



Experiments on horizontal mergers: Does size matter?[☆]

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ABSTRACT

Current Department of Justice merger guidelines assume that merging the capacities of two firms will translate into an equivalent increase in market shares. Size matters. Economic theory asserts size is determined by marginal revenue and marginal cost not capacity. Size does not matter. In this paper we run horizontal merger experiments and find that the firms tend to share monopoly profits regardless of the size of the firms.

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1. Introduction

If one duopolist has twice the capacity as compared to the other will equilibrium market shares be unequal? The question is important in several literatures. In ushering in an extensive literature, Salant et al. (1983) find an implication of Cournot theory that they consider “bizarre”; namely, size does not matter in the sense that capacity does not influence market shares or profits. For example, consider three identical Cournot firms producing perfect substitutes. A merger between any two clearly doubles the resulting firm’s capacity but the market shares for the two remaining firms may well end up to be 1/2 each. The market share of the merged firms drops from two-thirds to 1/2 and, even if industry profits rise due to the reduced competition, the merged firm’s profits may well fall. Indeed for linear demand and cost functions, the merged firm’s profits do fall. Farrell and Shapiro (1990) note that this implies that the Department of Justice’s

merger guidelines (Department of Justice, 2010, Section 5.3) are potentially faulty as they assume the merged firm will retain a 2/3 share.³

A second literature, in contrast, suggests size may matter. Rabin (1993), for example, argues good and bad intent is judged relative to potential and therefore high capacity firms that choose low outputs might be considered kind and low capacity firms may want to reward them. However, Charness and Rabin (2005) note that while punishment of bad behavior is common, rewarding good behavior, especially if the reward comes at some cost, is quite rare.

This paper sets up an experiment to examine the question.

2. Experimental method

Ninety-four subjects were recruited using the email based system at the University of California, Santa Barbara and reported in person to the economics laboratory. In each session, between 12 and 22 subjects were paired and shown Table 1. One subject in each pair is randomly assigned to have a capacity of four units and is the row player while the other is assigned a capacity of

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³ The DOJ calculates the pre- and post-merger Herfindahl index and states that the increase in the index is “equal to twice the product of the market shares of the merging firms” which is correct only if the market share of the merged firms is the sum of the two pre-merger market shares. Increases in excess of 100 points trigger additional investigation.

Table 1
Profit table for row and column (in cents).

	0	1	2	3	4	5	6	7	8
0	0	0	55	0	100	0	135	0	160
1	55	0	50	45	90	40	120	35	140
2	100	0	90	45	80	70	105	60	120
3	135	0	120	40	105	70	90	75	100
4	160	0	140	35	120	60	100	75	80

Table 2
Percentage of responses for each cell.

	0	1	2	3	4	5	6	7	8	Total
0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.5	1.0
1	0.0	0.0	0.1	0.1	0.9	0.3	0.1	0.2	0.0	1.7
2	0.0	0.0	0.3	0.8	2.2	1.2	0.2	0.1	0.0	4.8
3	0.0	0.8	1.1	66.6	5.5	0.9	0.2	0.1	0.0	75.2
4	1.0	1.2	1.8	5.5	5.0	2.3	0.5	0.0	0.0	17.3
Total	1.0	2.0	3.4	73.0	13.5	4.8	1.3	0.5	0.5	100

eight units and is the column player. The profits in each cell are calculated from the function $\pi_i = (60 - 5q_1 - 5q_2)q_i$ where each point represents one penny that is paid at the end of the experiment. The experiment lasts a minimum of 18 rounds and is randomly terminated thereafter. All rounds are paid and a fixed fee of \$5 is added to the total. Subjects keep the same random pairing throughout.

There are two information conditions. In one condition, subjects are allowed to chat before making any decisions and to log an non-binding agreement. Agreements are facilitated by allowing subjects to make an offer by clicking on a payoff cell in Table 1. The cell is outlined in both subjects' screens and an offer box presents the offer as text. The subjects may also use a chat box to explain their reasoning. Each subject may then accept or make a counter offer. Then subjects simultaneously choose any output they wish. Subjects are informed of their pay, and behavior is compared to any agreement. In the other information condition subjects make a simultaneous output choice with no chat and no mechanism to log an agreement. The software, available from authors, is programmed in z-Tree (see Fischbacher, 2007). Instructions are available online.

3. Experimental context

Huck et al. (2004) survey the extensive experimental literature and conduct experiments that vary by the number of firms. As they note, previous experiments manipulate size by altering cost functions and firms with equal cost functions are treated equally by the experimenter. For example, in their own experiments each subject has the same maximum output. Charness and Rabin (2005) argue that, while intentions may be imperfectly surmised from observed decisions, allowing and recording chat is an important aid to assess motivations particularly if fairness considerations are in play.

The theoretically shared monopoly solution is at (3, 3) with profits of \$0.90 each. The non-cooperative solution is at (4, 4) with profits of \$0.80 each. The Stackelberg leader position has the large firm choosing 6 while the small firm chooses 3, offering profits of \$0.90 and \$0.45, respectively. The small firm cannot be the Stackelberg leader as its output is limited to 4. Leadership could be arranged in the chat and agreement period with the large firm simply informing the small firm of their choice.

4. Results

A total of 94 subjects completed the experiment with chat and agreements possible. Results for the 923 pairs of observations over

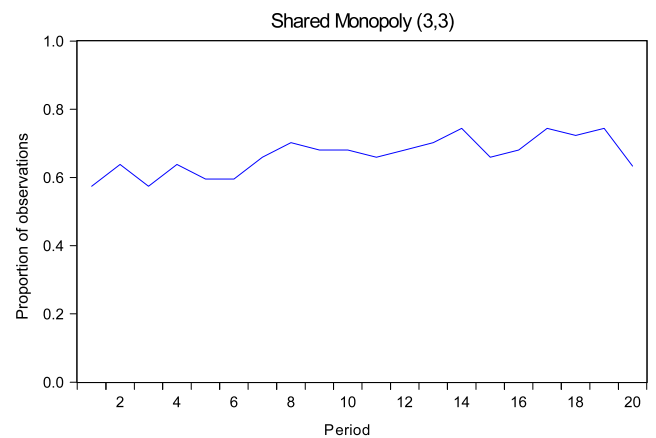


Fig. 1. Proportion of observations choosing the shared monopoly over the course of experiment.

all the rounds are presented in Table 2. One subject selects columns 0–8 and the other rows 0–4.

The core result that size does not matter is immediately apparent as only 7.1% of the choices involve any outputs larger than four units for either duopolist. The proportion selecting the symmetric shared monopoly ranges from 57% to 74% with an upward trend of 0.5% per round (see Fig. 1). Even defections from the agreement show no asymmetry due to size: the (3, 4) choice and the (4, 3) choice both occur 5.5% of the time.

For the 14 subjects that are not allowed to communicate or make an agreement the results are nearly identical: only 4.5% ever involve an output choice larger than 4 units and 63% select the symmetric shared monopoly. There is some slight indication of asymmetry in the deviations from shared monopoly: (3, 4) occurs 10.5% of the time while (4, 3) occurs 4.5% of the time.

The chat is informative. It is fairly common for the column chooser to notice their potential for higher output and pay but most have been convinced by the row player, even by the first round, to cooperate and pick (3, 3). One pair does pick (2, 4) nearly the entire experiment with the column player arguing that they “deserve” more because they are capable of “producing 2× as much”. The row player responds “smaller businesses need to grow though too” and column chooser asserts “lower overhead, same profit”. An argument that escapes us but the row player eventually accepts “well luckily I’m starting to understand your logic”. The resulting pay for the row and column is \$16.95 and \$28.95, respectively. In another pairing, the column player is just as assertive but the row player is more cunning. Column player: “I’ve got the advantage”. Row player: “if you plan on 6 then I’m picking 4”. Note that 4 is not

a best response but it is rational if the row player is willing to pay to punish the column player. End result? Pay of \$17.75 and \$21.95 with \$22.10 the expected pay from (3, 3).

5. Discussion and conclusion

Popular culture, fairness, intuition, strategic play and the DOJ all support the hypothesis that size matters. However subjects placed in an environment where one player has the greater range of choice than a horizontal merge would allow generally behave symmetrically. This behavior supports theoretical predictions of output based on marginal revenue and marginal cost that ignore capacity constraints. The clear implication for the DOJ then is that analysis may need to be centered on revenues and costs and how the merger will affect these values and not entirely on historical market shares. The lessons for the fairness literature are more nuanced. Failure to press an advantage is not interpreted as kindness and is not rewarded as one might expect from Rabin (1993). This tends to support Charness and Rabin (2005) with punishment looming larger than reward.

Appendix. Supplementary data

Supplementary material related to this article can be found online at <http://dx.doi.org/10.1016/j.econlet.2012.07.016>.

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