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The Pricing Strategy with the Effect of Reference Dependence Under Monopolistic Competition

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ABSTRACT

As the consumers searching for the goods, it is very likely for them to use the strategy that choosing the product of the large firm as the reference point and compare it with the other products in order to purchase the most satisfied one. In the real world the market competition is most likely to be Monopolistic competition. The proposing of model in this work is based on this phenomenon. Consequently, this paper raised questions: in which sense the reference dependence and loss aversion parameter affect the pricing strategy of the different firms. The work finds out the reference dependence can still affect the pricing of products either for the large and small firms under monopolistic market and its effect is shown a downward trend as consumers searching times increased. The producers can choose to adapt their pricing strategy to the result which have been discovered in this paper and reply to the consumer behaviors.

Keywords: *Monopolistic competition, reference dependence, loss aversion parameters, reference point*

1. INTRODUCTION

In everyday life, people would always subliminally or deliberately compete one product with others of different quality or appearance. “This fact that consumer choices are often reference dependent and affected by loss aversion parameters.”[1][2](Kahneman and Tversky; DellaVigna) And in some cases, people would buy such products which are not fully satisfied, because the loss aversion parameters are playing their roles. This paper is going to propose a model under monopolistic competition with reference dependence, the effect of loss aversion parameters and changeable reference point. (How reference point work will be introduced in part 2 of this paper in detail).

The prototype of the model is a shopping mall, thus the model should have consisted of the shopping mall characters. Imagine in the mall, there would be one whole floor specialized for clothes selling. Various brands would be there, and one of them will be the largest market power owner. Although the difference in the amount of market power owned is not large, since the firms which can join in the mall are all in some kind of sense popular in the society, and which made the market as a whole a monopolistic competition. The proposing of the model is based on this. Consequently, the questions come: How far will the reference point affect the market? In which sense the reference dependence and loss aversion parameter affect the pricing strategy of the different firms. This paper finds out the reference dependence can still affect the pricing of the product either for the large and small firms under monopolistic market and its effect is shown a downward trend as consumers searching times increased.

Part 2 will show the literature that we have cited, and what the paper have learned from them and the differences between the model in this paper, particular Zhou(2011) which is the inspired paper of this work. Part 3 is going to introduce the model, and how is that going to work, the timing is also going to be shown there. The working rules for reference point and loss aversion parameter will also be included. Part 4 is going to respectively study the pricing strategy of different firms when consumers search once or several times. The conclusion and overview of the model will be placed in part 5. All the detailed calculations and proof will be written down in the appendix.

2. LITERATURE

“The model in this work is adapted from the one in Zhou’s paper which mainly talked about the influence of consumer reference dependence under the duopoly competition." [3]Different from Zhou's paper, this model is under a monopolistic competition market; in Zhou's paper, he assumed the market as a whole is symmetric, however, in this model, this paper tend to differentiate the price of the large firm and small firm into two different variants, thus it is asymmetric; In addition, this paper divided different situations by assuming consumers would search once or T times, which Zhou never considered the times that consumers search in his paper; The point that is especially distinct from Zhou's model is this paper allows consumers change their reference point continuously while they are searching and so this paper have created a situation that consumers would change their reference point from one firm to another.

"In Wolinsky's paper, the paper builds a monopolistic competition and assumes consumers own imperfect knowledge of the market, aiming to restrict the effect of substitutability among brands, and so the market as a whole would be under the true monopolistic competition." [4]This work adapted the same assumption in this model. However, the paper modelled the market as a rather different monopolistic competition which told the market to have one relatively large firm and the rest are relatively small. Also, all firms in this paper sell horizontally differentiated products.

"Heidhues and Koszegi's paper aim to explain the problem that why in the market where sellers sell differentiated goods, the tendency is still reducing price variation. "[5]Just like in this model, they conclude the element of reference point and base the reference dependent "gain and loss utility", there are also n firms within the market. But different from his paper, the firm sizes are different, thus own the different market power and the consumers may all choose the product of large firm as their reference point, even in this case, the other small firms still own a range of market power.

"Kahneman, Knetsch and Thaler's paper mainly discussed the concept of loss aversion parameter."[6]By combining this paper and Zhou[1], our paper added the loss aversion parameter from two different dimensions: price dimension and product dimension. "In Karle,Kircheighter and Peitz, it proves and strengthens the loss aversion parameter by using empirical study."[7]

"In Parakhonyak and Titova's paper, they construct a model of a market for differentiated goods in which firms are located in marketplaces, and there are search frictions between marketplaces, but not within."[8] Marketplaces differ in size. This paper calculates the equilibrium when the consumers set the biggest firm as reference point and search followed with the order of firms' sizes, which is different from our paper since this paper did not construct a model with such rule of searching order.

"In Anderson and Renault' paper, they mainly discovered the price competition in the presence of search costs and product differentiation."[9]What similar with our model are the search costs, the reservation price which is the highest price consumers are willing to pay for the products in market and the construction of market structure which is monopolistic competition. Learning from Simon P. Anderson and Regis Renault[9] this paper knowing the differences of market equilibrium between setting the market is monopolistic competition and oligopoly.

3. MODEL

This section describes the model in the monopolistic market with the effect of reference dependence and loss aversion parameter on two domains, the firms and the consumers

Consider the market works as a standard hoteling setting. The start point is at 0 and the ending is at 1.

3.1. Firms

Unlike the model in Zhou[1], this paper assume that there are n different firms in the market. The amount of n is large enough and the firms can not locate at the same spot, thus all the firms are distributed uniformly in the market. Among all the firms, there is one relatively large firm (denote by r) and the rest are the relatively smaller firms (denote by j). The factor that distinguishes the large and small firm is the amount of market power they have owned.

All firms in the market sell horizontally differentiated goods which means the merchandises are of the same type but the brand is rather different. Thus even though the goods are similar, the market is asymmetric in a large sense. The fact that there is different size of firms also contributes to the point.

Since this paper is not explicitly trying to find the relationships between the market andcost, so it would not affect the conclusion that the work want to have, so it

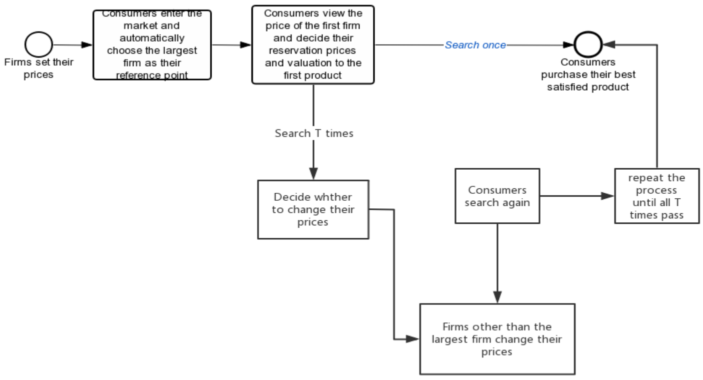

Figure 1 Timing graph

assumes all firms have zero production cost.

3.2. Consumers

For the sake of simplicity, the mass of consumers in the market is assumed to be 1, thus, theoretically each firm would have a fraction of consumers that would buy from them, $\frac{1}{n}$. Further, all consumers in this model would all choose the large firm as their primary reference point regardless where is the consumer live and the location of the large firm. By this way, the initial fraction of consumers that large firm going to have before searching is 1. But after search around, consumers may find purchasing other good would better satisfied, consequently, considered the matching value and location of the product, the fraction owned of large firm would decrease to (1 - θ). θ here is the prominence difference causing by the factors mention above. Without loss of generality, $\theta \in \left[0,\ \frac{1}{2}\right]$, the reason that the highest value is not $\frac{1}{n}$ is the existence prominence of the large firm and its higher market power. As the fraction of consumers owned by the large firm decrease, that of the single small firm would increase to $\left(\frac{1}{n}+\theta\right)$.

Similar with Zhou's paper, the way that consumers exhibit reference dependence preference in the sense that "each consumer will take some product as her reference point, and she will over weigh the other product's relative disadvantage (higher price or lower match utility) in the spirit of loss aversion.(Zhou[1])

The consumers in the market have to do sequential search and they can either search once or T times (T<n). Before searching, buyers have to pay a range of search cost which would make the consumer can only search to T, but the amount of s is considered very small with it alone, so can highlight the influence of reference dependence to the reference point. Also because of imperfect information, before searching the only information that consumers know about the market is the price and location of large firm which set to be reference point. Through out the searching, consumers can change their reference point under the situation if the other product has a higher valuation and lower price.

Consumers view the good of each firm from these aspect: V, the consumer valuation to the product(G is the distribution of consumer valuation); w, the reservation price; p, the price of the product(P is the distribution of price); X the location of the firm(treating the location of firms as the matching value in this paper).

After searching, consumers would have to purchase the best satisfied product.

Note each firm can reset their prices after every consumers search. The details of the timing is shown in Figure1 above.

4. ANALYSIS

4.1. The demand (search once)

This sector is going to separate it in two main part: consumers search once and T times. The first part is going to talk about how will the firms set their prices when consumers only search for one time, which is very similar with Zhou[1], however, this paper emphasizes more on the time consumer have searched.

As the price of the large firm p_r and the price of smaller firms p_j are two different variables, there will be two different kind of situations:$p_r > p_j$ and $p_r < p_j$.

So when , $p_r < p_j$ the demand functions for the small firm will be the following:

$$D^a{}_{r1} = (1-\theta)\times\left[1-G\big(w(j)\big)\right]\times\left[\frac{x_r}{2}+\frac{\lambda_p}{2}\left(p_j-p_r\right)\right]$$

$$D^a{}_{r2} = (1-\theta)\times\left[1-G\big(w(j)\big)\right]\times\left[\frac{x_r}{2}+\frac{p_j-p_r}{2\lambda_x}\right]$$

As this paper assumed that there are unit 1 of consumers in the market and buyers would all choose the large as their primary reference point, before consumers search the fraction of consumers owned of the largest firm should be 1. However, after searching, some consumers may find it is not worthy to still purchase the product of the large firm since they gain the knowledge of the prices of the small firm. Θ of consumers may not buy the largest firm product anymore. However, consider the reference dependence, the fraction won't decline to $\frac{1}{n}$. $1-\theta$ is the fraction of consumers who is still going to buy the large firm product. Under the situation of $[1-G(w(j))]$, the consumer valuation to the small firm is higher than the reservation prices given to them, thus the consumers should be rationally stopped when they searched once, because they found it is not worthy to search further. There are two different kind of situations that consumers would still going to purchase the large firm product: They found the losses from low match utility is smaller than the gains from low price or they find there is a benefit from the high match value. The first is represented by the last part of the first demand function and come from$2x-x_r<(p_j-p_r)\lambda_p$; while the second is represented by the last part of the second demand function and come from$(2x-x_r)\lambda_x<p_j-p_r$. Thus the demand of the largest firm when $p_r<\ p_j$ is

$$D^a{}_{r1}+D^a{}_{r2}=x_rh+\left[\frac{\lambda_p\lambda_x+1}{2\lambda_x}h(p_j-p_r)\right]$$

Where $h=1-w(j)-\theta+w(j)\theta$

It is a very similar situation when $p_r>p_j$, however, since in this case the price of the largest firm is already higher than the price of the small firms, there wouldn't be a case that consumers found the losses from low match utility is smaller than the gains from low price. So the demand of the large firm when $p_r>p_j$ is:

$$D^b{}_{r2}=(1-\theta)\times[1-G(w(j))]\times\left[\frac{x_r}{2}+\frac{p_r-p_j}{2\lambda_x}\right]$$

And equals to

$$D^b{}_r=\frac{x_r}{2}h+\frac{1}{4\lambda_x}h(p_r-p_j)$$

In summarization, the above analysis of demand will be transformed into this:

$$D_r=\begin{cases} x_{rh}+\left[\frac{\lambda_p\lambda_x+1}{2\lambda_x}h(p_j-p_r)\right] & (p_j>p_r)\\ \frac{x_r}{2}h+\frac{1}{4\lambda_x}h(p_r-p_j) & (p_j>p_r)\end{cases}$$

The demand functions of the small firm can also be obtained in this case; however, the further calculation will not use that to get the price of the small firms, thus they are not going to be placed here.

4.2. The pricing strategy

Since when θ>0, there would be no Nash equilibrium in the game, the mixed strategy Nash equilibrium should consequently be obtained by taking the derivative of the best response function.

When consumers search once, our model is very similar with the one in Zhou[1]. Similar with him, this work has shown the large firm, which is the primary reference point will have the highest and lowest price they can set and they will random their price among them, as for the small firms, what they are going to do is just set a constant and medium price.

The prices which set by the large firm will be extract from the profit function of the theirs.

when $p_r>p_j$

$$\pi^r{}_1=\frac{p_rhx_j}{2}+\frac{p_r{}^2h-p_rp_jh}{2\lambda_x}$$

And when $p_j>p_r$

$$\pi^r{}_2=p_rx_rh+\left[\frac{\lambda_p\lambda_x+1}{2\lambda_x}h(p_rp_j-p_r{}^2)\right]$$

It can see from the two functions, even though it is the profit function of the same firm, it's still can be different as the background situation altered. When $p_r>p_j$, the price of the large firm is the highest in the market, and thus by taking derivative of that, it would obtain the highest price of the large firm. When $p_j>p_r$, since the price is the lowest in the market, by doing the same process, it will come to the lowest price of the large firm. The price of the small firms can be obtained by setting $\pi^r{}_1=\pi^r{}_2$

By taking the derivative of the profit function when $p_r>p_j$, largest p_r can be obtained.

$$\pi^r{}_1=\frac{p_rhx_r}{2}+\frac{p_r{}^2h-p_rp_jh}{2\lambda_x}$$

$$\frac{\delta\pi^r{}_1}{\delta p_r}=\frac{x_rh}{2}+\frac{2p_r-p_j}{4\lambda_x}h$$

Set it equals to zero

$$\frac{x_rh}{2}+\frac{2p_r-p_j}{4\lambda_x}h=0$$

$$\frac{x_r}{2}+\frac{2p_r-p_j}{4\lambda_x}=0$$

$$2x_r\lambda_x+2p_r-p_j=0$$

And isolate p_r

$$p^H{}_r=\frac{p_j}{2}+x_r\lambda_x$$

And by the similar process, we can obtain the lowest price

$$\pi^r{}_2=p_rx_rh+\left[\frac{\lambda_p\lambda_x+1}{2\lambda_x}h(p_rp_j-p_r{}^2)\right]$$

$$p^L{}_r=\frac{p_j}{2}+\frac{x_r2\lambda_x}{\lambda_p\lambda_x+1}$$

And put the two p_r into their own profit functions and set $\pi^r{}_1(p^H{}_r\ ,p_j)=\pi^r{}_2(p^L{}_r\ ,p_j)$, p_j can be gotten. Then the expression of p_j can be placed into the expression of the two p_r respectively, because when the consumers can only search once, the pricing of firms can not depend on the pricing of other firms, since all firms simultaneously set their own prices.

The large firm can only range their prices between these given prices because they are all the profit maximized prices. If the large firm set a price higher than ${p^H}_r$, they may not able to maximize their profit and loss even more consumers due to the loss aversion parameter on the price dimension that work swith the small firms; And they have zero chance to set a price lower than ${p^L}_r$, since they can maximize their profit with a little increase on their prices.

Proposition 1: When θ>0, consumers search once and there is no Pure Nash equilibrium in the market, the Mixed strategy Nash equilibrium would be:

$$
\begin{aligned}
{p^L}_r &= \frac{2\sqrt{8{\lambda_p}^2{\lambda_p}^4{x_r}^2 - 32\lambda_p{\lambda_x}^3{x_r}^2 - 40{\lambda_p}^2{x_r}^2}}{{\lambda_p}^2{\lambda_x}^2 - 4\lambda_p\lambda_x - 5} \\
&\quad + \frac{x_r 2\lambda_x}{\lambda_p\lambda_x + 1} < p_j \\
&= \sqrt{\frac{8{\lambda_p}^2{x_r}^2}{{\lambda_p}^2{\lambda_x}^2 - 4\lambda_p\lambda_x - 5}} < {p^H}_r \\
&= \sqrt{\frac{8{\lambda_p}^2{x_r}^2}{{\lambda_p}^2{\lambda_x}^2 - 4\lambda_p\lambda_x - 5}} + x_r\lambda_x
\end{aligned}
$$

It is needed to notice that there are no specific restrictions on reference dependence here. It is because in the assumption part this paper have already assumed the market power owned by the large firm is just relatively larger than the other firms, thus the reference dependent effect will not be strong, and so the propositions would always work in this case, since there will always be an obvious number of θ.

In this equilibrium, the large firm will be randomized their price among the highest and lowest the works have shown. Similar to the result shown in Zhou[1], the large firm would be very likely to randomize their price and keep the small firm guessing, otherwise the small firms will just set a lower price than the price of the large firm. And it is exactly the reason why there are no signs of p_j when interpreting the expressions of either of the large firm prices, because in the first search neither the firms have any information about the prices the other firms would set.

Corollary1: The pricing of each firm is strongly related to the loss aversion parameters; When prices are positive number, the effect of loss aversion parameter has a positive relationship with the price of the firms.

As it can see in these expressions, h are all being removed, so the location of the large firm and the loss aversion parameter are the only variables that determine the amount of price. Since the location always adhered with the product dimension loss aversion parameter, these parameters hold an extremely important position. Also, as consumers have a small space of choosing, the differences in price and distance are further strengthened, consequently, the effects of loss aversion parameters also have been enlarged, thus pricing strategy would have been strongly correlated with that.

4.3. The demand (search T times)

The second part of this sector is going to have the demand functions of the firms when they search for T times. Compared with the situation when consumers search once, instead of modelling the probability that they would stop after search once, this paper model the situation as they would or not change their reference point. Thus, consider the reference dependence to their primary reference point, the other products have to satisfy the condition which the product has a lower price and higher valuation compare to the product of the largest firm. Also, the expressions which describe the consumers location other than the areas closed to the firms would come to purchase their product need to change. The work has adapted the original formula $2x - x_r < (p_j - p_r)\lambda_p$ into $2(T - 1 + x) - x_r < (p_j - p_r)\lambda_p$. The adding of 2(T+1) is mainly because when the consumers search further, they are very likely to approach the largest firm which is their primary reference point, which because of the special reference dependence. Thus the demand functions will be modelled as follow:

When $p_j > p_r$

$$
{D^T}_{r1} = (1 - \theta) \times \left(\frac{x_r}{2} + \frac{p_j - p_r}{2\lambda_x} + 1 - T\right) \times \left(1 - P(p_r)\right) \times G(V_r)
$$

$$
{D^T}_{r2} = (1 - \theta) \times \left(\frac{x_r}{2} + \frac{\lambda_p(p_j - p_r)}{2\lambda_x} + 1 - T\right) \times \left(1 - P(p_r)\right) \times G(V_r)
$$

When $p_r > p_j$

$$
{D^T}_{r3} = (1 - \theta) \times \left(\frac{x_r}{2} + \frac{p_j - p_r}{2\lambda_x} + 1 - T\right) \times \left(1 - P(p_r)\right) \times G(V_r)
$$

Unlike search once, when consumer search for T times, the demand function of small firms have to be carried out here, because they have to make a difference to their prices regarding the original price of the large firm, and consider their different location of firms, they prices may no more be the same. However, the demand function of the small firms is very similar to the demand functions of large firm, apart from the expression of the fraction of consumers and reference point changed.

When $p_r > p_j$

$$
{D^T}_{j1} = \left(\frac{1}{n} + \theta\right) \times P(p_r) \times [1 - G(V_r)] \times \left(\frac{x_j}{2} + \frac{p_r - p_j}{2\lambda_x} + 1 - T\right)
$$

$$
{D^T}_{j2} = \left(\frac{1}{n} + \theta\right) \times P(p_r) \times [1 - G(V_r)] \times \left(\frac{x_j}{2} + \frac{\lambda_p(p_r - p_j)}{2\lambda_x} + 1 - T\right)
$$

When $p_j > p_r$

$$D^{T}{}_{j1} = \left(\frac{1}{n} + \theta\right) \times P(p_r) \times [1 - G(V_r)] \times \left(\frac{x_j}{2} + \frac{p_r - p_j}{2\lambda_x} + 1 - T\right)$$

In summarize, the demand function would be

$$D_r = \begin{cases} L\left[x_r + (p_j - p_r)\dfrac{\lambda_p\lambda_x + 1}{2\lambda_x} + 2 - 2T\right] & (p_j > p_r) \\ L\left(\dfrac{x_r}{2} + \dfrac{p_r - p_j}{2\lambda_x} + 1 - T\right) & (p_r > p_j) \end{cases}$$

$$D_j = \begin{cases} Q\left[x_r + (p_r - p_j)\dfrac{\lambda_p\lambda_x + 1}{2\lambda_x}\right] & (p_r > p_j) \\ Q\left(\dfrac{x_r}{2} + \dfrac{p_r - p_j}{2\lambda_x} + 1 - T\right) & (p_j > p_r) \end{cases}$$

Where

$$\mathrm{L} = \mathrm{V_r} - \mathrm{V_r}\theta - \mathrm{p_r}\mathrm{V_r} + \mathrm{p_r}\mathrm{V_r}\theta$$

And

$$\mathrm{Q} = \frac{\mathrm{p_r}}{\mathrm{n}} - \frac{\mathrm{p_r}\mathrm{V_r}}{\mathrm{n}} + \mathrm{p_r}\theta - \mathrm{p_r}\mathrm{V_r}\theta$$

4.4. The pricing strategy

As θ>0, what for sure is, there are no Pure Nash equilibrium, thus the mixed strategy Nash equilibrium will have appeared again.

Different from the situation when the consumers searched once, if they have multiple chances to search, sellers would also have multiple chances to differ their prices, thus in the result under, both the price setting of large firm and small firms would randomize their prices among their own highest and lowest.

Similar to the process in the last part, we also need to take the derivative of the profit functions to obtain the two boundary prices:

$$\pi^{1}{}_{r} = p_r l\left[x_r + (p_j - p_r)\frac{\lambda_p\lambda_x + 1}{2\lambda_x} + 2 - 2T\right] \qquad (p_j > p_r)$$

$$\pi^{2}{}_{r} = p_r l\left[\frac{x_r}{2} + \frac{p_r - p_j}{2\lambda_x} + 1 - T\right] \qquad (p_r > p_j)$$

Consequently, it can also get the prices:

$$\pi^{1}{}_{r} = p_r l\left[x_r + (p_j - p_r)\frac{\lambda_p\lambda_x + 1}{2\lambda_x} + 2 - 2T\right]$$

$$\frac{\delta\pi^{1}{}_{r}}{\delta p_r} = Lx_r - \left(2p_rL - p_rp_jL\right)\frac{\lambda_p\lambda_x + 1}{2\lambda_x} + 2Lp_r - 2Tp_r$$

$$Lx_r - \left(2p_rL - p_rp_jL\right)\frac{\lambda_p\lambda_x + 1}{2\lambda_x} + 2Lp_r - 2Tp_r = 0$$

$$\mathrm{p^L}{}_{\mathrm{r}} = \frac{\lambda_x(4l - 4T + 2Lx_r)}{2l\lambda_p\lambda_x + 2l} - \frac{p_j}{2}$$

Similarly,

$$\mathrm{p^H}{}_{\mathrm{r}} = \frac{p_jL - 2L\lambda_x + 4T\lambda_x - Lx_r\lambda_x}{2L}$$

Proposition2: When θ>0, consumers search T times and there are no Pure Nash equilibriums in the market, the large firm can only set the prices between the range of:

$$p^{L}{}_{r} = \frac{\lambda_x(4l - 4T + 2Lx_r)}{2l\lambda_p\lambda_x + 2l} - \frac{p_j}{2} < p^{H}{}_{r} = \frac{p_jL - 2L\lambda_x + 4T\lambda_x - L\lambda_x x_r}{2l}$$

Similarly, there are no special restrictions on reference dependence on this proposition. You may notice that in both two expressions of large firm prices, the large firm always take into consideration the prices set by the small firm. It is because, after the search of the consumers, the other firms may be able to get to know the prices of the small firms. In order to expel the small firms from the market, the large firm has to set a price that depends on the prices which used to be set by the small firms.

The prices set by the small firms should be easily obtained in the same way.

Corollary2: When consumers search T times, λ_p increase with the decreasing of the lowest price of large firm, λ_p made no difference to the highest price of the large firm.

The result can be seen from proposition3. As the loss aversion parameter on the price dimension increase, the large firm is more likely to decrease its price in order to further expel the small firms from the market, since the larger the prices differences, the higher the effect of loss aversion parameter. Thus, in this case, λ_p is pro-competitive. The loss aversion parameter on the product dimension, instead, is jumped bwtween pro-competitive and anti-competitive. Because of the reference dependence, some of the consumers are going to purchase the goods with strong brand loyalty. However, since when the consumers search for T times, as they facing the chances to alter their reference point, some of the loyal consumers or other ordinary consumers may not go to the largest firm, thus the high loss aversion parameter on the product dimension can also rather make the firm lower their price. As for the highest price, since the small firms are for sure going to set a price lower than that, the large firm has no way to be benefited from the loss aversion parameter on the price dimension. Thus they seem rely completely on the loyal consumers and λ_x.

Corollary3: Compare to search once, the loss aversion parameters has a lower determinant power on both the profit and price function.

Compare to profit functions, the determinant powers of loss aversion parameters decrease, as there are more determinants such as T, which can weaken the power of loss aversion parameters. Also, it can be easily seen that the difference between proposition1 and proposition2. It is because as consumers facing more choices, the reference dependence may no more hold such an important position. Thus the effect of loss aversion parameter would also decline.

Proposition3: As the consumers can search for T times, the prices of the small firms should be no more the same, they would be able to differentiate their prices between:

$$p^L{}_j = \frac{\lambda_x(4Q - 4T + 2Lx_r)}{2lQ\lambda_x + 2l} - \frac{p_r}{2} < p^H{}_j = \frac{p_r L - 2L\lambda_x + 4T\lambda_x - L\lambda_x x_r}{2Q}$$

The process of getting two boundary prices is still the same, thus it is necessary to understand why there are a range of prices that allowed the small firms to differ. The demand function for the large firm have two kinks, if you draw them, one of them for the lowest price and another is the highest price. As for the small firms the demand function only have one inward kink when the consumers only search once, but as the they can search for multiple times, the demand function would have a similar shape with the large firm, and thus have two boundary prices as shown in Figure2. However, the prices of the small firms are still going to encase in the pricing range of the large firm. Since they do not want to set a price higher or much lower than the price of the largest firm, or otherwise they cannot grab consumers from them.

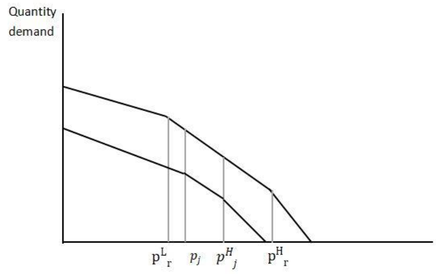

Figure 2 curves of the demand functions for small and large firms respectively

The prices of the small firms are no more the same because after seeing the price of the largest firm, the small firms may set their prices as a level that may make the buyers think it is not worthy to move forward, and consider the location and the size of loss aversion parameter on the product side, each firm may have their consideration on their prices, thus the prices may diverge. However, the prices of the small firms should still be ranged between the boundary prices of the large firms.

5. CONCLUSION

The model in this paper is adapted from Zhou[1]. This paper studied the reference dependence on monopolistic competition, emphasized the differences when consumers search once or multiple times. Thsi paper has found the pricing of the firms mostly rely on the effect of loss aversion parameter if they search once; The firms can change their prices due to the pricing strategy of the other firms as consumers are able to search for multiple times; And instead of the situation of search once, the single loss aversion parameter can have different influences on the different upper and lower prices of firms in the other case. Also, the power of loss aversion parameters is reduced. Hence, the capability of loss aversion parameters to cause price variation decrease as the consumers facing more choices.

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