Profitable mergers with endogenous tariffs

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Abstract

In this note, we suggest a link between tariff protection and firms' incentives to engage in a horizontal merger. We consider a Cournot oligopoly with equal, constant marginal costs where firms have to decide on lobbying efforts prior to choosing output. These lobbying efforts will determine whether a prohibitive tariff is introduced. We find that the possibility of lobbying may enlarge the set of mergers that are profitable, even without cost reductions.

1 Introduction

Salant et al. (1983) first pointed out that, in the absence of reductions in production costs, mergers are seldom profitable. In particular, given a linear market demand, mergers are unprofitable unless they involve at least 80% of the firms in the industry. Faulí-Oller (1997) generalized this result considering a general demand function, and a number of articles have further explored the issue of merger profitability, typically considering the possibility of mergers reducing fixed and/or marginal costs, which increases the scope for merger profitability. For instance, Davidson and Mukherjee (2007) is a recent contribution in this literature.

In this note, we propose a model to analyze merger profitability where mergers bring about no cost reductions of any kind. In the model, firms may lobby the domestic government to introduce a prohibitive tariff. The tariff raises the cap on the domestic price, since domestic producers face competition from foreign producers, which are willing to sell any amount of the good at the world price. Mergers increase the profitability of lobbying: since the equilibrium price increases after the merger, the payoff from lobbying increases relative to the pre-merger situation. Foreseeing this, and for particular realizations of the world price, firms may have incentives to merge, even if the number of firms involved in the merger is low relative to the industry total.

There are industry cases analyzed in the Economic History literature that suggest a positive correlation between industry concentration and tariff protection. Indeed, the late 19th and early 20th Century was characterized by a turn towards protectionism and high concentration in many Western European industries. For instance, Webb (1980) points at a strong interrelation between cartels and tariffs in the German steel industry of that period. In a similar way, Mendi and Veszteg (2007) study the case of the late 19th Century Spanish iron and steel industry to find a joint occurrence of concentration and increasing tariffs, with active and successful lobbying by major producers. This paper provides a simple theoretical explanation for the relationship between mergers and tariff protection.

The paper is organized as follows. Section 2 presents the basic model, and Section 3 analyzes the conditions for merger profitability and presents the specific example of a linear demand function. Section 4 summarizes the main findings and concludes.

2 The model

All N firms in the industry have access to the same technology, which allows them to produce with constant marginal cost c. We restrict our attention to symmetric equilibria, where firms have equal shares in total sales. Given the world price p^W and the tariff T, the inverse demand faced by firms in the industry is given by

$$p(Q, p^W + T) = \max \left\{ \min \left\{ p^W + T, \phi(Q) \right\}, 0 \right\}, \tag{1}$$

where Q is industry output, and $\phi(Q)$ is a continuous, differentiable, and non-increasing function. Therefore, the industry demand curve is horizontal at $p^W + T$ for $Q \in \left[0, \widetilde{Q} \right]$, where $\widetilde{Q}$ is such that $\phi\left(\widetilde{Q}\right) = p^W + T$ and, for $Q > \widetilde{Q}$, it is given by $\phi(Q)$. We assume that the relationship between lobbying efforts $L = \sum_i l_i$, where l_i is firm i's individual contribution to lobbying, and the tariff rate T is non-decreasing. In particular,

$$T = \left\{ \begin{array}{cl} 0 & \text{if } L < L^* \\ p^M - p^W & \text{if } L \geq L^*, \end{array} \right.$$

where p^M is the monopoly price. Hence, the tariff will be zero if lobbying efforts fall short of some specific level, L^*. By contrast, if lobbying exceeds this threshold, the outcome is a prohibitive tariff. This discontinuity greatly simplifies the analysis below.

This model is used to analyze the profitability of mergers that involve M out of the N firms in the industry. We consider three stages:

1. One of the M firms involved in the merger proposes the rest of the $M - 1$ firms involved to merge. These firms accept or reject. After the merger stage is over, there are $N - M + 1$ active firms if the merger is successful, and N firms if it is unsuccessful.

2. Active firms after the merger stage choose, in a non-cooperative way, how much lobbying effort to provide, l_i. Aggregate lobbying effort determines tariff protection T.

3. Given T, active firms non-cooperatively choose output levels q_i. Profits are realized.

Once the value of T is determined in the second stage, firms simultaneously choose quantities in the third stage. This gives rise to profits $\pi(p, K)$, which is an individual firm's profits in a symmetric equilibrium with K active firms, all of them with marginal cost c, and the maximum equilibrium price is p. Clearly, π is non-decreasing in p and decreasing in N.

In the second stage, firms simultaneously choose the amount of resources that they devote to lobbying, l_i, and $L = \sum_i l_i$. Firm i's choice of lobbying effort l_i as a function of other firms' contributions $\sum_{j \neq i} l_i$ is given by:

$$
l_i \left(\sum_{j \neq i} l_i \right) = \left\{
\begin{array}{cl}
0 & \text{if } \sum_{j \neq i} l_j \geq L^* \\
L^* - \sum_{j \neq i} l_j & \text{if } \pi(p^M, K) - \pi(p^W, K) \leq \sum_{j \neq i} l_j < L^* \\
0 & \text{if } \sum_{j \neq i} l_j < \pi(p^M, K) - \pi(p^W, K)
\end{array}
\right.
$$

where $\pi(p, K)$ is the previously defined profits function. There may be equilibria where firms free ride on other firms' lobbying efforts. However, in this paper we focus on equilibria that are symmetric in lobbying, since we are interested in the conditions that make lobbying possible. There are equilibria where all firms contribute to the introduction of the prohibitive tariff, or other equilibria where firms free ride on other firms' lobbying efforts. Also depending on the threshold level L^*, there may be other equilibria where the tariff is zero.

We consider equilibria where lobbying costs are equally split among firms in the industry. Since the Nash equilibrium price decreases with the number of firms K, lobbying becomes more profitable the fewer the number of firms. Hence, the following lemma:

Lemma 1 *There is a non-increasing relationship between the number of firms in the industry and aggregate lobbying efforts.*

To see this, if K increases, both $\pi(p^M, K)$ and $\pi(p^W, K)$ decrease. However, $\pi(p^M, K)$ always decreases by at most as much as $\pi(p^W, K)$, because the price cap is p^M instead of p^W. Thus, the difference $\pi(p^M, K) - \pi(p^W, K)$ either stays the same or decreases. Since this difference determines the range of values of lobbying by firms other than i that induce firm i to choose a positive l_i, and the problem is symmetric, aggregate lobbying either decreases or stays the same if the number of firms increases.

This lemma implies that firms' incentives to engage in lobbying increase after a merger. In some cases, this will induce firms to successfully lobby

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after a merger even if there was no lobbying at all before the merger. Taking this into account, merging firms might be better off after the merger, thus offsetting the reduction in profitability pointed out in Salant et al (1983).

3 Merger profitability

This section inspects under what circumstances a merger among M of the N firms in the industry is profitable not only for outsiders, but also for merging firms. We will focus on cases where $M\pi(p^W, N) < (N - M + 1)\pi(p^W, N - M + 1)$. In these cases, the merger among M firms is unprofitable, given the world price. If this condition did not hold, the merger would be profitable regardless of the tariff. In particular, Salant et al. (1983) consider the case $p^W = p^M$, since they ignored the possibility of imports. In the cases that we are considering, in order for the merger to be profitable, it will be necessary that combined lobbying efforts fall short of L^* before the merger, while they exceed this level once the merger takes place. Otherwise, we know that the merger is unprofitable. Hence, it must be true that, prior to the merger,

$$\frac{L^*}{N} > \pi(p^M, N) - \pi(p^W, N), \tag{2}$$

i.e. that the equilibrium tariff before the merger be zero.

After the merger, it must be true that firms find it profitable to contribute to lobbying. Notice that prices increase after the merger, which ultimately increases the profitability of lobbying efforts. Hence, in order for an equilibrium to exist where the prohibitive tariff is introduced, it is necessary that

$$\frac{L^*}{N - M + 1} < \pi(p^M, N - M + 1) - \pi(p^W, N - M + 1) \tag{3}$$

This condition ensures that the equilibrium where all $N - M + 1$ firms equally split lobbying costs exists.

Finally, merging firms must be better off after the merger, taking into account that their contribution to lobbying was zero before the merger, and is positive after the merger takes place. Hence, it must be true that:

$$M\pi(p^W, N) < \pi(p^M, N - M + 1) - \frac{L^*}{N - M + 1}. \tag{4}$$

Condition (2) imposes a lower bound on L^*, whereas (3) and (4) impose upper bounds on L^*. Since we are considering the case where $M\pi(p^W, N) >$

$\pi(p^W, N-M+1)$, then the relevant upper bound is (4). Then, from (2),

$$L^* > N \left[\pi(p^M, N) - \pi(p^W, N) \right].$$

and from (4),

$$L^* < (N-M+1) \left[\pi(p^M, N-M+1) - M\pi(p^W, N) \right].$$

Combining both expressions, in order for the merger to be profitable, it is necessary that

$$N\pi(p^M, N) < (N-M+1)\pi(p^M, N-M+1) - (N-M)(M-1)\pi(p^W, N). \quad (5)$$

Now, since

$$\lim_{p^W \to c} \pi(p^W, N) = 0$$

we can establish the following lemma:

Lemma 2 *For a sufficiently low value of the world price p^W, every merger may be profitable, i.e. there exist values of L^* such that the merger is profitable.*

Notice that as the world price approaches the marginal cost, the right-most term in (5) converges to zero. When this is the case, the inequality always holds, since the left-hand side becomes industry profits with N firms, whereas the right-hand side is industry profits with $(N-M+1)$ firms, and industry profits are decreasing in the number of firms. Thus, since $\pi(p^W, N)$ is non-decreasing in p^W, there is always an interval of values of the world price such that the merger is profitable. This result also gives rise to the following corollaries:

Corollary 3 *Given N and M, the greater p^W, the lower the probability of the merger being profitable.*

Here, what we mean by lower probability of profitable merger is the length of the interval of values of L^* that allow for condition (5) to hold. Notice that the right-hand side of (5) decreases with p^W, which implies that the interval of values of L^*such that the merger is profitable is reduced.

Corollary 4 *A merger to monopoly is always profitable, regardless of the value of p^W.*

Salant et al. (1983) constitutes a particular case of this model, where p^W is sufficiently high. If this is the case, then $\pi(p^W, N) = \pi(p^M, N)$. Hence, condition (5) may be rewritten as:

$$M\pi(p^M, N) < \pi(p^M, N - M + 1). \tag{6}$$

Thus, the merger will not be profitable unless (6) holds. For these values of p^W, investing on lobbying is not profitable, since the world price is above the domestic Nash equilibrium price. In other words, lobbying removes a non-binding constraint and has no actual effect. Hence, the condition for merger profitability is the same as in Salant et al. (1983).

3.1 Example: linear demand

As a matter of illustration, this subsection analyzes the case of a linear demand, where $\phi(Q) = 1 - Q$, and $c = 0$. With these parameter values, $p^M = \frac{1}{2}$. If the world price is above this monopoly level, then a merger that involves M of the N firms in the industry is profitable if

$$\frac{M}{(N+1)^2} \leq \frac{1}{(N-M+2)^2}$$

which implies that, for $M \geq 2$,

$$(N+1)^2 \leq M\left(2(N+1) - (M-1)\right). \tag{7}$$

However, if the world price is low enough, the merger may be profitable even if condition (7) does not hold. First, notice that

$$\pi(p^M, N) = \frac{1}{(N+1)^2}; \ \pi(p^W, N-M+1) = \frac{1}{(N-M+2)^2}; \ \pi(p^W, N) = \frac{p^W(1-p^W)}{N}$$

which allows us to write condition (6) as:

$$\frac{N}{(N+1)^2} < \frac{N-M+1}{(N-M+2)^2} - (N-M)(M-1)\frac{p^W(1-p^W)}{N}.$$

For instance, for a sufficiently high level of the world price, a bilateral merger ($M = 2$) is not profitable if $N = 4$. However, there is always a value of the world price that makes a bilateral merger profitable if $N = 4$. Notice that if the world price is arbitrarily close to the marginal cost (zero) then condition (7) reduces to $\frac{4}{25} < \frac{3}{16}$. As the world price increases, the right-hand side of (7) decreases, and for $p^W = 0.0584$, the condition no longer holds. For $p^W \in [0, 0.0584]$ it is possible to find values of L^* that make the merger profitable.

4   Conclusions

In this note, we propose a simple model where firms in an industry may lobby the domestic government to introduce a prohibitive tariff. This possibility may make some mergers profitable, even if they involve a relatively small number of firms. The model allows us to conclude first that aggregate lobbying decreases with the number of firms in the industry. Furthermore, the possibility of lobbying provide firms with additional incentives to merge. Also, merger profitability decreases with the world price. Therefore, as domestic firms become more efficient relative to foreign producers, their incentives to merge and seek tariff protection are reduced. Finally, if the cost of lobbying is either too high or too low, no merger will occur: if the domestic government is either totally influenced or totally unaffected by lobbying, firms will have no incentive to merge for lobbying reasons. The incentive to merge appears for intermediate minimum values of lobbying that induce the government to introduce the prohibitive tariff.

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