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STRATEGIC DECISION MAKING "Game Theory" Case study: "Viva Fresh Store and ETC market"

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Abstract

The decision making is a process which affects and includes people with vision, but to make this process more effective we have studied from the prospective of the Game Theory as an option to simplify the decision making process.

The game theory is a structural mathematic to calculate options and opportunities before individuals or institutions takes decisions. Game theory, analyzes subject's opportunities but at the same time analyzes the responses of the opponent, furthermore there is no game with a single player that's why we have to think also in opponent perspective.

At the beginning of last century many mathematicians have started to develop their theories about Game Theory, but John Nash was one of them who achieved to bring something new and useful for every decision maker. We use Game theory every time but businesses are the community which is most affects with decisions in daily or weekly bases.

This research for over six months in the perspective of Business Administration, at the two subjects of our study thesis Viva Fresh Store and ETC are potential companies to start using Game theory to increase their profits. While we have a lot of companies which operates in Kosovo's market this model will be a new perspective to structure the market.

Viva Fresh Store and ETC are expressing their commitment to use Game Theory in marketing companies because that will reduce costs of marketing. But, both firms are using Game theory in most of their decisions even if they don't know that they are taking decisions in Game Theory perspective.

Furthermore, Viva Fresh Store and ETC or other companies with same performance are collaborate when they can and compete when they must game theory will be easily used.

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This research paper is useful for firms in the new era of the market when the costumer has the power to decide what to buy and not the firms what to sell. This difference became more concrete when we study Game Theory and decision making by firms using Game Theory. The importance of this research paper stays in theoretical and practical side of the firms, because firms can use data and analyses of this thesis to know better for themselves.

Today firms have enough chance to double or triple their benefits in the market if they use their features. Furthermore, this research paper gave a perspective how firms can use their features to have a better performance in the market. Those mathematical problems will open another door of opportunities to all firms who operate at the same market. Therefore, this research paper is not just a theoretical analyze but it is more than that including also experience of two companies. Viva Fresh Store and ETC are two companies which operate in Kosovo's market for more than 10 years and have a sustainable growth over 100 million per year. Those two firms are analyzed in detail how they can collaborate to increase their profit more and more, and at the same Viva Fresh Store and ETC are firs users of Game Theory to take their decision.

The importance of this research paper is not always related with business, it is also useful in governance, politics, economy and every other field when it is necessary to take a strategic decision. Often decision makers use the same mathematic which we have use her to analyze business decision makers. The importance of Game Theory in strategic decision making is also a great methodology to analyze opportunities for our personal life when we have to choose for our future steps.

1   OBJECTIVES OF THIS PAPER WORK
1.2   QUESTION AND HYPOTHESIS

This research paper regarding the Strategic Decision Making "Game Theory" is written to study how firms can take decision and collaborate to increase their profit, but at the same time how firms can determinate the market to find a better position in the market. Today's market does not have "mercy" for anybody, therefore only the strongest will survive. This is a nature low of the market to support only the best, the greatest. Free trade market has a great feature, it brings competitors together to compete in the market. So, competitors or firms are forced to create the best products otherwise the market will take them out. Living in a market where only the bests can survive, they have to produce the best products otherwise costumers will not buy their products.

Free trade market is not perfect but today is the most successful one. This research paper give us another perspective of the market and competition. The goal of this thesis is to bring an option which is useful and most effective in the firm's perspective. Firms can collaborate with each other for better position in the market, they can earn higher profits and most important firms will offer good products to customers.

In this thesis we will elaborate the market when firms are alone without any collaboration, when firms use techniques and mathematical equations to act in the market together. This collaboration that we are explaining is not a "memorandum in the table", it is a theoretical calculation with competitors to share the market together. Therefore, this thesis will explain how firms can do their own calculation to the market, how firms can act like one (unique) and share their profit, firms will collaborate to share the market and also this thesis has another perspective to terminate the monopoly, oligopoly.

This thesis has an important goal which will be useful by firms who own more than 50 % of the market. The perspective of the firms in decision making using "Game Theory" is a window to see the market as single firm in the market when you competitors does not make any threat your, but they are your best collaborators. Therefore, the paperwork raised the following research questions and hypotheses:

Question:
Q1   Do Viva Fresh Store and ETC are taking decision with incomplete information of each other?
Q2   Does Viva Fresh Store and ETC collaborate when they can and compete when they must?
Q3   Does repeated strategies in marketing by Viva Fresh Store and ETC for domination in the market in front of other competitors?
Q4   Does Viva Fresh Store and ETC are taking their decision based in game theory but without their knowledge?

Hypotheses:
H1   Viva Fresh Store and ETC are taking decision with incomplete information for each other.
H2   Viva Fresh Store and ETC collaborate when they can and compete when they must.
H3   Repeated strategies in marketing by Viva Fresh Store and ETC for domination in the market in front of other competitors.
H4   Viva Fresh Store and ETC are taking their decision based in game theory but without their knowledge.

2   THE ART OF LITERATURE

Literature is the main source of information for this paper work; therefore we are carefully searching every possible access and use that information. Books, papers, publications and all source of information are hinted and strictly criticized before we decide to use for this research paper. Virtual network is playing a key role during this research work because we are saving time to reach information in every known source like USA constitution, wealth of Nation – Adam Smith, Cournot books, Nash, Neumann, Oskar and hundreds of other authors who have studied for game theory.

2.1 The Idea of Game Theory

The idea of making a perfect trade have started with Scottish Economist and Philosopher Adam Smith, with his book *Wealth of Nation* published in 1776[1]. Smith thought there is an "Invisible Hand"[2] which will rule the demand and supply than the market will worked based in personal benefits. This theory was built just in the era of Industrial Revolution, when the world changed from an agricultural economy to an industrial economy. Fore two and half centuries Smith's idea was unteachable and the most perfect that humankind can ever develop.

Turocy and Stengel[3], are mathematicians who have brought the era of game theory as a possible theory to study for mathematics solutions. The first example of game theory and analyses about the behavior of firms was set by Antoine Cournot in 1838 with his book *Researches into the Mathematical Principles of the Theory of Wealth*[4]. He was studding about duopolies in the market and the behavior of firms to maximize their profit. It is generally agreed that the first formal theorem in the theory of games was proved by E. Zermelo in an article on Chess appearing in German in 1913[5]. But, John von Neumann and Oskar Morgenstern with their book written in 1944 *Theory of Games and Economic Behavior,* found some mathematical gaps which can rule the economy of a nation in a better way. Still there were just some theory and crucial contribution until 1950s when John Forbs Nash, who share for the first time that how can be implemented the *Game Theory*. Nash was still early because just in 1970s the Game Theory has started implemented in Economy, Politics, Business, and Diplomacy.

"Game theory may be defined as the study of mathematical models of interaction between rational, intelligent decision makers"[6]. The decision makers are using a methodology which is based in strategic planes and very well calculated, we call it *game of strategic* because in those circumstances is depended in what the other are playing. Instead the player in a situation are

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[1] An Inquiry into the Nature and Causes of the Wealth of Nations, generally referred to by its shortened title The Wealth of Nations, is the magnum opus of the Scottish economist and moral philosopher Adam Smith. First published in 1776, the book offers one of the world's first collected descriptions of what builds nations' wealth, and is today a fundamental work in classical economics. By reflecting upon the economics at the beginning of the Industrial Revolution, the book touches upon such broad topics as the division of labor, productivity, and free markets.

[2] Smith. Adam: 1776. The Wealth of Nations, Book IV, Chapter II. Of restraints upon the important from foreign countries of such goods as can be produced at home.© MetaLibri 2007 digital edition. Page 347 – 352.

[3] Siegfried, Tom, , 2006. A Beautiful Math John Nash Game Theory and the Modern Quest for a Code of Nature. Washington, USA: Joseph Henry Press. Page 30

[4] Antoine Augustin Cournot, 1838. Researches into the Mathematical Principles of the Theory of Wealth; (translated by Nathaniel T. Bacon 1897)

[5] Schwalbe. Ulrich & Walker. Paul: October 1999, History of Game Theory. Department of Economics, University of Mannheim, Mannheim, Germany & Department of Economics, University of Canterbury, Christchurch, New Zealand. 1 Introduction. Page 1.

[6] Myerson. B Roger, 1997; Game Theory: Analysis of Conflict; Harvard University Press; Cambridge, Massachusetts – USA.

not choosing to be isolated, they make the decision which is interdependently related for their company. In the game theory every action have an impact to all participants, it is not important who have moved (played) we will be affected and depended to make our decisions. We have to react in every movement that the other players are taking, but we have to be informed to take more payoff and the best outcomes for ourselves, being informed for previous movement and also for response of next players makes us more prepared to use our *strategy* in the game.

2.2   Nash Equilibrium

Nash equilibrium is the fundamental concept of rational player, because each of us has to believe that we are doing our best for every think that we are doing. The point of the game is that we are not alone, we are dependent on what others are doing. Being part of a game means that we are related with other's decision and we will be in the game as long as other's action will not attack us even if they have an effect. "The most commonly used solution concept in game theory is that of Nash equilibrium. This notion captures a steady state of the play of a strategic game in which each player holds the correct expectation about the other players' behavior and acts rationally. It does not attempt to examine the process by which a steady state is reached"[7].

The combination of ideas for mathematical solutions had influenced Emil Borel[8] to develop a new equation since 1921, a formal game theory which later will be developed by other scientists and will be used as a guide and tutorial paper for next mathematicians' generations. One of the firsts was John von Noumann with his study research presentation "*Zur Theorie der Gesellschaftsspiele – On the Theory of Parlor Games"[9]*. Noumann had presented his research work in front of Mathematician association in Göttingen – Germany in 1924, but the English version was published in 1928.

Game theory as a different field of study has started with "*Theory of Games and Economic Behavior"[10]* in 1944 by John von Neuman and Oskar Morgenstern. Furthermore, Siegfrid later had studied the principles of game theory and analyzed the contribution of John Neumann and Oskar Morgenstern. John and Oskar have developed Game Theory using money as a usefulness unit, and their orientation were to find the best strategy to make more money[11].

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[7]Osborne J. Martin & Rubinstein. Ariel: Jan 7, 2014 A Course in Game Theory. The MIT Press Cambridge, Massachusetts London, England 2.2 Nash Equilibrium, Page 14

[8] Félix Édouard Justin Émile Borel ; 7 January 1871 – 3 February 1956 was a French mathematician and politician, known for his founding work in the areas of measure theory and probability.

[9] Tijs, Stef, Abstract of the Fifth Spanish Meeting on Game Theory and applications: Values in Game Theory, The Netherlands Tilburg University, 2002, Page 3.

[10] John von Neumann & Oskar Morgensternpublished. 1944 Princeton University Press, Theory of Games and Economic Behavior.

[11] Tijs, Stef, 2002. Abstract of the Fifth Spanish Meeting on Game Theory and applications: Values in Game Theory, The Netherlands Tilburg University, Page 31-35.

Nash Equilibrium is developed and created by the professor John Forbs Nash during 1950s, and won the Nobel Price for its discovery 1994 in Economy. Most of the times economists can explain the past and also can predict the future of economy, but they use tools like Nesh Equilibrium to understand actions of different firms. Nash Equilibrium, helps economists to understand when companies set their prices, unites produced, government policies, international trade collaboration. Explaining in a simple way the Nash Equilibrium is taking proportionally just your part of the "pie" as the best decision for yourself, based in what you think the others will do the same. And no one is better than other, no matter which strategy they choose everyone has the best opportunity which is possible. Nash equilibrium is also a good solution not just in economy, in business, in politics, but it is also good in sustainable development. Being informed in a game more than the other player, gives you more priority to choose your action carefully and with a high probability to realize your own plan without opponent impact. Also, taking the first role play or the second role play is another opportunity which gives you better position than the opponents, but it is dependent which game it is (Pishpirik).

2.3   Rational players behavior

Most of the games have some specifics because participants or players try to be rational on their decision. A rational player will always choose his decisions with a main purpose to earn payoffs which are prefers the most, and it will take its action after his opponent takes the expected action."… each decision-maker is "rational" in the sense that its aware of his alternatives, forms expectations about any unknowns, has clear preferences, and chooses his action deliberately after some process of optimization"[12].

A rational player will randomize her strategies if she wants to keep the opponent indifferent. In a strict competition (like a zero sum game), this is equivalent to prevent being exploited. Another reason why a rational player may want to randomize her actions arises in coordination games. Failing to find a way to coordinate or to form expectations regarding which NE in pure strategies is more likely, she may choose to randomize her actions. Preferred equilibrium coordination will require keeping the opponent indifferent between her actions.

2.4   Prisoners' Dilemma!

Prisoners' dilemma is applicable because of its simplicity of organizing the examples but more interesting is for the rationality of the game theory. In the year 1950 Trucker[13], was a professor when he shows interest in game theory than he created "Prisoner's dilemma" as a supposed tail to explain game theory. But still this was not the first attempting to explain this "mathematical problem". Edgar Alan Poe describes a situation when a detective tries to corrupt

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[12] Osborne J. Martin & Rubinstein. Ariel: Jan 7, 2014 A Course in Game Theory. The MIT Press Cambridge, Massachusetts London, England 1.4 Rational Behavior, Page 4
[13] Albert W. Trucker professor of John Nash in Princeton.

a member of a gang band to confess the crime. Therefore, Trucker created this tail to present when he was lecturing during a seminar in Stanford University. Prisoner's dilemma a tale with one page will became one of the most famous examples for future researcher as it was also for John Nash who won the Nobel Prize in Economy[14].

The Prisoners' dilemma is a tail when two suspects are interviewed my police officers for relations to a major crime. Suspects are staying separately in two different cells and they do **not** have any contact with each other. This is a simultaneous-move game, the movies of players are hidden so they cannot know for each other what are they playing.
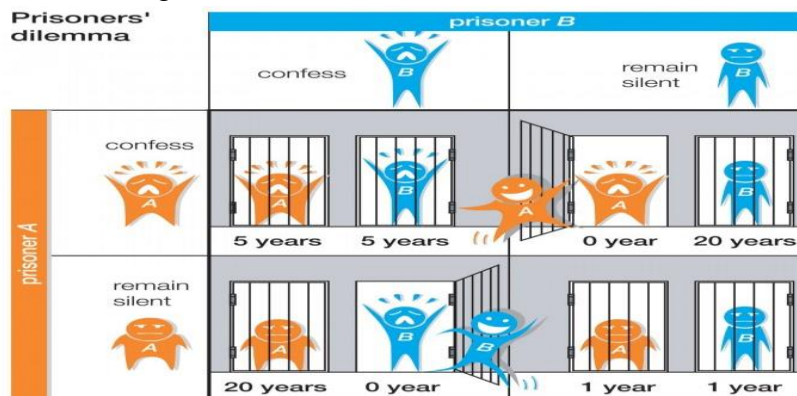
Image 1.1[15]

Figure 1: Prisoner's dilemma

The police officers have no right to convict either for the major crime even if the prisoners don't like to confess, but police officers able to secure conviction to prisoners against each other to accuse for a lesser crime. The games turns in to the prisoners hand and has a big dilemma, should they confess or should they remain silent for the crime they are suspected related with. Previous Image 1.1 shows an illustrated example of the prisoners' dilemma.

To make this example simpler we will illustrate a matrix (payoffs matrix).

		Prisoner B **Jimmy**	
		Deny	Confess
Prisoner A	Deny	-5 , -5	0 , -20
Tim	Confess	-20 , 0	-1 , -1

Table 1: Prisoner's dilemma matrix

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[14] The John von Neumann Theory Prize of the Institute for Operations Research and the Management Sciences (INFORMS) is awarded annually to an individual (or sometimes a group) who has made fundamental and sustained contributions to theory in operations research and the management sciences. It is regarded the "Nobel Prize" of the field.

[15] ©2010 Encyclopedia Britannica, Inc.

The prisoners will spend at least one year in jail but this is not that simple, because police officers will make Tim or Jimmy responsible for the crime. While the game is in the prisoner's hands this matrix explain their payoffs for Tim and Jimmy. If Tim decides to **deny** for the crime he will get 5 year in jail or 0 (he will be free), and if he decides to **confess** with the police officers he will get 20 years in jail or 1 years in jail. This game is simultaneously the same for Jimmy if he denies or confesses. This matrix explains in a really good way how both prisoners are dependent in each other decision. But, the point is because prisoners do not have any contact to see each other's decisions; they have to play alone but are dependent in each other

If Jimmy decides to deny what is the best alternative for Tim? Tim will choose between spending 1 year in jail or 20 years in jail, and of course between two worst things he will choose one which is least worst. Of course Tim will choose to spend 1 year in jail instead of 20, so he will decide to **deny**. But what will choose Tim if Jimmy decides to confess with police officers? The best payoff response for Tim if Jimmy confesses between 0 (being free) and spending 5 years in jail he will chose 0 (to be free). As we can realize Tim will deny, independently what Jimmy will choose to do, for this conclusion we can say that Tim has a **dominant-strategy** that he will always play.

The game is simultaneously the same for Jimmy, whatever Tim decides to play Jimmy will **deny**, and also he has a **dominant-strategy** which he will always play.

| | | Prisoner B **Jimmy** | |
		Deny	Confess
Prisoner A	Deny	-5 , -5	0 , -20
Tim	Confess	-20 , 0	-1 , -1

Table 2: Prisoner's dilemma Nash equilibrium

The prisoners' dilemma game has **Nash equilibrium.** The cell when two dominant-strategies matched is the Nash equilibrium, because no one of the players will get his bests off and his opponent the worst of but both players will get something which is the best for both of them together. <u>Best response</u>: In an "**n**" player game the best response function of player **i**, is the function **Ri(S-i)** that for given action **S-i** of all other players, it assigns an action **Si = Ri (S-i)** that maximizes.

2.5   Rational players

Rational players are self-motivated to take a decision when they have to. Rational player never plays their dominant strategy, even if the payoffs are the bests of other strategies. If players in one of the game are rational they will get same payoffs for all players, there is a win-win situation. Every game which ends with an equal result of payoff is typical game with rational player.

Rational players take their decision based in what the opponent can play, so they think for opponent the same like they think for themselves. We have lot of games with rational players, but we will pick one to explain how rational players take their decision. Chess is always a game which can be a good example when we talk for game theory. Imagine that two players are playing chess, and for every action (movement) that one of the players takes, it is the same response by the opponent. While players are playing a rational game they cannot think to beat the opponent, but to have a same result for both players. Viva Fresh Store and ETC will play as rational players if they want to share the market equally. So, rational players in the market should be loyal to each other than to think the same as the opponent. During our interview with ETC's manager we have seen that loyalty between those two firms is in interest based. If Viva Fresh Store and ETC decides to use rational player strategy both of them will have same payoffs and same results in the market.

3   APPLIED METHODOLOGY

This paper work layout in five different chapters. During our research work we have used different methods: comparative, concretization, historical, abstraction and analytic method. In the second and third chapter are analyzed the connection the most known written strategies by eminent writers, economists, mathematicians about strategic decision making. There are many thesis and papers which faced with each other and bring another elaboration which is useful and simple.

At the same chapters it is a comparative line between what economists and their theory says and what Viva Fresh Store and ETC are really doing. Sometimes we have a gap in theory and in practice, but in the other hand as we have said in one of our hypothesis, companies are using strategies without their knowledge. Primary data's are created by questionnaires with our subjects Viva Fresh Store and ETC. To be more familiar with topic we have used interviews with two of our main subjects to understand how they use their information for decision making. To understand this better we have interviewed Viva Fresh Store's managerial team and ETC's managerial tem. Questionnaires are the same for both subjects and we have used methodology of conversation to understand the decision making process from inside of the companies. Those data's are used to compare our hypothesis with literature review and responses of our subjects.

All those secondary data's are collected by books and articles published by authors which are accessible by public. Those materials which we have used and reviewed carefully to use for our research work are saved by "Harvard Style of Referencing".

After we have reviewed the literature and interviewed subjects of study we will analyze the opportunities how our subjects can use game theory in practice. Reviewing books and articles to find what other scientists have developed for game theory was necessary to bring their

experience in this thesis. More interesting was the process of collecting the primary result with our subjects Viva Fresh Store and ETC to know what are they thinking for game theory.

3.1   Companies profiles

Viva Fresh Store and ETC – Elkos Trading Centre are two subjects of our thesis which operates in Kosovo's market. Viva Fresh Store and ETC are companies which have good performance in last decade with sales and developing of their brands.

Viva Fresh Store

"Viva Fresh Store is a shopping center, offering a wide assortment of food and hygiene items, textile for children, men and women, footwear, household textiles and many other products that meet your family's request for the beauty of your home!"[16]. "Viva Fresh Store - where good THINGS are CHEAPER!"[17]

Figure 2: Viva Fresh Store logo   Viva Fresh Store has an experience in Kosovo's market of shopping and retail since 2003, with 39 branches in 15 cities of Kosovo. Total annual sale 31 December 2015 was 121,343,007 euro or 13.17% more than 2014 referring to the annual financial report[18]. Viva Fresh Store doesn't have any exclusivity of products but offers and retails products in Kosovo's market.

ETC – Elkos Trading Centre

ETC is brand of ELKOS group operating in Kosovo's market since 2005 in the industry of shopping and retail with 27 branches in 17 cities. ETC has an annual sale of 262,771,708 euro referring to the annual report of 31 December 2015 or 5.78% more than 2014[19].

ETC is the second tax payer in Kosovo with 3000 employee including interns.

"Mission of the company is to offer the widest assortment, affordable prices, quality, and services in order to meet all customer needs when

Figure 3: ETC logo

buying for their family"[20]. ETC is penetrating in the market of Albania, Macedonia and Montenegro, while until 2022 they have planned to reach 1 Billion of annual sale. ETC's vision is "always growing and evolving to meet European and world standards"[21].

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[16] Viva Fresh Store – About / Facebook, 2003.
https://www.facebook.com/pg/vivafresh.rks/about/?ref=page_internal
[17] Same source
[18] Deloitte, April 22, 2016 "Viva Fresh" Sh.p.k. Auditor's Report and Consolidated Financial Statements as at end for the year ended December 31, 2015. Shitjet. Page 22
[19] Deloitte, April 27, 2016 "ELKOS" Sh.p.k Independet Auditor's Report and Consolidated Financial Statements as at end for the year ended December 31, 2015. Sales, Page 22
[20] ETC – official web page: http://etc-ks.com/per-etc/
[21] Same Source

4   PRIMARY RESULTS (RESULTS FROM FIELDS)

Below are questions and subject's response after each question.

1. How do you consider the issue of competition between Viva Fresh Store and ETC, is this for the consumer benefit?

ETC's consider itself a leader, whereas from the Viva Fresh Stores's perspective, both competitors Viva Fresh Store and ETC are implementing strategies which increase the competition of each other.

2. Are you satisfied with the competitiveness amongst the Viva Fresh Store and ETC?

ETC is one of the biggest company in Kosovo's market, they see themselves as the leader of the market, and the competition with other competitors doesn't affect at

Viva Fresh Store is pretending to lead the market of retiling in Kosovo, and managerial staff believes that only ETC is the real competitor, while there is a big gap between Viva Fresh Store as the second biggest retail firm.

3. Do you have trade collaboration amongst Viva Fresh Store and ETC?

ETC and Viva Fresh Store have trade collaboration because ETC has the exclusivity for some of the most known products: Pfaner, Vital oil, butter, bambi biscuits and 2000 other articles. They sell to Viva Fresh Store some of the articles, but this collaboration is just basset in the business interest. Viva Fresh Store have no exclusivity or distribution for any article, all what they do is retailing products which they take by suppliers and distributers. This answer confirms our hypothesis:Viva Fresh Store and ETC collaborate when they can and compete when they must.

4. Do you compete with prices, quality or services?

ETC have advantages with prices and quality but in the market they will compete with services. Costumer care is a priority of this company for next three years, while ETC is developing "loyalty card" with 2 % discounts for regular consumers, and ETC is in process of creating an environment to support costumer to make than satisfied and to take the feedback from them. So, good services for consumers with moto "our consumer is our King" to direct all

marketing and services for satisfaction of the consumer.

Viva Fresh Store is competing with all three features prices, quality and services. Viva Fresh Store even if doesn't have the exclusivity for articles they buy products with discount (rabat), enough to implement strategies which will give Viva's advantages to compete with others. Services is the strongest feature of Viva Fresh Store because they are implementing

models of western countries, which are
better than other national industries.

5. Are you loyal with your competitor?

The ETC and Viva Fresh Store, if they have interest for one article or for another one they will continue the collaboration but they will still be competitors.

6. Media Marketing, is it directed with competitor (Viva Fresh Store .vs. ETC) or competing amongst each other to eliminating other competitors?

ETC wants to have collaboration with Viva Fresh Store when it has to do with marketing campaign. Therefore ETC and Viva Fresh Store are using same strategies at the same time, which makes to believe they are trying to eliminate the competitors. Furthermore, Viva Fresh Store isn't following ETC with its strategies.

7. Did you know that media marketing amongst each other brings you better profits from Game Theory perspective, because of eliminating other competitors?

ETC's managerial staff is a great managerial team because they are developing new strategies together with other managerial staff of ETC. For them is clear that collaboration in the marketing can bring better profits with low cost of marketing. They also share the idea for marketing campaign with special offers during the seasons.
Viva Fresh Store's managerial team, are not much familiar with Game Theory, also for them it is a new perspective. But, they have carefully studied western countries and companies how they collaborate to decrease the costs, they call it byer cooperative.

8. Does this access to the market with media marketing, creates the impression that you are structuring the market in oligopoly?

While the market in Kosovo is free trade market and very wild, managerial team of ETC is thinking that will be impossible to create oligopoly but if they have the chance to create marketing strategies without interruption to each other they will do it. Even if they create an oligopoly or duopoly the loyalty will be focused specially in marketing. Viva Fresh Store's managerial team does not believe in cooperation of the companies especially in media marketing. Because Viva Fresh Store pretends to be the leader of the market, while there is no need to follow any instruction of other opponents.

4.1 Symmetric Cournot Duopoly

Duopoly[22] model was known during the ancient market development, when only two firms own a source of goods or they owns two sources with the same goods. The duopoly model became more useful when mathematician and scientists start to study it and his features. The Cournot problem is to determinate the variables of both forms: prices and quantities to maximize their profits[23].

Let's take an example when two firms are producing at the market with the same product. Suppose in the Kosovo market are 2 companies Viva Fresh Store and ETC. They offer goods approximately for 1.2 million customers and those two companies own 80 % of the market. Viva Fresh Store and ETC are trading thousands of products and also apples for their customers. In the autumn season, farmers who have cultivated apple are harvesting and planning to sell all of apples to those companies, but the production is higher this year and they have to export a quantity of their production.

Ex: In a symmetric Cournot Duopoly example is modulated a situation, in which each firm chooses its decision independently. The annual production of apple in Kosovo is 3000 tons of apples, if they sell in the market higher quantity the price will be 600 Euro/tone.

What are the equilibrium price and quantity for Viva Fresh store respectively Firm1 and ETC respectively Firm2 to maximize their profit[24]?

C – cost P – price Q - quantity π - profit i – Firms R – response

q_1 – quantity for Firm 1 q_2 – quantity for Firm 2 q_i – quantity for both Firms

The cost for firms will be quantity multiplied with the price per unit, which is:

$$C_1(q_1) = 600q_i$$

The price they should apply to maximize their profit is annual quantity of product subtracted with total quantity of both firms, which is:

$$P = 3000 - Q \qquad (Q = q_1 + q_2) \quad \pi = \max(x - q_1 - q_2)q_1 - C_1(q_1)$$

And we have two firms which are acting together:

$$I = 1. \ 2$$

While those two firms are symmetric we need to find the best response just for one of them, because the other firm will do the same.

Firm 1:

$$\max(3000 - q_1 - q_2)\ q_1 - 600q_i$$

TR   -   TC

FOC - First order condition

$$3000 - 2q_1 - q_2 - 600 = 0$$

[22] A duopoly from Greek δύο, duo - two + πωλεῖν, polein - to sell

[23] Antoine Augustin Cournot, 1838; Researches into the Mathematical Principles of the Theory of Wealth; (translated by Nathaniel T. Bacon 1897) – Chapter V of Monopoly; Page 56-66.

[24] Cournot Duopoly — The Model, Pages 1-7; http://www.uni-magdeburg.de/vwl3/03_education/01_lectures/03_past/documents/cournot.pdf

Best response as a function of q_2^*

$$q_1 = \frac{2400 - q_2*}{2} = R_1(q_2)$$

$$R_2(q_1) = \frac{2400 - q_1*}{2} = q_2$$
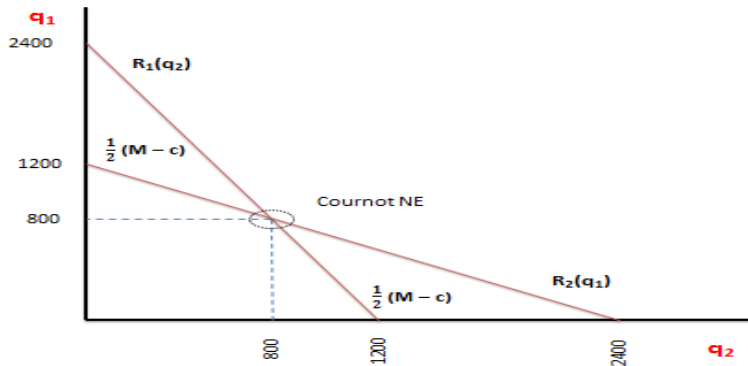
Than we draw graphically best responses for two firms:

Figure 4: Cournot Duopoly - Nash equilibrium

According to this we can find approximately the correct value of quantity for each firm. We have the formula which we will use to see if it is correct or not:

$3000 - 2q_1 - q_2 - 600 = 0$

If **q** is 900:

$3000 - (2 \times 900) - 900 - 600 = 0$

$-300 \neq 0$

So the quantity cannot be 900, it should be less.

If **q** is 800: **$3000 - (2 \times 800) - 800 - 600 = 0$**

$$0 = 0$$

So, we found the solution for this example, **q** is 800 tons.

$$q_1 = 800$$
$$q_2 = 800$$

Economic Results

Individual supply: $q_1^* = q_2^* = \frac{1}{3}(3,000 - 600) = 800$

Market supply: $q_i = q_1^* + q_2^* = \frac{2}{3}(3,000 - 600) = 1,600$

Equilibrium price: $p = \frac{1}{3} 3,000 + \frac{2}{3} 600 = 1,400$

Individual profit: $\pi_1 = \pi_2 = \frac{1}{9}(3,000 - 600)^2 = 640,000$

Aggregate profit: $\pi = \pi_1 = \pi_2 = \frac{2}{9}(3,000 - 600)^2 = 1,280,000$

4.2   Stackelberg Duopoly

Stackelberg duopoly model has started developing in the year 1934 by Heinrich Stackelbelrg, comparing with two other models Cournot and Bertrand duopolies, Stackelberg duopoly "is a model of imperfect competition based on a non-cooperative game"[25]. While we have two competitors which are not collaborating with each other and they have to share their market because they are in a duopoly market.Both firms are competing against each other to earn more profits and they do not have any motivation to control their expansions but just to be the leader

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[25] Policonomics, Stackelberg duopoly, 2012. http://www.policonomics.com/stackelberg-duopoly-model/

in the market. Being the leader in the market is "the triumph" in Stackelberg duopoly model, so the other firm has to be the follower.

Let's use Stackelberg duopoly model[26] for our example. Viva Fresh Store and ETC are two firms, and have one good which is apple. The quantity of apple is limited as well as number of companies with the right to trade it. Viva Fresh Store and ETC are not collaborating anymore and one of them have to lead the market.

In the equation below we have the demand side:

Inverse demand: $p = p(q_1, q_2) = M - q_1 - q_2$

$p = p(q_1, q_2) = 3,000 - 800 - 800 = 1,400$

In Stackelber duopoly model both firms can affect the market price, therefore both firms have their role to rule the market. Furthermore, Viva Fresh Store and ETC have this price of $ 1,400 to act in the market independently if. In the other hand we have the supply side, which implicate both firms to offer the product in the market. This offer to the market has a simple goal to maximize the profit but nothing more than that.

We have the identical costs: $c(q) = c \cdot q$

$c(q) = 600 \cdot 800 = 480,000$

According to the equation we have the cost per unit multiplied by the quantity required to produce one firm in duopoly. If firm 1 decides first to be the Stackelberg leader, firm 2 decides second, because firm 2 knowing firm 1's decision firm 2 will be Stackelberg follower. Our example has the same nature if one of the firms will lead the market in Kosovo and the other one should follow.

Stackelberg Duopoly - The Follower

We have the other problem to solve, what will be the follower decision[27]:

$\max \pi_2 = \max (3,000 - 600 - 800) \cdot 800 - 800^2$

$= \max 1,280,000 - 640,000$

$= \max 640,000$

According to this function we ha have the same profit for the follower firm like we have at the duopoly model. Furthermore, the follower firm will produce the same quantity and will earn the same profit.

Solution (Reaction function):

$R_2(q_1) = q_2^* = \frac{1}{2}(3,000 - 600 - 800)$

$R_2(q_1) = q_2^* = 800$

[26] See: UC Berkeley Haas School of Business Economic Analysis for Business Decisions; Game Theory II, Sep. 12, 2009; Stackelberg's duopoly model (1934), Pages 24-29

[27] Stackelberg Duopoly — The Model, Pages 14-19; http://www.uni-magdeburg.de/vwl3/03_education/01_lectures/03_past/documents/cournot.pdf

Stackelberg Duopoly - the Leader

But the focus is to the leader, how the leader will act, which strategic decision it will take? The function below is showing the profit of the firm and also the quantity which the leader is ready to produce for the market.

$$\max \pi_1 = \qquad \text{s.t} \quad q_2 = R_2(q_2)$$

$$= \max \frac{1}{2}(3,000 - 600) \cdot 800 - \frac{1}{2}800^2 = 640,000$$

Solution: $q_1{}^* = \frac{1}{2}(3,000 - 600)$

$$= 1,200$$

Solution for follower:

Substitute $q_1{}^*$ into reaction function:

$$q_2{}^* = \frac{1}{2}(3,000 - 600 - 1,200) = 600$$

$$= \frac{1}{4}(3,000 - 600) = 600$$

According to this reaction function we can see that the leader have to produce twice more than the follower. Let's think that Viva Fresh Store is the leader in the Stuckelberg duopoly model and ETC is the follower. Viva Fresh Store have to produce 1,200 units of apple while ETC just 600 units of apple.
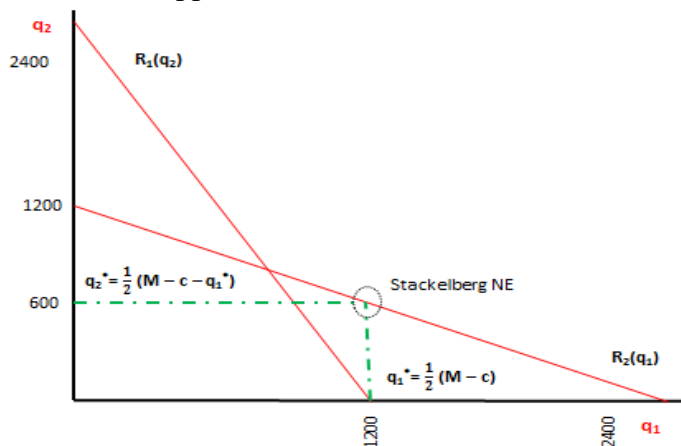

Figure 5: Stackelberg Duopoly - the Leader Nash equilibrium

This graph above shows the Stackelberg Nesh Equilibrium for the duopoly of Viva Fresh Store and ETC. As we can see in this graph the leader firm which leads the market has a priority to trade first in the market and consequently has higher profit compare with the other competitors. But, the question is: Why firms do not compare equals, with the outputs and profit? The Stuckelberg duopoly model is the most useful model in the market by companies. Instead of being a monopoly to pay extra taxes and avoid law, the "strongest" companies have a better solution to let another company to operate in the market. The second company most of the times is smaller and less powerful; therefore the leader uses it as a partner at the same time and as a competitor[28].

If Viva Fresh Store is the leader of the market will produce 1,200 units of apple will sell it in the market with an equilibrium price of $ 1,200 and will earn at least $720,000. In the other

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[28] Stackelberg definition: http://www.policonomics.com/stackelberg-duopoly-model/

hand ETC the follower will produce just half what the leader produce and will earn just half of what the leader earns.

Stackelberg Duopoly - Economic Results

Individual supply: $q_1{}^* = \frac{1}{2}\,(3{,}000 - 600) = 1{,}200$

$\qquad\qquad\qquad q_2{}^* = \frac{1}{4}\,(3{,}000 - 600) = 600$

Market supply: $\quad Y = 1{,}200 + 600 = 1{,}800$

$\qquad\qquad\qquad = \frac{3}{4}\,(3{,}000 - 600) = 1{,}800$

Equilibrium price: $\quad P = \frac{1}{4}\,3{,}000 + \frac{3}{4}\,600 = 750 + 450 = 1{,}200$

Individual profit: $\quad \pi_1 = \frac{1}{8}\,(3{,}000 - 600)^2 = 720{,}000$

$\qquad\qquad\qquad \pi_2 = \frac{1}{16}\,(3{,}000 - 600)^2 = 360{,}000$

Aggregate profit: $\quad \pi = 720{,}000 + 360{,}000 = 1{,}080{,}000$

$\qquad\qquad\qquad = \frac{3}{16}\,(3{,}000 - 600)^2 = 1{,}080{,}000$

4.3 Bertrand Duopoly - the Model

The Bertrand Duopoly model was ideated by Joseph Louis François Bertrand in 1883. Bertrand is a model used for competition in economics and it's describes interactions to the firms who are offering or selling a product that set a price for that product and costumers of that product who chose an amount of quantity for that price which is set by sellers[29].

The Bertrand duopoly model is used when two firms produce homogenous product (products are perfect substitutes), they sets prices simultaneously and both firms has the same constant marginal cost. Setting the same price for both firms has also an impact in the marginal cost which is equal to the price. The price which is sets by firms cannot be above the monopoly price, but setting a price equal to the marginal cost means no profit for none.

"For a sufficiently small industry capacity in relation to the market demand, then equilibrium prices are greater than marginal cost"[30]. In the Bertrand duopoly model, differentiation of the products is a movement to avoid this model.

In our example Bertrand duopoly is a good model to operate in the market, while also the costumers will not pay high price for the gods even if prices are set by both firms[31].

$\qquad$ **Demand Side** $\quad$ Demand $\mathbf{q = M - p}$

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[29] Bertrand Duopoly — The Model. Bertrand Competition

[30] Industrial Organization Oligopolistic Competition, ECON 312: Oligopolistic Competition, Page 5 http://people.stfx.ca/tleo/iolecture4.pdf

[31] Bertrand Duopoly — The Model, Page 20.

The marginal cost for a unit of apple is $ 600, so the minimum price that firms can set is the marginal cost price. Costumers always decide to buy the products with the lowest price, and sellers will compete with each other or will set the marginal cost price without profit.

Supply Side

On the supply side we have two firms and one good.

Identical costs: $c(q) = c \cdot q$

Both firms Viva Fresh Store and ETC choose their prices with a priority not their quantities.

Solution

$$q_1 = \begin{cases} M - p_1 & \text{if } p_1 < p_2 \\ \frac{1}{2}(M - p_1) & \text{if } p_1 = p_2 \\ 0 & \text{if } p_1 > p_2 \end{cases}$$
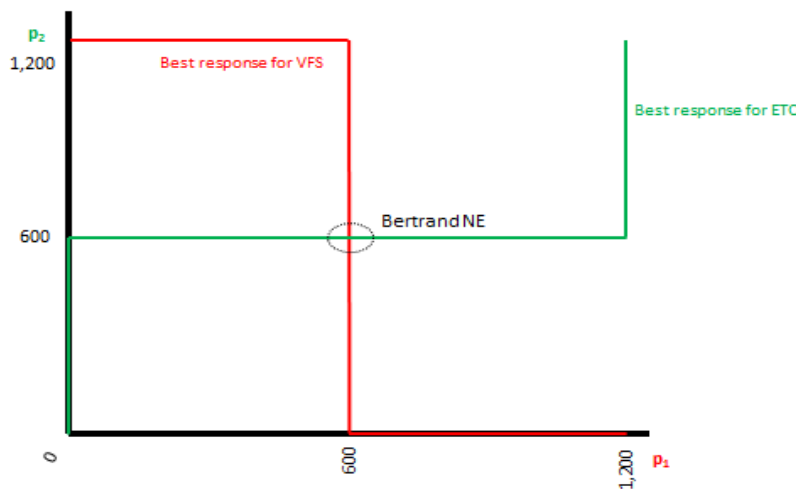

Figure 6: Bertrand Duopoly Nash equilibrium

Costumers will choose that product with lower price therefore the firm with the lower price captures the entire market demand. The graph above shows the Bertrand Nash Equilibrium, as a favorite solution also for costumers because is the same with marginal cost of the product. If Viva Fresh Store (Firm 1) moves first in the market, prices settees by firms cannot be above Monopoly price which is $ 1,800. Monopoly price is the highest price that firms in Bertrand duopoly model can decides to set and the minimum is the marginal cost of the product.

According to the formula **M - p_1** we have a price of $ 1,200 (3,000 – 1,800 = 1,200). **M** is the total quantity and **p_1** is the Monopoly price, but setting a price of $ 1,200 for Viva Fresh Store means that ETC should have a price higher than $ 1,200 and of course all costumers will buy Viva Fresh Store's products because $p_1 < p_2$ which means that this cannot be a Nash equilibrium. In the other hand if $p_1 > p_2$ Viva Fresh Store will sell **0** products because the price of ETC (Firm 2) is lower. But, than we have another limit which is half of the first price set by both firms if $p_1 = p_2$. Setting a price which is equal to both firms is also a Bertrand Nash Equilibrium, minimum price settees by firms and marginal cost price.

We can conclude that in Bertrand Duopoly model firms cannot earn profit if they chose to have a Nash Equilibrium price. Firms can earn profit if they set prices starting from Nash Equilibrium price $ 600 to the Monopoly price of $ 1,800.

4.4   Mixed Strategies

"The notion of mixed strategy Nash equilibrium is designed to model a steady state of a game in which the participants' choices are not deterministic but are regulated by probabilistic rules. We begin with formal definitions, then turn to their interpretation"[32].

In Kosovo's market are many products which are required by customers and also necessary for their families. Being in a global perspective we also have the chance to import products from other countries which cannot be produced in Kosovo. Two biggest companies in Kosovo Viva Fresh Store and ETC are importing many products which are new for Kosovo's citizens. One of those products is Avocado, an exotic fruit with a different taste and so important for human health. Avocado is a new product in Kosovo's market therefore costumers are not familiar with it. Both firms have exclusivity to import avocados, all analyze of the market are done and Viva Fresh Store and ETC is waiting for their collaboration to share the market.

Table 3: ETC & Viva Fresh Store - Mixed strategies payoffs matrix

		ETC	
Payoffs are in units of $100,000		Enter	Don't enter
Viva Fresh Store	Enter	-2 , -2	5 , 0
	Don't enter	0 , 5	0 , 0

This matric shows the payoffs for both firms if they decide to enter in the market with avocados or not. If both firms decides to enter each of them have a negative payoff of - 2 or $ 200,000, if one of firms enter and the other don't the firm which enter earn payoffs of 5 and if don't 0. <u>Calculation of the mixed strategy probabilities</u>: The probability for Viva Fresh Store will be written with **p** for enter and **1 – p** for don't enter. For ETC we will write the probability with **q** if ETC enter in the market and **1 – q** if don't enter.

Viva Fresh Store will chose **p** if ETC's best payoff from Enter is:

$$p(-2) + (1-p)(5) = -2p + 5 – 5p = 5 – 7p = 5 = 7p = p = 5/7$$

Viva Fresh Store will choose **p** if ETC's best payoff from Don't enter are:

$$p(0) + (1-p)(0) = 0$$

ETC will chose **q** if Viva Fresh Store's best payoff from Enter is:

$$q(-2) + (1-q)(5) = 2q + 5 – 7q = 5 – 7q = 5 = 7q = q = 5/7$$

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[32] Osborne J. Martin & Rubinstein. Ariel: Jan 7, 2014 A Course in Game Theory. The MIT Press Cambridge, Massachusetts London, England 3.1 Mixed Strategy Nash Equilibrium 3.1.1 Definitions, Page 31

ETC will chose **q** if Viva Fresh Store's best payoff from Don't enter is:
$$q(0) + (1-q)(0) = 0$$

In this Mixed strategy Nash Equilibria is when both firms choses to **Enter** with a probability $\frac{5}{7}$ and **Don't enter** with a probability of $\frac{2}{7}$. According to the function both chooses to enter in the market with new product.
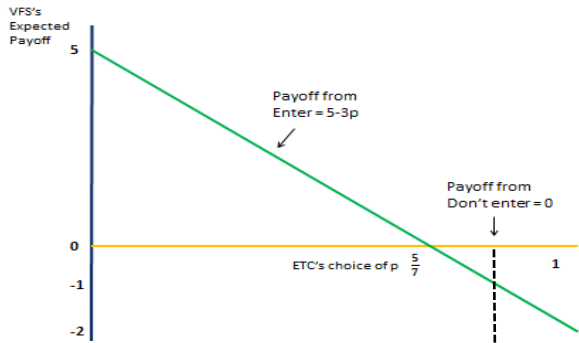
VFS's
Expected
Payoff

5

Payoff from
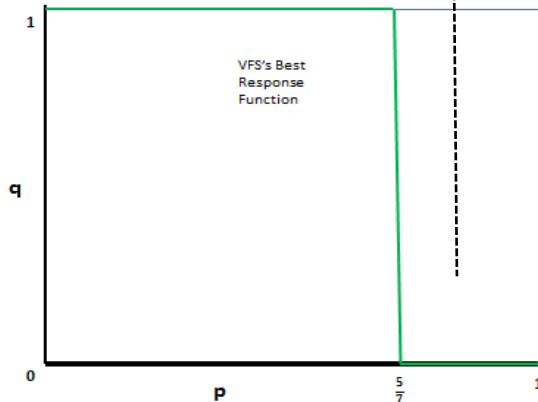Enter = 5-3p

Payoff from
Don't enter = 0

0

-1

-2

ETC's choice of p $\frac{5}{7}$ 1

Figure 8: Viva Fresh Store payoff

ETC's
Expected
Payoff

5

Payoff from
Enter = 5-3q

Payoff from
Don't enter = 0

0

-1

-2

VFC's choice of q $\frac{5}{7}$ 1

Figure 7: ETC payoff

1

VFS's Best
Response
Function

q

0

P $\frac{5}{7}$ 1

Figure 10: Viva Fresh Store best response

1

ETC's Best
Response
Function

P

0

q $\frac{5}{7}$ 1
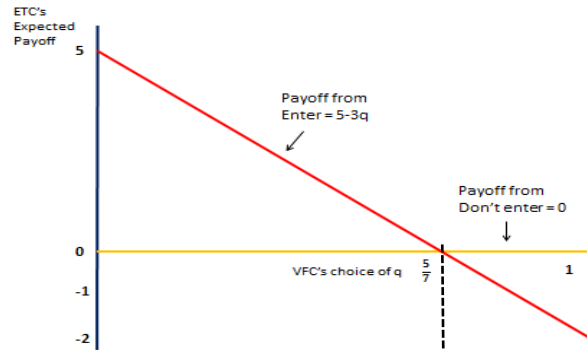
Figure 9: ETC's best response

1

Pure strategy equilibria 1

Combination Best
Response Function
Of VFS's and ETC's

$\frac{5}{7}$

Mixed strategies NE

q

Pure strategy equilibria 2
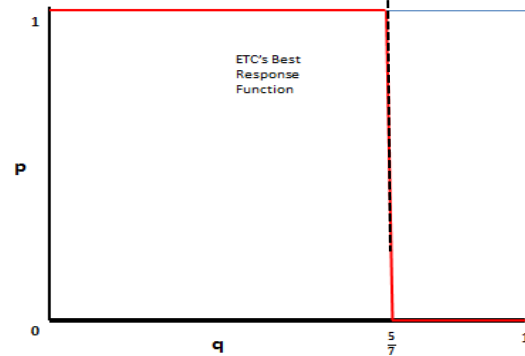
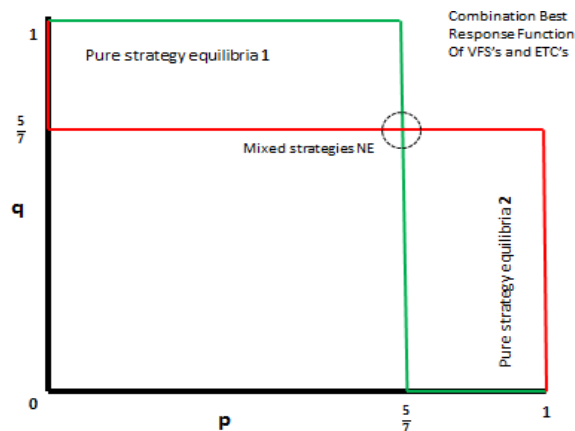0

P $\frac{5}{7}$ 1

Figure 11: Viva Fresh Store & ETC mixed strategies Nash equilibrium

4.5 Economics Results of the Mixed Strategy Equilibrium

Mixed Strategy Equilibrium is the solution which shows the best solution for both firms basset in their probability calculation.

Both firms decides to **enter** in the market with a probability of $\frac{5}{7}$.

Expected payoffs for two firms Viva Fresh Store and ETC if they decides to **enter** in the market with new product is $= -\frac{5}{7} + \frac{5}{7} = \mathbf{0}$. The same if they decide **don't enter** $= \mathbf{0}$ Probability if both firms decides to **enter** in the market is calculated using multiplication rule $\frac{5}{7} \cdot \frac{5}{7} = \frac{25}{49}$ which is approximately **51 %** that both firms will **enter**. Probability that Viva Fresh store to **enter** in the market is $\frac{5}{7}$ and for ETC **don't enter** in the market is $\frac{2}{7}$. Using the multiplication rule we have $\frac{5}{7} \cdot \frac{2}{7} = \frac{10}{49}$ or approximately **20 %**. It is the same probability if ETC **enter** and Viva Fresh Store **Don't enter**.

Probability that neither firms **enters** in the market is $\frac{2}{7} \cdot \frac{2}{7} = \frac{4}{49}$ or **9 %**

Now we have the function: $\frac{25}{49} + \frac{10}{49} + \frac{10}{49} + \frac{4}{49} = \frac{49}{49}$ or **1.0**

If we calculate the payoffs for both firms Viva Fresh Store and ETC we have the function:

$$\frac{25}{49} \cdot (\mathbf{-2}) + \frac{10}{49} \cdot (\mathbf{5}) + \frac{10}{49} \cdot (\mathbf{0}) + \frac{4}{49} \cdot (\mathbf{0}) = \mathbf{0}.$$

4.6 Asymmetric Mixed Strategy Equilibrium

Suppose we have the same companies which are competing in Kosovo's market with the same product Avocado. Now, Viva Fresh Store will have payoff of **7** if ETC **don't enter** in the market and Viva Fresh Store operate alone. But in the other hand ETC does not change its payoffs if Viva Fresh Store **don't enter** in the market and ETC operate alone.

To make it simpler we have this matrix below:

Table 4: Viva Fresh Store & ETC Asymetrix mixed strategy payoffs

		ETC	
Payoffs are in units of $100,000		**Enter**	**Don't enter**
	Enter	**-2 , -2**	**7 , 0**
Viva Fresh Store	**Don't enter**	**0 , 5**	**0 , 0**

Comparing with the symmetric game before the Asymetrix mixed strategy has some changes in calculation of probability. While ETC's payoffs have no change in the matrix, also Viva Fresh Store mixture if chose to play **p** does not change. Viva Fresh Store has some changes of payoff also ETC if it is chosen **q** must change. Is ETC choses to play **q** to make viva Fresh Store indifferent in its decision to **enter** in the market or **don't enter**. If Viva Fresh Store chose to **enter** it will earn **(-2)q + 7(1-q) = -2q + 7 – 7q = 7 – 9q = 7=9q = q =** $\frac{9}{7}$. And if Viva Fresh Store chose **don't enter** it will earn = **0**. Now in Asymetrix game we have a change in the

probability for viva Fresh Store to enter in the market it was $\frac{5}{7}$ and now it becomes $\frac{9}{7}$. the change in payoffs have an impact in probability also positive or negative.

4.7   Dynamic Games of Complete information

Dynamic game of complete information is another model of surviving games and players in their decisions making and strategies chosen. There is a difference when players completely know for movies of each other, because in a game with complete information where players are leaders and followers they know strategies movies and decisions of each other.

In game theory, a game has perfect information if each player because players also know the full history of each other. When making any decision, is perfectly informed of all the events that have previously occurred, including the initialization actions or movements of the game. Perfect information Moves occur is sequence, when Player 1 play and wait what Player 2 will play. Than Player 2 will plays depend on what Player 1 have played before, than Player 1 plays again depend on Player 2 and the game continues with network of history.

Let's take an example for our subjects ETC and Viva Fresh Store if they decide to enter in the Macedonian's market together with an objective for profit of 20 million euros for the year 2018. How can they find Nash equilibrium and derive the game in to the sup perfect game SPE. Viva Fresh Store have invest 1,341,278[33] euro in marketing during the year 2015 for Net profit of 7,123,152[34]. ETC looks like is using the same strategy while they have spent 1,543,571[35] euro for marketing during the year 2015 for Net profit of 8,772,602[36]. Both of them are planning for next year to develop new strategies of marketing to increase their profit with lower cost of marketing.

ETC is the leader and have the advantage to move first in the market. While ETC is developing two different strategies with different costs. First ETC will include The Brandon Agency[37] do develop ETC's marketing strategy for the year 2018. The Brandon Agency is very well known for its success with other business clients, therefore they guaranty that ETC will increase sales 9 – 10 %. For the whole year of 2018 The Brandon Agency will take care of everything that

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[33] Deloitte, April 22, 2016 "Viva Fresh" Sh.p.k. Auditor's Report and Consolidated Financial Statements as at end for the year ended December 31, 2015. Shitjet. Page 23.

[34] Same source – page 24.

[35] Deloitte, April 27, 2016 "ELKOS" Sh.p.k Independet Auditor's Report and Consolidated Financial Statements as at end for the year ended December 31, 2015. Sales, Page 23

[36] Same source – page 5

[37] "We are a NEW BREED of advertising agency … part business consultant, part marketer, part tech start-up, part idea factory, all bundled together with a keen understanding of consumer behavior and an ability to not only generate forward-thinking ideas but execute them on time and on budget with amazing results". http://www.thebrandonagency.com/

has to do with ETC's marketing: media marketing, campaigns, sales representative, staff training and all other marketing strategies during the year 2018. This will cost to ETC 3.5 million euros for a profit of 15 million euro.

Second choose is if ETC follows the same traditional way of marketing which will cost them 1.2 million euros for a profit of 8 million euros. Viva Fresh Store is the follower and dependent on what ETC will play firs than Viva Fresh Store will response with its action. If ETC chose the first strategy; Viva Fresh Store will invest 500.000 euros for an annual profit of 5 million euro. But, if ETC decides to enter in the Macedonian's market Viva Fresh Store will use its advantage of traditional marketing with an investment of 1.8 million euro for profit of 12 million euro.

Ex: i – {ETC, Viva Fresh Store}

            ii   Strategies of ETC

          S_{ETC} = { The Brandon Agency campaign, Traditional marketing}

              Answers of Viva Fresh Store A_{VFS} = {Enter, Stay out}

ETC move first

Table 5: ETC move first - payoffs matrix

	The Brandon Agency campaign	Traditional marketing
Profit of ETC	15 million €	8 million €
Profit of VFS	5 million €	12 million €
Total profit	**20 million €**	**20 million €**
Total cost	**4 million €**	**3 million €**

If Viva Fresh Store Enters

Table 6: ETC's response payoffs matrix

	The Brandon Agency campaign	Traditional marketing
Profit of ETC	15 million €	8 million €
Profit of VFS	2.5 million €	6 million €
Total profit	**17.5 million €**	**14 million €**
Total cost	**4 million €**	**3 million €**
Net profit	**13.5 million €**	**11 million €**

Table 7: Viva Fresh Store's response payoffs matrix

	The Brandon Agency campaign	Traditional marketing
Profit of ETC	0 €	0 €
Profit of VFS	2.5 million €	6 million €
Total cost	**4 million €**	**3 million €**
Net profit	**-1.5 million €**	**3 million €**

4.8   Nash equilibrium in a dynamic game

The set of Nash equilibria in a dynamic game of complete information is the set of Nash equilibria of its normal-form. To find the Nash equilibria in a dynamic game of complete information we have to construct the normal-form of the dynamic game of complete information.

ETC

The Brandon Agency
campaign

Traditional
marketing

VFS

VFS

Enter

Don't enter

Enter

Don't enter

13.5 M €
--1.5 M €

16 M €
0 M €

17 M €
0 M €

ETC's payoffs
VFS's payoffs

11 M €
3 M €
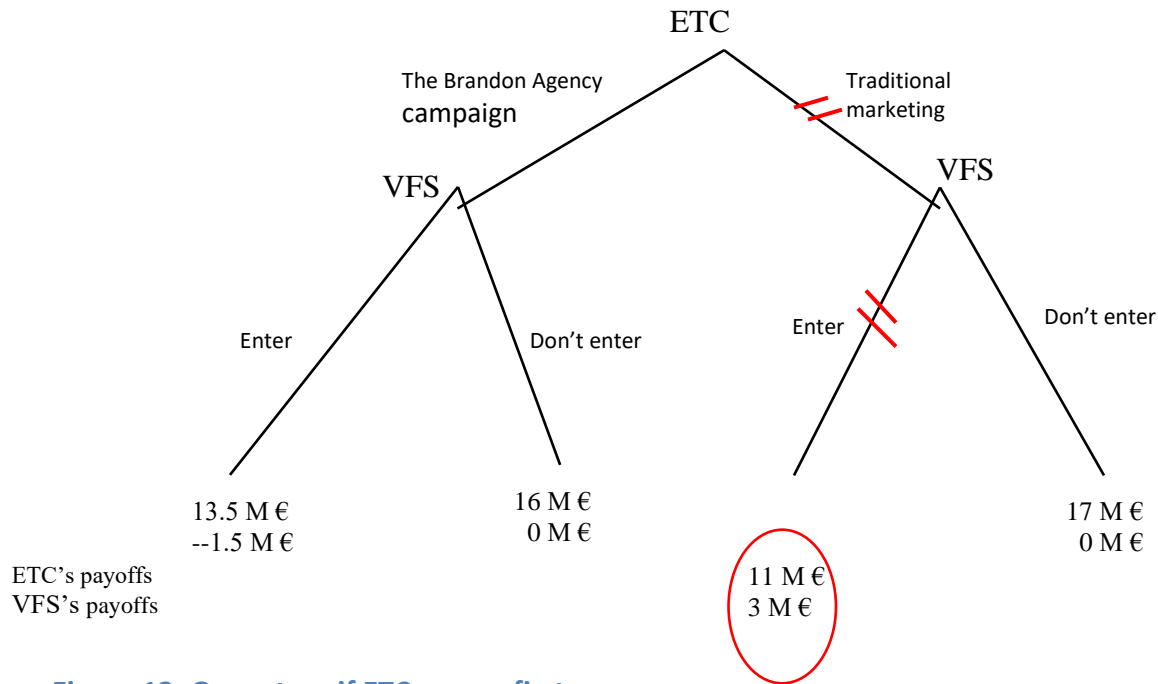
Figure 12: Game tree if ETC moves first

Strategies of ETC are simply decided on the results of payoffs.

S_{VFS} ={(Enter, Enter) (Enter, Don't enter) (<u>Don't enter, Enter</u>) (Don't enter, Don't enter)}

SPE = {Traditional marketing (Don't enter, Enter)}

ETC will choose the best payoff with the lowest investment and if we survive there are two options The Brandon Agency campaign and traditional marketing. Traditional marketing's payoffs are 11 M € or 17 M €, comparing with the first strategy or option when ETC's payoffs are 3.5 M € or 16 M €.

While ETC decides to enter in the Macedonian market with a traditional marketing, Viva Fresh Store have to decide to **Enter** in Macedonian's market with a payoff of 3 M €.

Table 8: Viva Fresh Store & ETC matrice of payoffs

|		ETC	
		The Brandon Agency campaign	Traditional marketing
	Enter, Enter	-1.5 , 3.5	3 , 11
	Enter, Don't enter	-1.5 , 3.5	0 , 17
VFS	Don't enter, Enter	0 , 16	3 , 11
	Don't enter, Don't enter	0 , 16	0 , 17

Subgame-perfect Nash equilibrium

Subgames perfect Nash equilibrium are created to explain the decision process of players when they have complete information for their opponents. SPE (sub perfect game) eliminates NE (Nash equilibrium) that involve non-credible threats. In the game with perfect information, the strategy profile selected using back-words induction is always a NE. A credible threat exists if it is in the player's own interest to curry out the threat gives the option.

Zermelo's theorem[38] is implemented in any finite two-person game of perfect information in which the players move alternatingly and in which chance does not affect the decision making process, if the game cannot end in a draw, then one of the two players must have a winning strategy. Any finite game of perfect information has a pure strategy SPE[39].

A winning strategy for a player is a strategy that enables the player to win no matter what moves his or her opponent makes[40]. A drawing strategy is a strategy which does not guarantee a win for a particular player, but guarantees that he or she does not lose[41].

Figure 13: Game tree of Viva Fresh Store responses ETC
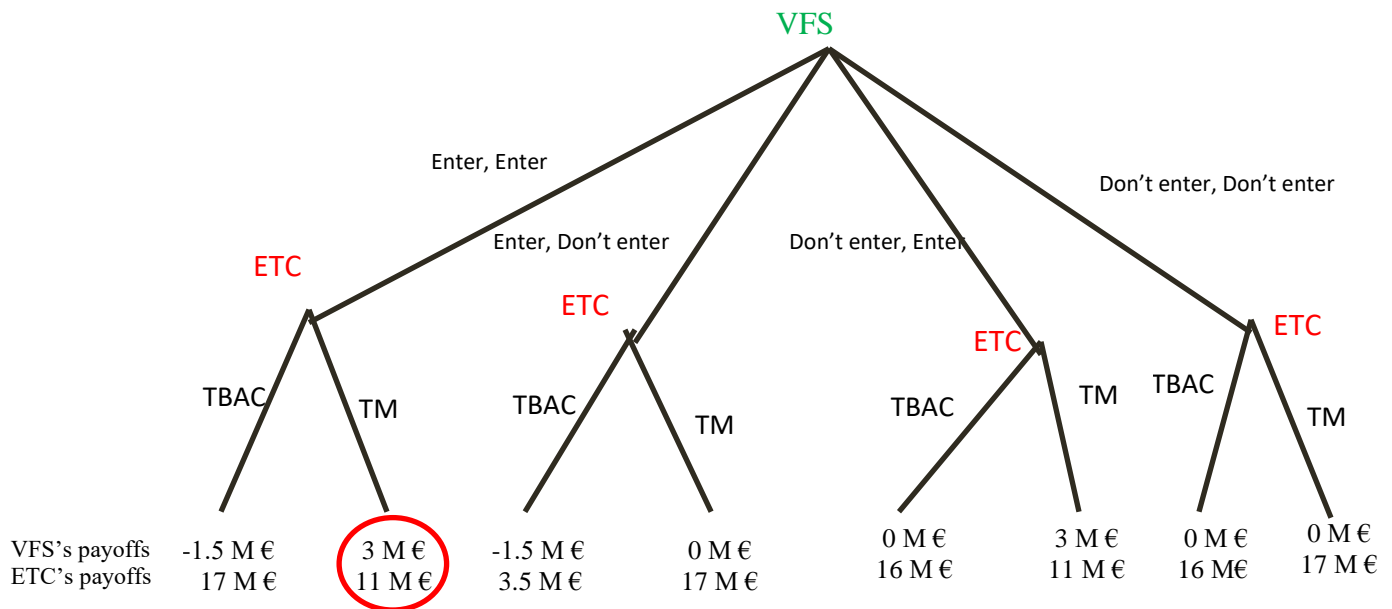
ETC have 16 strategies: S_{ETC} ={ (TBAC, TBAC, TBAC, TBAC) (TBAC, TBAC, TBAC, TM) (TBAC, TBAC, TM, TM) (TBAC,TM,TM,TM) (TM,TM,TM,TM) (TM,TM,TM, TBAC).....}

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[38] Ernst Friedrich Ferdinand Zermelo (1871-1951), was a German mathematician. He studied mathematics, physics and philosophy at Halle, Freiburg and Berlin where he received his doctorate in 1894. He taught at G¨ottingen, Z¨urich and Freiburg and is best known for his work on the axiom of choice and axiomatic set theory.

[39] Zermelo, Ernst (1913), Uber eine Anwendung der Mengenlehre auf die Theorie ¨ des Schachspiels, Proc. Fifth Congress Mathematicians, (Cambridge 1912), Cambridge University Press 1913, 501-504.

[40] Dr. Ng Tuen Wai. April 6, 2008. Workshop - Games and the Mathematical Mind, Department of Mathematics, University of Hong Kong. Page 11.

[41] Same source

4.9   Dynamic Games of incomplete information

In Game Theory there are many options when companies can use to achieve their goals, but it is also something very well known that competitors are loyal to each other just in minimum level of collaboration. Therefore, in duopoly model or monopoly model if the companies stay loyal to each other they also will know the history of each other. If they know their opponents past movements or decisions, companies have the possibility to determinate opponent's future decision. But, game with incomplete information where the players does not know about payoffs, strategies and decision of players[42].

Today, market is so flexible therefore probability to use opponent's past for decision making is not enough. Based in this hypothesis opponents have incomplete information even if they collaborate to each other. Viva Fresh Store and ETC are two companies in Kosovo's market with not enough knowledge for each other, but their decision for marketing are similar to each other. We have a historical biography of both companies that they decide to "hit" the market with marketing strategies at the same time. Or to make it simpler if Viva Fresh Store uses campaign for Christmas starting at the end of November, ETC will create something the same to compete with Viva Fresh Store. Those strategies are vice versa most of the time not just in marketing but also in other strategic business movements.

5   CONCLUSIONS AND RECOMMENDATIONS

5.1   Conclusions

This thesis is a study guide to understand the process of decision making for individuals. Results that we have found during our research work are impressive because some simple mathematical equations can determinate the success of our decisions which later will give us a better position.

Game is not simply a match where two or more opponents meet each other to argue for the best position. There are a lot of games when first place is not the goal, but players with their own movies support each other to stay in the game. The same topic is studied with our subjects Viva Fresh Store and ETC

Out of all results we conclude that our entire hypothesis stays and are verified by our research but also hypothesis are verified by subjects of study. Viva Fresh Store and ETC are taking decision with incomplete information for each other, because they do not know each other in detail but just within the framework of the business cooperation. Based in business interest they expect each other to use one strategy, but incomplete information for forward steps.

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[42] Harsanyi. C John; November, 1967. Games With Incomplete Information Played By "Bayesian" Players, Management Science Vol U No 3.Printed in U S A, Part I. The Basic Model, Pages 159-182

Viva Fresh Store and ETC are two biggest firms in the retail sector in Kosovo's market and they collaborate when they can and compete when they must. Each of them pretends to be the leader of the market competing with prices, quality and services but at the same time they cooperate in business framework. Furthermore, both of them express ideas of cooperation in marketing and in cooperative buying. Those two ideas are calculated in concreate results if they cooperate in duopoly model, monopoly model or callusing with each other in business perspective. Those model that we have articulated with formulas are useful for every product if Viva Fresh Store and ETC decides to cooperate: in marketing, apple, Bosch any other business interest.

Viva Fresh Store and ETC does not accept that they are repeating strategies in marketing for domination in the market in front of other competitors. But they use same strategies during the marketing campaigns and seasons even if the accept that they want to collaborate
Managerial teams at Viva Fresh Store and ETC accepts that they don't use game theory's perspective to take their decision. As we have seen during our research work they are taking their decision based in game theory but without their knowledge. Marketing strategies, penetration in the market, and most of the strategic decisions are very well calculated before they decide to move forward. Therefore, both companies are taking their decision using concrete strategies and analyze which are definitely game theories.

5.2   Recommendations
Game theory is an unlimited platform of calculation to find which strategy is the best against other strategies. While we are dependent by our decision every effective mathematic will put us in a better position, therefore we recommend every individual to use those mathematics for every important decision that we take. Specially we argue with our partners for family decision, we argue with our boss for new strategy, we argue with our friends for bastes or games but game theory will always give you true facts about which strategy is better than other one.

We recommend our study subjects to implement strategies which are results of game theory perspective. It is not so complicated to calculate every possible result and to derive it in to a perfect strategy. Furthermore, Viva Fresh Store and ETC have expressed their interest to cooperate without interruption of each other in media marketing and cooperative buying.

We recommend them to use subgame perfect equilibrium model when they are taking any marketing decision, because is the simples and effective model for those kind of decision. Cooperative buying is the best idea when Viva Fresh Store and ETC can implement game theory, because they can simply decide for prices and quantity. As cooperative buyer Viva Fresh Store together with ETC create advantage in the market because they became exclusive distributer of that article.

We recommend Viva Fresh Store and ETC to use Monopoly model than they can share the profit or duopoly model if there is any legal prohibition. Mixed strategy is also useful therefore we recommend it if Viva Fresh Store and ETC cannot use previews strategies. Game theory is easily implemented in Viva Fresh Store and ETC because we also have the support of managerial staff but more important is that our hypotheses for cooperation and competition is verified. Therefore, we recommend Viva Fresh Store and ETC to take their decision in game theory perspective.

REFERENCES

1. Antoine Augustin Cournot, 1838. Researches into the Mathematical Principles of the Theory of Wealth; (translated by Nathaniel T. Bacon 1897)
2. Carmichael. Fiona; 2005. A Guide to Game Theory. © Pearson Education Limited   ISBN 0 273 68496 5
3. Colin F. Camerer, 2003 Behavioral Game Theory: Experiments in Strategic Interaction, 5.7 Theories.
4. Davies, Howard & Lam, Pun-Lee, 2001. Managerial Economics – An Analysis of   Business Issues. Harlow, UK: Prentice Hall.
5. Friedman. D. David, 1990. Price Theory: An Intermediate Text; Published by South-Western Publishing Co 1986, Chapter 10 - Small-Numbers Problems: Monopoly and All That.
6. Harsanyi C. John, 1967. Games with incomplete information played by Bayesian players.
7. John von Neumann & Oskar Morgensternpublished. 1944 Princeton University Press, Theory of Games and Economic Behavior.
8. Kagel and Roth, 1997. eds, Handbook of Experimental Economics, Princeton Univ, Press.
9. Miller, D. James, 2003. Game Theory at Work – How to Use Game Theory to Outthink and Outmaneuver Your Competition, New York, USA: McGraw-Hill
10. Myerson. B Roger, 1997; Game Theory: Analysis of Conflict; Harvard University Press; Cambridge, Massachusetts – USA.
11. Osborne J. Martin & Rubinstein. Ariel: Jan 7, 2014. A Course in Game Theory. The MIT Press Cambridge, Massachusetts London, England.
12. Roger A. McCain, 1999. Strategy and Conflict: An Introductory Sketch of Game Theory.
13. Schwalbe. Ulrich & Walker. Paul: October 1999, History of Game Theory. Department of Economics, University of Mannheim, Mannheim, Germany & Department of Economics, University of Canterbury, Christchurch, New Zealand.
14. Siegfried, Tom, 2006. A Beautiful Math John Nash Game Theory and the Modern Quest for a Code of Nature. Washington, USA: Joseph Henry Press.
15. Smith. Adam: 1776. The Wealth of Nations, Book IV, Chapter II. Of restraints upon the important from foreign countries of such goods as can be produced at home. © MetaLibri 2007 digital edition.
16. Tijs, Stef, 2002. Abstract of the Fifth Spanish Meeting on Game Theory and applications: Values in Game Theory, The Netherlands Tilburg University.
17. Theodore L. Turocy (Texas A&M University) and Bernhard von Stengel (London School of Economics); October 8, 2001. Game Theory*; CDAM Research Report LSE-CDAM-2001-09; Glossary.
18. Vikram Krishnamurthy, Qing Zhao, Minyi Huang, May 24-26, 2012. Game Theory for Networks: Third International ICST Conference, GameNets 2012, Vancouver, Canada, Efficiency Loss in a Cournot Oligopoly with Convex Market Demand.
19. William A. Darity, Jr. December 4. 2007. INTERNATIONAL ENCYCLOPEDIA OF THE SOCIAL SCIENCES, 2ND EDITION, NASH EQUILIBRIUM, Page 540. http://www.columbia.edu/~rs328/NashEquilibrium.pdf
20. Zermelo, Ernst (1913), Uber eine Anwendung der Mengenlehre auf die Theorie ¨ des Schachspiels, Proc. Fifth Congress Mathematicians, (Cambridge 1912), Cambridge University Press 1913.

Articles and Publications
1. Aldi supermarkets chain https://www.aldi.us/
2. Antoine Augustin Cournot; From Wikipedia, the free encyclopedia; last modified on 27 October 2016 https://en.wikipedia.org/wiki/Antoine_Augustin_Cournot
3. Antitrust definition https://www.boundless.com/economics/definition/antitrust/

4. Bertrand Duopoly — The Model. **Error! Hyperlink reference not valid.**

5. Bayesian games Lesson 1: Types, Beliefs and Bayesian Equilibrium Universidad Carlos III de Madrid http://www.eco.uc3m.es/docencia/new_juegos/en_doc/3.3%20Bayesian.pdf

6. Central Bank of the Republic of Kosovo, FINANCIAL SUPERVISION, REGISTERED FINANCIAL INSTITUTIONS, Commercial Banks; Bilanci i gjendjes dhe pasqyra e të ardhurave   http://bqk-kos.org/index.php?m=t&id=20

7. Coop Group http://www.coop.ch/en/about-us/company.html

8. Cournot Duopoly — The Model. **Error! Hyperlink reference not valid.**

9. Collusion – The model. **Error! Hyperlink reference not valid.**

10. Deloitte, April 22, 2016 "Viva Fresh" Sh.p.k. Auditor's Report and Consolidated Financial Statements as at end for the year ended December 31, 2015.

11. Deloitte, April 27, 2016 "ELKOS" Sh.p.k Independet Auditor's Report and Consolidated Financial Statements as at end for the year ended December 31, 2015.

12. Dr. Ng Tuen Wai. April 6, 2008. Workshop - Games and the Mathematical Mind, Department of Mathematics, University of Hong Kong.

13. ETC – official web page: http://etc-ks.com/per-etc/

14. Fifty-first Congress of the United States of America, At the First Session, Sherman Anti-Trust Act; Sec. 2, Approved, July 2, 1890

15. Industrial Organization Oligopolistic Competition, ECON 312: Oligopolistic Competition, Page 5 http://people.stfx.ca/tleo/iolecture4.pdf

16. Germany's No. 1 mineral water brand. Gerolsteiner GmbH & Co. KG https://www.gerolsteiner.de/en/

17. KOSOVO BANKING ASSOCIATION, Official Web page: http://bankassoc-kos.com/en/about-kba

18. OPEC "Our Mission". Retrieved 16 February 2013. http://www.opec.org/opec_web/en/about_us/23.htm

19. Policonomics, Stackelberg duopoly, 2012.   http://www.policonomics.com/stackelberg-duopoly-model/

20. Monopoly — The Model. **Error! Hyperlink reference not valid.**

21. Stackelberg definition: http://www.policonomics.com/stackelberg-duopoly-model/

22. Stackelberg Duopoly — The Model **Error! Hyperlink reference not valid.**

23. The Brandon Agency - http://www.thebrandonagency.com

24. UC Berkeley Haas School of Business Economic Analysis for Business Decisions; Game Theory II, Sep. 12, 2009; Stackelberg's duopoly model (1934).

25. Viva Fresh Store – About / Facebook, 2003.   https://www.facebook.com/pg/vivafresh.rks/about/?ref=page_internal