Divisionalization in Vertical Structures*

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Abstract:
We re-evaluate the incentives to create within-industry independent divisions once the vertical structure of the industry is considered. Divisionalization allows a firm to gain market share in the final market, but each division loses bargaining power in the input market. The less competitive the upstream market, the more important the second effect will be; and this reduces the profitability of divisionalization. As a consequence, firms create fewer divisions in equilibrium. We therefore show that a less competitive upstream segment leads to a lower total number of divisions in equilibrium and a less competitive final market, harming end consumers who will face higher prices.

JEL classification: L10, L11, L20

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1. Introduction

A firm's organizational design influences its competitive advantage in two ways: first because the efficient use of its resources and capabilities is necessary to create value and second, as noted by Sengul (2018), because organizational design influences its ability to capture value in the presence of rivalry in the market. One aspect of organizational design important for the strategy of a firm is whether it adopts an organizational structure with multiple independent divisions. The industrial organization literature has investigated the incentives of firms to create divisions that compete independently in the same market. If a firm creates multiple divisions, value creation is reduced because head-to-head competition for sales by divisions of the same firm leads to lower prices. Yet, it increases the value captured by the firm because the overall market share of the firm increases. As a consequence, divisionalization is a profitable strategic decision for the firm. However, taking into account the strategic decision of all firms in the market to divisionalize, Corchón (1991), Baye, Crocker, and Ju (1996), and Corchón and González-Maestre (2000) obtained the counterintuitive result that as divisionalization costs tend to zero and divisions sell a homogenous good, Cournot competition leads to a perfectly competitive outcome, that is, to the full dissipation of the oligopoly rents, even when there are only two firms in the industry. This equilibrium outcome is the same obtained with Bertrand competition.[1]

In this paper, we re-evaluate the incentives to divisionalize when one considers the vertical structure of an industry. Retail firms must buy a basic input from upstream firms. We assume unobservable contracts in the intermediate market, as in Rey and Tirole (2007), and two suppliers of the input, one more efficient than the other. Downstream firms may create divisions without any fixed setup cost.

As noted above, firms have a strategic incentive to divisionalize in an oligopoly because the creation of independent divisions commits a firm to more aggressive behavior that increases its market share at the expense of rivals. In a vertical relationship, however, there is a countervailing effect: divisionalization reduces the bargaining power of each division against upstream firms. Below, we show that, as a consequence, incentives to divisionalize in a vertical structure are drastically reduced. In a downstream duopoly, the

[1] This equivalence with the Bertrand result extends to the case of cost-asymmetric firms: the divisions of the inefficient firm do not produce at all because in equilibrium price is equal to its marginal cost (Fauli-Oller, 2022).

equilibrium number of divisions is always finite and therefore a perfectly competitive outcome is never attained. In some circumstances, firms do not divisionalize at all.

The fact that we explicitly model the vertical structure of the industry allows us to analyze the connection between upstream and downstream markets. When competition upstream increases, downstream firms obtain better deals from suppliers. In that case, the vertical relationship loses importance, and downstream firms focus on the advantages of divisionalization to gain market share in the final market. Therefore, a less competitive upstream segment ends up causing a less competitive downstream segment as well.

The amount of literature on downstream mergers in a vertical structure is vast (e.g., Dobson and Waterson, 1997; Inderst and Wey, 2003; Lommerud et al., 2006; Fauli-Oller and Bru, 2008; Symeonidis, 2010). Of the existing literature on merger incentives, the paper most similar to ours is that by Fauli-Oller and Bru (2008). These authors study the profitability of exogenous mergers in the same vertical setting as the one considered in the present paper. They find that mergers are profitable if the second source of the input is inefficient enough.

However, while divisionalization can be seen as the reverse of a merger, Mizuno's (2009) study is, to the best of our knowledge, the only one to examine incentives to divisionalize within a vertical organizational structure. Nevertheless, it is important to note that the context in that study differs significantly from ours. Mizuno considers quantity competition both upstream and downstream, assuming symmetric technology and divisionalization incurring a fixed cost. In contrast, our framework is based on a two-part tariff competition among upstream firms, with asymmetric technology and divisionalization without any associated fixed setup cost.

We will show below that the existence of market power in the intermediate market reduces the incentives to create divisions downstream. Consequently, the market equilibrium we obtain differs from the competitive outcome obtained in Corchón (1991), Baye, Crocker, and Ju (1996), and Corchón and González-Maestre (2000). The previous literature on divisionalization has shown that this is not the only way to obtain different equilibria from the perfectly competitive outcome, even with zero fixed costs per division. Ziss (1998) examines inter-firm product differentiation and finds that in equilibrium firms create a finite number of divisions with a decreasing degree of product differentiation (see also Yuan, 1999). A finite number of divisions is also obtained if one considers homogenous products with increasing marginal costs (Zhou, 2013). González-Maestre (2000) considers the situation where after firms choose the number of divisions, the divisions choose the weight given to sales in the incentive packages of the managers running the divisions. He finds that no divisionalization takes place in duopoly. In Tesoriere (2021), firms decide on the number of divisions and then invest a fixed amount, *F*, to obtain a drastic cost-reducing innovation. For intermediate values of *F*, firms do not divisionalize and do not invest because if one firm divisionalizes, the competitor will find it profitable to invest and the divisionalized firm will be expelled from the market.

In Section 2, we briefly revisit the framework of unobservable contracts we use to model the vertical relationship between firms and present the main result of the paper. In Section 3, we study the effect of upstream competition on the relevant equilibrium market variables. In Section 4, we provide the main conclusions of our analysis.

2. The model and its main result

We consider a downstream market in which two firms, $i = A, B$, transform one unit of input into one unit of final product without additional costs of production.[2] The final product they sell is homogeneous, and its demand is given by $P(Q) = \alpha - Q$. The downstream firms buy the intermediate input from upstream firms. There is an upstream firm *U* that produces the input at marginal cost $\underline{c} \geq 0$. There also exists a (less efficient) alternative source for the input[3] at marginal cost $\overline{c}$ that we assume satisfies[4] $\underline{c} < \overline{c} < \frac{2\alpha+\underline{c}}{3} < \alpha$.

Upstream and downstream firms set vertical contracts that establish the terms under which inputs are transferred. We model this vertical relationship following the framework in Rey and Tirole (2007), where contracts are secret (or unobservable) and firms have passive conjectures. After contracts are set, downstream firms choose the amount of output they produce.

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[2] We could generalize the analysis to the case of more than two downstream firms and the main results would still hold. Therefore, for the sake of simplicity, we present the results for two downstream firms.

[3] This alternative source of input can be in-house production, a second upstream firm that competes with *U* on tariffs, or a competitive fringe. In any case, the relevant assumption is that divisions obtain this alternative source of input at marginal cost $\overline{c}$.

[4] Condition $\overline{c} < \frac{2\alpha+\underline{c}}{3}$ ensures that without divisionalization, a downstream firm always earn strictly positive profits, even when it is forced to use this alternative source of input because there is no agreement with upstream firm *U*.

We want to address how the process discussed above is affected by the decision of downstream firms to act through divisions. These divisions will be independent both (i) in bargaining with suppliers and (ii) deciding the level of sales in the final market. In contrast to previous work on divisionalization that concentrates on point (ii), we want to stress the importance of the interaction of both decisions. Downstream firms may create as many independent divisions without any fixed setup cost, as they find it is in their private interest. The full game we consider has the following stages:

Stage 1: Downstream firms A and B decide their firm structure, namely the number of divisions, n_A and n_B.

Stage 2: Upstream firms secretly offer each division a contract; each division chooses a supplier, orders a quantity of input, and pays accordingly.

Stage 3: Divisions transform input into final products and compete in the final market à la Cournot.

Notice that we assume that the level of divisionalization is chosen before supply contracts are settled. We believe that divisionalization is a decision that affects firms and market structure and so is a decision that cannot be easily changed. However, supply contract terms are easier to modify and adapt. The order of the stages we propose here reflects these considerations.

Upstream firms offer two-part supply contracts. When supply contracts are secret and divisions have passive conjectures, the equilibrium in the final product market is unique and characterized by the Cournot quantities with $n = n_A + n_B$ players that produce at marginal cost $\underline{c}$ (see, for instance, Rey and Tirole, 2007) because in equilibrium U serves all divisions and sets a two-part tariff that has a marginal wholesale price $w = \underline{c}$. Thus, in equilibrium each division produces the Cournot quantity $q^c(n)$ and obtains Cournot profits $\pi^c(n)$.

Downstream firms always have the option to use the less efficient input and produce at marginal cost $\overline{c}$. Competition between upstream firms drives down payments for input until downstream firms are indifferent between producing at high and low marginal costs. More specifically, the efficient firm U supplies all divisions for a fixed fee equal to the following expression:

$$\pi^c(n) - \max_{q \geq 0}\{P\big((n-1)q^c(n) + q\big) - \overline{c}\}q, \tag{1}$$

and hence each division has net profits equal to the profits it would obtain *off* the equilibrium path with the second source of input,[5]

$$\pi^D(n) \equiv \max_{q\geq 0}\{P\big((n-1)q^c(n)+q\big)-\overline{c}\}q. \quad (2)$$

With linear demand $P(Q)=\alpha-Q$, each division's production in equilibrium is $q^c(n)=\frac{\alpha-\underline{c}}{n+1}$, and in case of disagreement with U,[6] each division produces the quantity that solves the problem in (2),

$$q^{off}(n) = \arg\max_{q}\{P\big((n-1)q^c(n)+q\big)-\overline{c}\}q = max\left\{0,\frac{\alpha-\underline{c}}{n+1}\left(1-\frac{(n+1)(\overline{c}-\underline{c})}{2(\alpha-\underline{c})}\right)\right\}. \quad (3)$$

The firm's net profits are then

$$\pi^D(n) = \left(q^{off}(n)\right)^2. \quad (4)$$

Therefore, in order to evaluate the profits of each division, downstream firms must consider the effect of the total number of divisions *n* in $\pi^D(n)$. In the earliest stage of the game, each downstream firm chooses its optimal number of divisions; that is, each chooses the number of divisions that solves

$$\max_{n_i} \Pi^i(n_i,n_j) = n_i\,\pi^D\big(n_i+n_j\big) \text{ where } \forall i=A,B \text{ and } i\neq j. \quad (5)$$

The optimal number of divisions satisfies the first-order condition (FOC) of the problem in (5). The marginal revenue for a downstream firm with an additional division has two terms, the increase in revenues from an additional division and the reduction in profits per division due to the increase in competition in the final market:

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[5] Notice that rival divisions expect an agreement between U and each division and thus produce the aggregate quantity $(n-1)\,q^c(n)$.

[6] For a sufficiently high number of total divisions, each division faces a residual demand such that $P\big((n-1)q^c(n)\big)<\overline{c}$. In such a case, the second source is irrelevant; the efficient upstream firm may reap all the rents from the vertical relationship, and π^D is driven down to zero.

$$\frac{\partial \Pi^i}{\partial n_i} = \pi^D + n_i \frac{\partial \pi^i}{\partial n_i}. \qquad (6)$$

The literature on divisionalization shows that with a linear demand the marginal revenue of divisions is equal to zero, at $n_i = R(n_j) = n_j+1$ $\forall i = A, B$ and $i \neq j$. The incentives to obtain a larger share in the market are so strong that in equilibrium firms dissipate all the rents through an excessive number of divisions.[7] In our model, the FOC (6) becomes:

$$\frac{\partial \Pi^i}{\partial n_i} = \pi^D + n_i \frac{\partial \pi^i}{\partial n_i} = \left\{\left[P\left((n-1)q^c(n) + q^{off}\right) - \overline{c}\right] + \left[n_i P' \frac{\partial (n-1)q^c}{\partial n_i}\right]\right\} q^{off} = 0. \qquad (7)$$

When we compare the marginal revenue of an additional division in our case and in the literature we see that:

(i) The profits of a division are now affected by the efficiency of the second source because the rents that the more efficient upstream firm extracts to the division is increasing in $\overline{c}$; this is reflected in the first term in brackets in (7), the mark-up off the equilibrium path, which is the relevant one for downstream firms.

(ii) However, the reduction in profits per division as the number of divisions increase occurs through the change in the production of rivals. This is the second term in brackets in (7). Rivals produce at low marginal costs ($\underline{c}$); this effect is basically the same in our model as in any other standard paper on divisionalization.

Thus, the vertical structure of the industry reduces the positive incentives to set divisions but does not change the negative incentives. For a linear demand, the FOC (7) becomes

$$\frac{\partial \Pi^i}{\partial n_i} = \left\{\frac{\alpha - \underline{c}}{(n+1)^2}\left(n_j + 1 - n_i\right) - \frac{\overline{c} - \underline{c}}{2}\right\} q^{off} = 0, \qquad (8)$$

where $q^{off} = \frac{\alpha - \underline{c}}{n+1} - \frac{\overline{c} - \underline{c}}{2}$, which leads to the best-response function

$$n_i = R(n_j) = \frac{\left((\alpha - \underline{c})^2 + 4(\alpha - \underline{c})(\overline{c} - \underline{c})(n_j + 1)\right)^{1/2} - (\alpha - \underline{c}) - (\overline{c} - \underline{c})(n_j + 1)}{\overline{c} - \underline{c}}. \qquad (9)$$

[7] This is a negative externality of what Sengul (2018) refers to as structural cannibalization.

Notice that the optimal number of divisions $n_i = R(n_j)$ now satisfies $R(n_j) < n_j + 1$. The fact that $\overline{c} > \underline{c}$ decreases the mark-up of a division forced to produce under the alternative and $n_i P' \frac{\partial (n-1) q^c}{\partial n_i} = -\frac{2n_i}{(n+1)^2}(\alpha - \underline{c})$ is kept constant implies that increases in $\overline{c}$ reduce the incentives to divisionalize, $\frac{\partial R(n_j)}{\partial \overline{c}} < 0$; $R(n_j)$ approaches $n_j + 1$ as $\overline{c}$ approaches $\underline{c}$, that is, as the difference in costs between suppliers vanishes we obtain in the limit the standard result (see Corchón, 1991; Baye, Crocker, and Ju, 1996) that -when divisionalization has no fixed costs and the vertical structure of the industry is assumed away- each firm wants to set one more division than its rival, which drives them to the competitive outcome.

The strategic response to divisionalization by the rival firm is affected as follows: The impact of changes in n_j on the best-response function, $\frac{\partial R(n_j)}{\partial n_j} = \frac{2(\alpha - \underline{c})}{\left((\alpha - \underline{c})^2 + 4(\alpha - \underline{c})(\overline{c} - \underline{c})(n_j + 1)\right)^{1/2}} - 1$, is positive only if $1 \leq n_j < \frac{3(\alpha - \underline{c}) - 4(\overline{c} - \underline{c})}{4(\overline{c} - \underline{c})}$. Hence, for low levels of divisionalization, divisions are strategic complements, and a firm reacts to an increase of divisionalization by its rivals by also creating more divisions, while divisions become strategic substitutes for higher levels of divisionalization, and the maximum number of divisions that a firm will create is $R\left(\frac{3(\alpha - \underline{c}) - 4(\overline{c} - \underline{c})}{4(\overline{c} - \underline{c})}\right) = \frac{\alpha - \underline{c}}{4(\overline{c} - \underline{c})}$. Figure 1 shows the best-response function when parameter values are $\alpha = 1, \underline{c} = 0, \overline{c} = 2/25$. When we evaluate the equilibrium number of divisions under a linear demand, we obtain the following result.

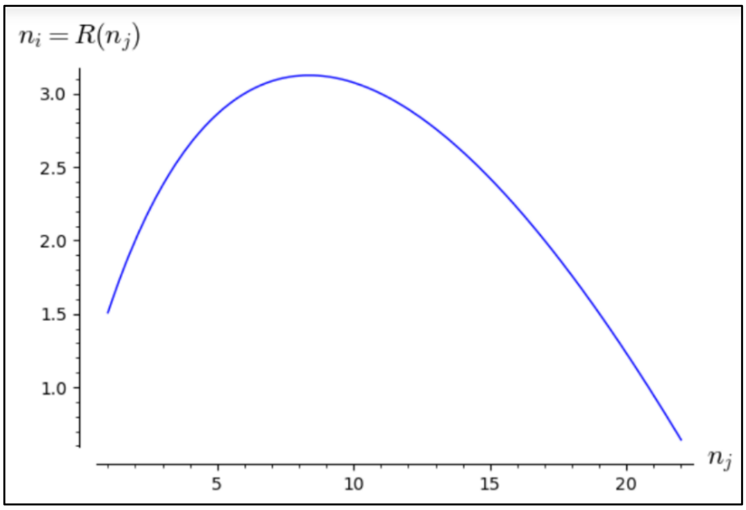

Figure 1. Best-response function $n_i = R(n_j)$ ($\alpha = 1, \underline{c} = 0, \overline{c} = 2/25$).

Proposition 1. *In equilibrium, downstream firms choose the number of divisions.*

$$n_A^* = n_B^* = \begin{cases} \frac{1}{2}\left[\left(2\frac{\alpha-\underline{c}}{\overline{c}-\underline{c}}\right)^{1/2} - 1\right] & if \quad \overline{c} \in \left(\underline{c}, \frac{2\alpha+7\underline{c}}{9}\right) \\ 1 & if \quad \overline{c} \in \left[\frac{2\alpha+7\underline{c}}{9}, \frac{2\alpha+\underline{c}}{3}\right) \end{cases}$$

For low levels of $\overline{c}, \overline{c} \in \left(\underline{c}, \frac{2\alpha+7\underline{c}}{9}\right)$, *firms create a finite number of divisions* $n_A^* = n_B^* > 1$. *For high levels of* $\overline{c}, \overline{c} \in \left[\frac{2\alpha+7\underline{c}}{9}, \frac{2\alpha+\underline{c}}{3}\right)$, *firms do not divisionalize at all,* $n_A^* = n_B^* = 1$. *In the equilibrium number of divisions, downstream firms obtain strictly positive profits.*

Proof. With a linear demand, $\frac{\partial \Pi^i}{\partial n_i}$ is defined in (8) as

$$\frac{\partial \Pi^i}{\partial n_i} = \left\{\frac{\alpha-\underline{c}}{(n+1)^2}(n_j+1-n_i) - \frac{\overline{c}-\underline{c}}{2}\right\} q^{off}$$

$\forall i = A, B$ and $i \neq j$. If $\overline{c} \in \left(\underline{c}, \frac{2\alpha+7\underline{c}}{9}\right)$ and we take the number of divisions as a continuum number $n_i, n_j \geq 1$, the equilibrium in divisions $n_A^* = n_B^* = \frac{1}{2}\left[\left(2\frac{\alpha-\underline{c}}{\overline{c}-\underline{c}}\right)^{1/2} - 1\right]$ stated in Proposition 1 solves $\frac{\partial \Pi^i}{\partial n_i} = 0$. And this is indeed a global maximum of a firm's maximization because the term in brackets $\frac{\alpha-\underline{c}}{(n+1)^2}(n_j+1-n_i) - \frac{\overline{c}-\underline{c}}{2}$ is decreasing in n_i, and therefore $\frac{\partial \Pi^i}{\partial n_i}$ is positive iff $n_i < R(n_j)$.[8] For $\overline{c} \in \left[\frac{2\alpha+7\underline{c}}{9}, \frac{2\alpha+\underline{c}}{3}\right)$, if $n_j = 1$ we have that $\left.\frac{\partial \Pi^i}{\partial n_i}\right|_{n_i=1} < 0$, and therefore firms do not divisionalize in equilibrium. ■

The literature on divisionalization has shown that in an oligopoly market, the strategic incentives to increase the market share of a firm lead to the full dissipation of oligopolistic rents through the excessive creation of divisions. To avoid perfect competition as the outcome of the divisionalization process, previous papers need to exogenously impose a restriction on the number of divisions that firms may create: an ad-hoc upper bound, fixed costs of divisionalization, etc. We obtain the same result by taking into account the vertical relationships within the industry.

Indeed, for a sufficiently inefficient alternative, in equilibrium *downstream firms do not divisionalize at all*, but in any case, *downstream firms choose a finite number of divisions*. Figure 2 shows the best-response functions and the number of divisions in equilibrium, $n_A^* = n_B^* = 2$, when parameter values are $\alpha = 1, \underline{c} = 0, \overline{c} = 2/25$.

[8] We have $\frac{\partial^2 \Pi^i}{\partial n_i^2} < 0$ iff $n_i \in \left[1, \frac{2(\alpha-\underline{c})-(\overline{c}-\underline{c})(n_j+1)}{(\alpha-\underline{c})+(\overline{c}-\underline{c})(n_j+1)}(n_j+1)\right)$, where $R(n_j) < \frac{2(\alpha-\underline{c})-(\overline{c}-\underline{c})(n_j+1)}{(\alpha-\underline{c})+(\overline{c}-\underline{c})(n_j+1)}(n_j+1)$; and for $n_i \in \left[\frac{2(\alpha-\underline{c})-(\overline{c}-\underline{c})(n_j+1)}{(\alpha-\underline{c})+(\overline{c}-\underline{c})(n_j+1)}(n_j+1), 2\frac{\alpha-\underline{c}}{\overline{c}-\underline{c}} - (n_j+1)\right]$ we have $\frac{\partial \Pi^i}{\partial n_i} < 0$ and $\frac{\partial^2 \Pi^i}{\partial n_i^2} > 0$, with $\Pi^i = 0$ at $n_i = 2\frac{\alpha-\underline{c}}{\overline{c}-\underline{c}} - (n_j+1)$ because for this value of n_i divisions cannot profitably produce using the alternative source of input. Therefore, $q^{off} = 0$.

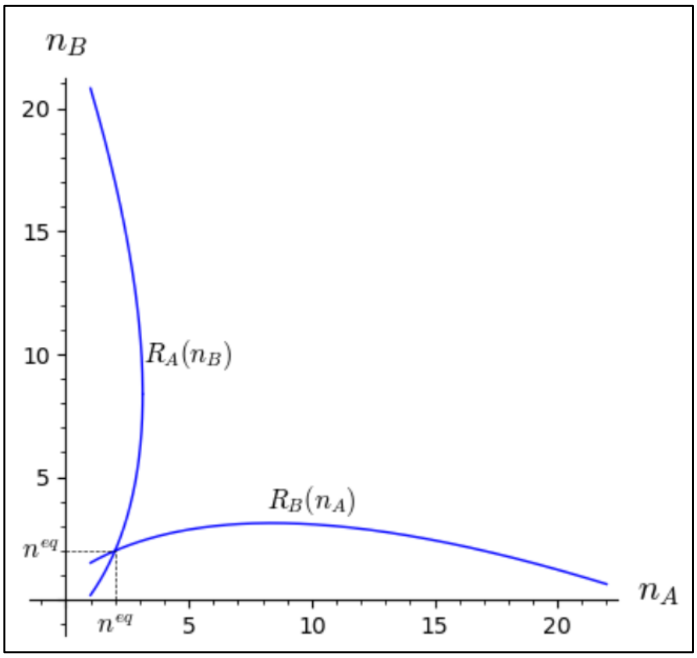

Figure 2. Equilibrium with a finite number of divisions ($\alpha = 1, \underline{c} = 0, \overline{c} = 2/25$)

3. The effect of upstream market competition on market performance

The result we obtain in Proposition 1 is the main one of this paper, and it allows us to analyze how changes in the level of competition upstream affects the overall performance of the industry. We start by looking at the comparative statics of the final price with respect to the differences in costs $\overline{c} - \underline{c}$, which measures the level of competition upstream. The final price is $p = \frac{1}{n_A+n_B+1}\left(\alpha + (n_A + n_B)\underline{c}\right)$, which is decreasing in the total number of divisions n. For the number of divisions in equilibrium, the final price becomes:

$$p^* = \begin{cases} \left(\frac{(\alpha-\underline{c})(\overline{c}-\underline{c})}{2}\right)^{1/2} + \underline{c} & if \quad \overline{c} \in \left(\underline{c}, \frac{2\alpha+7\underline{c}}{9}\right) \\ \left(\frac{\alpha+2\underline{c}}{3}\right) & if \quad \overline{c} \in \left[\frac{2\alpha+7\underline{c}}{9}, \frac{2\alpha+\underline{c}}{3}\right) \end{cases}.$$

When downstream firms are essentially dependent on a single source for obtaining the intermediate input because of the very limited or virtually no competition upstream, this leads to the lowest level of downstream competition (no divisionalization at all). This results in the highest final price, which increases with $\underline{c}$. Without divisionalization, as in

Rey and Tirole (2007), the final price does not depend on competition upstream because input contracts are efficient. The only effect is that rents are redistributed from suppliers to downstream firms.

However, when the alternative source (the less efficient upstream firm) becomes viable for obtaining the input, the increasing downstream competition resulting from divisionalization leads to lower final prices. Nevertheless, the final price is strictly above $\underline{c}$ when $\overline{c} > \underline{c}$ increases in $\overline{c}$ and only converges to the competitive price as the cost differential vanishes. Therefore, we find that consumers benefit if the less efficient suppliers catch up with the efficient one and $\overline{c}$ approaches $\underline{c}$ because more competition upstream is reflected in the final price through an increase in competition downstream. In our model, input contracts are also efficient, and the result is obtained through the effect of upstream rivalry on the number of divisions. Given that the final price is always higher than marginal cost $\underline{c}$, social welfare evolves as consumer surplus, so that it is also decreasing with $\overline{c}$. Therefore, we can state the following result:

Proposition 2. *Final consumer surplus and social welfare decrease with $\overline{c}$ and increase with upstream competition*.

We have seen that more competition upstream always benefits consumers. However, this is not necessarily the case for downstream firms. If $\overline{c}$ decreases, U must charge downstream firms a lower fee, but then each division is more valuable, and downstream firms are more tempted to increase their market share, which reduces the overall level of industry profits. When evaluated at the equilibrium number of divisions stated in Proposition 1, if $\overline{c} \in \left(\underline{c}, \frac{2\alpha+7\underline{c}}{9}\right)$, downstream firms create divisions and have profits

$$\Pi^i = n_i^* \left(q^{off}(n_A^* + n_B^*)\right)^2 = \frac{(\overline{c}-\underline{c})^2}{8}\left[\left(2\,\frac{\alpha-\underline{c}}{\overline{c}-\underline{c}}\right)^{1/2} - 1\right]^3, \tag{10}$$

and if $\overline{c} \in \left[\frac{2\alpha+7\underline{c}}{9}, \frac{2\alpha+\underline{c}}{3}\right)$, they do not create divisions and have profits:

$$\Pi^i = \left(q^{off}(2)\right)^2 = \left(\frac{2\alpha+\underline{c}-3\overline{c}}{6}\right)^2. \tag{11}$$

When we evaluate how profits in (10) and (11) evolve when $\overline{c}$ changes, we obtain the following result:

Proposition 3. *The profits of downstream firms strictly increase in* $\overline{c}$ *when* $\overline{c} \in \left(\underline{c}, \frac{\alpha+7\underline{c}}{8}\right)$, *strictly decrease when* $\overline{c} \in \left(\frac{\alpha+7\underline{c}}{8}, \frac{2\alpha+\underline{c}}{3}\right)$ *and reach a maximum at* $\overline{c} = \frac{\alpha+7\underline{c}}{8}$.

Proof. In the values of $\overline{c}$ for which downstream firms create divisions in equilibrium, $\overline{c} \in \left(\underline{c}, \frac{2\alpha+7\underline{c}}{9}\right)$, we have for profits in (10) that:

$$\frac{\partial \Pi^i}{\partial \overline{c}} = \frac{\overline{c}-\underline{c}}{16}\left[\left(2\frac{\alpha-\underline{c}}{\overline{c}-\underline{c}}\right)^{1/2} - 1\right]^2 \left[\left(2\frac{\alpha-\underline{c}}{\overline{c}-\underline{c}}\right)^{1/2} - 4\right]. \qquad (12)$$

We can see that $\frac{\partial \Pi^i}{\partial \overline{c}} > 0$ for $\overline{c} \in \left(\underline{c}, \frac{\alpha+7\underline{c}}{8}\right)$, $\frac{\partial \Pi^i}{\partial \overline{c}} = 0$ at $\overline{c} = \frac{\alpha+7\underline{c}}{8}$, and $\frac{\partial \Pi^i}{\partial \overline{c}} < 0$ for $\overline{c} \in \left(\frac{\alpha+7\underline{c}}{8}, \frac{2\alpha+7\underline{c}}{9}\right)$. For larger values of $\overline{c}$, downstream firms do not create divisions, and their profits (11) decrease in $\overline{c}$. ■

The endogenous determination of divisions changes the intuitive result obtained when the number of downstream competitors is fixed. One may tend to think that facing more powerful suppliers should hurt downstream firms because then the profits they can obtain using the second source supplier are lower. However, in our context, there is a countervailing force, namely that more powerful suppliers induce downstream firms to create fewer divisions, which reduces competition downstream and increases their profits. Proposition 3 states that this latter (strategic) effect dominates the former when suppliers are not very powerful (i.e., when $\overline{c}$ is not very high) and downstream firms are creating many divisions.

Comparing Proposition 2 with Proposition 3, one can conclude that the interests of consumers and downstream firms are not aligned as far as the optimal degree of competition upstream is concerned. Consumers prefer perfect competition upstream, while downstream firms prefer that the efficient supplier conserves some market power. This divergence can create controversy between both parties when the government must take measures that affect upstream competition.

For example, suppose that in the upstream sector apart from firm U we have two additional firms (1 and 2) whose marginal costs of production satisfy $\underline{c} < c_1 < c_2 \leq \frac{\alpha+7\underline{c}}{8}$.

Suppose that before the game described above is played, firm U and firm 1 propose to merge, and the merger should be allowed to proceed by the Antitrust Authority. Downstream firms will then try to persuade the Antitrust Authority to approve the merger, while consumer organizations will try to stop it.

The result in our model that an increase in the (relevant) cost of the divisionalized firm may end up increasing its profits is akin to what happens in Baye et al. (1996). They consider a model where the divisionalized firm has to bear a fixed cost per division. It turns out that the equilibrium profits of the divisionalized firm increases when the fixed cost increases. The explanation is the same as in our model: the cost increase limits the extent of divisionalization. The only difference is that this (paradoxical) result always holds in Baye et al. (1996), while in our case it only holds for low enough costs. Apart from that, the signs of the comparative statics of the other equilibrium variables with respect to the cost increase are the same in both models (see Baye et al., 1996, p. 229): the cost increase reduces output, the number of divisions, and the output of each divisionalized firm while it increases the profits and the output per division.

4. Concluding remarks

This paper analyzed the incentives of downstream firms to create divisions when we take into account the vertical structure of an industry. We show that firms divisionalize less that what was suggested in previous related work. Excessive divisionalization reduces the bargaining power against upstream firms, and this effect countervails the usual strategic incentive to divisionalize in order to gain market share in the final market.

This result is in accordance with the evolution of different industries, for example the US food sector, where there has been a parallel process of consolidation in food processing and retailing (Sexton, 2000, 2013). Kastrinaki and Stoneman (2011) also provide evidence from seven of the eight EU countries studied, indicating that merger activity in food manufacturing has led to merger activity in food retailing. They suggest that this phenomenon may be attributed to retailers' efforts, via consolidation, to bolster their countervailing market power to obtain better deals from suppliers.

In another industry quite distant from the food sector, Ben-Yosef (2005) highlights that the consolidation and concentration trend within U.S. airlines during the 1990s was, in part, a response to mergers, acquisitions, and strategic alliances occurring within input markets, such as equipment manufacturing and related services. This parallel consolidation process also aligns with our findings.

As the strategic incentives to consolidate are similar to the ones to reduce divisionalization, it would be worthwhile analyzing changes in the level of divisionalization related to changes in market power along the chain supply. When we compare the model with vertical relations without divisionalization (see Caprice, 2005) and with divisionalization, a very important difference emerges. With divisionalization, the level of competition upstream reduces the price paid by consumers, while this effect is absent without divisionalization. Although in both situations downstream players are supplied by the efficient firm at its marginal cost, with divisionalization upstream, competition reduces final prices because it stimulates the creation of divisions by downstream parent firms.

As upstream competition is negatively affected by upstream consolidation, this different result in both models has important implications regarding the empirical predictions of the models and their policy implications. With divisionalization, upstream mergers between efficient suppliers will increase the cost downstream divisions pay if they do not reach an agreement with the dominant supplier and will trigger a process of consolidation downstream as downstream firms close down divisions. As previously mentioned, this parallel process of consolidation in both the upstream and downstream sectors has been documented in several studies.

However, if the objective of the Antitrust Authority is either consumer surplus or total welfare (in particular, it does not care about how producers' surplus is divided between the upstream and the downstream sectors), a very different antitrust policy is implied by the two models. The model without divisionalization implies a very lenient policy regarding upstream mergers because they do not affect final prices. On the contrary, in the model with divisionalization upstream mergers (that increase the cost of the second source supplier) should be forbidden because they reduce competition downstream, and as a consequence final consumers end up paying a higher price.

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