THEORETICAL BACKGROUND FOR COMPETITIVE MERGER ANALYSIS

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Abstract: *The aim of this paper is to provide theoretical background for the assessment of merger policies. We discuss two standard models: Cournot Oligopoly with Homogeneous Goods model and Bertrand Competition with Product Differentiation model – to derive simple method how to evaluate competitive effect of a horizontal merger. We found out a unique correspondence between change in consumer surplus and change in competitors' profits generated by the level of efficiency created in the merger.*

Keywords: *Oligopoly, Cournout oligopoly model, Bertrand oligopoly model, horizontal mergers*

1. Introduction

In order to be able to identify anticompetitive mergers in our empirical analysis, we need to present the theoretical basis that enables us to create an effective framework for competitive merger assessment. Let us assume that the main goal of the antitrust authority is to protect consumers from abusive behavior at the after-merger market. In that case, every market configuration resulting in decrease of consumer welfare (surplus) should be seen as anticompetitive and therefore rejected. In our analysis, we use external effects of merger on competitors in order to assess welfare changes instead of direct measurement of consumer surplus' changes. Using the two well-known theoretical models, widely applied in the merger literature ([5] or [5]). (Cournot Quantity Competition and Bertrand Price Competition), we will show there is a unique correspondence between change in consumer surplus and change in competitors' profits generated by the level of efficiency created in the merger.

2. Cournot Oligopoly with Homogeneous Goods

In this part we illustrate the clear link between changes in consumer surplus and changes in profit of merger parties' competitors in the following simplified model. Let us assume a market where N firms with identical cost and production structure produce the same homogenous good. The marginal costs are constant and identical for all firms (denoted by c). Firms decide simultaneously on their production quantity (Cournot oligopoly) and face a linear demand function of the following form:

$$Q(P) = A - P \quad \text{where } A, c > 0; A > c \qquad 1)$$

Profits of the firms can be denoted as:

$$\Pi_i = (A - \sum_{j=1}^{N} q_j - c)q_i \quad for\ \forall i \qquad 2)$$

where q_i represents a quantity produced by firm *i*.

From the first order condition we derive the reaction function for each of the firms:

$$\frac{\partial \Pi_i}{\partial q_i} = 0 \quad => \quad q_i^*(q_j) = \frac{A - \sum_{j=1}^{N-1} q_j - c}{2} \qquad for\ \forall i \qquad 3)$$

From firms' symmetry follows that $q_i^* = q_j^* \quad for\ \forall i, j$ and we get the optimal quantity produced by each firm at equilibrium.

$$q_i^* = \frac{A-c}{N+1} \qquad for \quad \forall i \qquad 4)$$

Let us further simplify by assuming *N=3*. Then, we get:

Quantity produced by each firm: $q_i^* = \frac{A-c}{4} \quad for\ i \in \{1,2,3\}$ *5)*

Total equilibrium quantity: $Q^* = \frac{3}{4}(A-c)$ *6)*

Equilibrium price: $P^* = \frac{1}{4}(A+3c)$ *7)*

Profit of each firm : $\Pi_i = \frac{(A-c)^2}{16} \quad for\ i \in \{1,2,3\}$ *8)*

Consumer surplus is in that case equal to:

$$CS = \frac{(A - P^*)Q^*}{2} = \frac{9}{32}(A-c)^2 \qquad 9)$$

Let us now assume two firms decide to merge. We further assume merger generates efficiencies for the merging firms (denoted by e). We do not specify the efficiencies' nature; we only presume ability of merging parties to decrease their marginal costs due to the efficiency effects. We do not assume any 'spill-over' effects of the merger - cost structure of the other firms in the market remains unchanged.

Profit of the merged entity is therefore:

$$\Pi^m = (A - q_m - q_c - (c-e))q_m \qquad 10)$$

While profit of competitor firm remains unchanged:

$$\Pi^c = (A - q_m - q_c - c)q_c \qquad 11)$$

From the first order conditions we derive reaction functions of both firms:

$$q_m^*(q_c) = \frac{A - q_c - c + e}{2} \qquad 12)$$

$$q_c^*(q_m) = \frac{A - q_m - c}{2}$$

Fig. 1 shows the reaction functions of merged entity (R_m) and its competitor (R_c). The efficiency effect is demonstrated through a movement of the R_m to the right and illustrated by a new reaction function of the merged entity (R_m^e)

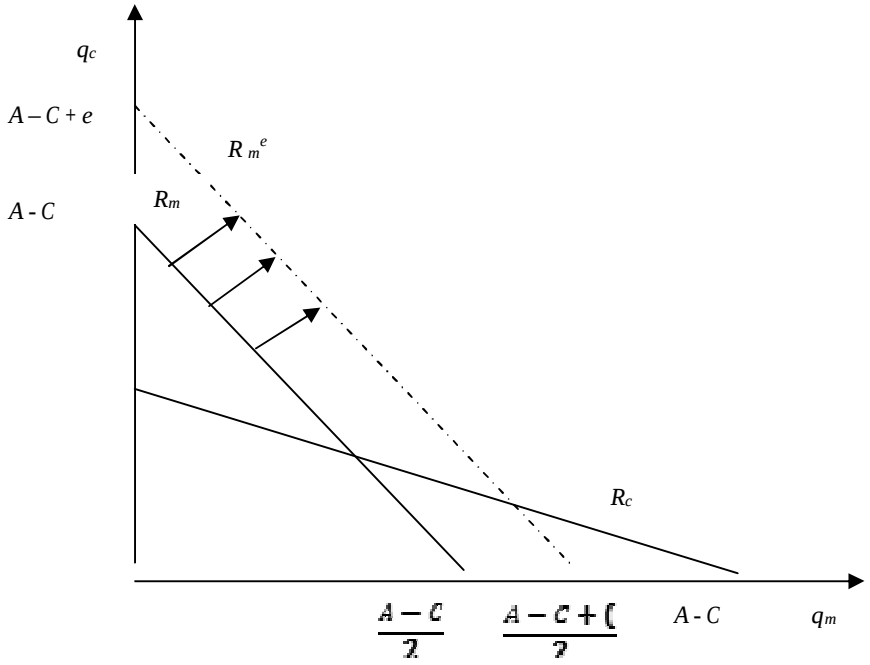

Fig. 1: Efficiency and Reaction Functions

Source: Authors

We thus derive quantities produced by both firms in equilibrium as well as total produced quantity and new equilibrium price at the market:

Quantity produced by merged entity: $q_m^* = \frac{A - c + 2e}{3}$ *13)*

Quantity produced by competitor: $q_c^* = \frac{A-c-e}{3}$ *14)*

Total equilibrium quantity: $\tilde{Q}^* = \frac{2}{3}(A-c)+\frac{1}{3}e$ *15)*

Equilibrium price: $\tilde{P}^* = \frac{1}{3}(A+2c)-\frac{1}{3}e$ *16)*

With higher level of efficiencies achieved by the merger, production of merged entity increases while production of competitor decreases, resulting however in an increase of total production and thus in lower prices.

Profits after merger are distributed subsequently:[1]

$$\Pi^m = \frac{(A-c+2e)^2}{9} \quad 17)$$

$$\Pi^c = \frac{(A-c-e)^2}{9}$$

while consumer surplus after merger is equal to:

$$\tilde{\tilde{CS}} = \frac{2}{9}(A-c+\frac{1}{2}e)^2 \quad 18)$$

In order to evaluate the total effect of the merger more easily, let us define the welfare change as sum of the surplus changes:

$$\Delta W = \Delta\Pi^m + \Delta\Pi^c + \Delta CS \quad 19)$$

where

20)

$$\Delta\Pi^m = \Pi^m - 2\Pi_1 = \frac{(A-c+2e)^2}{9} - 2\frac{(A-c)^2}{16}$$

$$\Delta\Pi^c = \Pi^c - \Pi_1 = \frac{(A-c-e)^2}{9} - \frac{(A-c)^2}{16}$$

$$\Delta CS = \tilde{\tilde{CS}} - CS = \frac{2}{9}(A-c+\frac{1}{2}e)^2 - \frac{9}{32}(A-c)^2$$

As we see above, both the change in profit of merged entity and change in consumer surplus are increasing in e, while change in competitors profit decreases in e.

$$\frac{\partial\Delta\Pi^m}{\partial e} > 0;\ \frac{\partial\Delta\Pi^c}{\partial e} < 0 \ \textit{and}\ \frac{\partial\Delta CS}{\partial e} > 0 \quad 21)$$

See also that for $e = 0$ $\Delta\Pi^m < 0; \Delta CS < 0$ but $\Delta\Pi^c > 0$. In other words, merger is not profitable for merging firms if there are no efficiencies present. Intuitive explanation could be

[1] we further assume that $A > c + e$ ensuring that the competitors do not exit the market

that the new merged entity supplies 'half of the market', while prior to the merger merging parties supplied 'two thirds' of the market, due to the symmetry of firms active in the market. At the same time, price increase generated by the merger is not large enough to compensate for decrease in production of the two firms. Increased market concentration is beneficial only for competitors as they can fully exploit the concentration effects of the merger - they market share increases while prices are higher than before the merger.

First, when a certain level of efficiencies $e' = 0.03(A-c)$ is reached, merger becomes profitable for merging parties. Note that $\Delta W[e=e'] < 0$, i.e. at the low level of efficiencies e', total welfare decreases as increased profits of merged firms and their competitors (producer surplus) do not outweigh the decrease in consumer surplus. When level of efficiencies increases further and reaches $e'' = 0.05(A-C)$, total after-merger change in welfare rises above zero. However, even in this case merger should be considered as anticompetitive - the change in consumer surplus remains negative even at the e'' level of efficiencies.

When level of efficiencies generated by merger reaches the point $e''' = 0.25(A-c)$, consumer surplus' change is equal to zero. The most interesting outcome of this comparative analysis is the fact that at the same time change in competitor's profit is equal to zero. In other words, it holds that:

$$\Delta CS \geq 0 \ \ iff \ \ e \geq e''' \qquad 22)$$
$$\Delta \Pi^c \leq 0 \ \ iff \ e \geq e'''$$

Using the results from above, it is possible to illustrate the correspondence between consumer surplus and competitor's profit at the following figure:

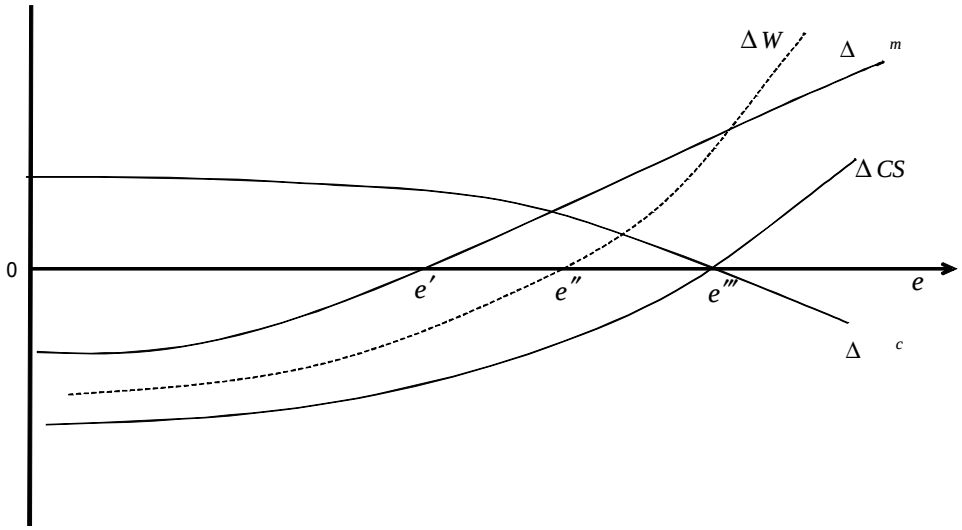

Fig. 2: Efficiency and Welfare Changes

Source: Authors

As we can observe from the Fig. 2, change in competitors profits 'mirrors' the changes in consumer surplus. As the level of efficiencies increases profits to competitors fall and the level of efficiency which ensures that competitors do not gain (denoted by e''') is exactly the level which ensures that consumers are not hurt. In this framework therefore, if a merger hurts competitors, it will benefit the consumers and vice versa.

As shown by Farrell and Shapiro [3], correspondence between the consumer surplus and competitors' profits holds in wide variety of homogenous Cournot games that satisfy some

weak conditions, such as uniqueness and stability. In other words, property that ΔCS >0 if and only if ΔΠc <0 shown in our simplified model, is valid for homogenous Cournot games in general. Moreover, as shown by Kreps and Scheinkman [4], in the two-stage game where firms decide first about their capacities and then compete with each other by setting their prices simultaneously, the equilibrium results correspond with those from traditional Cournot model. However, results of this two-stage model depend heavily on the rationalization rule. For more details, see Davidson and Deneckere [1].

Note that clear correspondence between the sign in CS and competitors' profits is lost in quantity games with product differentiation. Some prices may go up, while other may go down as a result of merger. Exact change in consumer surplus depends then on the consumer preferences, and is independent of the change in competitor profits. For more details, see for instance, Werden and Froeb [8].

3. Bertrand Competition

In order to further illustrate correspondence between consumer surplus and competitors' gains, we will present short overview of those effects in another widely used Bertrand oligopoly model where firms compete with each other by setting prices. In standard price competition with homogeneous goods, efficiency gains from merger will be fully absorbed by increased profits of merged parties. In the new after-merger equilibrium price will be almost equal to marginal costs of competitors (price thus remaining virtually unchanged), while merged entity will supply the whole market and make positive profit due to lower marginal costs generated by merger's efficiencies. Consumer surplus will thus remain unchanged and competitors' profits will still be equal to zero.

The outcomes of price competition with product differentiation are less straightforward, but the clear correspondence between competitors' profits and consumer welfare still holds, as shown in Duso, Neven and Roeller [2]:

Let us assume well known Bertrand competition with product differentiation. Let the sum of the competitors' profits be denoted by $\Pi_c(p_c, p_m)$, where p_c is a price vector of competitors' prices and p_m is a price vector of the merging firms. Further let the products be substitutes such that $\Pi_c(p_c, p_m)$ is increasing in p_m. Assume that there are well-defined reaction functions, and that there is a unique and (locally) stable Nash equilibrium that depends smoothly on the efficiency e. Let the pre-merger equilibrium be denoted by (p_c^*, p_m^*). Note that the merger will have two effects: a change in efficiency (e) and a collusive price setting amongst the merging firms (m).

Consider first a sole increase in efficiency and denote the resulting equilibrium prices by (p_c^e, p_m^e). As has been shown by Vives [7], the comparative statics with respect to e under the above assumptions are such that all prices decrease, competitors profits decrease, and consumers benefit. In particular, we have $p_c^e < p_c^*$ and $p_m^e < p_m^*$, that is all prices fall. Consider now the effect of collusion that is the m firms set their prices collusively. Denote the post-merger equilibrium by p_c^{**}, p_m^{**}, where $p_c^e < p_c^{**}$ and $p_m^e < p_m^{**}$. There are two cases, depending on whether the efficiency or the collusion effect dominates:

Case (i): Suppose $p_m^* < p_m^{**}$, that is post-merger prices of the merging firms are higher. Given that prices are strategic complements, we also have that $p_c^* < p_c^{**}$. Furthermore, we have

$$\Pi_c(p_c^*, p_m^*) < \Pi_c(p_c^*, p_m^{**}) < \Pi_c(p_c^{**}, p_m^{**})$$

The first inequality is due to the assumption of substitutes (i.e. $\Pi_c(p_c, p_m)$ is increasing in p_m) and the second is from the equilibrium definition of p_c^{**}, p_m^{**}. This implies that a merger yields higher profits for competitors, while consumers are hurt (all prices rise), i.e. CS<0 and $\Pi_c > 0$.

Case (ii): Suppose $p_m^* > p_m^{**}$, that is post-merger prices of the merging firms fall. Given that prices are strategic complements, we also have that $p_c^* > p_c^{**}$. Furthermore, we have

$$\Pi_c(p_c^*, p_m^*) > \Pi_c(p_c^*, p_m^{**}) > \Pi_c(p_c^{**}, p_m^{**})$$

The first inequality is due the equilibrium definition of p_c^*, p_m^* and the second is from the assumption of substitutes. This implies that a merger yields lower profits for competitors, while consumers benefit (all prices fall) i.e. CS>0 and $\Pi_c < 0$. Q.E.D.

4. Conclusion

Using the well known theoretical framework we have showed that, under some general assumptions, there is a clear correspondence between the effect of a merger on consumers and competitors. However, it should be noted that we analyzed only external effects of horizontal mergers and that the clear correspondence is lost in cases of vertical mergers where firms involved in the merger are the different level of the supply chain. For the merger cases between firms involved in totally unrelated business activities (conglomerate mergers), the correspondence between consumer welfare and competitor's profits may break down too. If particular conglomerate merger leads to marginalization (or even foreclosure) of competitors, the negative reaction in competitors' profits does not necessarily mean that consumers will not be hurt by the merger. Therefore, the potential empirical analysis based on the theoretical framework presented above need to be restricted only to the cases where merger is of a purely horizontal nature (non-vertical nature respectively) and it is necessary to control for the potential conglomerate effects.

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