Effectiveness of Enterprise Economic Management Based on Price Competition

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Abstract. In order to improve the core competitiveness of an enterprise, it must first start with the implementation of cost accounting, and then improve the economic management ability of the enterprise. This paper systematically studies quantity competition and price competition among enterprises. It reveals the influencing factors of how enterprises conduct price competition. Build an objective function that maximizes both profit and output. The difficulty of cooperation and the amount of punishment for poly-oligopoly firms with asymmetric marginal costs are discussed. Finally, this paper verifies the impact of price competition on the cost and profit of enterprises through examples.

Keywords: Price Competition; Economic Management; Cost; Profit Maximization; Objective Function

1. Introduction

With the rapid development of economic globalization and information technology, the competition among enterprises is not only the competition between individual enterprises, but also the competition between supply chains. The globalization of the economy, the rapid development of information technology and the high uncertainty of customer demand have promoted the continuous updating of electronic products, which also led to the rapid decline of their prices. For example, the personal computer industry is characterized by an average price drop of 50%-58% for desktops in the first year of their life cycle [1]. Therefore, in order to ensure that each brand manufacturer maximizes its own profit and that the retailer's profit is not negative, and also to avoid the price war in the retail terminal from affecting the brand image, the brand manufacturer often has the right to decide the price of the terminal product. In the oligopoly market, the Cournot model and the Steinberg model are two important models for analyzing this market. It is also the earliest research object of game theory, and many scholars and economists have studied it. Matsumura through Cournot model analysis of finite stages. Rasserti et al. studied the convergence of the equilibrium solutions of the Cournot equilibrium. Huck et al. studied the learning effect and the influence of exogenous conditions on the game outcome. For example, Sherali created a multi-manufacturer Steinberg competition game model with m first movers and n later movers. It is concluded that the profit of first movers is higher than that of later movers and when m is 1, that is, the situation of 1 versus N above. at this time the profit of the first-moving firm reaches the maximum [2]. When m is 0, that is, the multi-oligopoly Cournot model, the profit of the latter-moving firm reaches the maximum. Daughty analyzed the equilibrium solution of the Steinberg game model with m first-moving firms and n later-moving firms. Mergers do not necessarily reduce social welfare. Simon studied the multi-oligarch Cournot and Steinberg games, and pointed out that in the multi-oligarch Steinberg game, the profit of the first-moving oligarch is greater than that of the second-moving oligarch, and the profit of the first-moving oligarch is not necessarily greater than that of the Cournot competition game when the number of oligarchs is greater than 2 The profits of oligarchs.

2. The game model under the multi-oligopoly

Given the output $q_{1s} \geq 0$ of the leading oligarch E_1, how does the backward oligarch $E_i\left(i=2,...,n\right)$ decide its own output according to the output of E_1. According to the profit maximization principle, we get:

$$\max \pi_{is} = q_{is} P\left(\sum_{j=1}^{n} q_{js}\right) - C_{is}\left(q_{is}\right), i = 2,...,n \tag{1}$$

Substitute the above linear inverse demand function and cost function into (1), and solve the optimal first-order condition, omitting the matrix calculation process, and obtain the optimal decision output taken by oligopoly $E_i\left(i=2,...,n\right)$ when observing the output of leading oligarch E_1:

$$q_{is}^{*} = \frac{a-c-q_1}{2b\left(n-1\right)}, i = 2,...,n \tag{2}$$

Conversely, this paper considers the game in the first stage. Since oligarch E_1 predicts that the back-moving oligarch $E_i\left(i=2,...,n\right)$ will choose the best output q_{is}^{*} according to (2), the leading oligarch E_1 in order to maximize its own profit, the problem becomes:

$$\max \pi_{1s} = q_{1s} P\left(\sum_{i=2}^{n} q_{is}^{*} + q_{1s}\right) - C_{1s}\left(q_{1s}\right) \tag{3}$$

Substitute (2) of the above formula into (3), consider the linear inverse demand function and cost function at the same time, and omit the calculation process for the optimal first-order condition of formula (3). The optimal output of leading oligopoly E_1 is obtained as:

$$q_{1s}^{*} = \frac{a-c}{2b} \tag{4}$$

Substituting equation (4) into (2), the optimal output of rear-moving oligarch $E_i\left(i=2,...,n\right)$ is obtained as:

$$q_{is}^{*} = \frac{a-c}{4b\left(n-1\right)}, i = 2,...,n \tag{5}$$

According to the above analysis, the sub-game Nash equilibrium $\left(q_{1s}^{*}, q_{2s}^{*}, ..., q_{ns}^{*}\right)$ of the N-stackelberg game model can be obtained, and then an oligarch E_1 can be the first mover, that is, the leading oligarch, and other oligarchs $E_i\left(i=2,...,n\right)$ can participate in the game decision-making as the latter movers, and each oligarch can obtain The corresponding profit is:

$$\pi_{1s}^{*} = \left(\frac{\left(a-c\right)^2}{4b}\right) \tag{6}$$

Analysis of the results obtained above:

When $n=1$, there is only one oligopoly in the market at this time, obviously there is no game at this time, which is what economics calls a complete monopoly [3]. This has no research significance, so this paper considers the case of $n \geq 2$. Obviously there will be:

$$\pi_{1s}^{*} > \pi_{i}^{*} \tag{7}$$

$$\pi_{1s}^{*} > \pi_{is}^{*} \tag{8}$$

Among them, $i = 2,...,n$.

Of course, in other words, if oligarch n participates in the market competition game, then the profit of B as the leading oligarch in the N-stackelberg competition game is more than that of the oligarch in the N-Cournot competition game, and it is also higher than that of the oligarch E_1 in the N-Cournot competition game [4]. In the stackelberg competition game, the oligopoly as the late mover has more profit, and I think this is the first mover advantage.

The focus of this paper is to compare the profits of the late-moving oligarchs in the N-stackelberg competitive game with the profits of the oligarchs in the N-Cournot competitive game. According to the above equations (1-4) and (1-11), this paper can have:

$$\pi_{is}^{*} - \pi_{i}^{*} = \frac{(a-c)^2}{16b(n-1)} - \frac{(a-c)^2}{b(n+1)^2}, i = 2,...,n. \tag{9}$$

Easy to get:

When $2 \le n \le 12$, $\pi_{is}^{*} - \pi_{i}^{*} < 0$, then $\pi_{is}^{*} < \pi_{i}^{*}$;

When $n \ge 13$, $\pi_{is}^{*} - \pi_{i}^{*} > 0$, then $\pi_{is}^{*} > \pi_{i}^{*}$.

So this paper can get the following theorem:

When the N-Cournot competitive game reaches equilibrium, the profit obtained by each oligarch is the N-Cournot profit, and when the N-stackelberg competitive game reaches equilibrium, the profit of each backward oligarch is the N-stackelberg backward profit, as follows: At that time, N -Cournot profit is greater than N-stackelberg post-movement profit; when N-Cournot profit is less than N-stackelberg post-move profit.

3. The company's price competition strategy

The strategic analysis of oligopoly is to analyze the strategic interaction among the participants, and non-cooperative game theory has become an important tool in this regard. Moreover, non-cooperative game theory has many applications in modern economics, and oligopolistic competition is a major form of market competition. Contains the main content of game theory [5]. The analysis of oligopolistic markets has always appealed to many economists, both because this market structure is more common, and because the diversity of oligopoly behavior makes theoretical research more meaningful. But since Cunot gave his analysis on oligarchic theory many years ago, there is still no substantial progress in this aspect of western economics. Even as far as the efficiency of oligopolistic markets is concerned, there is currently no model accepted by the majority. Modern economists have conducted individual studies on the classical Kunot model, Bertrand model, and Stackelberg model, but have not conducted systematic analysis.

What is the reciprocal degree of the relationship between welfare and competition? From the calculation of social welfare above, we know that the social welfare of a perfectly competitive market is the largest, and the welfare loss of a complete monopoly in an imperfectly competitive market is the largest. Therefore, it can be seen that competition can be improved Social Welfare. From a general point of view, market competition can prompt manufacturers to reduce prices or increase production, which are beneficial to consumers, and welfare has indeed improved. However, the promotion effect of inter-firm competition on social welfare is closely related to the degree of product differentiation in the market [6]. In the chapter on price competition strategy of oligopolistic enterprises, product differentiation is introduced into the Bertrand model, and it is concluded that the equilibrium price decreases with the increase of the mutual substitution coefficient of the two products, that is, the more similar the products produced by the two manufacturers are. , the lower the market price, the more intense the competition, and the more benefits consumers get. It can also be seen from the calculation

of social welfare that the smaller the substitution coefficient, the smaller the welfare index. Market competition does not always bring about the improvement of social welfare, on the contrary, it may worsen the social welfare situation [7]. In the previous quantity competition and price competition, there are such conclusions: the higher the marginal cost of the enterprise, the higher the equilibrium price, the less the equilibrium output, and the less the equilibrium profit. If the cost of travel is included in the cost, it is more profitable for each party to increase the travel cost per unit of the consumer's goods to buy the rival's goods than to increase the travel cost of the consumer's own commodity to buy. In order to obtain more profits, operators have the desire to increase each other's travel costs. In practice, this method often manifests itself as uncivilized and unfair competition behaviors, such as undermining competitors and dealing in commodities, or blocking and destroying channels for consumers to lead to competitors [8]. This phenomenon is more common in times and regions where market regulations are not yet sound. The travel cost here represents a social benefit, and the smaller it is, the better the social benefit.

In order to increase social welfare, when the government manages and controls the market, it should pay attention to the following points: 1. Welfare and competition. From a general point of view, competition can bring about an increase in social welfare. The government can stimulate competition among enterprises, and at the same time must regulate market regulations and promote civilized competition. 2. The government should pay attention to the needs of the market, conduct regulation and control, and avoid the formation of cartel organizations among enterprises. 3 Note the loss of benefits when the degree of product differentiation changes [9]. The higher the degree of product differentiation, the greater the welfare loss. This is a means of enterprise competition, and the government cannot interfere, but can only guide.

4. System verification

In this paper, it is assumed that the number of oligarchs gradually increases from 2 to 15, that is, n gradually increases from 2 to 15. $a=10$, $b=2, c=1$. The equilibrium output of the leading oligarch is 2.25 and the equilibrium profit is 10.125. The listed tables are shown in Table 1 below:

Table 1. Cournot and Steinberg equilibrium output and equilibrium profit under polypoly

n	Cournot equilibrium output	Steinberg's post-move oligarchic equilibrium output	Cournot equilibrium profit	Steinberg's post-move oligarchic equilibrium profits
2	1.5	1.125	4.5	2.5313
3	1.125	0.5625	2.5313	1.2656
4	0.9	0.375	1.62	0.8438
5	0.75	0.2813	1.125	0.6328
6	0.6429	0.225	0.8265	0.5063
7	0.5625	0.1875	0.6328	0.4219
8	0.5	0.1607	0.5	0.3616
9	0.45	0.1406	0.405	0.3164
10	0.4091	0.125	0.3347	0.2813
11	0.375	0.1125	0.2813	0.2531
12	0.3462	0.1023	0.2396	0.2301
13	0.3214	0.0938	0.2066	0.2109
14	0.3	0.0865	0.18	0.1947
15	0.2813	0.0804	0.1582	0.1808

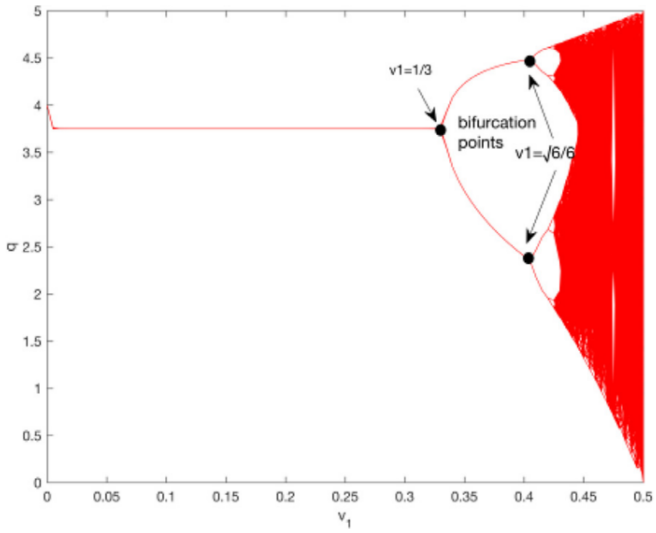


Fig 1. Equilibrium output of Cournot and Steinberg after the number of oligarchs changes

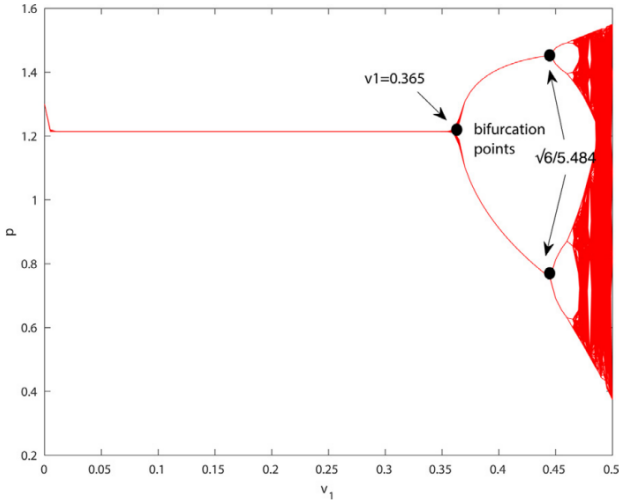


Fig 2. Equilibrium profit of Cournot and Steinberg after the change in the number of oligarchs

From the above list and drawing, it can be concluded that the theory obtained in this paper is correct and consistent with the theoretical results obtained. So, this paper can apply this conclusion to real life.

5. Conclusion

When the amount of punishment changes, so does the likelihood of cooperation. In this paper, the social welfare is calculated when the marginal cost changes, the demand changes, and the product differentiation degree changes in the social optimum, the Kunot type, the Bertrand type, and the collusion. And get the conclusion that the promotion effect of inter-enterprise competition on social welfare is closely related to the product differentiation degree of the market and the market demand function. It is recommended that the government adjust the demand function to reduce welfare losses.

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