The Research of Enterprise Advertising Competition on the Ground of Network Externality

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Abstract

This paper analyzes the characteristics of products with network externality,the approximate demand curve of such products is obtained, And then gives the model which production strategy in the production of such products under the oligopoly market conditions, manufacturers to make independent decisions and the same time when the decision-making advertising strategy, and get the profit when the manufacturers maximize the advertising strategy, and through the analysis of the results, showsing that manufacturers have different choices under different network scale.

Keywords

Network Externality; Profit Maximization, Advertising Competition.

1. Introduction

In real life, we will find that there are some extraordinary products, The return of the consumer to the product will increase as the number of other consumers who own the product increases, such as telephone, e-mail, and now the Internet; that is, when the network has a lot of users and the network links between unimpeded, network value can be achieved and greater play. This is the network economics referred to in the network externalities.

When a product produced by a manufacturer has network externality, manufacturers should consider how to maximize people to accept his products. So that the product 's network achieve a certain scale, network value can be achieved and greater play. So that manufacturers can achieve profits. Manufacturers in order to fight for consumers, to join their own product network, it is necessary to fierce competition. There are a variety of competition among manufacturers, including price competition, advertising competition, technical standards, mergers and so on. This article will analyze the behavior of advertising competition among manufacturers.

In the actual economic activities, due to the different nature of the product, so the product life cycle is different,and then the market competition and market structure is also different, so companies have different advertising content and advertising strategy. Advertising has the role of providing information, such advertisements are called information advertisements, such as the characteristics of products introduced.

Advertising has the effect of providing information that is called informational advertising, such as the characteristics of the product ;Advertising also builds and enhances brand loyalty, which is called persuasion. This paper will start from the persuasive advertising of the enterprise, take advantage of the basic principles of economics, set the special demand curve of the product under the network externality, and analyze the existence of the network externality in the product according to the principle of maximizing the profit of the manufacturer Under the conditions of the enterprise's advertising competition behavior.

2. The Analysis of Product Features with Network Externality

From the producer point of view, with the network externalities of the product cost is more special, have the following several characteristics:

(1) high fixed costs: When manufacturers produce the first product, it needs to invest a lot of manpower, material and financial resources, there is a high cost of research and development, so it has high fixed costs;

(2) the cost of change is extremely low: wait until the manufacturer's production has a certain scale, the production of follow-up products is only a simple copy, this time the production of the product changes in the cost is extremely small;

(3) the marginal cost of the same: for the production of products with network externalities, especially digital products, production is no limit, no matter how many copies of production, the cost will not increase, so the marginal cost of the same;

(4) economies of scale and marginal revenue increase: the special cost structure of such products, determines the manufacturers in order to recover its huge sunk costs, only to expand the scale of production, mass production, thus forming economies of scale. This also reflects another feature of the network's external product, that is, the marginal revenue of the product is increasing, That is, the marginal revenue of the product increases, rather than the traditional economics of the marginal revenue decline.

From the demand side of the product with network externality, the demand curve of the product with network externality is also special. The demand curve for such goods is not as good as the traditional economics is a curve from left to right downwards. For products with network externality, the expected demand curve can usually be used as the demand curve. The characteristic is that when the product is not a lot, because the value of the externalities of the network is extremely small, the marginal consumers' willingness to pay for the products is extremely small. With the increase of the users, the external effect of the network is gradually displayed, and the marginal users gradually improve the evaluation of the product; Finally, when a considerable number of users join the product network, the marginal user's willingness to pay for the product is reduced, because those who have a higher willingness to pay the consumer groups have become products users, the rest are those who evaluate the product is extremely low consumers. Therefore, the demand curve with the network external product can be shown in Figure 1:

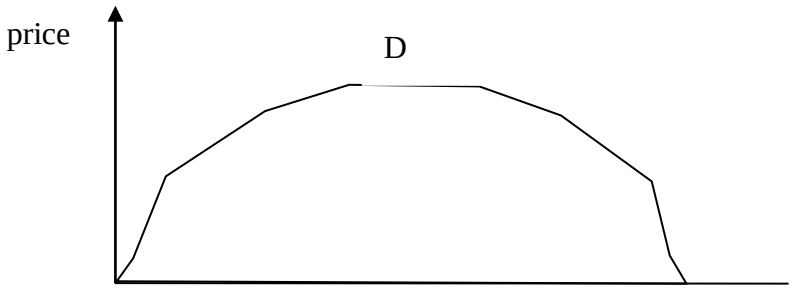

Figure 1 Demand curve for products with network externality

3. Analysis of Advertising Decision Behavior of Individual

Assumptions:

(1) the market is an oligopoly of the market structure.

(2) The products produced by the enterprises in the market are networked and not fully compatible or completely incompatible.

(3) The enterprises in the market according to their own products already have the size of the network to determine it's advertising volume. Do not consider other manufacturers of advertising decisions.

(4) According to the above analysis of the characteristics of the product with network externality, the demand curve for each vendor is simplified as a parabola: (where $a<0, b>0$)

(5) Set the product manufacturers to carry out advertising investment, to determine the number of advertises for the X_a, the unit advertising by the average demand for products, manufacturers of unit production costs for the C (excluding advertising costs), The average cost per unit of advertising is set to C_a.

The demand function generated by the advertise is: $P = a(\beta \mathrm{X}_a)^2 + b\beta \mathrm{X}_a$

So that make $C_a^{'} = C_a / \beta$,It represents the average advertising cost of generating the unit product demand, And make $C^{'} = C + C_a^{'}$, Represents the unit market cost or market penetration cost of the product when the vendor invests in advertising.

You can write the profit function of the manufacturer : $\pi = \left[(a\beta^2 X_a^2 + b\beta X_a) - C^{'} \right] \bullet \beta X_a$

The goal of the enterprise is to pursue profit maximization, so the maximum value of the profit function is required.

First, make a first derivative of the profit function of the manufacturer and make it equal to 0:

$$\frac{\partial \pi}{\partial X_a} = 3a\beta^3 X_a^2 + 2b\beta^2 X_a - \beta C' = 0$$

Solutions have to: $X_{a1,2} = \frac{-b \pm \sqrt{b^2 + 3ac'}}{3a\beta} > 0$

Then, the second step derivative of the profit function of the manufacturer, and make the second derivative less than 0, thus verifying which of the two solutions satisfies the requirement:

$$\frac{\partial^2 \pi}{\partial X_a^2} = 6a\beta^3 X_a + 2b\beta^2 < 0$$

Will be obtained above the two solutions into the test, we can see that only when $X_a = \frac{-b - \sqrt{b^2 + 3ac'}}{3a\beta}$ appropriate.

That is, when the product has the characteristics of network externality, the manufacturer does not consider the decision of other manufacturers and make independent decisions, when the manufacturer's advertising quantity $X_a = \frac{-b - \sqrt{b^2 + 3ac'}}{3a\beta}$, the manufacturers can achieve the maximum profit, that is, X_a and β inversely proportional.

From the above derivation results can be seen, when the market manufacturers do not consider other manufacturers of advertising decisions and independent decisions, only to maximize their own profits, the amount of business advertising depends on the unit of advertising products caused by product demand and the two are inversely related, that is, That is, when the unit advertising caused by the demand for a long time, manufacturers can reduce advertising investment, when the unit advertising caused by the small demand for products, manufacturers can increase the advertising efforts to promote consumption.

4. An Analysis of the Competitive Behavior of the Advertisement in the Oligopoly Market

In the following, we will deepen the model to discuss when the manufacturers in addition to taking into account their own profit maximization, but also taking into account the production and its products are not fully compatible with or completely incompatible with other manufacturers of advertising decisions advertising behavior.

Assumptions:

(1) The market structure for the oligopoly market.

(2) The products produced by the enterprise in the market are networked and not compatible or not fully compatible with each other.

(3) The companies in the market not only according to their own production products already have the size of the network to determine its advertising volume, but also take into account the advertising decisions of competitors.

(4) The market capacity of this oligopoly is 2H. Two manufacturers of production were q_1 , q_2 , which is the size of the two manufacturers of product network.

In order to discuss the convenience, further simplifies the demand curve with network externality products,which is reduced from a parabolic property to a polyline with respect to x = H symmetry. (Figure 2)

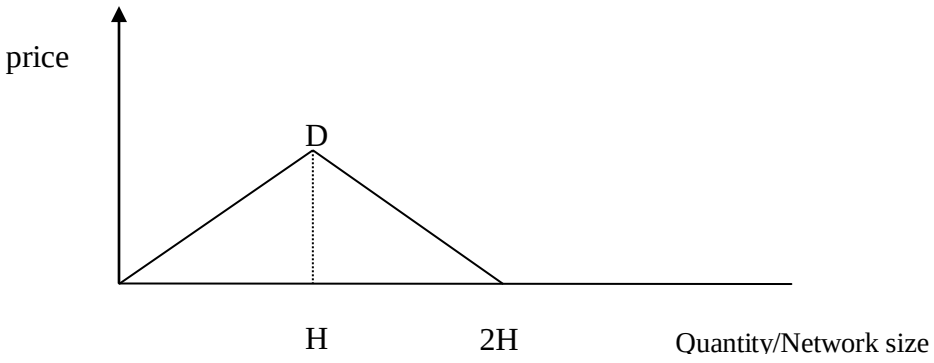

Figure 2 Simplify the demand curve with a network of external

Based on the above assumptions, we can derive the demand curve for a market with network externality, expressed as:

$$P=\begin{cases} a(q_1+q_2) & ,H\le q_1+q_2 \\ -a(q_1+q_2)+2aH, & H\le q_1+q_2\le 2H \end{cases}$$

(among them，a〉0）

So that make $C_{ai}^{'}=C_{ai}/\beta$,it means that the manufacturer i produces the average advertising cost per unit of product demand and makes $C_i^{'}=C_i+C_{ai}^{'}$, it possible to show the market cost or market penetration cost of the i unit in the competition.

(1) Then when $q_1+q_2<H$, the demand function caused by advertise serving can be written as: $P=a\beta(x_{a1}+x_{a2})$

The demand function can write the profit function of the manufacturers: $\pi=\left[a\beta(x_{a1}+x_{a2})-c_i^{'}\right]\times\beta x_{ai}$ (i=1,2)

As the manufacturer's goal is to maximize profits, so the following were the two manufacturers profit function to maximize the amount of advertising input solution.

First, the profit function of the manufacturers 1 guide, equal:

$$\begin{aligned}\frac{\partial\pi}{\partial x_{a1}}&=\beta[a\beta(x_{a1}+x_{a2})-c_1]+\beta x_{a1}\cdot a\beta\\&=2a\beta^2x_{a1}+a\beta^2x_{a2}-c_1\beta\\&=0\end{aligned}$$

Solution have to :

$$x_{a1} = \frac{c_1 - a\beta x_{a2}}{2a\beta} \tag{1}$$

The same can be solved by the vendor's 2 largest advertising delivery

$$x_{a2} = \frac{c_2 - a\beta x_{a1}}{2a\beta} \tag{2}$$

(1), (2) can be solved so that the two companies at the same time to achieve the maximum profit when the advertising level:

$$\begin{cases} x_{a1} = \dfrac{2c_1^{'} - c_2^{'}}{3a\beta} \\ x_{a2} = \dfrac{2c_2^{'} - c_1^{'}}{3a\beta} \end{cases}$$

among them

$$\beta(x_{a1} + x_{a2}) = q_1 + q_2 = \beta(\frac{2c_1^{'} - c_2^{'}}{3a\beta} - \frac{2c_2^{'} - c_1^{'}}{3a\beta}) = \frac{c_1^{'} + c_2^{'}}{3a} \tag{3}$$

Therefore, substitute ithe results into the profit function of the enterprise, you can get the two companies at this time the maximum profit were:

$$\begin{cases} \pi_1 = -\dfrac{(2c_1^{'} - c_2^{'})^2}{9a} \\ \pi_2 = -\dfrac{(2c_2^{'} - c_1^{'})^2}{9a} \end{cases}$$

From the above analysis can be seen in the left half of the curve, mainly have the following several characteristics: First, the amount of advertising and the cost of the enterprise is proportional to that when the enterprise market costs (including production costs and advertising investment) is relatively large, the enterprise is relatively at a disadvantage, to reverse this disadvantage, we must expand market share, rapid occupation of the market in order to achieve economies of scale (network external product characteristics), expand market share, it is necessary to increase the amount of advertising; The amount of the enterprise and the other business costs inversely proportional to the principle of the same as above. Second, the profit of the enterprise is negative at this stage. As the initial production, consumer demand for smaller products , the product network is relatively small, has not yet formed economies of scale, and because the fixed investment in enterprises is relatively large, although the initial small-scale production gains can make up for changes in costs, but can not make up so fixed cost, resulting in a negative profit phenomenon, that is, at a loss. Third, the profit at that stage is mainly determined by the difference between the cost of the manufacturer and the cost of the enterprise. The smaller the gap, the smaller the loss of the enterprise and vice versa. Fourth, the period of the main way to increase profits for the expansion of advertising volume, the rapid possession of the market. From the above analysis we can see that the market at this stage did not reach a balance, there is only a temporary short-term equilibrium.

(2) At the $H \le q_1 + q_2 \le 2H$ time, the demand function caused by the ad can be written as: $P = -a\beta(x_{a1} + x_{a2}) + 2aH$

Which can write the manufacturer's profit function: $\pi = \left[-a\beta(x_{a1} + x_{a2}) + 2aH - c_i^{'}\right] \times \beta x_{ai}$

With the above method can be obtained to maximize the profits of manufacturers, the two companies the optimal advertising volume:

$$\begin{cases} x_{a1} = \dfrac{2aH + c_2^{'} - 2c_1^{'}}{3a\beta} \\ x_{a2} = \dfrac{2aH + c_1^{'} - 2c_2^{'}}{3a\beta} \end{cases}$$

And then get the manufacturers at this time to maximize profits:

$$\begin{cases} \pi_1 = \dfrac{(2aH + c_2^{'} - 2c_1^{'})^2}{9a} \\ \pi_2 = \dfrac{(2aH + c_1^{'} - 2c_2^{'})^2}{9a} \end{cases}$$

From the above analysis, we can conclude that when the demand for consumers in the market increases, the network has a certain scale, that is, the part of the right half of the demand curve set in Figure 2, The following characteristics: First of all,. Enterprise advertising volume and the other side of the enterprise market cost is proportional to the cost of the enterprise is inversely proportional. As a result of this stage, the market has reached a certain scale, to achieve an increase in the scale of income, but the development of the market by the market capacity constraints, the number of consumer groups determines the development of the product network to a certain scale, no longer development space, Therefore, when the other enterprise 's low cost, the enterprise at a disadvantage, and then increase the amount of advertising can not further expand the market, that is, the marginal revenue of advertising decline, and this time the enterprise already has a certain market share. So you can reduce the amount of advertising to reduce costs. When the cost of the enterprise is relatively high. Similarly. The Second, the profit at that stage is positive, the characteristics of network external products determine the larger the size of the network, the lower the average cost of the enterprise, the greater the profits. Third, the profit is still mainly due to the other side of the enterprise cost relative to 2 times the cost of the gap between the enterprise decision, that is, the smaller the gap, the less profitable business, and vice versa. The way to increase profits at this stage is to reduce costs rather than expand advertising because the chances of further growth in the market are smaller. In this half of the curve will form a two manufacturers a balance point, the equilibrium point will be a long-term equilibrium of the two manufacturers, that is, the two business costs and profits tend to coincide that point.

5. The fourth Analysis on the Competition Strategy of manufacturers' Advertisement

From the above analysis we can see that the manufacturer with the product of network externality, in the advertising decision-making, if not consider the other manufacturers of advertising decisions, given the product demand function, the optimal advertising spending, only with Advertising unit advertising needs, and with the advertising needs of the reverse direction of change, That is, the unit advertising caused by the small demand for products, manufacturers need to put the amount of advertising the greater, so as to expand the market share, with more consumers.

But when the vendor not only takes into account its own profit maximization, but also taking into account the competitors of advertising decisions, the situation is extremely different.

When the market demand for consumers is still small, the product network is smaller, that is, as shown in Figure 2 set the demand curve of the left half of the part of the said. As the fixed cost of investment is too high, the initial production, the network has not reached a certain size, manufacturers of fixed asset investment has not yet recovered, to be further expanded consumer demand, which is mentioned earlier with a network of external features of one of the products , At this time, the market did not reach a balance, but a temporary balance. Therefore, if the production cost is higher in this stage, in order to obtain the profit, according to the increasing nature of the network externalities, the manufacturers must increase the advertising investment and publicity, attract more consumers, quickly capture the market, realize the scale income, So that their products have a network of externalities. In order to increase profits. Thus, we can see that the profit maximization at this stage is mainly due to the increase in advertising investment.

When the market demand for consumers increases, the network has a certain scale, that is, as shown in Figure 2 set the demand curve of the right half of the part of the said. This part will form a long-term equilibrium of the two manufacturers, at the lower of this equilibrium point, the price is lower than the consumer's willingness to pay; and on the right, the willingness to pay is lower than the price. In this half of the curve will form two manufacturers of another equilibrium point, the equilibrium point will be a long-term equilibrium of the two manufacturers. At this stage, the product network size has reached a certain degree, because the market capacity is limited, therefore, manufacturers to maximize profits to rely mainly on reducing costs, Vendor 1 to make $\pi_1 > \pi_2$, then $c_1^{'} < c_2^{'}, x_{a1} > x_{a2}$, , then that is, manufacturer 1 want to make their own profits greater than each other, he needs to meet their own market penetration costs lower than the other side, and their advertising level is higher than the other side, then, enterprise 1 can be a lower cost to break through the enterprise 2 advertising line of defense , And with more advertising scale than the enterprise 2 more profit. Enterprise 2 will need to be widely and effectively advertised, and strive to improve product quality of service and reduce the cost of their own market penetration to overcome the business of advertising caused by the loss of goodwill, when the two sides of the same market penetration costs, the two manufacturers to maximize profits The amount of advertising under the same amount of profit is consistent, then, the two enterprises have the same status. In addition, the network has a certain size, the two manufacturers of advertising spending level and the market capacity has a great relationship.

6. Conclusion

The 21st century is the era of economic globalization and competition in digitalization. As China's accession to the WTO, China's enterprises will face all aspects of network competition. In the information age, the research of advertising behavior of enterprises is getting more and more attention. This paper analyzes the advertising decision of the enterprise in the presence of network externality, and obtains the advertising expenditure model which maximizes the profit of the enterprise. In order to simplify the analysis, this paper will exist in the network externalities of the market demand function set to linear, which also provides a convenient future research.

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