E C O N O M I C S   B U L L E T I N

Merger, spin−off and divestiture: insights from a spatial model

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Abstract

Mergers and spin−offs are typically opposite strategies for firms, and are not simultaneously profitable in a standard linear Cournot model. We propose a simple spatial Cournot framework, where merger is profitable but subsequent divisionalization is even more. However, this is true only for partial spin−off, not for total divisionalization, due to the opportunity for specific efficiency gains in a spatial setting. Finally, the resulting market structure is analyzed in terms of a post−merger divestiture required by the merger control authority. We show here the divestiture can be profitable for firms even if the merger was not, while still fulfilling its corrective role.

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1. Introduction

Merger and divisionalization are by definition opposite strategies for firms. Moreover, they are mutually exclusive for Cournot firms from the profitability viewpoint, at least as long as the linearity assumptions on demand and cost functions are maintained. Early contributions on merger theory pointed out the (un)profitability paradox for Cournot mergers (see Salant et al (1983)), whereas the literature on divisionalization in a Cournot industry established that firms have unilateral incentives to form independent competing units (see Corchon (1991), Polasky (1992), Baye et al. (1996) and Corchon and Gonzalez-Maestre (2000)). With constant identical marginal costs and product homogeneity, Cournot merging partners acting jointly necessarily contract output and thus provide a positive externality for outsiders, hence the profitability paradox. In contrast, divisionalization represents a credible commitment to increase output, which allowed Polasky (1992) and Baye et al (1996) to conclude, under the same hypotheses as Salant et al. (1983), on the profitability of divisionalization for a set of firms that would find merger unprofitable.

This paper tackles the opposition between the two, by studying in a simple spatial Cournot model the optimality of complete integration of affiliates through merger, despite its proven profitability[1]. We find that the highest post-merger profit is actually obtained by only partially integrating affiliates.

In a non-spatial model with heterogenous constant marginal costs, Tombak (2002) discusses precisely this decision to consolidate or not following a takeover. Merger profitability is restored if affiliates are run separately as independent divisions. This is made possible in his framework by cost differentials, which enable profitable technology transfers between affiliates. He also studies the link between integration and opportunity to monopolize a market[2], and concludes that consolidation of affiliates is optimal only for a monopoly, or, in the limit case, for a firm prevented from further acquisitions by the anti-trust agency.

Our very simple framework conforms with this conclusion, in as much as the merged entity fares better by running independent divisions. However, we contradict the optimality of total divisionalization (i.e. single-store divisions) in a framework with multi-store affiliates. This allows us to discuss the impact of divestitures for merger profitability, since spin-offs are basically asset transfers

[1] By creating delivery cost differentials, the spatial framework allows merging firms to profitably coordinate output decisions, provided they relocate (see McAffe et al. (1992) and Norman and Pepall (1998, 2000)).

[2] See also Kamien and Zang (1990,1993)

between firms. We find that divesting is profitable even when merging is not, although it stills fulfills its corrective role to lower the price. This may be a rationale for unprofitable mergers, which may be submitted so as to entail profitable divestitures afterwards.

2. Model

Consider the following very simple framework. An infinite number of consumers are uniformly located on the unit segment. Three Cournot firms produce a homogeneous good with the same technology exhibiting constant marginal costs, normalized to zero. Two firms are single-store, whereas the third one operates three outlets. For ease of exposition, let stores 1, 2 and 3 be jointly owned, whereas plants 4 and 5 be individually run. Plant's i location is denoted by x_i, $i = 1, 2, 3, 4, 5$. At any consumer location x on the segment, $x \in [0; 1]$, demand is given by $p(x) = a - Q(x)$, $a > 0$, where $p(x)$ is the product price at that location and $Q(x)$ is the total output supplied at x. Firms incur transport costs $(t\,|x - x_i|)$, linear in distance and quantity, in order to ship output to consumers. t is a positive constant, but since the transport cost parameter enters as a multiple in the profits expression, for our profitability analysis assume $t = 1$ without loss of generality[3]. Consumers have a prohibitive costly transport cost, preventing arbitrage, so firms can and will price discriminate across the set of spatially differentiated markets. Given constant marginal delivery costs, a set of independent Cournot equilibria obtains for each location x. There are no set-up or (re)location costs, nor merging or spinning-off costs. Let $a > 1.5$, so that each firm supplies a positive quantity at every local market.

Two mergers to duopoly are possible in this framework. We restrict our analysis to the merger between the three-store firm and one of its single-store competitors, since this will yield a sufficient number of outlets for the resulting entity to allow the discussion of meaningful divestitures[4].

The discussion is organized as follows: first we identify the post-merger equilibrium with centralized decision-making, and check corresponding merger profitability[5]. We consider a simple two-period post-merger game: firms relocate

[3] Equivalently, let a be the transport-cost adjusted reservation price.

[4] When two single-store firms merge, discussing divestitures cannot be relevant, since divesting one of the two plants implies that the merger should not have occured in the first place.

[5] Norman and Pepall (2000) made clear that Cournot spatial mergers involving centralized decisions can only be profitable if stores relocate.

simultaneously and then simultaneously play Cournot. The equilibrium concept is the subgame perfect Nash equilibrium. Finally, we show that partial spin-off increases the merged entity's profit, and interpret this in terms of divestiture-based outcome.

Merger

To discuss merger profitability, we identify first the location equilibria before and after merger.

Pre-merger pattern

The analysis of Pal and Sarkar (2002) shows that both single-store firms locate at the market center, together with one of the 3-store firm's outlets, whereas its remaining two stores are symmetrically located around 1/2. Denote 1 and 2 these two outlets, whose locations x_1 and $x_2 = 1 - x_1$ are determined by the First Order Conditions on the 3-store firm's profit, which writes

$$\Pi_{1,2,3} = 2\left(\begin{array}{c} \int_0^{x_1}\left(\frac{a-3(x_1-x)+2(1/2-x)}{4}\right)^2 dx + \int_{x_1}^{\frac{x_1+1/2}{2}}\left(\frac{a-3(x-x_1)+2(1/2-x)}{4}\right)^2 dx \\ + \int_{\frac{x_1+1/2}{2}}^{1/2}\left(\frac{a-3(1/2-x)+2(1/2-x)}{4}\right)^2 \end{array}\right)$$

$= \frac{1}{64}a + \frac{9}{128}x_1 + \frac{3}{16}ax_1 + \frac{1}{16}a^2 - \frac{33}{64}x_1^2 + \frac{23}{32}x_1^3 - \frac{9}{16}ax_1^2 + \frac{7}{768}$

$\Rightarrow \frac{\partial}{\partial x_1}\Pi_{1,2,3} = \frac{3}{16}a - \frac{33}{32}x_1 - \frac{9}{8}ax_1 + \frac{69}{32}x_1^2 + \frac{9}{128} = 0$. The solution satisfying the Second Order Condition is $x_1^* = \frac{6}{23}a - \frac{1}{23}\sqrt{20a + 36a^2 + 13} + \frac{11}{46}$. Given that the profit of the single-store merger partner writes

$$\Pi^4 = 2\left(\begin{array}{c} \int_0^{x_1}\left(\frac{a-3(1/2-x)+(x_1-x)+(1/2-x)}{4}\right)^2 dx + \int_{x_1}^{\frac{x_1+1/2}{2}}\left(\frac{a-3(1/2-x)+(x_1-x)+(1/2-x)}{4}\right)^2 dx \\ + \int_{\frac{x_1+1/2}{2}}^{1/2}\left(\frac{a-3(1/2-x)+2(1/2-x)}{4}\right)^2 \end{array}\right),$$

the pre-merger global profit of the merging partners is given by $[\Pi_{1,2,3} + \Pi^4]$ evaluated in $x_1^* = \frac{6}{23}a - \frac{1}{23}\sqrt{20a + 36a^2 + 13} + \frac{11}{46}$.

Post-merger pattern

After merger, the remaining single-store firm (denoted 5) does not relocate, whereas the merged entity locates two stores within each half-segment, symmetrically around the mid-point (as shown by Pal and Sarkar (2002)). The merged firm's profit writes:

$$\Pi_{1,2,3,4}^M = 2\left(\begin{array}{c} \int_0^{x_1^M}\left(\frac{a-2(x_1^M-x)+(\frac{1}{2}-x)}{3}\right)^2 dx + \int_{x_1^M}^{\frac{x_1^M+x_2^M}{2}}\left(\frac{a-2(x-x_1^M)+(\frac{1}{2}-x)}{3}\right)^2 dx \\ + \int_{\frac{x_1^M+x_2}{2}}^{x_2^M}\left(\frac{a-2(x_2^M-x)+(\frac{1}{2}-x)}{3}\right)^2 dx + \int_{x_2^M}^{1/2}\left(\frac{a-2(x-x_2^M)+(\frac{1}{2}-x)}{3}\right)^2 dx \end{array}\right)$$

where x_1^M and x_2^M are the locations of the left-hand side outlets.

The First Order Conditions are in turn given by:

$\frac{\partial}{\partial x_1^M}\Pi_{1,2,3,4}^M = \frac{2}{9}x_2^M - \frac{2}{3}x_1^M - \frac{4}{3}ax_1^M + \frac{4}{9}ax_2^M + \frac{2}{9}x_1^M x_2^M + \frac{13}{9}\left(x_1^M\right)^2 - \frac{1}{3}\left(x_2^M\right)^2$ and
$\frac{\partial}{\partial x_2^M}\Pi_{1,2,3,4}^M = \frac{4}{9}a + \frac{2}{9}x_1^M + \frac{2}{9}x_2^M + \frac{4}{9}ax_1^M - \frac{4}{3}ax_2^M - \frac{2}{3}x_1^M x_2^M + \frac{1}{9}\left(x_1^M\right)^2 + \frac{1}{9}\left(x_2^M\right)^2 - \frac{1}{9}$

This system yields no explicit general solutions, but we computed solutions for particular values of the demand parameter. Table 1 presents these solutions, as well as the corresponding merged entity's profit.

Comparing the latter with the total pre-merger profit of merger partners, we find that the merger is basically profitable for low enough values of the reservation price: $1.5 < a \leq 3$. The explanation is provided by the merger location effects: the merged entity will supply each local market from the closest store only, so that stores have no longer overlapping market areas. This output reallocation is enhanced by outlet relocation: the four affiliates spread out towards the market borders in an attempt to minimize total transport costs. Consequently, the merger entity captures demand at the extreme consumer locations. For this captive demand to be sufficient to guarantee merger profitability, the demand parameter itself needs to be low enough, otherwise, the market shares gained on demand located at the market borders do not compensate for the market shares lost on the rest of the segment[6].

Spin-off

In a non-spatial context, as long as the market is not monopolized, Cournot firms increase their profits by credibly committing to produce more, by means of spin-offs. However, the spatial framework also provides incentives to divisionalize, incentives related to the merger's location effects.

Relocation towards the market borders generates efficiency gains for the merged entity, by reducing transport cost and by allowing it to capture distant demand. For this, strategic substitutability requires stores take up distinct locations. Consequently, the segment mid-point is forsaken by the merged entity, allowing the outsider to benefit alone from this most-preferred location on the segment. Actually, as long as the merged entity owns an even number of plants, the central location is abandoned to the outsider. However, spinning off into two independent divisions, each owning two outlets, mitigates the market share loss at the mid-segment locations, while still allowing to capture demand at distant ones.

Partial divisionalization

Consider thus the merged entity spinning off into two independent two-store divisions competing against the single-store outsider. More precisely, output and

[6]Remember that horizontal mergers exhibit a business stealing effect benefitting the outsider(s).

location decisions are independent between divisions, but are centralized within them. Let $\Pi^{1,2}$ and $\Pi^{3,4}$ denote the divisions' profits. From the analysis of Pal and Sarkar (2002), we know that each division will locate both outlets symmetrically around 1/2, with rival stores sharing symmetric locations. To put it short, rival stores 1 and 3 locate at $z^* \in (0;1/2)$, whereas 2 and 4 at $1-z^*$, where z^* is given by the First Order Condition on a division's profit, which writes

$\Pi^{1,2} = 2\left(\int_0^z \left(\frac{a-2(z-x)+(\frac{1}{2}-x)}{4}\right)^2 dx + \int_z^{\frac{1}{2}} \left(\frac{a-2(x-z)+(\frac{1}{2}-x)}{4}\right)^2 dx\right)$

$= \frac{1}{4}az - \frac{1}{16}z - \frac{1}{32}a + \frac{1}{16}a^2 + \frac{1}{6}z^3 - \frac{1}{2}az^2 + \frac{1}{64}$. The First Order Condition requires $\frac{1}{4}a - az + \frac{1}{2}z^2 - \frac{1}{16} = 0$, hence $z^* = a - \frac{1}{4}\sqrt{16a^2 - 8a + 2}$.

To conclude on the profitability of partial integration with respect to that of total integration we need to compute the difference between the profit of the group of two independent 2-store divisions with that of the merged entity with centralized decision making. Taking into account the optimal location z^*, the profit of the group is

$\Pi^{1,2} + \Pi^{3,4} = 2\Pi^{1,2} =$
$\frac{5}{8}a^2 - \frac{3}{16}a - \frac{2}{3}a^3 + \frac{1}{48}\sqrt{2}\sqrt{8a^2-4a+1} - \frac{1}{12}a\sqrt{2}\sqrt{8a^2-4a+1} + \frac{1}{6}a^2\sqrt{2}\sqrt{8a^2-4a+1} + \frac{1}{32}$

Since in the previous section we had already computed the profit of the integrated 4-store merged firm for different values of the demand parameter, we only need to evaluate the group's profit for the same values, presented in a separate column of Table 1. To put it short, we find $(\Pi^{1,2} + \Pi^{3,4}) - \Pi^M_{1,2,3,4} > 0$ for $a > 1.5$. The comparison is unambiguous: for all but the lowest values of the demand parameter, partial integration is more profitable than centralized decision-making.

Complete divisionalization

The partial divisionalization equally turns out to be always more profitable than total divisionalization. To see that, suppose that following the merger the group decides to spin off into 4 single-store independent divisions. Let Π_{ind} be the profit of such a single-store division. The groups' profit writes now

$4\Pi_{ind} = 4\left(2 \cdot \int_0^{1/2} \left(\frac{a-(1/2-x)}{6}\right)^2 dx\right) = \frac{1}{9}a^2 - \frac{1}{18}a + \frac{1}{108}$, since each independent division will locate at the segment mid-point, together with the outsider. It is straightforward to compute the difference between this total decentralized profit and the one folowing partial spin-off:

$4\Pi_{ind} - (\Pi^{1,2} + \Pi^{3,4}) =$
$\frac{19}{144}a - \frac{37}{72}a^2 + \frac{2}{3}a^3 - \frac{1}{48}\sqrt{2}\sqrt{8a^2-4a+1} + \frac{1}{12}a\sqrt{2}\sqrt{8a^2-4a+1} - \frac{1}{6}a^2\sqrt{2}\sqrt{8a^2-4a+1} - \frac{19}{864}$, which is < 0 for all $a \geq 1.5$. Therefore, complete divisionalization is always

less profitable that partial divisionalization. Moroever, evaluating $4\Pi_{ind}$ for the same demand parameter values as before (the results are as well exhibited in Table 1), we obtain that the complete spin-off is actually not profitable here, since $\Pi^{1,2,3,4} > 4\Pi_{ind}$ always. Table 1 summarizes these comparisons for the demand parameter values retained initially for merger profitability.

Optimality of partial divisionalization

To sum up, partial integration is more profitable than both total integration and total divisionalization. The intuition is based on the idea that the partial integration strikes a balance between two opposing profit-oriented strategies for the merged firm.

On the one hand, by running independent divisions, the merged entity is able to reduce the business stealing effect induced at every location x by the strategic substitutability. But total divisionalization in this spatial setting cannot be optimal, since it would waste any efficiency gains from relocation[7]. On the other hand, owning multi-store divisions does preserve the relocation advantage, i.e. the possibility to capture the distant demand located at the segment borders. To put it differently, four is too high a number of outlets to efficiently capture distant demand. One store on each side is actually optimal, since this still ensures a lower marginal delivery cost at the market borders, but the location closer to the market center also reduces the outsider's marginal delivery cost advantage for middle locations. These positive relocation effects enhance the reduction of business stealing and justify the optimality of this partial spin-off, which allows the merged entity to benefit from the advantages of both strategies. The only exception occurs for the lowest values of the demand parameter (a in the neighborhood of 1.5). For such a very low demand, the location advantage of having a store very close to the market border is overwhelming, thus justifying the profitability of the integration strategy. However, this is always the case with spatial Cournot mergers, which become less and less profitable when the demand parameter increases[8].

Divestiture

A straightforward comparison between the total pre-merger profit of the merging partners and the group's profit with partial divisionalization reveals that the partial spin-off is always profitable for the two merger participants, even when merger is not, namely for the higher values of the demand parameter. In other

[7] Remermber that each independent store locates at the market center, just like the outsider

[8] When a increases, the gain of market shares at distant locations becomes relatively less important, whereas the loss of market shares at the other locations weighs more and more.

words, it can be profitable for firms to merge unprofitably but to spin off afterwards and thereby increase their profits. Mergers often raised profitability doubts in practice, not only in theory. We argue here that unprofitable mergers may occur since they provide firms with the opportunity to (more) profitably spin off or divest afterwards. Spin-offs are basically transfers of property rights on the firm's assets, just like structural merger remedies. Our framework thus suggests an interpretation in terms of divestitures, since they may very well improve merger profitability instead of reducing it, even when they fulfill their corrective role.

To support this idea, we briefly discuss the price effect of the merger. Since independent Cournot equilibria obtain for each local market $x \in [0; 1]$, the price comparison is performed accordingly. Rather extensive computations are necessary, and since they are space-consuming, they are grouped in a Technical Appendix available on request.

A first price comparison at every local market on the segment reveals that the merger to duopoly is everywhere anticompetitive, i.e. it leads to a price increase throughout the set of spatial markets. In such cases, merger control authorities typically require an asset transfer to remedy the competitive harm. Divestitures are meant to make the market structure more symmetric, and thus enhance competitive pressure exerted on the merged entity, preventing therefore the price-raise effect of the merger. Here, one of the merging partners is single-store, so meaningful remedies necessarily involve the divestiture of two outlets.

In our framework, the market entry through the take over of the two divested affiliates yields the same market structure and spatial pattern as the partial spin-off. The latter lowers the post-merger price, so such a divestiture would be declared successful by the merger control authority[9]. Yet, we have seen that at the same time it improves merger profitability, through the revenue from the sale of the two affiliates[10]. This is precisely the intuition for the positive impact of the divestiture for the merger profitability: since a merger generates a positive externality for the

[9] Moreover, the price comparison between the market structure before merger and the one after divestiture equally shows that the latter reduces the average price. To be precise, the only markets where price goes up after divestiture are those in the close neighborhood of 1/2. Nevertheless, further computation reveals that the total positive effect on all other consumers exceeds the consumer loss for these central markets, so the divestiture has a net positive overall effect.

[10] Note however that the implicit assumption is that the merged entity cashes in the maximum willingness to pay of the new entrant, but this is rather a standard assumption, which can be justified by the fact that the divestiture represents an opportunity to enter the market for the external firm, therefore the bargaining power lies with the incumbent.

other firms in the industry, the revenue from divestiture allows the merged entity to recover part of this externality.

3. Conclusion

This paper addresses the issue of profitable spin-off following a horizontal merger in a spatial Cournot framework. Merging and spin-off are opposite strategies for firms, and under standard linearity hypotheses they are not simultaneously profitable. Here, merging and completely integrating affiliates is indeed profitable, thanks to efficiency gains from relocation. Nevertheless, the subsequent spin-off is even more profitable. However, that does not mean operating completely independent outlets, but just partially divisionalizing into multi-store divisions. This still allows the group to benefit from the relocation advantage, but also represents a commitment to increase output at every local market. To a certain extent, we identify here a rationale for mergers (regardless of their internal profitability), namely the opportunity to profitably divisionalize afterwards. The market outcome is actually the same as after the divestiture to a new entrant, which yields a particular conclusion on the impact of structural remedies on merger profitability: divestitures, even when they do restore competition, basically allow the merged entity to recover some of the externality it exerted on the other firms on the market, so in a sense they increase merger profitability. The effect is all the more outstanding when the merger is not only anticompetitive (so the remedy is necessary), but also unprofitable in the beginning.

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Table 1: Profitability comparisons

a	$\Pi_{1,2,3}+\Pi_4$	x_1^M	x_2^M	$\Pi_{1,2,3,4}^M$	$\Pi^{1,2}+\Pi^{3,4}$	$4\Pi_{ind}$
1.5	0.27663	0.11535	0.36354	0.29644	0.28718	0.17593
2	0.48481	0.11764	0.36631	0.50474	0.50576	0.34259
2.5	0.75554	0.11904	0.36840	0.76861	0.78689	0.56481
3	1.0888	0.11999	0.36955	1.088	1.1306	0.84259
3.5	1.4846	0.12069	0.37036	1.463	1.5368	1.1759
4	1.9429	0.121212	0.370964	1.8936	2.0055	1.5648
4.5	2.4637	0.121621	0.371426	2.3797	2.5367	2.0093
5	3.0470	0.121951	0.371793	2.9213	3.1304	2.5093
6	4.4011	0.122449	0.372339	4.17113	4.5054	3.6759