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Price leadership and unequal market sharing: Collusion in experimental markets☆

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ABSTRACT

We consider experimental markets of repeated homogeneous price-setting duopolies. We investigate the effect on collusion of sequential versus simultaneous price setting. We also examine the effect on collusion of changes in the size of each subject's market share in case both subjects set the same price. Our results show that sequential price setting compared with simultaneous price setting facilitates collusion, if subjects have equal market shares or if the follower has the larger market share. With sequential price setting, we find more collusion if subjects have equal market shares rather than unequal market shares. We observe more collusion if the follower has the larger market share than if the follower has the smaller market share.

1. Introduction

In about one third of the cartel cases prosecuted by the European Commission, the market had a price leader and (several) price followers (Mouraviev and Rey, 2011). Examples include markets for fittings, professional videotape and candle wax (DG Competition, 2006, 2007, 2008).

In a recent study, Mouraviev and Rey (2011) theoretically investigate the role of price leadership with regard to (tacit) collusion. They allow for the possibility of unequal market shares in case firms set the same price. They argue that sequential price setting, compared with simultaneous price setting, facilitates collusion by making it easier to punish deviations by the leader, which relaxes the incentive of the leader to deviate. Furthermore, they show that, with sequential price setting, collusion is facilitated if the follower's market share is higher, in case both firms set the same price. In particular, considering a repeated duopoly model with homogeneous goods and sequential price setting, Mouraviev and Rey demonstrate that collusion can be sustained for any discount factor, if the follower's market share is large enough. In contrast, with simultaneous price setting, collusion can only arise in equilibrium if the discount factor is large enough (Friedman, 1971).

Inspired by Mouraviev and Rey (2011), we consider experimental markets of repeated homogeneous price-setting duopolies. We investigate the effect on collusion of sequential versus simultaneous price setting. Further, we examine the effect on collusion of changes in the size of each subject's market share in case both subjects set the same price. In particular, we address the following two questions. First, does price leadership facilitate collusion, for a given type of market sharing? Second, with sequential price setting, does a larger market share of the follower facilitate collusion? There is one related issue which we will also examine. Mouraviev and Rey (2011) argue that market-share inequality in case firms set the same price, might facilitate collusion with sequential price setting. But we know from standard theory that with simultaneous price setting, market-share inequality hinders collusion (Ivaldi et al., 2003; Motta, 2004, pp. 164–165). We also investigate this claim in our experiment.

In our experiment we impose whether subjects set prices simultaneously or sequentially. We exogenously impose market shares in case subjects set the same price, to isolate the effect of market-share inequality. With simultaneous price setting we consider two treatments

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which differ in how the market is shared in case subjects set the same price. In one treatment the market is shared equally, in the other unequally. With sequential price setting we consider three treatments which differ in how the market is shared in case subjects set the same price. In one treatment the market is shared equally, in one the follower obtains the larger market share, and in one the follower obtains the smaller market share. To the best of our knowledge, we are the first to conduct an experiment on price leadership with homogeneous Bertrand competition, and our experiment is the first with unequal market sharing in case subjects set the same price. The simple experimental setup allows us to focus on the effect of the different tie-breaking rules.

Concerning the theory, there are two possible caveats in relation to our experiment. First, since we focus on tacit collusion, subjects might find it difficult to coordinate on the same collusive price. In the theoretical analyses of collusion by Motta (2004) and Mouraviev and Rey (2011), this coordination problem does not play a role. In practice, however, the coordination problem might be relevant, in particular in the case of simultaneous price setting. Scherer and Ross (1990, pp. 346–347) mention that one reason to introduce leadership in a market is indeed to facilitate tacit coordination on the same collusive price. This coordination problem is due to the unobservability of the competitor's price when one has to set her own price. A subject who wants to coordinate on the same price or wants to undercut her competitor, can therefore not be certain what her optimal strategy should be. Second, the larger the market share of the follower in case firms set the same price, the larger the difference between the collusive payoffs of the follower and leader. In the theoretical analysis of Mouraviev and Rey (2011), the utility of one firm does not depend on the profit of the other firm, but it might have an effect in practice. We know from the experimental literature that fairness arguments, in the sense that subjects dislike (large) payoff differences, matter (e.g. in the ultimatum game, see Roth, 1995; Camerer, 2003). In addition, Gibbons and Murphy (1990) and Albuquerque (2009) empirically show that CEOs of firms do not only care about their absolute performance, but also care about their relative performance. If such an effect is relevant in our experiment, it might imply that subjects are not willing to collude, if that would lead to too large payoff differences. Thus, an increase in payoff differences might (partially) offset the pro-collusive effect identified by Mouraviev and Rey.

In evaluating the results, we use three measures of collusion. We find the following with regard to our two main questions. First, we find more collusion with sequential price setting than with simultaneous price setting, if firms have equal market shares. We also find more collusion with sequential price setting than with simultaneous price setting if the follower has the larger market share. However, if the follower has the smaller market share, evidence is mixed. We argue that this can be explained in terms of the coordination problem and fairness arguments mentioned above. Second, with sequential price setting, a larger market share of the follower sometimes facilitates collusion. In fact, we find an inverted u-shape: we observe more collusion if subjects have equal market shares rather than unequal market shares. However, if we compare the case where the follower has the smaller market share with the case where the follower has the larger market share, we find more collusion in the latter case. Based on these results, we also compare sequential price setting and a larger follower's market share with simultaneous price setting and equal market shares, which combines a change in the type of price setting and a change in the size of market shares. We find more collusion in the former case.

The remainder of this paper is organized as follows. Section 2 provides an overview of the related literature. Section 3 presents the theoretical model and Section 4 the experimental design. Section 5 gives our results, while Section 6 concludes. Our regression model and detailed information on the experiment are provided in the Appendices.

2. Related literature

Our experiment considers price leadership and a type of asymmetric market sharing. In this section we discuss the literature about (i) price and quantity leadership, (ii) different types of market sharing, and (iii) different types of asymmetries between firms.

Several experimental papers discuss price and quantity leadership. Hildenbrand (2010) provides an extensive overview. Kübler and Müller (2002) compare sequential price setting with simultaneous price setting in a repeated duopoly with heterogeneous products and symmetric firms. They find that sequential price setting yields more collusion than simultaneous price setting. Huck et al. (2001) conduct an experiment on quantity leadership in homogeneous duopoly markets. They observe in a repeated game higher levels of output, and thus less collusion, with sequential quantity setting than with simultaneous quantity setting. These two experiments impose one of the subjects to take the role of the leader, while the other subject acts as the follower. In our experiment we do the same. Some other experiments consider endogenous timing where each round consists of two stages and subjects are allowed to choose in which stage to set their price or quantity. For example, Datta Mago and Dechenaux (2009) investigate repeated price-setting homogeneous duopolies with capacity-constrained firms. They find more collusion when it turns out that subjects have chosen to set prices in different stages rather than in the same stage. Furthermore, this effect is stronger with asymmetric capacity constraints. Further, Fonseca et al. (2006) consider repeated homogeneous duopolies where subjects announce when to set their quantity. They find no effect on collusion between sequential and simultaneous quantity setting. Other related experiments are Huck et al. (2002) and Fonseca et al. (2005). In summary, we see that sequential price setting facilitates collusion, while sequential quantity setting hinders collusion. With endogenous timing, there is more collusion when it turns out that subjects have chosen to set prices in different stages rather than in the same stage, while there is no such effect for quantity setting.

Some experiments consider different types of market sharing. Puzzello (2008) investigates the effect on collusion of two different tie-breaking rules in case firms set the same price in a homogeneous duopoly with simultaneous price setting and capacity-constrained firms. She considers a *share* tie-breaking rule where the market is shared equally, and a *random* tie-breaking rule where each firm is selected with the same probability to supply the market first. The random tie-breaking rule implies unequal market sharing ex post, but ex ante payoffs do not differ between the two rules. Puzzello finds more collusion with the share tie-breaking rule than with the random tie-breaking rule. On the other hand, Davis and Wilson (2002) find no difference in collusion between these two tie-breaking rules in an auction with homogeneous goods and four capacity-constrained sellers per market. Thus, evidence on the effect on collusion of asymmetric market sharing is mixed. In our experiment we impose unequal market shares in a number of treatments. However, our firms are not capacity constrained.

A number of experiments focus on different types of asymmetries between firms. Mason et al. (1992) investigate quantity-setting duopolies with a homogeneous good. Each firm has either low or high constant marginal cost. The authors find more collusion if firms have equal marginal costs than if firms have different marginal costs. Dugar and Mitra (2009) vary the size of the marginal cost asymmetry in homogeneous Bertrand-duopolies under fixed matching of subjects and random assignment of marginal costs in every round. They find more collusion if the difference between the two possible values of marginal costs is smaller.[1]

Phillips et al. (2011) examine heterogeneous quantity-setting duopolies and different marginal costs. They find more collusion if firms have equal marginal costs than if firms have different marginal costs. They

[1] This result is confirmed by Dugar and Mitra (2013) in the same experimental setup with random matching of subjects and fixed marginal costs.