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A REVIEW OF NON-COLLUSIVE OLIGOPOLY AS IT PATTERNS TO NIGERIA

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Abstract: **The oligopoly market structure is very apparent in the soft drink industry. Two large producers, Coke and Pepsi, maintain a dominant role in the industry. High barriers to entry prevent smaller firms from making a large impact this allows these two firms to compete on areas other than price in an attempt to maximize profit. In the non-collusive oligopolistic model, there is interdependence and rivalry among the firms. Depending on the conjectures made by the firms, we get different models. The whole analysis of the kinked demand curve points out that price rigidity in oligopolistic markets is likely to prevail if there is a price reduction move on the part of all sellers. Changes in costs and demand also lead to price stability under normal conditions so long as the MC curve intersects the MR curve in its discontinuous portion. But price increase rather than price rigidity may be found in response to rising cost or increased demand. The Cournot model deals with the case when the firms make conjecture that the rival would stick to the previous level of output. Here the firms deal with output changes. Finally, the firms together end up producing 2/3 of the total market demand. In the Bertrand model, the case is similar to that of Cournot except that the firms compete in terms of price. Here they end up producing the competitive level of output. In the Stackelberg model one firm acts as the leader and the other follower. A firm is a leader in the sense that it knows the reaction function of the follower. The leader maximises profit after incorporating the reaction function of the follower.**

Keywords: **Non collusive, oligopoly, market, price, Nigeria.**

1. INTRODUCTION

An oligopolistic market is characterized by the existence of a small number of firms who have the market power in the sense that they can affect the market price by changing their output level. In such a market, the firms may produce identical or differentiated products. The distinguishing feature in it is strategic interdependence among the firms with regard to price and output decisions.one of the important features of oligopoly is price rigidity. And to explain the price rigidity in this market, conventional demand curve is not used. In this article we will consider the Coca- Cola Company and Pepsi Cola in the soft drink or beverage industry as an example of Non collusive oligopoly. (Aker, 2003)

2. NON-COLLUSIVE OLIGOPOLY

Oligopoly can be of two types: non-collusive and collusive. In the noncollusive oligopoly, there is rivalry among the firms due to the interdependence. On the other hand, in collusive oligopoly the rival firms enter into a collusion to maximise joint profit by reducing the uncertainty due to rivalry. Under non-collusive oligopoly each firm develops an expectation about what the other firms are is likely to do. This brings us to an important concept of "Conjectural Variation" (CV) of a firm. CV of ith firm is defined as the reaction of the jth firm, corresponding to a marginal adjustment in the ith firm's strategy variable as perceived by the ith firm. For instance, if output were the strategic variable, then the CV of the ith firm would be given by (δqj/δqi)– the amount of change in the output level that would be brought about by the jth firm for an additional change in the output level of the ith firm, as perceived by the ith firm. Depending on CV, we can have different models under oligopoly. For instance, in the Cournot Duopoly model, CV of each firm is zero because each of the duopolists assumes that the other would stick to its previous period's output level. In the Stackelberg model, there is a

leader and a follower. Here the leader knows what the follower is likely to do; hence, the CV of the leader is positive.(Neary,2010). In the following sections, we would see how equilibrium is arrived at in the important models of non-collusive oligopoly—Cournot model of duopoly, Bertrand model, Stackelberg model, Edgeworth, Chamberlin and the Kinked Demand curve analysis of Sweezy. To do this we would make use of the concept of reaction functions (RF). A reaction function of a firm gives the best response of the firm, given the decision taken by the rival firm. (Henderson and Quandt,1979)

Competitive Strategies in Non- Collusive Oligopoly:

In the carbonated soft drinks industry, when we narrow down to the cola market, there are two well-known giants existing in the market, which are Coca-Cola and Pepsi Cola. Coke and Pepsi are selling cola drinks with similar taste and color, therefore they are perfect substitutes. Both the companies have been competing strongly against each other for decades. The market is dominated by these two industry leaders with a total market share of 72%; Coke's market share is 42% and Pepsi's 30% (Russell, 2012). This is known as an oligopoly market, where there are few large firms competing with each other in the industry (McConnell et al., 2009).

The Coca- Cola Company uses a variety of competitive strategies to maintain its dominant position in the soft drink industry the most noticeable strategy is the companys engagement in product differentiation. It is essential for the company to maintain a brand image that appears significantly than its main competitor Pepsi. The company produces two products that are identical yet the marketing practices have managed to create a high level of brand loyalty for each product. These tactics are expected in the oligopoly market structure (Aker, 2012) Since Coke and Pepsi are perfect substitutes, the price elasticity of demand should be perfect elastic. However, there are some factors that results in a fairly elastic demand. When Coke increases its price, most of its customers that are highly sensitive to price changes will switch to Pepsi due to the similarity of the taste. Nevertheless, part of its customers that are highly loyal are willing to pay more for Coke because they placed Coke as their only preference. This can be proven in a blind test between Coke and Pepsi which Pepsi conducted to determine the preferences of cola drinkers. The results shows most of the participants preferred the taste of Pepsi but they still argued that Coke is their brand of choices (Tanner, 2012). This experiment has clearly shown that Coke has a strong brand loyalty and its customers tend to stay even though the price has increased. Therefore, the price elasticity of demand is just fairly elastic, when price increases, consumers will seek for substitutes and hence, the quantity demanded decreases, but not zero. In addition, both giants experience positive cross elasticity of demand, where customers of Coke tend to switch to Pepsi when price increases, and vice versa.

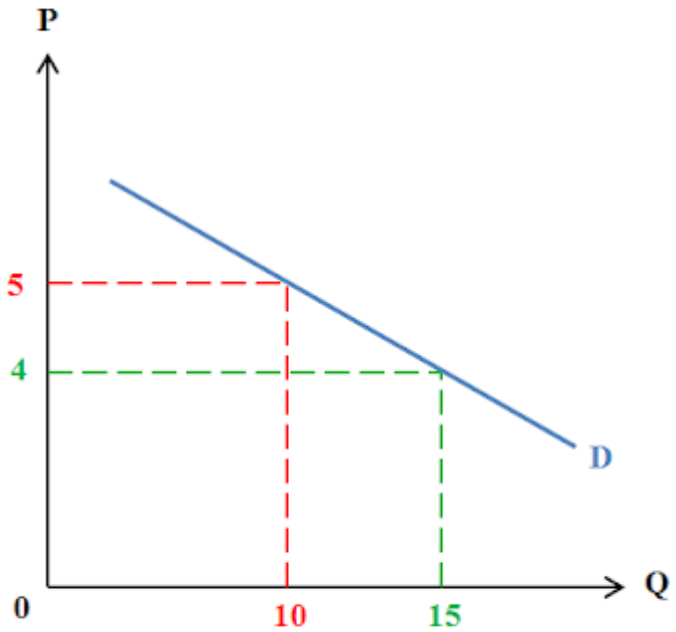

Figure 1: Normal Demand curve

In an oligopolistic industry, firms are mutual interdependence, where the profit gained is depending not only on the prices but on the other firms (McConnell et al., 2009). Coke and Pepsi have to consider the reaction of each other when one of them wants to make a move. For example, when Coke lowers its price, it will grab more customers from Pepsi and Pepsi lose profits, Coke has to think about Pepsi's reaction against the price decrease. According to the corporate news in Business Daily, Coke is going to lower its price to battle with Pepsi and defend its market share. The price cut has resulted in a reaction for Pepsi. Pepsi is currently offering a 350ml bottle at a same price with Coke 300ml (Otuki, 2013). When Coke reduces its price, Pepsi tends to follow to avoid customers switching to Coke. Mutual interdependence can be described as a chess game, when player X makes a move, it has to think that how player Y reacts to this move, will the next move affect X and etc. Coke and Pepsi are both engaging in strategic behavior, where both of them have to think before making a move and be aware of the reactions of another that might affect the company's profitability.

Instead of having price cuts, oligopolists tend to have non-price competition. Both the companies will invest a lot on extensive advertising to differentiate their products and gain higher sales. There are minor differences between both of them, which is Coke contains lesser sugar and calories as compared to Pepsi. They differentiate themselves by the nutrition level of the cola. Besides that, Coke concentrates on creating happiness by placing magical 'Happiness Machines' in campuses (Arandilla, 2011). Pepsi focuses on celebrities like Beyoncé and JJ Okocha to promote its products. The economic profits that they earned is sufficient to finance their reseaZrch and development of products and improve the existing ones. Coke has come up with Diet Coke to gain more market share as compared to Pepsi, which is standing alone and competing with the two Coke products. In the cola wars back in 2010, Coke has successfully gain more sales by the regular Coke as #1 (sales of 1.6 billion) and Diet Coke as #2 (sales of 927 million), whereas Pepsi as #3 (sales of 892 million) in the entire industry (Cardenal, 2013). Diet Coke has successfully grown the business and captured more market share in the industry. The expenditures that both companies spent on advertising will shift the demand curve to the right, results in a higher price and output as compared to perfect competition.

Coke and Pepsi have created high barriers to entry in the industry. In oligopoly, the smaller the number of firms, the more difficult for new rivals to enter the market. This is due to the majority market share is owned by Coke and Pepsi and they are large enough to serve and control the entire industry. Coke has been dominated the market since 1886 and followed by Pepsi 13 years later. They are now well established, they have the most advanced technology to reduce the cost of production; they know their customers very well; their products are widely available. They also have their own well-managed distribution channels, suppliers and bottlers. Most importantly, Coke and Pepsi are the two main dominants that serve the entire market so they will get a large sales volume. Thus, they gain supernormal profits and experience significant economies of scales over the years. When new rivals enter the market, they will lower the price and new rivals have to follow. After a period of time, even though they are making loss, they tend to survive; but new rivals will unable to survive due to the loss and quit. The action of increasing price is to protect the industry from being shared by new firms and to maintain the market shares of theirs. Besides that, brand loyalty is what kills the new rivals. Coke and Pepsi are both very strong brand and they have high recognition across the globe as well as copyrights and registered trademarks as their legal protections by the government. Hence, it is not easy to beat them down. There are still chances to enter the market but new rivals have to been through hard times and put in a lot of efforts in the beginning.

Source: Russell, 2012

Figure 2: Non Collusion between Coke and Pepsi

There is a breakdown of collusion between these two industry leaders resulting in a price war. Coke and Pepsi were both involving in a price war back in the 1990's. It was a hot summer season in Atlanta and both companies has kicked off a summer promo. They had similar price cuts; Coke has cut 20 cents to $5.47 with giving away cash promotions and at the same time, Pepsi cut 20 cents to $5.43 and giving away clothing, bikes and trips (Roush, 1997). As a result, 66% of US consumers prefer Coke's promotion while only 30% prefers Pepsi. This case claims that these two giants have the power of control over price. Coke and Pepsi can decide on setting the prices and outputs levels to maximize their profits. Thus, they are the price makers in the industry. Similar to monopoly, they tend to get positive economic profits in the long run by setting the prices on their own.

Sweezy's Kinked Demand Curve Model:

One of the important features of oligopoly market is price rigidity. And to explain the price rigidity in this market, conventional demand curve is not used. The idea of using a non-conventional demand curve to represent non-collusive oligopoly (i.e., where sellers compete with their rivals) was best explained by Paul Sweezy in 1939. Sweezy uses kinked demand curve to describe price rigidity in oligopoly market structure. (Henderson and Quandt, 2003)

The kink in the demand curve stems from the asymmetric behavioural pattern of sellers. If a seller increases the price of his product, the rival sellers will not follow him so that the first seller loses a considerable amount of sales. In other words, every price increase will go unnoticed by rivals. On the other hand, if one firm reduces the price of its product other firms will follow the first firm so that they must not lose customers. In other words, every price will be matched by an equivalent price cut. As a result, the benefit of price cut by the first firm will be inconsiderable. As a result of this behavioural pattern, the demand curve will be kinked at the ruling market price. Suppose, the prevailing price of an oligopoly product in the market is QE or OP of Fig. 5. If one seller increases the price above OP, rival sellers will keep the prices of their products at OP. As a result of high price charged by the firm, buyers will shift to products of other sellers who have kept their prices at the old level. Consequently, sales of the first seller will drop considerably.

In an oligopoly, there is an assumption that when one firm increases the price, the competitor does not follow because it will gain more customers with its price; when one firm decreases the price, the competitor will follow to avoid losing customers. The market demand is elastic above P_0 because customers will switch to competitor's brand; it is inelastic below P_0 because firms decrease price together and it will not affect the demand. This results in a kinked demand curve which is uniquely applied to oligopolistic market only. Oligopolistic firms are not allocatively efficient because the price is always above the marginal cost. The price is always higher than perfect competition because oligopoly does not apply the profit maximizing rule of marginal revenue equals to marginal cost in perfect competition. Coke and Pepsi are the two main giants that control the industry, they have the power to set the price higher to maximize profits. Moreover, when the price is higher than marginal cost, the output will automatically lower than the minimum average total cost and this explains they are not productively efficient as compared to perfect competition where P = min ATC. Both the companies will restrict output to make greater profits. The efficiencies above prove that Coke and Pepsi enjoy supernormal profits in the long run.

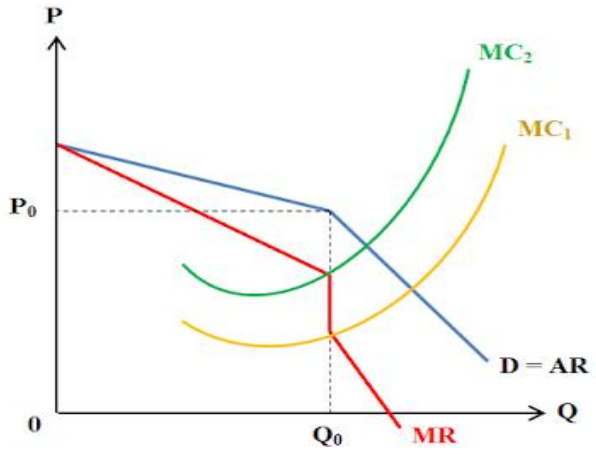

Figure 3: Swezzy Kinked Demand Curve

Coca-Cola and Pepsi Cola are the most recognizable cola brands around the world. Both the companies clearly demonstrate how oligopoly occurs. There are still a number of cola sellers in the market but Coke and Pepsi seems to be the dinosaurs that capture majority of the market shares, thus they are known as oligopolists. Both of them have created a healthy competition within the cola market, where they have to expand and diversify their products to gain more sales. This would be more beneficial to the consumers. Consumers will be offered by various choices as compared to monopoly where consumers have no choice

That is why demand curve in this zone (dE) is relatively elastic. On the other hand, if a seller reduces the price of his product below QE, others will follow him so that demand for their products does not decline. Thus, demand curve in this region (i.e., ED) is relatively inelastic. This behavioural pattern thus explains why prices are inflexible in the oligopoly market — even if demand and costs change. The kink in the demand curve at point E results in a discontinuous MR curve.

The MR curve has two segments:

At output less than OQ the MR curve (i.e., dA) will correspond to DE portion of AR curve, and, for output larger than OQ, the MR curve (i.e., BMR) will correspond to the demand curve ED. Thus, discontinuity in MR curve occurs between points A and B. In other words, between these two points, MR curve is vertical. Equilibrium is achieved when MC curve passes through the discontinuous portion of the MR curve. Thus the equilibrium output is OQ, to be sold at a price OP. Suppose, costs rise. As a result, MC curve will shift up from MC_1 to MC_2. The resulting price and output remain unchanged at OP and OQ, respectively. This fact explains stickiness of prices. In other words, in oligopolistic industries price is more stable than costs.

At first sight, the model seems to be attractive since it explains the behaviour of firms realistically. But the model has certain limitations. Firstly, it does not explain how the ruling price is determined. It explains that the demand curve has a kink at the ruling price.

In this sense, it is not a theory of pricing. Secondly, price rigidity conclusion is not always tenable. Empirical evidence suggests that higher costs force a further price rise above the kink. Despite these limitations, the model is popular among textbook authors.

Thus the firm lowering the price will not be able to increase its demand much. This portion of its demand curve is relatively inelastic.

On the other hand, if the oligopolistic firm increases its price, its rivals will not follow it and change their prices. Thus the quantity demanded of this firm will fall considerably. This portion of the demand curve is relatively elastic. In these two situations, the demand curve of the oligopolistic firm has a kink at the prevailing market price which explains price rigidity.

In an oligopolistic market situation, due to rivalry among the firms, any one lowering the price is interpreted by others as an attempt to eliminate their profit. Therefore, other firms also respond by cutting their prices as well. This chain of price cuts is called a *price war*. In the model by Sweezy, we would analyse what happens when the firms behave in the manner described above. Each firm in an oligopolistic market faces two demand curves D1D1 and D2D2 as shown in Figure 2. D1D1 is the demand curve that a particular oligopolist faces on the assumption that others do not change their prices and D2D2 has been drawn on the assumption that if one firm changes the price, then all others also change theirs.

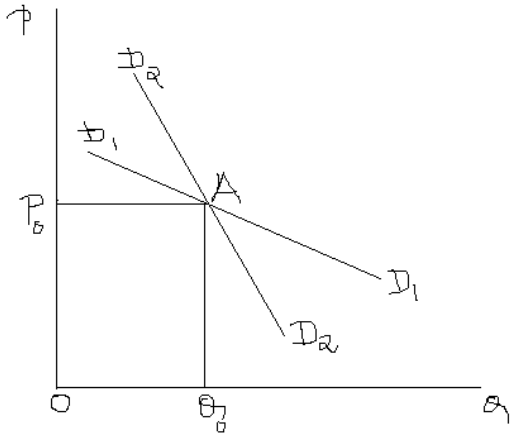

Figure 4: Demand Curves Faced by a Firm

Suppose A is the current position of the firm with price P0 and quantity produced Q0.If the firm raises price, the rivals will not follow a similar course, since they stand to gain by capturing the sales of this firm. However, if it reduces price, other respond by matching the price reduction. Thus, the demand curve that the firm faces is given by the segment D1D1 to the left of A and the segment of D2D2 to the right of A. The relevant demand curve is given by D1AD2, which has a kink at A.

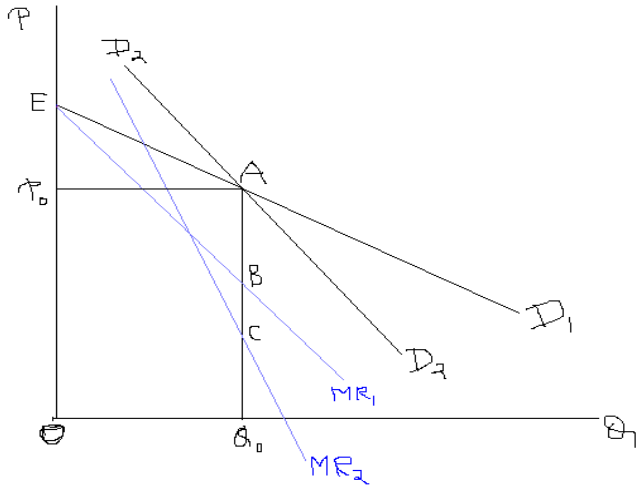

Figure 5: Marginal Revenue Curves in Kinked Demand Model

The marginal revenue curve corresponding to the kinked demand curve is shown in Figure 3. MR1 is the marginal revenue corresponding to D1D1 and MR2 is the marginal revenue curve corresponding to D2D2. To the right of Q0 the demand curve is given by the segment of D2D2 and hence the marginal revenue given by the corresponding segment of MR2. At the quantity Q0 there is a sudden drop in marginal revenue, from the point B to point C in Figure 3. The marginal revenue curve for the kinked demand curve in Figure 2 is given by the line EBCF in Figure 3.

See that there is some range within which changes in the firm's marginal cost will not result in changes in price and quantity. This is shown in Figure 4. Note that both for MC1 and MC2, the price and quantity given by the equilibrium condition MC = MR are the same. Hence, the price is "sticky", and the model is also known as the "sticky price model".

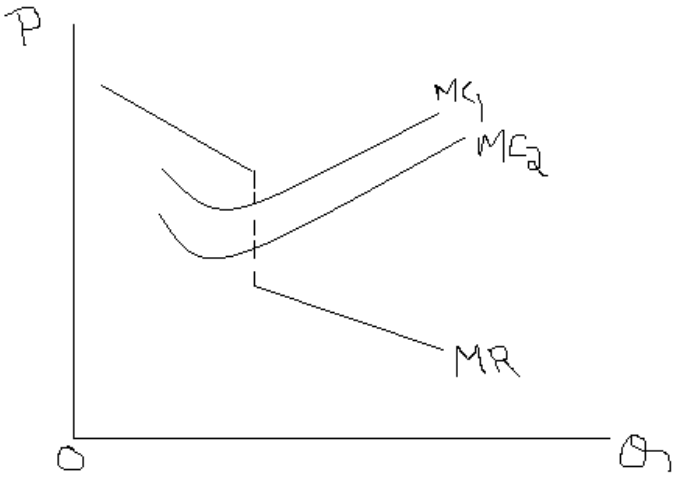

Figure 6: Kinked Demand Curve

The kinked demand is derived on the assumption that price increase by one of the oligopolistic firm is not followed by others but price reductions.

Changes in Costs:

In oligopoly under the kinked demand curve analysis, changes in costs within a certain range do not affect the prevailing price. Suppose the cost of production falls so that the new MC curve is MC_1 to the right, as in Figure 6.

It cuts the MR curve in the gap AB so that the profit- maximising output is OR which can be sold at OP_o price. It should be noted that with any cost reduction the new MC curve will always cut the MR curve in the gap because as costs fall the gap AB continues to widen due to two reasons: (1) As costs fall, the upper portion KP of the demand curve becomes more elastic because of the greater certainty that a price rise by one seller will not be followed by rivals and his sales would be considerably reduced.

(2) With the reduction in costs the lower portion PD of the kinked curve becomes more inelastic, because of the greater certainty that a price reduction by one seller will be followed by the other rivals.

Thus the angle KPD tends to be a right angle at P and the gap AB widens so that any AC curve below point A will cut the marginal revenue curve inside the gap. The net result is the same output OR at the same price OP_o and large profits for the oligopolistic sellers.

In case the cost of production rises the marginal cost curve will shift to the left of the old curve MC as MC_2. So long as the higher MC curve intersects the MR curve within the gap up to point A, the price situation will be rigid.

However, with the rise in costs the price is not likely to remain stable indefinitely and if the Ml curve rises above point A, it will intersect the MC curve in the portion KA so that a lesser quantity is sold at a higher price.

We may conclude that there may be price stability under oligopoly even when costs change so long as the MC curve cuts the MR curve in its discontinuous portion. However, chances of the existence of price-rigidity are greater where there is a reduction in costs than there is a rise in costs.

Changes in Demand:

We now explain price rigidity where there is a change in demand with the help of Figure 7, D_2 is the original demand curve, MR_2 is its corresponding marginal revenue curve and MC is the marginal cost curve. Suppose there is a decrease in demand shown by D_1 curve and MR_1 is its marginal revenue curve.

When demand decreases, a price-reduction move by one seller will be followed by other rivals. This will make LD_1 the lower portion of the new demand curve, more inelastic than the lower portion HD_2 of the old demand curve.

This will tend to make the angle at L approach a right angle. As a result, the gap EF in MR_1 curve is likely to be wider than the gap AB of the MR_2 curve. The marginal cost curve MC will, therefore, intersect the lower marginal revenue curve MR_1 inside the gap EF, thus indicating a stable price for the oligopolistic industry.

Since the level of the kinks H and L of the two demand curves remains the same, the same price OP is maintained after the decrease in demand. But the output level falls from OQ_2 to OQ_1. This case can be reversed to show increase in demand by taking D_1 and MR_1 as the original demand and marginal revenue curves and D_2 and MR_2 as the higher demand and marginal revenue curves respectively.

The price OP is maintained but the output rises from OQ_1 to OQ. So long as the MC curve continues to intersect the MR curve in the discontinuous portion, there will be price rigidity.

However, if demand increases, it may lead to a higher price. When demand increases, a seller would like to raise the price of the product and others are expected to follow him. This will tend to make the upper portion MH of the new demand curve elastic than the NL portion of the old curve.

Thus the angle at H becomes obtuse, away from the right angle. The gap AB in the MR_2 curve becomes smaller and the MC curve intersects the MR_2 curve above the gap, indicating a higher price and lower output. If, however, the marginal cost curve passes through the gap of MR_2, there is price stability.

Reasons for Price Stability:

(1) Individual sellers in an oligopolistic industry might have learnt through experience the futility of price wars and thus prefer price stability.

(2) They may be content with the current prices, outputs and profits and avoid any involvement in unnecessary insecurity and uncertainty.

(3) They may also prefer to stick to the present price level to prevent new firms from entering the industry.

(4) The sellers may intensify their sales promotion efforts at the current price instead of reducing it. They may view non-price competition better than price rivalry.

(5) After spending a lot of money on advertising his product, a seller may not like to raise its price to deprive himself of the fruits of his hard labour. Naturally, he would stick to the going price of the product.

(6) If a stable price has been set through agreement or collusion, no seller would like to disturb it, for fear of unleashing a price war and thus engulfing himself into an era of uncertainty and insecurity.

(7) It is the kinked demand curve analysis which is responsible for price rigidity in oligopolistic markets.

It's Shortcomings:

But the theory of kinked demand curve in oligopoly pricing is not without shortcomings.

(1) Even if we accept all its assumptions it is not likely that the gap in the marginal revenue curve will be wide enough for the marginal cost curve to pass through it. It may be shortened even under conditions of fall in demand or costs, thereby making price unstable.

(2) One of its major shortcomings, according to Professor Stigler, is that **"**the theory does not explain why prices that have once changed should settle down, again acquire stability, and gradually produce a new kink." For instance in Figure 6 the kink occurs at P because OP_o is the prevailing price. But the theory does not explain the forces that established the initial price OP_o.

(3) Price stability may be illusory because it is not based on the actual market behaviour. Sales do not always occur at list prices. There are often deviations from posted prices because of trade-ins, allowances and secret price concessions. The oligopolistic seller may outwardly keep the price stable but he may reduce the quality or quantity of the product. Thus price stability becomes illusory.

(4) Moreover, it is not possible to statistically compile actual sales prices in the case of many products that may reflect stable prices for them. It is, therefore, doubtful that price stability actually exists in oligopoly.

(5) Critics point out that the kinked demand curve analysis holds during the short-run, when the knowledge about the reactions of rivals is low. But it is difficult to guess correctly the rivals' reactions in the long-run. Thus the theory is not applicable in the long-run.

(6) According to some economists, the kinked demand curve analysis applies to an oligopolistic industry in its initial stages or to that industry in which new and previously unknown rivals enter the market.

(7) The kinked demand curve analysis is based on two assumptions: first, other firms will follow a price cut and, second, they will not follow a price rise. Stigler has shown on empirical evidence that in an inflationary period the rise in output prices is not confined only to one firm but is industry-wide. So all firms having similar costs will follow one another in raising price.

Cournot Model of Duopoly:

The model by Augustin Cournot deals with two profit maximising firms. Let the two firms be A and B. A doubopoly industry contains two sellers. An oligopolistic industry contains a number sufficiently small so that the sections of any individual seller have a perceptible influence upon his rivals.(Henderson and Quandt, 2003). Cournot duopoly, also called Cournot competition, is a model of imperfect competition in which two firms with identical cost functions compete with homogeneous products in a static setting. It was developed by Antoine A. Cournot in his "Researches Into the Mathematical principles of the Theory of Wealth", 1838. Cournot's duopoly represented the creation of the study of oligopolies, more particularly duopolies, and expanded the analysis of market structures which, until then, had concentrated on the extremes:There are two firms operating in a limited market. Market production is: $P(Q)=a-bQ$, where $Q=q_1+q_2$ for two firms. Both companies will receive profits derived from a simultaneous decision made by both on how much to produce, and also based on their cost functions: $TC_i=C-q_i$.

Assumptions:

1) Each of the firms faces a linear market demand curve

2) Both sell identical products. In Counot's model, the two are assumed to sell mineral water.

3) The cost functions are identical and the marginal cost (MC) of each firm is zero.

4) Each firm assumes that the other would continue to produce the same output as in the last period.

Reaction Function Approach:

The reaction function approach is a useful tool in analysing oligopolistic markets. With this approach, it becomes easier to analyse the equilibrium condition of the different oligopolistic models. We would apply it to the Cournot duopoly model in the following.

In his duopoly model, Cournot makes a very naïve assumption that the firms think their rivals would stick to their past periods output level. Therefore, the conjectural variation (CV) of both the duopolists is equal to zero. Retaining the same assumptions that both the duopolists i) face linear market demand curve, ii) maximise profit and iii) have MC = 0.We can write the model as follows:

Let the demand function be $p = a - bq$, where $q = (qi + qj)$ = total market

demand and $a, b > 0$

Given the above assumptions, we can write the profit function of the ith firm

as:

$\Pi i = pqi - C(qi)$; where i = A, B

$= (a - bq)\, qi - C(qi)$

$= [a - b(qi + qj)]\, qi - C(qi)$

Each firm being a profit maximiser, Each firm being a profit maximiser, we would differentiate Πi partially with respect to qi and set the derivatives equal to zero.

Thus, $\delta\Pi i/\delta qi = a - 2bqi - b(qj + qi\, \delta qj/\delta qi) - \delta C/\delta qi = 0$.

As in this model CV = 0, $\delta qj/\delta qi = 0$. Hence, we have,

$a - 2bqi - bqj = 0$ (as $\delta C/\delta qi = 0$, by assumption)

From such an optimisation exercise we get:

$qi^* = (a - bqj)/2b$, $qi^* = Ri(qj)$ where, qi^* gives the profit maximising level

of output of firm i(i, j =A, B; $i \neq j$)

The equilibrium output levels of both the firms is obtained by solving the two reaction function equations as:

$qA^* = a/3b$, $qB^* = a/3b$

For each firm, Ri represents the reaction function. Given the output level of the jth firm the reaction function shows the best response (i.e., qi*) of the ith firm, which maximises its profit. The reaction functions in this exposition will be downward sloping straight lines, as shown below in Figure 10.2 where SP is the reaction function of firm B and MN is the reaction function of firm A.

For any level of output of firm B say qB 1 the level of output which would maximise firm A's profit is given by qA from A's reaction function MN .We can similarly explain each point on the reaction curve of firm B.(Koutsiyianis,2003)

Edgeworth Model:

To analyse the Edgeworth solution of oligopoly let us consider two profit maximising firms A and B, selling a homogeneous product and having identical cost function with marginal cost (MC) equals to zero. We also assume that they face a linear market demand curve. In the following figure, DA represents the market demand faced by firm A and DB represents that of firm B

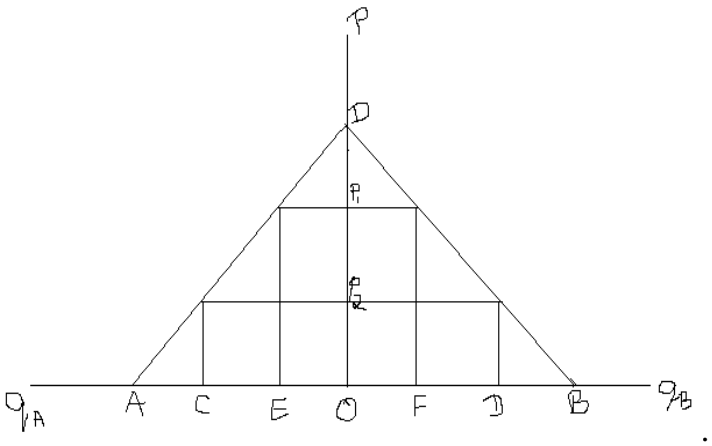

Figure 7: Edgeworth Solution

Unlike Bertrand, Edgeworth assumes that none of the duopolists can produce an output as large as the competitive market's. Suppose firm A is the first one to enter the market. Equating MR and MC, it decides to produce OE at price OP1.Now suppose B enters the market and sets price slightly below OP1 and thus captures all of A's customers. But then B can cater to the market demand only up to OD, hence amount left to be sold by firm A is AC (= DB, by construction). Firm A rather than accept the reduction in revenue decides to reduce the price slightly below that of B's. As a result, A can now capture all of B's customers. However, once again, A can sell only up to OC. This process would go on until price falls to OP2, and each of the duopolist produce the maximum possible output. However, the price OP2 is not stable because one of the firms can raise it's price and thereby it's revenue as well as profit (because MC = 0). For instance, A will try to raise price assuming B will maintain it if OP2. A has no fears of loosing customers to B, because B is producing it's maximum possible output so that rest of the market is to be catered to by A only. Now B would also reconsider that a price rise from OP2 would not result in a loss of sales. Therefore, it would raise price almost up to OP1. A would respond by reducing price and the same process ensues once again as before. We see that price would fluctuate between OP1 and OP2 and there would be no stable price equilibrium. (Henderson and Quandt,2003)

Chamberlin's Oligopoly Model:

Chamberlin suggested that a stable equilibrium can be reached in an oligopolistic market if the firms charge monopoly price. This will be possible if the firms recognise their interdependence, unlike in the Cournot model where they act on the naïve assumption of rival marinating its previous mperiod's price or output level. In this model, the setting (i.e., assumption) is similar as that in Cournot's except for the fact that the firms do recognise their mutual interdependence. Let us study the model on the basis of the following diagram. Let DQ be the linear market demand curve. Suppose firm A enters first in the market and sells OQ1 units at the price OP1 on the basis of (MR = MC), thereby reaping monopoly profit given by the area OQ1CP1. Let us now consider firm B's entry into the market. Given that firm A produces OQ1, CQ becomes firm B's relevant market demand curve. Therefore, the best B can do acting on the basis of (MR = MC) is to market Q1Q2. As a result, price falls to OP2 and the total profit accruing to both is given by the area OQ2FP2.

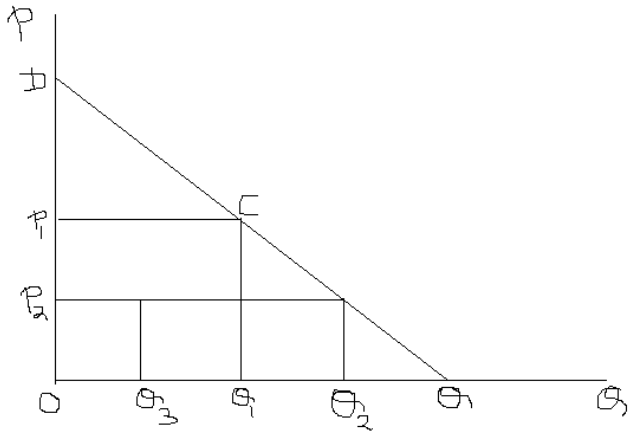

Figure 8: Chamberlin Equilibrium

According to Chamberlin, firm A will survey the market situation after B's entry and will figure out that sharing the profit level OQ1CP1 is the best for either of them. Therefore, firm A would reduce its output level from OQ1 to OQ3 and firm B would stick to the output level Q1Q2 = Q3Q1. With this arrangement, the firms together produce OQ1 and the price level is retained at

OP1. Thus, we see that firm A produces OQ3 = ½ OQ1 and B Q3Q1 = ½ OQ1. The total output is OQ1 to be sold at a price OP1 with firms A and B sharing the monopoly profit equally. Firms, in this kind of an agreement, produce more than in the Cournot case, where each one produces one-third of the total market demand. According to Chamberlin, firm A will survey the market situation after B's entry and will figure out that sharing the profit level OQ1CP1 is the best for either of them. Therefore, firm A would reduce its output level from OQ1 to OQ3 and firm B would stick to the output level Q1Q2 = Q3Q1. With this arrangement, the firms together produce OQ1 and the price level is retained at

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Stackelberg Model

In Stackelberg model, quantity is the strategic variable of the firms. We would analyse the model in terms of iso-profit curves. Let us assume that there are two profit maximising duopolistic firms A and B. An iso-profit curve shows the alternative combinations of output qA (quantity of output of firm A) and qB (quantity of output of firm B) that would yield the same profit. Let us suppose the following:

• Demand function faced by both the firms are p = p (q), where q = qA+qB ,

the aggregate output produced by both the firms.

• Cost function Ci = Ci (qi) where i = A,B

Derivation of Iso-profit Curve

Consider the profit function of firm A given by, ΠA = pqA – C(qA) and take Π0 to be the desired level of profit. To arrive at the iso-profit curve of firm A choose those combinations of qA and qB, which would yield a profit level of Π0 to it;

i.e., Π0 = pqA – C(qA) = p(q) qA – C(qA) = p(qA+qB) qA – C(qA)……..(1)

To arrive at those combinations of qA and qB, we totally differentiate Π0, to getdΠ0 = pdqA + qA dp – ∂C/∂qA dqA or, 0 = pdqA + qA dp/dq(dqA + dqB) – ∂C/∂qA dqA…….(.2)

As Π0 is a constant, dΠ0 = 0 and pdqA + qA dp/dq (dqA + dqB) – ∂C/∂qA dqA = 0……(3)

By simple manipulation, we see that dqB/dqA = - [(MRA + MCA)/(qA dp/dq)]…..(4)

The demand curve by assumption is downward sloping, therefore dp/dq < 0. Hence, the iso-profit curve will be > =< 0 according as MRA> = < MCA.

Diagrammatically the iso-proft curve will have an inverted U shape as shown in Figure 9.

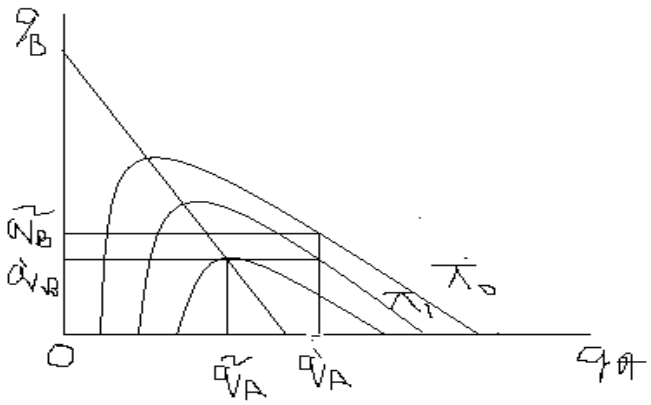

Figure 9: Iso-proft Curve

qA remaining constant at q1 Aif qB increases from q1 B to q2 B, the firm ends up at the iso-profit curve Π0, which represents a lower level of iso-profit than Π1. Hence, the iso-profit curves lying away from the horizontal axis represents lower level of profit. The objective of firm A being profit maximisation, it would try to produce such an output that is on the highest iso-profit curve, for a given level of output of firm B. Given say output level q1 B firm A would obtain maximum profit by producing q2 A amount of output which is given by the tangency between q1 B and the innermost iso-profit curve. Therefore, locus of the highest points of the iso-profit curves of firm A gives the reaction function of firm A. By a similar process, we can derive the iso-profit curve of firm B. The reaction function of a firm gives it's best response to any output decision of it's rival.(Koutsoyianis ,1979)

The Stackelberg model of oligopoly deals with the leadership of a firm. Let firm A be the leader which implies that it will make a conjecture that firm B will accept A's output as a datum while making a output plan and B willactually behave in this manner. In other words, firm A will incorporate this in the profit maximising objective of firm B. For this reason, which the conjectural variation of firm B is zero, it is non-zero for firm A. Basically, firm B operates on the naïve Cournot conjecture. In other words, firm A being the leader can perceive the reaction function of firm B and would know beforehand the strategy firm B is going to adopt. Firm A incorporates this knowledge in its profit maximising exercise in the sense that it knows thereaction function of B. Given the iso profit curves of A and the reaction function of B, firm A can find out from the tangency between the two. This is illustrated in the following diagram. In the diagram, point E gives the Stackelberg equilibrium. Firm B being on its reaction function would have no incentive to deviate from E. In addition, as firm A is maximising its profit, it has no incentive to deviate. Hence, this equilibrium is stable.

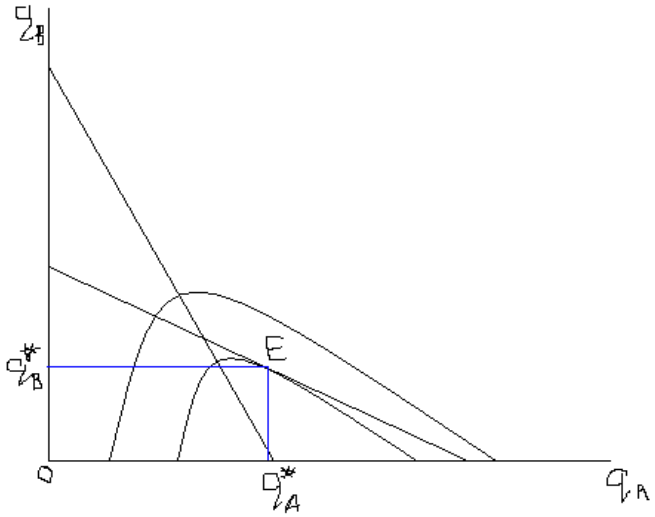

Figure 10: Stackelberg Solution

3. CONCLUSION

The oligopoly market structure is very apparent in the soft drink industry. Two large producers, Coke and Pepsi, maintain a dominant role in the industry. High barriers to entry prevent smaller firms from making a large impact this allows these two firms to compete on areas other than price in an attempt to maximize profit In the non-collusive oligopolistic model, there is interdependence and rivalry among the firms. Depending on the conjectures made by the firms, we get different models. The whole analysis of the kinked demand curve points out that price rigidity in oligopolistic markets is likely to prevail if there is a price reduction move on the part of all sellers. Changes in costs and demand also lead to price stability under normal conditions so long as the MC curve intersects the MR curve in its discontinuous portion. But price increase rather than price rigidity may be found in response to rising cost or increased demand. The Cournot model deals with the case when the firms make conjecture that the rival would stick to the previous level of output. Here the firms deal with output changes. Finally, the firms together end up producing 2/3 of the total market demand. In the Bertrand model, the case is similar to that of Cournot except that the firms compete in terms of price. Here they end up producing the competitive level of output. In the Stackelberg model one firm acts as the leader and the other follower. A firm is a leader in the sense that it knows the reaction function of the follower. The leader maximises profit after incorporating the reaction function of the follower.

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