high level of revenues. Informally stated, the presence of downstream entry barriers may lead to too powerful retailers, which generates “too much” destructive competition among suppliers. Hence, allowing some consolidation upstream may be good for retailers ex-ante (i.e., at the entry stage), even if ex-post they would prefer to bargain with less consolidated suppliers.

5 Concluding remarks

This paper is a contribution to the understanding of competition policies favoring horizontal mergers in a bilateral oligopoly model in which several up- and downstream firms bargain supply contracts. To this end, we examine the impact of upstream consolidation on industry performance for a given level of downstream competition. We find that, in the presence of downstream entry barriers, consolidation upstream allows producers to retain a higher amount of the rents obtained in the whole industry. Moreover, since firms inside any merger obtain higher profits than outsiders, the final outcome without regulation would be a monopoly in the upstream side of the industry, independently of the original number of producers.

The model also suggests that, taking the structure of the retail segment as given, changes in the structure of the upstream market, in the sense that productive plants are differently shared, does not affect the performance of the whole industry. In particular, the overall equilibrium quantity and the retail price are independent of the upstream market structure and correspond to the (symmetric) Cournot duopoly. Hence, upstream mergers are innocuous for consumers and overall welfare in the short-run.

In the long-run free-entry equilibrium upstream, we obtain the startling result that consumers never benefit from restrictions on upstream mergers, while entry in the upstream market can be excessive or insufficient from a social welfare perspective. In sum, upstream
consolidation is potentially desirable, even without recourse to increases in productive efficiency.

From a regulatory point of view, our results suggest that a tolerant merger policy may benefit consumers. Allowing complete upstream consolidation would surely increase consumer surplus, but it could also lead to excessive upstream entry from a social point of view (once the duplication of fixed costs is taken into account). If the regulator sees a threat of excessive upstream entry, it can restrict entry either by setting a cap to the level of consolidation allowed.
### Table 1 A summary of main notations

<table>
<thead>
<tr>
<th>Notation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>$1, 2, ..., n$</td>
<td>The productive plants or producers in the upstream industry</td>
</tr>
<tr>
<td>$A, B$</td>
<td>The downstream firms or retailers</td>
</tr>
<tr>
<td>$i$</td>
<td>The coalition $i$ of producers or upstream firms with $k_i$ productive plants, $1 \leq i \leq n$</td>
</tr>
<tr>
<td>$k_i$</td>
<td>The number of plants in hands of the coalition $i$ of producers, $1 \leq k_i \leq n$</td>
</tr>
<tr>
<td>$\mu_i$</td>
<td>The share of total capacity owned by the coalition $i$, $\mu_i = k_i / n$</td>
</tr>
<tr>
<td>$\mu^R$</td>
<td>The maximum share of capacity allowed for each coalition $i$, $1/n &lt; \mu^R &lt; 1$</td>
</tr>
<tr>
<td>$Q_{di}$</td>
<td>The amount of production of coalition $i$ for downstream firm $d$, $d=A,B$</td>
</tr>
<tr>
<td>$q_i$</td>
<td>The production per plant of coalition $i$ of producers delivered to each downstream firm, $q_i = Q_i / k_i$</td>
</tr>
<tr>
<td>$Q_{d-i}$</td>
<td>The production for downstream firm $d$ of the rest of coalitions different to coalition $i$, $Q_{d-i} = \sum_{j \neq i} Q_{dj}$</td>
</tr>
<tr>
<td>$Q$</td>
<td>The total output, $Q = Q_A + Q_B$</td>
</tr>
<tr>
<td>$T_{di}$</td>
<td>The money transfer from the downstream firm $d$ to the coalition $i$ of producers</td>
</tr>
<tr>
<td>$t_{di}$</td>
<td>The payment per plant made by downstream firm $d$ to the coalition $i$ of producers, $t_{di} = T_{di} / k_i$</td>
</tr>
<tr>
<td>$T_{d-i}$</td>
<td>The money transfer from the downstream firm $d$ to the rest of coalitions of upstream firms different to coalition $i$, $T_{d-i} = \sum_{j \neq i} T_{dj}$</td>
</tr>
<tr>
<td>$\Pi_i$</td>
<td>The profits of the coalition $i$ of producers</td>
</tr>
<tr>
<td>$\pi_i$</td>
<td>The profits per plant of coalition $i$ of producers, $\pi_i = \Pi_i / k_i$</td>
</tr>
<tr>
<td>$\Pi_d$</td>
<td>The profits of the downstream firm $d$</td>
</tr>
<tr>
<td>$\Pi_i^{Dis}$</td>
<td>The disagreement profits of the coalition $i$ of upstream firms</td>
</tr>
<tr>
<td>$\Pi_d^{Dis}$</td>
<td>The disagreement profits of the downstream firm $d$</td>
</tr>
</tbody>
</table>
Appendix

**Proof of Lemma 1.** A coalition $i$ of upstream firms of size $k_i$ and the downstream firm $A$ agree to produce and deliver the quantity $Q_{Ai}^*$ of intermediate good that solves the problem

\[
\text{Max}_{Q_{Ai}} P( Q_{Ai} + Q_{A-i} + Q_B^*) (Q_{Ai} + Q_{A-i}) - k_i C \left( \frac{Q_{Ai} + Q_{Bi}^*}{k_i} \right),
\]

where each plant produces the same quantity in order to minimize costs. The optimal quantity $Q_{Ai}^*$ (or, in this case, $q_{Ai}^*$) is the one that satisfies the first-order condition

\[
P( Q_{Ai}^* + Q_{A-i} + Q_B^*) (Q_{Ai}^* + Q_{A-i}) + P( Q_{Ai}^* + Q_{A-i} + Q_B^*) - C \left( \frac{Q_{Ai}^* + Q_{Bi}^*}{k_i} \right) = 0.
\]

Consider a duopoly where each upstream firm owns $n/2$ productive plants. Under Assumptions 1 and 2, a solution to the duopoly problem exists and it is unique (see Vives, 2000, pp. 97-99). The first-order condition for a duopolist to be in equilibrium is given by

\[
P(2Q^*)Q^* + P(2Q^*) - C \left( \frac{2}{n} Q^* \right) = 0.
\]

If every productive plant in the upstream market produces the same quantity $q^* = Q^*/n$ for each downstream firm, the first-order condition (A.2) coincides with (A.3). We know that this constitutes an industry equilibrium and that it exists. It is straightforward to see that there is only a symmetric equilibrium or, equivalently, that there cannot be asymmetric equilibria with some upstream plants producing a different quantity to $q^*$. Hence, for any partition of upstream firms in coalitions, the equilibrium is unique and it is given by the quantity $q^*$ that solves the condition

\[
\text{Max}_{Q_{Ai}} P( Q_{Ai} + Q_{A-i} + Q_B^*) (Q_{Ai} + Q_{A-i}) - k_i C \left( \frac{Q_{Ai} + Q_{Bi}^*}{k_i} \right),
\]
This completes the proof of the lemma. 

\textbf{Proof of Lemma 2.} From the fact that

\begin{equation}
\frac{\partial t^*_{Ai}}{\partial k_i} = \frac{\alpha}{k_i^2} \left\{ -\left[ P^* \left( Q^*_{A-i} + Q^*_{B} \right) Q^*_{A-i} + P \left( Q^*_{A-i} + Q^*_{B} \right) \right] \frac{\partial Q^*_{A-i}}{\partial k_i} k_i \right. \nonumber \\
- \left[ P \left( Q^*_{A-i} + Q^*_{A-i} + Q^*_{B} \right) \left( Q^*_{A-i} + Q^*_{A-i} \right) - P \left( Q^*_{A-i} + Q^*_{B} \right) \right] \left\} \right.
\end{equation}

and taking into account that \( \frac{\partial Q^*_{A-i}}{\partial k_i} k_i = -Q^*_{Ai} \), Equation (A.5) becomes

\begin{equation}
\frac{\partial t^*_{Ai}}{\partial k_i} = \frac{\alpha}{k_i^2} \left\{ \left[ P^* \left( Q^*_{A-i} + Q^*_{B} \right) Q^*_{A-i} + P \left( Q^*_{A-i} + Q^*_{B} \right) \right] Q^*_{Ai} \right. \nonumber \\
- \left[ P \left( Q^*_{A-i} + Q^*_{A-i} + Q^*_{B} \right) \left( Q^*_{A-i} + Q^*_{A-i} \right) - P \left( Q^*_{A-i} + Q^*_{B} \right) \right] \left\} \right.
\end{equation}

Finally, considering that (i) \( \left. \frac{\partial t^*_{Ai}}{\partial k_i} \right|_{Q_{Ai}=0} = 0 \), and (ii) \( P^*(Q)Q_d + 2P'(Q) < 0 \) implies that

\begin{equation}
\frac{\partial^2 t^*_{Ai}}{\partial k_i \partial Q_{Ai}} = \frac{\alpha}{k_i^2} \left\{ \left[ P^* \left( Q^*_{A-i} + Q^*_{B} \right) Q^*_{A-i} + P \left( Q^*_{A-i} + Q^*_{B} \right) \right] \right. \nonumber \\
- \left[ P \left( Q^*_{A-i} + Q^*_{A-i} + Q^*_{B} \right) \left( Q^*_{A-i} + Q^*_{A-i} \right) + P \left( Q^*_{A-i} + Q^*_{B} \right) \right] \left\} > 0, \right.
\end{equation}

it follows that \( \frac{\partial t^*_{Ai}}{\partial k_i} > 0 \), as the lemma establishes.
Proof of Proposition 1. Since \( \pi_i = 2 \frac{4L_i}{k_j} - C(2q^*) \), it holds that \( \frac{\partial \pi_i}{\partial k_j} = 2 \frac{\partial l_i}{\partial k_j} > 0 \), by virtue of the result in lemma 2.

Proof of Lemma 4. From the expression (20b), the derivatives of per plant profits’ function of upstream firms with respect to \( n \) and \( \mu^R \) are, respectively, \( \frac{\partial \pi_u}{\partial n} < 0 \) and \( \frac{\partial \pi_u}{\partial \mu^R} > 0 \). Thus, it follows that \( \frac{\partial n}{\partial \mu^R} = -\frac{\partial \pi_u}{\partial \mu^R} \bigg/ \frac{\partial \pi_u}{\partial n} > 0 \).

Proof of Proposition 2. Consumer surplus amounts to \( CS(Q(n)) = \frac{1}{2} (Q(n))^2 = 2 n^2 \left( \frac{A}{3n + 4c} \right)^2 \) and is an increasing function of total capacity \( n \), which, from Lemma 4, is also in the long-run an increasing function of parameter \( \mu^R \).

Proof of Proposition 3.

Consider the free-entry equilibrium number of plants \( n^{FE} = n^{FE}(\alpha, \mu) \) for any set of values of parameters \((A, r, c)\). It is easy to check that \( \frac{\partial W}{\partial n} \bigg|_{n^{FE}=n^{FE}(0,1)} > 0 \) and \( \frac{\partial W}{\partial n} \bigg|_{n^{FE}=n^{FE}(1,1)} < 0 \) (the second inequality can indeed be derived as a special case of proposition 1 in Mankiw and Whinston, 1986).

Both signs of the derivative and continuity for other parameters imply the existence, respectively, of regions 2 and 3 in the Proposition.

From both signs of the derivative, given that (i) \( \frac{\partial n^{FE}}{\partial \alpha} > 0 \) and (ii) \( \frac{\partial^2 W}{\partial (n^{FE})^2} < 0 \), and by continuity in \( \alpha \), there is a value \( \alpha^* \), \( 0<\alpha^*<1 \), implicitly defined by the equation.
\[ (A.8) \]
\[
\left[ \frac{A^2}{r} \alpha + \sqrt{\frac{A^2}{r} \left( \frac{A^2}{r} \alpha^2 - 6\alpha + 18c \right)} \right]^3 \\
+ 60 \frac{A^2}{r} c \left[ \frac{A^2}{r} \alpha + \sqrt{\frac{A^2}{r} \left( \frac{A^2}{r} \alpha^2 - 6\alpha + 18c \right)} \right] - 288 \frac{A^2}{r} c^2 = 0 ,
\]

for which \( \frac{\partial W}{\partial n} \bigg|_{n^{FE} = n^{FE}(\alpha^*, l)} = 0 \), i.e., for which \( n^{FE}(\alpha^*, l) = n^{SB} \). Furthermore, in the locus defined by condition \( n^{SB} = n^{FE}(\alpha, \mu^R) \), it happens that \( \frac{\partial \mu^R}{\partial \alpha} < 0 \). Hence for any consolidation level allowed by the regulator, \( \mu^R \), in the interval \( \left[ \frac{1}{n^{FE}}, 1 \right] \), there is a threshold value \( \alpha = \alpha(\mu^R) \), implicitly defined by condition \( \frac{\partial W}{\partial n} \bigg|_{n^{FE}(\alpha, \mu^R)} = 0 \), that satisfies \( n^{FE}(\alpha, \mu^R) = n^{SB} \).

References


Tribunal de Defensa de la Competencia, “Informe sobre las condiciones de competencia en el sector de la distribución comercial (I 100/02),” 2003 (http://www.tdcompetencia.org).

Parameters: $A = 100, r = 50, c = 0.5$