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Bibliography

- Lectures notes from Tobias Kretschmer, Professor in Institute for Strategy, Technology and Organization (e-learning at <https://www.coursera.org/>)
- Colin Camerer - Redirecting Research in business policy and strategy
- Avinash Dixit, Susan Skeath - Games of Strategy
- Game theory lecture notes- levent kockesen
- Introducion to game theory muhimu

I. Chapter 1 - Introduction

Introduction

This thesis is about the behavior of companies in competitive markets. Facing competition forces firms to look ahead and anticipate developments. How to act if the rivals firms change their marketing strategy, the quality of their products or the price. We focus on such instances of “strategic interdependencies” in real business situations. We describe some methods of strategies that companies might follow to be more competitive against their rivals. Sometimes the best strategy is to cooperate with the rival company. We are analyzing the different decisions firms take and we provide the best strategy they should follow.

II. Chapter 2 - Power of complements

Power of complements

Two products, are complements if the usage of the second increases the user's utility from the first and vice versa . The utility from using both of the products together is higher than the utility of using the first product. On its own plus the utility of using the second product on its own. We can take a numerical example:

The utility you get from using a laptop is 50. The utility from software as such without a computer is 0. Utility is basically how much you are better off using the particular good in question. By using a laptop we are assuming that you are 50 units better off, than if you do not. If we combine laptops and software and we are able to use them together, it would be worth more than just a laptop and it would definitely be worth more than just the software. And it would even be more than the sum of the two. We can imagine a situation where using the laptop and the software is worth 100. That is the definition of complement in terms of the user utility. An implication from this is when we think about cross price elasticity. So two products A and B are complements if the demand for B increase when the price of A drops, and vice versa. In other words, if the price for product A goes down then people are going to buy more of good B. This phenomenon is referred to as negative cross-price. Meaning that the price of one product and the demand for the other product go in opposite directions. We can use the example of the laptop and the software. The price for the laptop goes down, then the demand for software is going to increase . The decrease of the laptop's price does two things. First of all , the demand for

laptops will be increased. So there will be more people buying laptops in the first place, And secondly people that do buy a laptop anyway, will have a larger budget for additional software. In both cases from new consumers and from consumers that now have more disposable budget for buying software, the demand for software goes up. Most of the times, the complements are fairly obvious like the laptop and the software. But sometimes complements can show up in the most surprising places.

Example: Cloth shops in the same mall:

- Shop A's price cut make the whole mall more attractive.
- Shop B's sales increase due to the additional customers.

If shop A now initiates a price cut, that price cut is going to do two things. First of all, the people that went to the mall already might go to shop A rather than shop B because it relatively speaking has became cheaper. On the other hand, it also makes the whole mall more attractive. So words going to get around , and more customers will go to the mall, So this is going to mean that shop B, even thought their prices have not changed and the prices of a competitor have decreased , there might still see a sales increases, because they have additional consumers that went to the mall.

Supporting the other side

- It may make sense to support the supplier of the complement
 - Better quality of complement
 - Higher sales of complement
- } Good for own product

Generic Strategies of basically dealing with complements. One strategy would be supporting the other side. One firm can support another firm even if it does not benefits it directly because it is not part of it. It may make sense to support the supplier of the complement by enabling him to provide a better quality of complement and to sell more of the complement. These are both good things for your own product because as we saw, the better a complement the higher demand for your own product, or the more sales for the complement, the more demand for your own product. So the more useful it becomes to have the base product. By supporting the other side can take a number of different forms. We can use one specific example. The example of Apple

- Apple gave laptops to students writing software for Mac OS
- More compatible software titles made Apple's laptops more attractive

Giving out laptops that people would have or might have otherwise also bought a laptop, seems like just throwing away money and like giving away revenues that Apple otherwise might have had. But, the students who were writing software for the Mac OS , they produced more compatible software for Mac OS, they produced meaning that more compatible software titles made using Apple's laptops more attractive. Apple makes it easier to produce complement products for their base product and that makes use of their base product more profitable or more useful.

Supporting the other side, can also take even more commercial directly commercially forms in financial terms.

Example : Game console manufacturer 3Do.

- Problem
 1. Console manufacturers sold consoles for high prices to make profits
 2. This attracted a limited number of costumers
 3. Neither optimum for console manufacturers nor for game publishers

- Solution
 1. Publishers paid a fee of 3 dollars to 3DO for every game copy sold.
 2. 3DO could sell consoles much cheaper and attract more customers
 3. this way, publishers could sell more copies and increase net profit

Supporting the other side would be one reason, one mechanism to deal with the complements. A more extreme or more direct way of taking care of the complements good would be to produce it yourself.

2 .Producing Complements

- It may make sense to produce the complement yourself
- Sony produces game console and video games
- Hewlett Packard manufacturing printers and printing ink

Sony produces a game console and they produce video games themselves. Which means whenever a customer buys a Sony console , they know there is going to be a number of game available , produced by Sony that will ideally take the advantage of all the software and all the hardware produced by Sony. Hewlett Packard manufacture printers but they also manufacture printing ink and also printing cartilages or ink cartilages. The produce the base product and they produce the complement product. This might be good but it also might have a couple of issues. There might be some problems that may arise as a consequence , First of all, the market for complements may simply be unattractive. There might be a reason why they did not go into, say the movie business, as a consumer electronics manufacturer if they are not particularly good at it or if it is just a profitable business .

Competitors as Complementors

- In certain situations, firms may be
 1. Competitors in part of the market

2. Complementors in another part of the market in such a constellation, they may not compete that harshly

Sometimes, competitors can also be complementors. There are some companies that produce multiple products. And these multiple products, some of those will be direct substitutes and some of those will be complements. In certain situations firms may simply be competitors in one part of the market. So, they might also be complementors in the other part of the market. In such a situation they may not compete as harshly as if they were just competitors. In other words, the fact that they are producing a product that may be complement to their rival's product may soften competition and make them behave more cooperatively

III. Chapter 3 -Eliminating dominated strategy

Eliminating dominated strategy

Dominant Strategy

A dominant strategy is a strategy that always does better than any other strategy. Hence, should always be chosen by a rational player. You can rely on a rational rival always by playing a dominant strategy.

Elimination Process

To achieve that we have to eliminate dominated strategies one by one, until we can find a solution to the game. We cannot eliminate more.

Nash Equilibrium

When we are talking about Nash Equilibrium, we refer to a combination of strategies that no player can deviate unilaterally from his/her current strategy, aiming at improving his/her payoffs.

Relationship to other concepts

The question that must be asked now, are the following; if a Nash Equilibrium is the same as a dominant strategy, can a Nash Equilibrium contain dominated strategies and will every Nash Equilibrium contain dominant strategies?

To start up, Nash Equilibrium is not the same as a dominant strategy because a dominant strategy refers to a single player instead of Nash Equilibrium which is the combination of strategies and it is about a strategy for each player in the game.

Further up, if we want to maximize our profits and payoffs we are going to choose something that will give us the highest payoff. In that case, a dominated strategy will never be part of a Nash Equilibrium.

As for the last question, it is not necessary for a Nash Equilibrium to contain a dominant strategy.

Prisoners' Dilemma

Coming back to the example of Apple and Samsung, both businesses would have higher profits if both did not advertise. But both of them have an individual incentive to advertise anyway, regardless what the other player does. This is called Prisoners' Dilemma.

Nature of Prisoners' Dilemma

There is no issue about information, because both players know the game inside out. The dilemma arises because both of them act selfishly and as for the result, they maximize individual payoffs and not the joint payoffs.

IV. Chapter 4 - Take care of our competitor

		ADVERTISE	NOT ADVERTISE
	ADVERTISE	<i>10 million-5 million=5 million each</i>	<i>16 million/4 million</i>
	NOT ADVERTISE	<i>4 million/16 million</i>	<i>10 million each</i>

V. Chapter 5- Reasons for cooperation

Reasons for cooperation

In some situations, companies are actually better off by cooperating with each other. Sometimes, quite simple, competition is not in the company's best interest. And sometimes companies need each other. In these situations cooperating can help to avoid inefficient solutions. They are going to achieve cooperation between profit maximizes. Companies can use two different mechanisms.

- **Repeated Games** . They are both using Prisoner's Dilemma not just a single time but a repeatable number of times.
- **Commitment**. They can settle on a course of actions before the other firm has done it.

Repeated Games Finite and Infinite Repetition

The companies, in a prisoner's dilemma, kind of situation, they can increase their joint profits. If they are able to coordinate their behaviors. Repeated games basically take into account that interactions between two players, between multiple players, can take place not only once but a repeatable number of times. Sometimes, interactions just take place a couple of times in a row. And the way in which that changes the dynamics of the game or that changes the dynamics of competition between two players is by making the future matter.

For example, suppose that we have two different players. Player A and Player B. Player A can threaten Player B or vice versa. So if Player A does not cooperatively this time in one instance of the game, then Player B will retaliate the next time. And of course the other way around.

We are going to see , if this kind of threat can effectively enforce cooperation we have to distinguish between two different types of repetitions.

First one is Finite repetition, where it is clear from the beginning how often the game is going to be repeated and when the game ends. So we can figure out the outcome or what the end point of the game is, and we can to work towards this end point.

The second on is the Infinite repetition where there is no defined end to the game, the number of repetitions is unclear and it is not possible to know if one round is the last round of a particular game.

We can take one particular example of finite repetition game. The installation of street lights in London for the Olympic games.

The organizing committee orders 500 street lights from a contractor. the contractor have to install them over time leading up to the Olympics . Olympics will start in a certain date and by that date the street lights have to be installed.

- Every month only 100 street lights can be manufactured and installed
- The whole process takes 5 months

It is a game that is it repeated five times and it is over after these, after the fifth iteration.

Player A	Player B
Contractor	Organizing committee

Player A has to decide

- high quality street light (worth 45.000 £ and costs 15.000£)
- low quality street lights (worth 30.000 £ and costs 12.000£)

Player B has to decide

- Paying the agreed price of 30.000£
- Renegotiating the price down to 20.000£ (it is possible to renegotiate the price by finding some small fault or some slightly lost delivery, or something that is not entirely up to specifications)

MATRIX FORM

Contractor		Organizing Committee	
		Accept price	Renegotiate price

	High Quality	<i>15.000 and 15.000</i>	<i>5.000 and 25.000</i>
	Low Quality	<i>18.000 and 0</i>	<i>8.000 and 10.000</i>

The fairest or the most sensible outcome for the game would be if the Contractor delivers high quality, and the Organizing Committee pays the agreed price of 30.000£. Delivering high quality, means it is worth 45.000 £ and the Organizing Committee pays 30.000£. The Contractor has 15.000 £ surplus .But there is a chance that there can be an incentive for both of them to actually not stick to the agreement plan. This game will be played five times in row. Both of them can threats each other if someone does not behave according to the rules

Threats

- The Contractor threatens the Organizing Committee : If the Organizing Committee renegotiates the price in one month, they will deliver low quality in all subsequent months.
- The Organizing Committee threatens the Contractor : If the contractor delivers low quality in one month, they will renegotiate the price in all subsequent months.

Backward Induction

- Can be used to analyze repeated games with finite repetitions
- Process of reasoning backwards in time :
 1. First consider the last stage of a game and determine the best action at that time.
 2. with this in formations determine what to do in the penultimate stage

VI. Chapter - Bertrand Paradox

BERTRAND PARADOX

Bertrand model

There are two companies, two ice cream sellers on a beach and they have price competition, sellers set their prices. They both sell identical products, in this case, same ice cream and same flavor. The game is played once, and sellers set their prices once. We have market transparency and all of the customers know both prices, also there is infinite price elasticity which means that seller with lower price gets all customers. Finally, there is no capacity constraints, each seller can produce endless amounts of ice cream.

We can analyze it as a game

Each seller can set

- Low price
- High price

SELLER A

		SELLER A	
		HIGH	LOW
SELLER B	HIGH	50% / 50%	0% / 100%
	LOW	100% / 0%	50% / 50%

They can both charge high prices or low prices.

When both companies set low prices, we get a Nash Equilibrium.

Prices are not typically a discreet thing and they met binary.

UNIQUE NASH EQUILIBRIUM

- Prices equal costs (no fixed costs)

- Profits equal zero

In this model profits do not exist. This happens because of the fact that very aggressive prices are imposed by the firms. The last ones are charging prices equal to their marginal cost.

The paradox is that in reality, firms do make profits. This phenomenon, this paradox in real life seems to be positive. It gives profits, but in this model it does not. This is what we call Bertrand Paradox.

Bertrand paradox basically tells us that in a model with, seemingly, fairly reasonable assumptions, we get a result that does not make a lot of sense. So, we have the assumptions that we have got prices and little product differentiation and so on. This way we get to the conclusion that firms make no profits.

BERTRAND MODEL

- Two companies
- Price competition
- Identical products
- Game played once
- Market transparency
- Infinite price elasticity
- No capacity constraint

Let's try to remove these assumptions one by one and see what the result might be. The first and the easiest one is that maybe firms do not have identical products.

➤ **Identical products**

In reality, consumers have different tastes, so products are differentiated. As in the example above, each seller produces a different flavor of ice cream.

Monopolization is not possible. If one of the products charges a slightly lower price than the other and the flavors are different, the consumers are not going to care that much about tiny price differences in order to choose the flavor they want. So monopolization is not possible because consumers are willing to buy from both firms.

➤ **Game played once**

In reality, the game has indefinite repetitions. Every summer season, sellers set their prices.

In collusion it is possible to expect threats of retaliation.

Another assumption is that we had complete market transparency. This means that every consumer knows the prices of both of the sellers.

➤ **Market transparency**

In reality, there is imperfect market transparency. Some consumers know price of one seller only. And if you only know the price of one, then does not matter what price the other one will set. Which means that undercutting prices has an effect on some consumers only, not on everyone. which is going to make it less attractive to lower prices.

➤ **Infinite price elasticity**

In reality, costs for consumers associated with switching seller. Sellers introduce loyalty program.

Undercutting prices has limited effect. This is going to mean that undercutting prices will have a limited affect.

Finally, we can also relax the assumptions of no capacity constraints.

➤ **No capacity constrains**

In reality, companies have limited capacity. Each seller can produce limited amount of ice cream only.

No incentive to induce a price war over the complete demand because they are simply not going to be able to satisfy this demand.

There are all characteristics of the market, but firms can actually try to actively influence these aspects to avoid the Bertrand trap.

- ❖ Agree on price, implicitly or explicitly. Play the game repeatedly to make sure that there is no endpoint.
- ❖ Limit their capacity. So, it kind of keeps them from giving an incentive to undercut
- ❖ Increase switching costs. So, it is going to make it more difficult for rivals to steal their customers.
- ❖ Differentiate their product.

VII. Chapter - Product Differentiation

PRODUCT DIFFERENTIATION

Differentiation depends on consumers' preferences. It is beneficial if consumers are heterogeneous and only then. If everyone would prefer the same, if everyone would like the same product, it would not make any sense to offer anything different from the main product.

FACTORS

- Technical features

Cell phones have different form factors, they have cameras, they have Dictaphones and these are all technical features by which products may be different.

- Durability

Some shoes just wear at very quickly, some shoes you can wear forever and it is a way of differentiating the product.

- Resale value

The resale value is going to be very different for some house or flats than for others.

- Taste / Image

Cars are very highly branded products, and that means that of we buy a car, we buy into a certain brand, a certain image and that is going to be important.

- Location

If there is a gas station that is right on our way home from work, then there is much more likely to choose that one than to choose one that is on a street next to us because it is more convenient to get there.

- Time

When we buy a product or a service, will also depend on giving us different utilities, according to our preferences. So, for flights sometimes we just have to take a certain flight. In that case, a different flight is not good for us.

Products can be differentiated along two lines

HORIZONTAL DIFFERENTIATION

Given equal prices, some consumers would choose product A whereas others would choose product B.

VERTICAL DIFFERENTIATION

Given equal prices, every consumer would choose product A over product B.

HORIZONTAL DIFFERENTIATION

HOTELLING BERTRAND MODEL

Named after their two inventors, or the people who first analyzed it, Hotelling Harold and Bertrand Joseph. It is done this way because it is highly relevant for analyzing product differentiation and for the consequences, in terms of prices and the profits that firms make.

SET UP

- Beach
- Consumers
 - ❖ Lying at the beach
 - ❖ Feel discomfort from walking

- Two ice cream sellers
 - ❖ Same ice cream
 - ❖ Located in the middle

We are back in the Bertrand paradox and both firms make zero profits, because they are selling the same product, at the same location and there is no product differentiation.

FACTORS POSITIVELY INFLUENCING PRICES AND PROFITS

- Distance of sellers from each other

The further away firms are from each other, the more likely it is that a consumer is going to find attractive.

- Magnitude of discomfort from walking

Also means that even small differences, small distances between the two are going to make the real difference between the two products very large. So, it is going to have another positive impact on profits.

- Number of consumer along the beach

Because the more consumers there are, the higher the profits are going to be.

INTERPRATATION OF PARAMETERS

The parameters in the beach example can be interpreted in a boarder sense.

- Different location of sellers
Horizontal differentiation of products along one product dimension
- Distance of sellers
Degree of differentiation of the products
- Position of a certain consumer along the beach
Preference of this consumer regarding the products
- Discomfort from walking
Strength of preference, lost by deviating from the ideal good

At Bertrand Hotelling model, differentiating product horizontally can relax price competition. And by relaxing price competition, firms were able to move up in prices and profits. So, in other words, they can make positive profits if they differentiate their product.

VERTICAL DIFFERENTIATION

SET UP

- London City Center
- Consumers
 - ❖ Some would pay a lot for good ice cream
 - ❖ Others have money constraints and prefer an average ice cream at a reasonable price
- Two ice cream sellers
 - ❖ Same ice cream
 - ❖ Located next to each other

Consumers are heterogeneous, but they are heterogeneous in a different dimension. They are distributed according to their willingness to pay for high quality. Some would pay a lot for good ice cream, and they are willing to pay any amount almost just because they love it. Some are constrained either by money or they just do not want to spend as much money on ice cream so they would prefer an average ice cream at a more reasonable price.

It is the same story of horizontal differentiation, but with slightly different strategic variables.

SUPPORTING FACTORS

Factors positively influencing prices and profits.

- Difference in quality of the products

The more different two products are, the easier it is going to get for both firms to make positive profits.

- Degree of heterogeneity in terms of willingness to pay.

In other words, if there are two segments that are very different from each other, one segment of the market is very price conscious and has very small willingness to pay for higher quality. And another segment of the market is very much willing to pay high amounts of money for high quality.

These are two different markets, and these two firms will serve different markets and will make fairly high profits.

One very important implication is that firms that offer low quality products can realize positive profits just as firms offering high quality products.

For business strategy this means that in a market, we do not have to be the highest quality provider. In fact, if there is a high quality provider of a service, or of a product that it might be optimal for us to reduce the quality to make the other products more different. And that can actually be increasing the profits, rather than trying to match the quality of the other one. In that case we would get more similar and we would be back again in the Bertrand paradox.

VIII. Chapter - Conclusion

For epilogue, we would say that there are a handful of cost-effective models that support the economical growth and profitability of the firms, that differ in terms of theoretical infrastructure and practical application, but nonetheless both are effective. All of them are necessary and contribute in the manifestation of more profitable firms, and the development of what is called Economic Science. More specifically, based on game theory, the player/firm after it understands the nature and strategy of its competitors, attempts to find and utilize all those resources and strategies needed, that will assist it to overcome the advantages of competition and render it as a pioneer with greater economical benefits for its firm.

