Application on Game Theory: Cement Industry in Egypt-Arabian Cement Company

Article *in* International Journal of Business, Economics and Management · September 2018

Nadeen Sherif El Adawy
Modern Sciences and Arts University

Doaa M. Salman Abdou
Modern Sciences and Arts University

American Journal of Business, Economics and Management
2018; 6(3): 49-56
http://www.openscienceonline.com/journal/ajbem
ISSN: 2381-4462 (Print); ISSN: 2381-4470 (Online)

Application on Game Theory: Cement Industry in Egypt - Arabian Cement Company

Doaa Mohamed Salman Abdou, Nadeen Sherif El Adaway

Department of Economics, October University for Modern Sciences and Arts (MSA), Giza, Egypt

Email address

dsalman@msa.eun.eg (D. M. S. Abdou), nadeen.sherif1@msa.edu.eg (N. S. El Adaway)

To cite this article

Doaa Mohamed Salman Abdou, Nadeen Sherif El Adaway. Application on Game Theory: Cement Industry in Egypt - Arabian Cement Company. *American Journal of Business, Economics and Management.* Vol. 6, No. 3, 2018, pp. 49-56.

Received: May 25, 2018; **Accepted**: June 18, 2018; **Published**: July 25, 2018

Abstract

This research paper explores the cement industry in Egypt by overlooking the history of the industry and taking the Arabian cement company as an example. The cement industry in Egypt is performing price discrimination as a result of the high market power that the firms have. To understand more about price discrimination and game theory, a literature review has been made in the paper about is price discrimination, the types of price discrimination, game theory, strategies of game theory and relation between price discrimination and game theory. Last but not least, a case study about the industry in Egypt is made during the period of 2013-2017, and it was concluded that the cement market in Egypt is an oligopoly and third degree price discrimination is done by competitors in the market and game theory strategies are applied.

Keywords

Game Theory, Price Discrimination, Industry

1. Introduction

Choosing the right pricing strategy is one of the most difficult decisions any business face all over the globe, as there are countless strategies and each one is applicable in certain conditions. This paper is going to explain one of the well known strategies which are the price discrimination strategy. Discriminating price depends on various factors such as segment, time, user rate, age and gender. Some of the types of price discrimination are first degree discrimination, second degree discrimination, third degree discrimination, and bundling, tying and intertemporal discrimination [15]. Price discrimination is beneficial for the whole economy as some people benefit from lower prices which persuade them to buy more and increase consumption. Moreover, it gives control of the market to the supplier which overcomes the problem of congestion in specific periods of time. Not only customers benefit from price discrimination, the suppliers are the main people in the economy that benefit as they increase their revenue by converting the consumer surplus to revenue, which increase their profits. On the other hand, price discrimination brings some disadvantages to suppliers and consumers, for example some customers are burdened with overpriced goods/services which makes it unfair because those who are charged the highest might be the poorest, and that increase inequality which affects the whole economy negatively.

There are few conditions for a firm to be able to price discriminate in the market, some of the main is to have high market power/share, to be able to segment the customers and to respond differently to different price elasticity of demand and to have the ability to prevent arbitrage which is the processes of buying the product will low price and resell it with higher price. This paper is going to discuss the practices of price discrimination and its type. The practices of game theory and some of its strategies that are applied in cement industry in Egypt focusing on the Arabian cement company as a case during the period of 2013-2017. Finally conclusion is provided to analyze this practice.

2. Literature Review

There are various structures of markets every economy and each structure is uniquely characterized than the others. In order to differentiate the market types there are for features to look at which are the number of players and the market share, the barriers to enter that market, type of product and the ability to influence prices. Despite the fact that there are countless types of market structure in real world, there are three main types that are well known which are monopoly, oligopoly, perfect competition and monopolistic competition [11].

First, the monopoly market structure is the condition in the economy when one supplier has the ability to produce enough of a product/service to satisfy the whole demand in the market with the ability to price discriminate as that supplier is the main player in the market, in this type of market there are extremely high barriers to enter the market and its expensive too. Second, oligopoly market is the market where very few players have control over the market and those players are satisfying the whole demand. The oligopoly market is similar to the monopoly market in terms of barriers and expenses, as both markets have higher barriers for the entry of new player, and if a new player will enter the market the costs would be extremely high. As there are only few players dominating the market, the action of every one of them is interdependent on the other [9]. Third, the perfect competition which is the market with large number of competitors, identical products/services and none of those competitors have the power to affect the prices in the market, because the products/services of this type of market are considered elastic, thus if any competitor increased the price he/she would lose market share. The barriers to enter a perfect competitor market are incredibly low. The fourth type is the monopolistic competitive market structure, which is the market that has very large number of competitors that produce similar products/services yet each player differentiate its product/service to increase its market share. The monopolistic competitive market has very low barriers for entry of the market and it cheap too [11].

Price discrimination is the practice that some suppliers do when they charge different group of customers' different prices for the exact same product/service. There are various types of price discrimination in any market; however there are some conditions that must be satisfied in order to be able to discriminate price, those conditions is the market power, elasticity of demand. Varian (1989) was against that basic definition as that the varying in prices might be as a result of different transportation costs or any other cost. Stigler (1987) defined price discrimination as the act of selling same goods with costs that are not equal to the marginal cost of the product.

There are three main conditions in order for the supplier to discriminate the prices in the market. Firstly, the firm that is discriminating prices must have market power to be able to charge different prices without the risk of losing customers to customers. In monopoly and oligopoly markets price discrimination is a normal practice among competitors, as each firm in the market has high market charge that enable it to set the prices as high as they want [10]. Furthermore, the firm that is discriminating should figure out the different elasticity of demand of different customers, because not all customers have the same willingness to pay.

In order to maximize profit, the firm should charge each customer the maximum price that they are willing to pay; therefore lowering the price to all customers may lead to losses. As the product is more elastic to the customers, their willingness to pay will decrease as they are sensitive to changes in price, and vice verse in the case of inelastic product the customer would not be willing to give up the product, therefore increasing the prices would be very beneficial for firms [15]. Last but not least, the firm that is price discriminating must have the power and the ability to segment the market in order to be able to set different prices and benefit from the consumer surplus. For instance in the case of electric power providers, the firms segment the customers into two main segments which are residential users and commercial users [10].

Type of price discrimination; Fist degree price discrimination is commonly known as perfect discrimination. Each customer is burdened with the maximum price he/she has the ability to play. First degree is not commonly practiced in real world, as it's extremely hard to identify the ability of each customer. This type of discrimination is beneficial for the supplier as it switch the consumer surplus into revenue to the supplier which increase the supplier profits [2]. Second degree: This type of discrimination is usually known as the non-linear price discrimination. Second degree price discrimination happens when different quantities are sold with different prices to different groups of people; it is beneficial for people buying in huge amounts because they benefit from bulk discount which makes them benefit from economies of scale. As the quantity bought increase the price charged decrease and as the quantity bought decrease the price increase, which shows the negative relation between price and quantity [15].

Third degree price discrimination is known in real world as segmentation price discrimination, as it is based on the concept of segmenting the customers into groups to be charged differently. This type is the most type that is used in real world, and they usually segment their customers based on their elasticity of demand [2].

Bundling is one of the various types of price discrimination which depends on connecting and relating products to each others to discriminate the price. There are two types of bundling, pure bundling which sets a condition that the product sold in bundle with another product is not sold separately, and the mixed bundling allows customers to buy the product alone or in the bundle based on their preferences. Also, Intertemporal Discrimination: This pricing strategy is very closely related to third degree price discrimination; however it is concerned with time. Briefly, the firm segment the customers into few segments with different elasticity of demand and the price of the product in the market vary at different time [15]. For instance when a product is just launched in the market, its price is expected to be higher than it will decline as time passes [13].

In any economy all over the world people interact with each other, however those interaction can be harmonized when people agree with each other's or can be chaotic when they disagree. The interaction between decision makers in the economies is known as behavioural economics, which is a study that takes into consideration the psychology of decision makers. One of the theories that branched from behavioural economics is the game theory, many economists and mathematicians initiated the idea of game theory, however the mathematician John von Neumann was the first one to reach an official and reasonable conclusion in his paper in 1928, then he continued to elaborate this theory more till he published his book "Theory of games and economic behaviour" in 1944 which was co-authored by the economist Oskar Morgenstern. The game in general is known as the situation where two or more players are interdependent on each other's decisions; the decision of one decision maker in the market affects all other players so the game is to select the best strategy. Therefore, the players are the decision makers that are involved in the game. Thus, game theory studies the behaviour of strategic decision makers either by cooperation or conflicts in the market they are competing in, in other words it shows the strategies that decision makers make in order to survive in a market where the decisions of all competitors depends on each other's [6].

A cartel is chiefly an action taken by the dominating firms to join together to have more power over the market and to control the prices to increase their profit. However, as cartels are illegal there are no rules or laws to protect the competitors against each other, and the majority of the time it ends up by one participant cheating on the other and stealing market share. Scholar has encouraged players in oligopoly market to cooperate together in order to have more market power and have the ability to price discriminate, however he stated that there are four conditions for this cooperation which were to make all players on good terms and on the same page, to be aware of any kind of cheating from any player and to set a penalty for any player who cheat or break the agreement [12]. On the other hand, if the players decided to play the non-cooperative game, it is believed that their profits will be much lower.

3. Case Study

Egypt is considered one of the oldest countries manufacturing cement in the MENA (Middle East and North Africa) region, with the first plant to manufacture cement being established in 1972 by Torah Cement Company. Later in 1929 Helwan Cement Company entered the market in Egypt, followed in 1948 Alexandria Cement Company and the National Cement Company in 1956. During the period of president Andwar ELSadat in the 1970s, Egypt construction sector was emerging which increased the demand on cement as those two products are complements, and this demand was not met by the production of Torah, Helwan, Alexandria and National cement companies which pushed the government to import and the prices were notably increasing. As a result, few other producers entered the market as Suez, Assuit and Amyreya cement companies. However, even though the production of cement was increasing in 1980s Egypt became the largest country in the world importing cement. It was considered a market failure as the demand was not met by enough supply, which was motive for entry of new competitors in the market; in 1990s six more companies entered the market. The production of cement kept increasing till it satisfied the high demand and in 2004 Egypt stopped importing and started exporting and by time it became the largest country exporting cement in MENA region.

The only private sector firm was Suez Cement Company which entered the market in 1977, which later founded the Egyptian cement company in 1994. During the period of shortage of cement several private companies entered the market. In 1990s Egypt introduced a privatization program to improve the economic position of the country, and this program affected all the industries in Egypt as about 50 percent of companies were sold to private sector. In the cement sector, Helwan, Torah and Amereyah cement were sold, followed by Assuit, Alexandria and Beni-Suif cement. Toroah Cement Company was sold to Suez cement company which was the main and original player in the private sector [5].

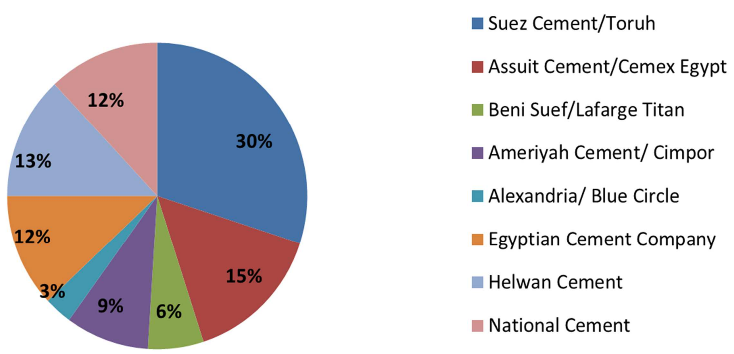

Figure 1. *Market share of cement companies during 2000-2001.*

Source: Kompass/EFG-Hermes (CARANA, 2002).

As it became clear from figure 1, the only three Egyptian owned companies were Suez and Toruh Cement, Egyptian Cement Company and Helwan cement which accounts to 55 percent of the market and the rest owned by foreigners. Also, the only public company left was the national cement which accounts to 12 percent and the rest 88 percent are private companies.

3.1. Market Overview in Egypt of Cement

Cement is one of the main components of concrete, it is very high quality and economically material that is used in any construction project all over the world. As the cement is one of most vital products that everything in the economy is dependent on it, any fluctuation in its prices affect the whole economy. The cement industry is really interesting to be studied as in the majority of the world it is an oligopoly market, which means there is not high level of competition yet there are strategies between the players in the market. The cement is a complement product to any construction activity in an economy; therefore cement is important product that is linked to the development of the country however manufacturing such product leads to high social costs.

There are various types of cement; the main four in Egypt are Portland, white, blended and resistant. First types are Portland cement which is used the most all over the world, one of its main uses is making concrete. While the second type is the white Portland cement which is similar to the regular Portland but it's more expensive as it has white color. The third type is the blended which is a mix of regular Portland cement with some minerals, which is more environmentally friendly. The last type is resistant cement has more resistant than regular cement which is mostly used in areas near high level of sulphate. The white cement in Egypt is dominated by three main players Sinai white Cement Company, EL Menya cement royal company, Suez Company and CEMEX Company. While the regular Portland cement is dominated by Suez Cement Company, Lafarge Egypt Cement Company, ASEC Cement Company and Arabian Cement Company.

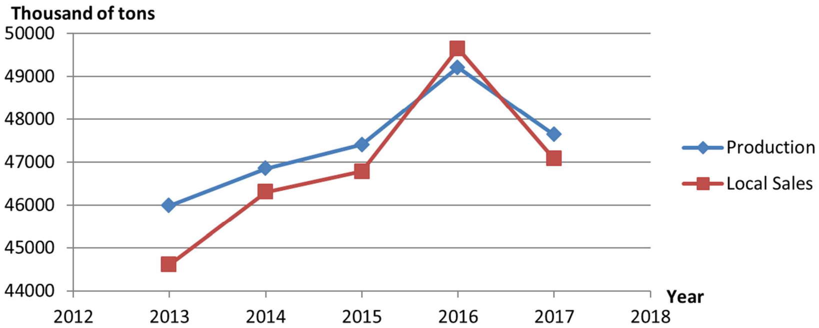

Figure 2. *Cement production and sales in Egypt (2013-2017).*

Source: Central Bank of Egypt.

The market of cement is Egypt is considered oligopoly market, as only few players dominate the market. Those firms have the power to affect price and quality supplied in the market. As shown in figure 3, the main three players are Italcementi group owning Suez, Helwan and Toruh cement, Lafarge owning Egyptian Cement Company, ASEC cement and Arabian Cement Company. Customers in the cement market are not loyal to a certain brand, as all manufacturers are providing the same products with no difference which makes it impossible to create brand identity or image, thus customers will always go to the cheaper brand. The competition in such market is based on the prices, cost efficiency and choosing the right distribution channels [7].

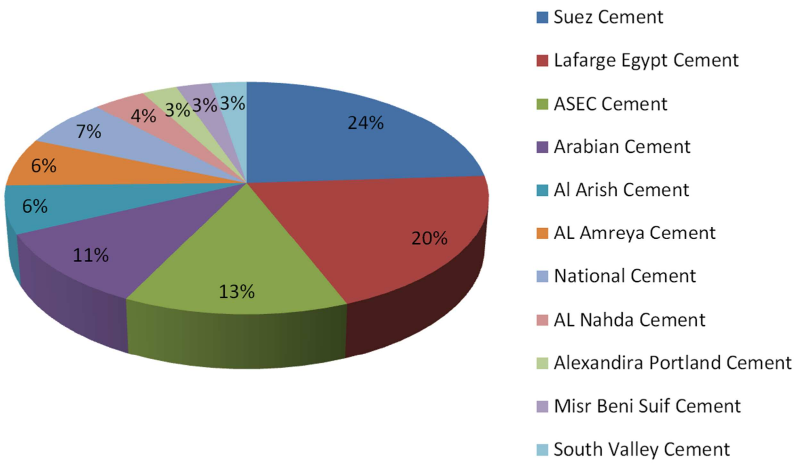

Figure 3. *Share of total capacity of cement producers in Egypt 2017.*

Source: Al Mal Newspaper and AOLB Research.

The prices of cement in Egypt faced many fluctuations, one of the main was during 2008 when the construction industry expended which increased the demand on cement and the market faced a shortage and the price was pushed up to decrease the demand. In fact, in the beginning of 2008 the price was 400 EGP/ton which accelerated to 600 EGP/ton in 2009 [7]. By 2013 the price was about 800 EGP/ton, however the firms charge different priced based on the region they are selling the cement in.

3.2. Effects on the Economy

If the country has good cement production and enough supply to satisfy the local demand it’s a good indication. During economic boom or improvement in the GDP, the government tends to invest more in improving infrastructure, building houses and schools, building bridges and many other things, the only common thing among them all is the need for cement to accomplish any of those plans. Therefore, if the country has enough supply there won't be need to import from aboard, so the country budget would improve. However, as the cement industry is capital intensive and use very high amount of energy, it emits harmful gases which is considered a social cost of production. During the manufacturing process the factories produce high level of carbon dioxide which increase air pollution and affect the environment negatively.

In 1994 a law was published to protect the Egyptian environment that limits the emissions of dust from cement to 300 mg/m^3 for plants established before 1995, and for plants established after 200mg/m^3. Nitrogen oxides and Sulphur oxides emission was limited to 300 mg/m^3 for plants established before 1995 and 4000 mg/m^3 for plants after 1995. A new law was set by 2009 which followed an international limit standard of 100 mg/m^3 for old plants and 50 mg/m^3 for new plants, sulphur oxide is 400 mg/m^3 and nitrogen oxide 600 mg/m^3 [3]. Thus, those laws limited the social costs of producing cement in Egypt.

3.2.1. Population

Egypt is known that it is a high populated country. As the population increase the demand on houses increase, which increase the construction in the economy, and as mentioned before the construction and cement are complements goods. Moreover, the demand for houses is considered inelastic because it is a basic need for sheltering people, thus there is a strong positive relation between population size and demand on cement. As seen in figure 4, the population in Egypt has been showing a positive trend over the years, which is a strong indication to the massive boost the demand of cement.

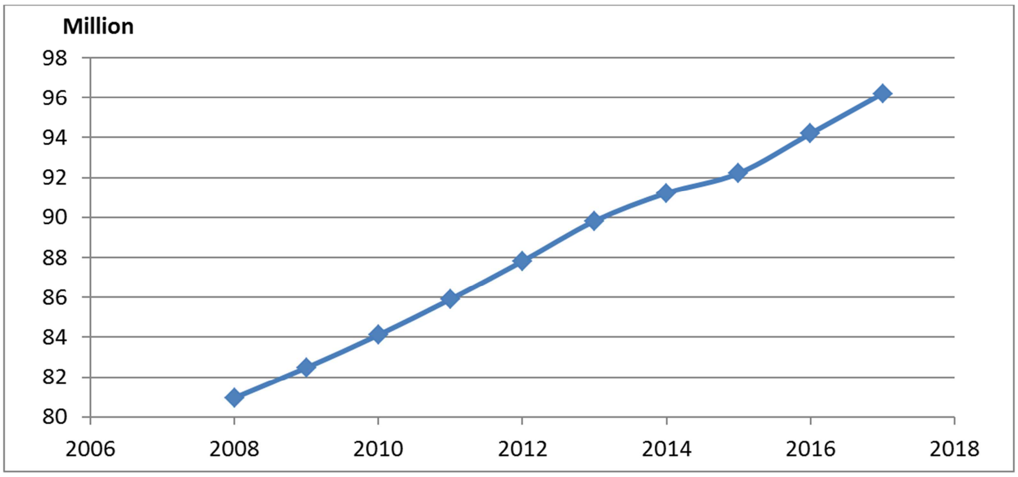

Figure 4. *Population of Egypt 2008-2017.*

Source: World Bank

3.2.2. Political Instability

After the revolution in 2011, the construction sector diminished, as the government was not investing in new projects. Furthermore, the instability in the economy and the high risk people stopped people investing in real-estate, which dropped the demand on cement. As labours were sticking in streets the production was interrupted and the prices of cement dropped as the demand dropped and production dropped. The only consumers were people working in the informal sector and building illegal buildings. Thus as the stability in a country increase the investment would increase and the number of projects by the government or foreign investors will increase increasing the demand on cement. The economic improvement in the Egyptian economy nowadays is expected to boost the demand for cement.

3.2.3. Currency

The value of the currency against US dollar affect greatly the price of cement in the Egyptian market, as the value decreased the cement prices dropped massively. However when the Egyptian government floated the currency and let the demand and supply determine the prices, the prices rose up again. Also, as the currency was floated the exports of Egypt increased, as suppliers were facing a difficulty when the exchange rate was fixed because they were losing the competitive advantages, so as the Egyptian pound depreciated the local prices of cement increased.

3.2.4. Energy Prices

Cement production requires large amount of fuel to operate the factories, thus any fluctuation in the fuel or energy would affect the prices of the cement. As the fuel prices increase in Egypt it was reflected on the prices of cement, because the cost of production increase and people had to increase prices in order to maintain their profits. Cement production is considered one of the most energy consuming sector in Egypt as it consumes more than nine percent of the primary energy available in Egypt. The majority of plants in Egypt use either fuel (diesel) or natural gas to operate the factories. As the Egypt has been going through economic reform to decrease the government spending it started to decrease subsidies but they announced that the industries subsidies would decrease expect for the cement industry. As the production of cement on the most energy consuming products, the government increased the price of diesel per ton in 2017 from EGP 2,500 to EGP 3,000 per ton. As a result of the increase in costs, the manufacturers had no other option than to increase the burden on customers [14].

During 2013-2014 there was shortage in the natural gas, and this affected the average production of cement in Egypt negatively. By 2016 the government removed all the subsidies on natural gas and the price hiked to be four times higher than 2010 [8].

Another aspect that affects the cost of production for cement producers is the price of electricity. As a part to the economic reform too the government started to increase the prices of electricity gradually on both residential and commercial users. As a result, when the subsidies where being removed gradually on electricity, the costs increase on manufacturer which forced them to increase the burden the consumers more to maintain their profit margin.

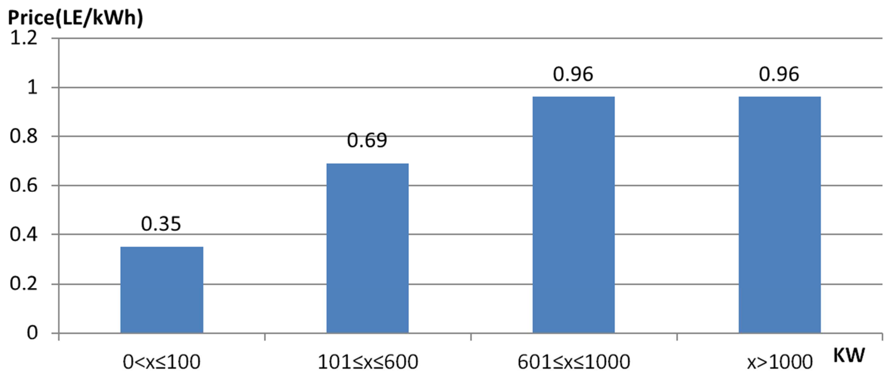

Figure 5. *Electricity tariffs for commercial customers in 2016.*

Source: Egyptian Electricity holding company annual report 2015-2016.

3.2.5. Technological Advancement

As the company producing cement is more innovative and has the equipment for that, their production costs decrease. When the cost decrease and prices are the same the company will gain advantage on its competitors which would increase the profits of the company.

3.3. Arabian Cement Company

The Arabian Cement company was founded in Egypt in 1997. The company targets to supply their clients with high quality products and services. ACC focus its production on construction materials, such as cement, clicker and concrete. Also, they offer their clients a delivery service called "Express Wassal" by offering different sizes of their cement products starting with the normal bagged, bulk, big bags and reaching big containers. Arabian Cement Company provides several type of cement to the Egyptian market, which are mainly Portland and resistant cement[1].

3.3.1. Price Discrimination

As mentioned above, Arabian Cement Company provides the Egyptian market with mainly three types of cement. As the company is in an oligopoly market it has the power to price discriminate, which is done via characterising and segmenting the customers and providing them with the same product yet different prices. For instance AL Mosalah and AL Tahrir are both Portland cement, yet AL Mosalah price is higher than AL Tahrir. This pricing strategy is done by the company in order to capture consumer surplus and convert it into revenue an increase its profits, to have advantage over competing firms. This price discrimination strategy is considered third degree price discrimination as they segment

1 They have three main products: AL Mosalah cement: it is a regular Portland cement that has high strength, low volume expansion and greater rate of strength gain. AL Tahrir: it is also a regular Portland cement which same characteristics as AL Mosalah. AL Sadd Cement: this type of cement is resistant which is suitable to be used in areas with high level of sulphate

customers and charge them differently. In addition the company is discriminating price by charging those whom buy bulk amount of Portland cement lower price/ton than regular bagged.

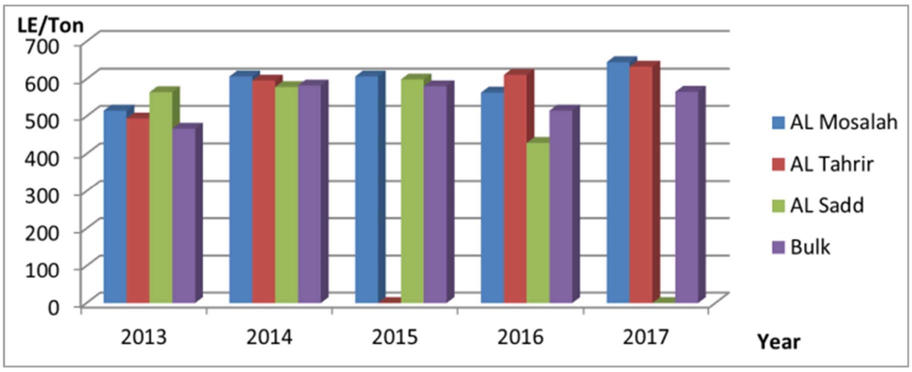

Figure 6. *Prices of cement products of Arabian Cement Company 2013-2017.*

Source: Investors Presentation of Arabian Cement Company 2013-2017

The Arabian cement company is expected to increase the prices by five percent through the years till 2020, which is expected to reach the price ceiling in the market. Globally the price ceiling of cement is expected to fall which puts a burden on ACC as the prices of the imported cement would be much cheaper than their products. Moreover, the price of Al Mosalah cement will remain higher than AL Tahrir because it is considered to be the premium product of the company that is targeting different group of consumers. However, there are no expectations for growth of supply because already the market is overcrowded with cement from the various competitors.

3.3.2. Application of Game Theory

It is believed that Arabian Cement Company is applying maximin strategy, which states that the aim of every player in the market is earn maximum profit. But in oligopoly market every player aim to decrease the risk and maintain its share and they accomplish this by maximizing their probabilities of minimum outcome to decrease the risk of operating in such competitive market. It is supported by the fact that all the companies in the Egyptian market are providing very similar products and no one of those competitors can create an identity for its product, thus if any of them increased the prices he/she will lose market share as customers will automatically shift to the competitor with lower price.

During the early days in Egypt, Suez Cement Company took over Helwan Cement Company and Toruh Cement Company, in order to increase their market share in the market and influence the prices and increase their profit margins.

4. Conclusion

In a nut shell, there is several type of market structure; it depends on the number of competing firms in the market. It became clear after exploring all the aspects of the market of cement that it is an oligopoly market. The demand curve of this market structure was explained by the kinked demand curve. Moreover, The Game theory and prisoner's dilemma theory are clear to be relevant to the cement industry.

It was also concluded that there are various type of price discrimination and each type has specific conditions to be applied to certain industries. Also, in order to price discriminate the supplier should be a monopoly or oligopoly and should be able to segment the customers based on their elasticity of demand. However, in real world some firms those don't have high market power or share to discriminate prices, but in the cement industry in Egypt suppliers are oligopoly following the required conditions to discriminate prices. The cement industry in Egypt is vital and the majority of its companies were privatized. The main factors that affected the demand in Egypt were the population, political stability and the value of the Egyptian currency. While on the other hand the main factor that affects the supply of cement is the cost of production, especially the energy costs, and the technological advancement.

Arabian cement company is one of the leading companies that is practicing in an oligopoly market, this company that is producing cement is using third degree price discrimination and it is charging different group of customers different prices for the same product, and from my opinion it is applying maximin strategy of game theory because there are few players in the market that are selling the same products, so they are all seeking to maintain their profits.

References

[1] Arabian Cement Co. (2018). Quantitative Equity Report. *Morningstar*.

[2] Armstrong, M. (2006, October). Price Discrimination. pp. 1-38.

[3] Askar, Y., Jago, P., Mourad, M. M., & Huisingh, D. (2010). THE CEMENT INDUSTRY IN EGYPT: Challenges and innovative Cleaner Production solutions. *Knowledge Collaboration & Learning for Sustainable Innovation*.

[4] Basar, T. (2014). Game Theory: Historical Overview. *Encyclopedia of Systems and Control*.

[5] CARANA. (2002). *The Results and Impacts of Egypt's Privatization Program*. United States Agency for International Development.

[6] Dragasevic, Z., Rakocevic, S., & Glisevic, N. (2011). THE APPLICATION OF THE GAME THEORY TO THE OLIGOPOLISTIC MARKET. *15th International Research/Expert Conference " Trends in the Development of Machinery and Associated Technology"*, 929-932.

[7] Global Investment House. (2009). Egypt Cement Sector Against all odds. *Global Investment House KSCC*.

[8] IFC. (2016). Unlocking Value: Alternative Fuels For Egypt's Cement Industry. *International Finance Corporation: World bank*.

[9] Iwaszczuk, N., & Kavalets, I. (2013). Oligopolistic market: stability conditions of the equilibrium point. *ECONTECHMOD*, *2* (1), 15-22.

[10] Machlup, F. (1955). CHARACTERISTICS AND TYPES OF PRICE DISCRIMINATION. In *Business Concentration and Price Policy* (pp. 397 - 440).

[11] Rosenberg, S., & O'Halloran, P. (2014). Firm Behavior In Oligopolistic Markets: Evidence From A Business. *Journal of Business Case Studies*, *10* (3), 239-254.

[12] Sagi, G. (2008). The oligopolistic pricing problem: A suggested price freeze remedy. *Bus. L. Rev*, 1-77.

[13] Sarafidis, Y. (2004). "Inter-temporal Price Discrimination with Time Inconsistent Consumers". *Department of Economics and Political Science, INSEAD*, 1-40.

[14] Vanderborght, B., Koch, F., Grimmeissen, L., Wehner, S., Heersche, P. H., & Degré, J.-P. (2016). Low-Carbon Roadmap for the Egyptian Cement Industry. Project "Egypt: Technology and Policy Scoping for a Low-Carbon Egyptian Cement Industry". *European Bank for Reconstruction and Development (EBRD)*, 1-35.

[15] Varian, H. R. (1987). PRICE DISCRIMINATION. In *Handbook of industrial organization,* (pp. 597-654).