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

Vertical mergers that eliminate double markups are procompetitive

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Abstract

Assuming that oligopolistic downstream firms take intermediate goods prices as given and that upstream and integrated firms choose their quantities first and simultaneously, this note shows that vertical mergers between upstream and downstream firms are procompetitive.

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1 Introduction

It has long been recognized that vertical mergers benefit consumers if they eliminate the inefficiencies due to double marginalization that are characteristic of industries with an upstream and a downstream monopoly.[1] In a setup where non-integrated downstream and non-integrated upstream firms compete oligopolistically amongst themselves and with vertically integrated firms[2], Salinger (1988) showed that the effects of a vertical merger on consumer welfare are ambiguous: If the number of downstream and upstream firms is reduced and the number of integrated firms is simultaneously increased by the same number, then consumer welfare can either increase or decrease. These potentially anticompetitive effects of vertical mergers are commonly thought to be due to strategic foreclosure of the intermediate goods market by integrated firms.[3]

Two assumptions in Salinger's paper can be perceived as debatable. First, although downstream firms exert market power on the downstream market, they act as price takers on the intermediate goods markets. Riordan (2008, footnote 37) suggests one way out of this inconsistency: If upstream firms first and simultaneously choose their capacities and then set prices on the intermediate goods market, input prices will be fixed for downstream firms once they place their orders on the intermediate goods market. Second, Salinger (1988, p.349) assumes that upstream firms move first and integrated and downstream firms move second. Therefore, a vertical merger in Salinger's setup has two effects. It eliminates some inefficiencies due to double markups *and* it changes the ratio of firms who move first and second.

In this note, I refer to mergers that only have the former effect as vertical mergers that eliminate double markups and I analyze the impact of such mergers on consumer welfare. Assuming that upstream and integrated firms move simultaneously, I show that the effects of vertical mergers to eliminate double markups are unambiguously procompetitive under fairly general assumptions about final goods demand. This leads me to conclude that the ambiguous effects in Salinger's model are entirely due to the assumption of sequential moves. If nonintegrated upstream firms differ from integrated firms only in that they cannot access the downstream market directly, then a vertical merger is unambiguously procompetitive.

2 Model

There are D downstream firms, U upstream firms and I integrated firms, indexed $d = 1,..D$, $u = 1,..,U$ and $i = 1,..,I$, respectively. The only difference between upstream firms and integrated firms is that upstream firms cannot access the final goods market directly and have to sell to downstream firms on the intermediate goods (or wholesale) market. Both upstream firms u and integrated firms i first simultaneously choose their capacities k_u and k_i at the constant marginal cost $c \geq 0$. There are no other costs

[1] See e.g. Spengler (1950).

[2] I use the convention that downstream and upstream firms are by definition not integrated and vertically integrated firms are called integrated firms.

[3] See e.g. Salinger (1988), Riordan (1998, 2008) or Rey and Tirole (2007).

of production.[4] Throughout, I assume that integrated firms do not participate on the wholesale market.[5] Instead, each integrated firm i is committed to sell its capacity k_i on the final goods market at the market clearing final goods price. Similarly, each upstream firm u is committed to sell its capacity k_u at the market clearing wholesale price.

Given the input price p^W, which they take as given, downstream firms d buy quantities q_d, which they will sell, together with the integrated firms, on the final goods market at the market clearing price $P(Q+K_I)$, where $Q \equiv \sum_{d=1}^{D} q_d$ and $K_I \equiv \sum_{i=1}^{I} k_i$ are the aggregate quantities sold, respectively, by downstream and integrated firms and where $P(.)$ is the inverse final goods demand function satisfying $P(0) > c$, $P' < 0, P'' \leq 0$ and $P''' \leq 0$. Alternatively, and loosely, P''' must not be too big.[6] I use the notation k_i, k_{-i} and K_I to denote, respectively, the capacity of the integrated firm i, the aggregate capacity of all integrated firms other than i and the aggregate capacity of all integrated firms. Analogous notation is used for all other firms' quantities and capacities. Throughout, I focus on symmetric equilibria meaning that firms of the same type play the same action in equilibrium.

3 Preliminaries: Equilibrium

I first derive the aggregate quantity traded Q by downstream firms as a function of the wholesale (or intermediate goods market) price p^W and of the aggregate capacity of integrated firms K_I, which are both given to them. So the typical downstream firm d maximizes $[P(q_d + q_{-d} + K_I) - p^W]q_d$ over q_d, which yields the first order condition

$$0 = P(Q+K_I) - p^W + P'(Q+K_I)\frac{Q}{D}, \tag{1}$$

where $Q \equiv q_d + q_{-d} = Dq_d$. Solving for p^W gives the inverse demand function $P^W(Q, K_I)$ to which the upstream firms sell on the intermediate goods market, where the argument K_I highlights its dependence on the aggregate capacity of integrated firms:

$$P^W(Q, K_I) = P(Q+K_I) + P'(Q+K_I)\frac{Q}{D}. \tag{2}$$

Observe that

$$\frac{\partial P^W(Q,K_I)}{\partial Q} = P'\left[\frac{D+1}{D}\right] + P''\frac{Q}{D} < 0 \quad \text{and} \quad \frac{\partial^2 P^W(Q,K_I)}{\partial Q^2} = P''\left[\frac{D+2}{D}\right] + P'''\frac{Q}{D} \leq 0,$$

[4] The constant marginal cost assumption is made to make comparison with Salinger (1988) straightforward. All of the results will go through with (weakly) increasing marginal costs of capacity. The assumption that downstream firms face no other costs than the wholesale price is made to ease the exposition. All results will be unaffected if downstream and integrated firms face an additional constant marginal cost $\delta \geq 0$.

[5] This assumption is the same as made by Salinger (1988, p.349).

[6] Both $P'' \leq 0$ and $P''' \leq 0$ are only sufficient conditions for the analysis to go through. Particularly, the assumption $P''' \leq 0$ is never close to being tight, as will become clear below. However, it is also clear that any alternative nice, general and sufficient condition is hard to come up with.

where arguments have been dropped and where the second inequality holds if P''' is not too large. A sufficient condition for this is $P''' \leq 0$, which has been assumed for convenience.[7]

Consider next the capacity choice by integrated firms. The typical integrated firm i maximizes $[P(k_i + k_{-i} + K_U) - c]k_i$ over k_i, where $K_U \equiv \sum_{u=1}^{U} k_u$ is the aggregate quantity sold by upstream firms to downstream firms who then sell it on the final goods market. The first order condition is

$$K_I = \frac{I[P(K) - c]}{-P'(K)}, \tag{3}$$

where $K_I = k_i + k_{-i} = Ik_i$ and $K \equiv K_I + K_U$.[8] Similarly, the typical upstream firm u maximizes

$$[P^W(k_u + k_{-u}, K_I) - c]k_u = \left[P(k_u + k_{-u} + K_I) + P'(k_u + k_{-u} + K_I)\frac{k_u + k_{-u}}{D} - c\right] k_u$$

over k_u. The corresponding first order condition can be written as

$$K_U = \frac{DU[P(K) - c]}{-P'(K)(D + U + 1) - P''(K)K_U}, \tag{4}$$

with $K_U = k_u + k_{-u} = Uk_u$.

Lemma 1 *The unique symmetric equilibrium outcome is characterized by the unique pair (K_I, K_U) that solves (3) and (4). Thus,*

$$K = \frac{I[P(K) - c]}{-P'(K)} + \frac{DU[P(K) - c]}{-P'(K)(D + U + 1) - P''(K)K_U} \tag{5}$$

is the unique aggregate capacity for any given D, U and I. Moreover, $K_I > 0$ and $K_U > 0$.

Proof: Concavity of $P(Q)$ and $P^W(Q, K_I)$ in Q implies $0 > \frac{dK_I}{dK_U} > -1$ and $0 > \frac{dK_U}{dK_I} > -1$.[9] Therefore, a unique pair (K_I, K_U) solving (3) and (4) exists. Moreover, the solution values K_I and K_U are strictly positive because $P(0) > c$. ■

4 Comparative Statics

The question of interest is how K changes as I increases and D and U simultaneously decrease by dI. That is, letting $D = N_D - I$ and $U = N_U - I$ be the number of downstream and upstream firms before merger, one would like to know the sign of

$$\frac{dK}{dI} = \frac{dK_I}{dI} + \frac{dK_U}{dI}.$$

[7] If downstream firms faced an additional per unit cost δ, the inverse wholesale demand function would simply be $P_\delta^W(Q, K_I) = P^W(Q, K_I) - \delta$.

[8] If integrated firms faced an additional per unit cost δ for the final goods production, their capacity would be given by $K_I(\delta) = \frac{I[P(K)-c-\delta]}{-P'(K)}$.

[9] The derivation is straightforward, though somewhat tedious.

The focus is on vertical mergers that do not eliminate all downstream firms nor all upstream firms, so I will assume $N_D - I > 1$ and $N_U - I > 1$ and henceforth neglect any integer constraints.

Notice first that K_I is still given by equation (3). Therefore,

$$\frac{dK_I}{dI} = \frac{P(K) - c}{-P'(K)} + I \frac{-[P'(K)]^2 + [P(K) - c]P''(K)}{[-P'(K)]^2} \frac{dK}{dI}. \tag{6}$$

The direct effect $\frac{P(K)-c}{-P'(K)}$ is positive. The fraction preceding dK/dI is strictly negative because $P'' \leq 0$. Hence:

Lemma 2 $\frac{dK}{dI} \leq 0$ *implies* $\frac{dK_I}{dI} > 0$.

With $D = N_D - I$ and $U = N_U - I$, aggregate capacity of upstream firms is

$$K_U = \frac{(N_D - I)(N_U - I)[P(K) - c]}{-P'(K)(N_D + N_U - 2I + 1) - P''(K)K_U}. \tag{7}$$

Before determining the effects of I on K_U, I have to determine the sign of $\frac{dK_U}{dK}$ since this term will show up when totally differentiating K_U with respect to I. From here onwards, I drop the argument in $P(K)$ and its derivatives. Totally differentiating (7) with respect to K yields

$$\begin{aligned} \frac{dK_U}{dK} &= (N_D - I)(N_U - I) \left\{ \frac{P'[-P'(N_D + N_U - 2I + 1) - P''K_U]}{[-P'(N_D + N_U - 2I + 1) - P''K_U]^2} \right. \\ &+ \left. \frac{P''(N_D + N_U - 2I + 1) + P'''K_U + P''\frac{dK_U}{dK}}{[-P'(N_D + N_U - 2I + 1) - P''K_U]^2} \right\}. \end{aligned}$$

Straightforward calculations now lead to the following result:

Lemma 3 $\frac{dK_U}{dK} < 0$.

To derive the overall effect of changes in I on K_U, it is convenient to analyze the direct and the indirect effects separately. The direct effect is:

$$\frac{dK_U^{dir}}{dI} = \frac{[2I - (N_D + N_U)][P - c]}{-P'(N_D + N_U - 2I + 1) - P''K_U} + \frac{-2P'[P - c](N_D - I)(N_U - I)}{[-P'(N_D + N_U - 2I + 1) - P''K_U]^2}.$$

Observe that the first term is negative and the second term is positive. The indirect effect is

$$\begin{aligned} \frac{dK_U^{ind}}{dI} &= \frac{P'(N_D - 1)(N_U - 1)[-P'(N_D + N_U - 2I) - P'']}{[-P'(N_D + N_U - 2I) - P''K_U]^2} \frac{dK}{dI} \\ &- [P - c](N_D - 1)(N_U - 1) \frac{[-P''(N_D + N_U - 2I) - P'''K_U - P''\frac{dK_U}{dK}]}{[-P'(N_D + N_U - 2I) - P''K_U]^2} \frac{dK}{dI}. \end{aligned}$$

The fraction in the first line preceding dK/dI is negative. Under the assumption that $dI > 0$ implies $dK < 0$, $dK_U/dK > 0$ holds by Lemma 3. Hence, if $dK/dI < 0$, the fraction in the second line preceding dK/dI is positive if P''' is not too big. Therefore, under the assumption $dK/dI < 0$, $\frac{dK_U^{ind}}{dI} > 0$ will hold. We know already that $dK/dI < 0$ implies $dK_I/dI > 0$. Therefore, the only way $dK/dI \leq 0$ could occur is that the negative direct effect present in the first term in dK_U^{dir}/dI somehow outweighs the opposite effects present in all the other terms. I am now going to show that this is not the case by showing that in aggregate the first and negative term in the direct effect on K_U and the direct effect on K_I are positive. Taken together, the two terms $\frac{[2I-(N_D+N_U)][P-c]}{-P'(N_D+N_U-2I+1)-P''K_U}$ and $\frac{P-c}{-P'}$ are equal to

$$\frac{(P-c)(-P'-P''K_U)}{(-P')[-P'(N_D+N_U-2I+1)-P''K_U]} > 0.$$

The following proposition summarizes these findings.

Proposition 1 *Vertical mergers that eliminate double markups are procompetitive.*

5 Discussion

The difference between the result obtained in the present model and the one in Salinger's setup is quite striking. This difference is due to his assumption that upstream firms move first and integrated and downstream firms move second, while here upstream and integrated firms are assumed to move simultaneously and first. Consequently, the implication for antitrust policy and legislation is that vertical mergers should be treated more permissively than Salinger's analysis suggests if the main difference between upstream firms and integrated firms resides in the latters' capability of directly accessing the downstream market rather than in the order in which they move.

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