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Experimentally observed imitation and cooperation in price competition on the circle

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Abstract

This paper reports an experiment on a location game, the so-called "Price competition on the circle." There are n symmetric firms equidistantly located on a circle. Consumers are uniformly distributed. Each consumer buys one unit from that firm whose price, including the cost of transportation, is the lowest, provided such a price is below a maximum willingness to pay. Experiments, extended over 200 periods, were run with 3, 4, and 5 participants. Subjects did not receive any information about the relationship between prices and profits, but they received feedback on prices and profits of two neighbors after each period. The evaluation compares predictions derived from imitation equilibrium and Cournot equilibrium, as well as symmetric joint-profit maximization. The results show that behavior is influenced by imitative tendencies and attempts to cooperate.

JEL classification: C72; C92; L13; R32

Keywords: Imitation; Cooperation; Location; Price competition; Market size; Experiments

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1. Introduction

It has often been proposed in the literature that competitors in an oligopolistic market may be guided by imitation rather than by profit calculations. Horst Todt (1970, 1972, 1975) has expressed this view in connection with his experiments on a locational oligopoly, involving investment and pricing decisions of hotels in three health resource towns. Later, the idea of imitation as a driving force of competition has been worked out by various contributors to evolutionary game theory (Vega-Redondo, 1997, 1999; Schlag, 1998, 1999; Rhode and Stegeman, 2001). In this literature processes of imitation are described which may not converged to Nash equilibrium but to other outcomes, e.g., the competitive equilibrium in the symmetric Cournot model.

In a paper by Selten and Ostmann (2001) the notion of imitation equilibrium is introduced. The imitation equilibrium is a behavioral static equilibrium concept, which can be compared to equilibrium points in pure strategies like the Nash equilibrium. Learning processes often involve several parameters which have to be estimated from the data. The concept of imitation equilibrium, however, does not involve any parameter and therefore permits a direct comparison with the static equilibrium point notion of non-cooperative game theory. In the paper by Selten and Ostmann, imitation equilibria have been determined for the symmetric Cournot model with constant average cost, for the asymmetric Cournot duopoly with constant average cost, and for a simple oligopolistic model of price competition on the circle. The experiments reported here concern the last of these three examples.

In the case of the oligopolistic model of price competition on the circle, imitation equilibrium predicts stronger competition for markets with three firms, than for those with four or five firms. This is a surprising theoretical result since usually one expects competition to get stronger with an increase in the number of competitors. It seemed to be an interesting research question to what extent the prediction of imitation equilibrium theory is supported by experimental data.

It is plausible to assume that imitation is favored by a lack of knowledge about the connection of prices and profits. Accordingly, in our experiments subjects did not get any information about how the profit depends on the prices. They were not informed about intervening variables like costs and sales, and they were not told that they were involved in a spatial competition situation. They were not even informed about the number of competitors in the market. They knew that they have to determine a price and that their profits would depend deterministically on all prices of the same period, and not on those on earlier periods. They got feedback about own price and profits, and the prices and profits of the left and right immediate neighbors, but they did not know anything beyond this. With these information conditions, we wanted to give the best chance to processes of imitation.

More than we expected it turned out that cooperation was often observed in the experiments. Probably, the frame of the experiment suggested the idea to subjects that a price increase by everyone may be good for everybody. Obviously, no knowledge of the functional relationship between profits and prices is necessary for being led to this conjecture. In our analysis of the results we try to disentangle the effects of imitation and cooperative behavior.