Social Preferences and Competition:

in Bertrand and Cournot Models

by

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Abstract

In this paper I investigate the effect of social preferences in oligopolistic competition, both when social preferences are determined exogenously and when they are chosen by owners as part of "profit-maximizing" corporate culture. The results reveal that a firm's attitude towards a competitor is changing with regards to type of competition such as Cournot, Bertrand and Differentiated Bertrand. Cournot model with social preferences demonstrate that firms exhibit anti-social or spiteful behavior towards each other competing on quantities. On the contrary, when firms compete on prices with differentiated products they display pro-social behavior expressed. However, firms do not reveal social preferences when they produce homogeneous products in Bertrand Oligopoly.

Keywords – Competition, Bertrand, Cournot, Social Preferences

Contents

1 Introduction

The general assumption of economic models is that individuals and organizations aim to further their own interest. However, in the real-world, people are not fully self-interested. At least to some extent, people care not only about themselves, but also about others. Examples illustrating these phenomena are: charity, volunteering, helping strangers, etc. In fact, according to *The Annual Report Philanthropy (2018)*, in 2017 the total amount of money transferred for donation was 410.02 billion US dollars. Examples illustrate that often people value moral principles more than wealth. They donate to many different projects such as helping to collect money to build a zoo for animals or donate in order to improve environment in the world by planting trees. There are other examples which illustrate that people do not care about themselves only, but for other good purposes. These acts represent pro-social behavior of people who are willing to sacrifice their own good for the sake of others. However, sometimes people commit acts which represent an anti-social behavior. For example, the falsification of elections or meanness towards competitors by using oppo research to blackmail pursuing personal gain.

Moreover, there are lots of work which examines implications in economic settings, in both theoretical and empirical frameworks. For example, Kahneman et al. (1986) created an experimental setup with two participants. In this experiment, Kahneman illustrated that on average, if one of them allocates the given amount of money between two of them, the participant whose role is "Dictator" will transfer a non-zero amount to another participant. This may be seen as a violation of the self-interest assumption too.

A substantial amount of theory work such as Bolton and Ockenfels (2000), Huck and Oechssler (1999) shows that social preference do not have to be neglected in economics. For example, Bolton and Ockenfels (2000) stated that for better understanding of people's behavior, the *social reference point* has to be taken into account. However, their model of *Equity, Reciprocity, and Competition* explains basic patterns of social preference behavior in one-shot games. Becker (1974) was one of the first who showed that altruistic actions in a form of philanthropy increase the utility of a person. More specifically, the sacrificed amount of money has a greater effect on utility rather the same amount earned.

Unfortunately, there is not much work connected to firms' behavior. But, firms may

exhibit social preferences too. For example, one firm may care not only about personal gain, but also about market efficiency and welfare of other market participants. Another case might be that stakeholders of firms might not be rivals, but rather friends, so that they are unwilling to compete fiercely. In general models of economics, these assumptions are usually neglected.

The focus of my paper is to examine the effect of the social preferences on oligopolistic competition. In order to do that, I will use the standard models of Cournot (1838) and Bertrand (1883) Oligopolies. I will present different implications of social preferences in the firms' behavior by modifying the assumption of pure self-interest. The basic idea of models is to observe how social preferences affect profits of each firm. I will show that different results apply to different models. In both the Cournot and differentiated Bertrand models, if both firms are nice to each other, then that increases both of their profits. The effect of an individual firm being nice, however, is completely different in the aforementioned models.

These observations in turn have important implications for situations in which social preferences are chosen endogenously by senior management such as CEO or board of directors. I revealed that there is exist a cultural equilibrium by which both firms gain by showing their social preferences to each other. Also, I find that when firms compete in Bertrand Duopoly, social preferences do not matter and don't play any role. Nevertheless, when firms acting positively to each other in the Differentiated Bertrand framework, it helps them to raise profits. Additionally, I will illustrate that when social preferences are endogenous, there exist an equilibrium of social preferences, which maximizes firms profit.

The paper is organized as follows. Section 2 discusses the related literature connected to the topic of social preferences. Section 3 illustrates and analyzes the simple model of Cournot Oligopoly with exogenous social parameter, which represents social preference in an industrial setup. It also illustrates the case in which the social parameter is controlled by senior management, so that it may be chosen. In this section, I will introduce the cultural equilibrium represented as the value of the social parameter. Section 4 introduces the social parameter in a standard Bertrand Model and discusses implications of it. In section 5, I will analyze the Differentiated Bertrand Model and analyze what is the effect of the social preference in the setup. As previously, I will consider two cases according

to whether social preferences are exogenous and endogenous. Section 6 concludes and discusses the implications of the results received in the previous sections.

2 Related Literature

According to Fehr and Fischbacher (2002), the formal definition of social preferences is that an agent shows an interest in resource allocation not only for herself, but rather for all agents involved in the particular resource allocation. These agents in the subset of the group with whom the initial agent is connected include colleagues, family, friends etc. They have selected five main categories of social preferences. The first two types are opposite of each other – selfishness and pure altruism. Whenever an agent exhibits selfish purposes, she solely pursues the goal of benefiting herself. In contrast, pure altruism implies that the agent's utility is positively responded to an increase of the welfare of another agent. Falk et al. (2008) illustrated that some portion of people have a negative effect on their utility by observing the material pay-offs of others. These types of preferences are defined as envious or spiteful. Simply speaking, an agent feels bad when she is observing that another agent has high welfare.

The field of behavioral economics is a new branch of economic theory which diverge from the classical economic theory. Many of the authors are adopting the modern psychological phenomenons integrated into economic settings. In the article "Behavioral Contract Theory", Kőszegi (2014) unites and discusses different models and approaches incorporated to economic framework. He argues that it is possible to predict and administer the behavior of agent by knowing his social preferences. For example, Fehr and Schmidt (1999), came to the conclusion that the if the agent exhibits the inequality aversion preference, she will exert the effort which maximizes the material payoff for the principal. An agent who has the inequality aversion preference tends to equally distribute the material payoffs between herself and the principal. Hence, the principal will set the wage which has the maximum effect on the social surplus and have the half of it.

Kőszegi (2014) also highlights the "intrinsic motivation" as the term for the activities that not based on the monetary pay-off motivation. He says that "intrinsic motivation" phenomenon is out of boundaries of standard moral hazard models. This view was

confirmed by Englmaier and Leider (2012) where they have established that the high fixed wage for an agent creates the profit maximizing outcome and benefits both, the agent and the principal. The reason is that if agent exhibits a inequality aversion preference, she will perform in the way that principal will have a proportional gain accordingly to the wage.

In contrast to the previous discussion, Kőszegi (2014) asserts that there are a number of reasons by which the output produced by an agent is not fully dependent on the wage. One possible reason for that is discussed by Rey-Biel (2008); he analyzes that in order to motivate agents, principal may create a competition among them to assure that the effort level will be maximized. The idea lays down in the way that it is possible to control the effort level of agents by incentives, which are different from monetary ones.

In addition to the previous research, Fehr and Schmidt (1999) designed a model based on inequality aversion, where the agents exhibit a strong desire to equalize the pay-off distribution among themselves and others. Nevertheless, it is a double-sided coin, such that one side implies that they do have positive intentions to increase the pay-off of others if the initial material distribution was below the equal threshold. However another side is that they decrease the material distribution of others in order to create an artificial equality amongst everybody.

Another type of social preferences was modelled by Charness and Rabin (2000), who created a quite complex model of reciprocity. In the manner of inequality aversion, an agent who exposes the reciprocal preferences searches for justice coupled with the internal understanding of what it is. For the purpose of justice, an agent behaves belligerently when she decides that the action directed at had bad intentions. Nonetheless, by pursuing fairness, an agent displays charitable behavior when actions towards her were having a forward-looking character. To accentuate these types of preferences and the existence of them in the real world, which is different from economics models assuming the selfish motives by economic agents, it is worth mentioning that sometimes the actions of an agents are not motivated by pure gain, in both, the material and non-material sense.

Firms are ruled by individuals, hence it is possible to conjecture that firms are affected by impact of social preferences just like individuals are. Feicht et al. (2016) investigated the phenomenon of Corporate Social Responsibility (CSR) in the framework of Bertrand market with homogeneous goods. They designed an experiment in which the firms or

producers may exhibit altruism as a form of CSR by donating some monetary amount from profits to non-profit organizations. They illustrated the type of social preferences directed to societal problems. The researchers define this phenomena as marketing method which is strictly aimed on increasing the firms' profitability. The purpose of the research was to find how the CSR approach may change the competition amongst two competing firms. The initial guess was that the inclusion of CSR may increase profits followed by the rise of the price level. The authors divided two firms into credible and non-credible, where the credibility was illustrated by an assumption of the commitment of firms to tell the true amount transferred to non-profit organizations. The idea that the involvement of CSR may potentially increase the company's performance was illustrated by McCluskey and Loureiro (2003), who showed that consumers have a positive response to an eco-wine and pleased to pay more in comparison to regular wines. However, an experimental setup of Feicht et al. (2016) rejected the initial predictions and showed that despite of eco-friendly and participation in socially valuable activities, consumers tend to buy the product which has lower price as in neo-classical assumptions.

The idea that firms may have social preferences towards each other is that they don't want to have a new competitor with which they did not compete before. The competition in the market helps to firms to keep the motivation for innovative solutions. Another possible reason that firms may have social preferences are personal relationships between CEOs of the firms. For example, if two competing firms are ruled by two friends or brothers, they don't have incentive to destroy each other, rather they will act in order to benefit both. The study of social preferences in the competitive markets begun with Smith (1962), who illustrated the irrelevance of social preferences in the competitive markets by using an experimental setup. Consequently, the study supported the neo-classical view in economics, which is based on the assumption that people guide their firms solely in the self-interested approach. In his study, he managed to replicate the real market by creating artificial buyers and sellers in the auction manner, where both groups of the may submit their orders at the same time. Also, the game was conducted in the several stages such that participants may learn from the previous information. The result was quite promising, because it illustrated the convergence of prices and quantities to the neo-classical equilibrium. Hence, it neglected the assumption that there are some social preferences which may affect the traditional outcome.

As it may observed, there a number of research papers which highlight the importance of social preferences in the firm structure, between agents and principals. However, the relationship between firms having social preferences is yet to be studied. In this thesis, I will shed light on the implications of social preferences on the part of the firms competing in duopoly. This will help to understand how the firms should value their behavior towards each other in a competitive markets. I will also discuss the rationalization of the social preferences by observing the effect, when firms may set their preferences towards each other.

3 Cournot Model with Social Preferences

3.1 Simple Model

I first analyze Cournot Oligopoly. In this model, I illustrate the environment consists of two firms competing in a market on the produced quantity basis.

Two firms produce a homogeneous good and exhibit the same cost function to produce it. The Cournot Oligopoly game is based on simultaneous decision making of how much to produce. Market Demand is given by:

$$P = a - b(q_1 + q_2) \tag{3.1}$$

where q_1 and q_2 stand for quantities produced by each firm.
Profits of each firm are given by:

$$\Pi_1 = (a - b(q_1 + q_2) - c))q_1$$

and

$$\Pi_2 = (a - b(q_1 + q_2) - c))q_2$$

Starting from when the model was created in 1838 by Antoine A. Cournot and up to today, the main assumption of economists was that the firms work and operate for the sake of highest level of profit. I modify this assumption by introducing social preferences, which may affect the rationality of the firms decision.

In the game of Cournot Oligolopy, the quantity produced by each firm is publicly available information, hence it is reasonable to assume that each of the firms observes how much the good was produced and calculates the profit of the opponent. In order to show the effect of the Social Preferences, I will assume that there exist some α_i, which is the social parameter in an utility of firm i and is the proportional weight that firm places on the other firm's profit.

Hence, the utility firm i is given by:

$$U_i = \underbrace{(a - b(q_i + q_j) - c))q_i}_{\text{own profit}} + \alpha_i \underbrace{(a - b(q_i + q_j -)c))q_j}_{\text{competitor's profit}} \tag{3.2}$$

where, $i, j = 1, 2$ and $i \neq j$.

For simplicity, I focus on pure strategy equilibrium throughout the thesis. In the foreground of the model, firstly I examine the case when α_1 and α_2 are fixed, and solve for choices and profits for each of the firm. Then, in the section 3.2, I will examine the case when α_1 and α_2 are endogenously chosen by senior management, such as CEO or board of directors. According to the choice of α, employees choose prices which maximize the firm's profit.

The equilibrium for two firms is derived from the utility function and then by taking a derivative and finding the best responses by each firm, we may observe the quantities produced affected by social preference parameter.

For firm 1:

$$\max_{q_1} U_1 = (a - b(q_1 + q_2) - c))q_1 + \alpha_1(a - b(q_1 + q_2) - c)q_2 \tag{3.3}$$

$$FOC : \frac{\partial U_1}{\partial q_1} = 0 \Leftrightarrow a - 2bq_1 - bq_2 - c - \alpha_1 bq_2 = 0$$

Hence, the best response of firm 1 is

$$q_1 = \frac{a - c}{2b} - \frac{q_2(1 + \alpha_1)}{2} \tag{3.4}$$

Due to the symmetry of the Cournot Model, one may know that the best responses for each of the firms are symmetric. Thus, the best response of firm 2 is

$$q_2 = \frac{a - c}{2b} - \frac{q_1(1 + \alpha_2)}{2} \tag{3.5}$$

Now, we have two different scenarios which are explained below.

Lemma 1

If the social preferences parameters α_1 and α_2 are equal, then the quantities produced by each firm are equal too.

From equations (4) and (5), it is easy to see that since firms are symmetric, then $q_1 = q_2 = q$. After solving a simple equation (3.4) or (3.5)

$$q = \frac{a-c}{2b} - \frac{q(1+\alpha)}{2}$$

by substituting aforementioned condition, the symmetric equilibrium quantity is given by

$$q^* = \frac{a-c}{b(3+\alpha)}$$

Assuming that the $\alpha > 0$, q^* is decreasing in α. This result is quite intuitive, because as the social parameter α increases, the quantity produced decreases. Consider the case when $\alpha = 1$; then the equilibrium quantity for each of the firm is given by $q^* = \frac{a-c}{4b}$. This outcome is the representation of an equilibrium in which firms cooperate, meaning that by producing less, they increase their prices and so profits. Moreover, all levels of quantity which are less than $q^* = \frac{a-c}{4b}$ are strictly dominated by it. Conjecturing, the $q^* = \frac{a-c}{4b}$ is the best outcome for both of the firms received by cooperation. The overall result when $\alpha = 1$ leads to a monopoly, since the total quantity in the market is given by $Q = \frac{a-c}{2b}$. However, when firms are having social parameter $\alpha > 1$, they are hurting each other by being too nice, since the turnover quantity of $q^* = \frac{a-c}{4b}$ is passed. If the $\alpha < 0$, then the case will be reversed and firms will engage in a high competition environment moving profit towards zero.

Lemma 2

If the social preferences parameters α_1 and α_2 are not equal, then the quantities q_1 and q_2 produced by the firms are not equal either.

This is the opposite of *Lemma 1.* These two crucial assumptions in the model cover different approaches in the simple model of Social Preferences incorporated to firms behavior in the Cournot Market type.

By solving a linear system of equations (4) and (5) with two unknowns, we find that:

$$q_1 = \frac{(a-c)(1-\alpha_1)}{b(3-\alpha_1-\alpha_2-\alpha_1\alpha_2)}; \tag{3.6}$$

and

$$q_2 = \frac{(a-c)(1-\alpha_2)}{b(3-\alpha_1-\alpha_2-\alpha_1\alpha_2)} \tag{3.7}$$

Assuming that $\alpha_1 < \alpha_2$ and comparing the equations (3.6) and (3.7) to compare, it is possible to see that it is the case when $q_1 > q_2$. As the equations are symmetrical, if $\alpha_2 < \alpha_1$, then $q_2 > q_1$.

So far, we know that firms care about each other. Hence, the above result illustrates that if one firm cares more about another firm, then this firm produces less quantity in the market. The quantity produced is a public information which means that firms know the social parameters of each other. The quantity drop will cause the increase in price following by higher profits. Therefore, the solicitude is expressed in nominal terms of increasing profits.

From the previous calculation we have seen that the equilibrium quantity following by *Lemma 1* is equal to $\frac{a-c}{b(3+\alpha)}$, then according to the inital conditions regarding the model,the profit of each firm is given by:

$$\Pi = (a - (\frac{2(a-c)}{(3+\alpha)}) - c)(\frac{a-c}{b(3+\alpha)}) \tag{3.8}$$

Taking the derivative w.r.t α in order to see what level of α maximizes profit,

$$\frac{\partial \Pi}{\partial \alpha} = \frac{(a-c)(a-c-a\alpha+c\alpha)}{b(3+\alpha)^3} = 0 \tag{3.9}$$

The only possible viable solution when the derivative of profit w.r.t α is maximized, when α=1.

This result illustrates that the profit is maximized when firms have a positive attitude

towards each others having the supportive argument for the social preference to exist.

Now, let's see of what happens to profits of a firm as its social preferences change if *Lemma 2* holds. Using the results obtained before and plug in into profit function for firm 1, we have:

$$\Pi_{\alpha_1} = (a - b(\frac{(a-c)(2-\alpha_1-\alpha_2)}{b(3-\alpha_1-\alpha_2-\alpha_1\alpha_2)}) - c)(\frac{(a-c)(1-\alpha_1)}{b(3-\alpha_1-\alpha_2-\alpha_1\alpha_2)}) \tag{3.10}$$

Taking the derivative w.r.t to α_1 in order to see the direction of profit as α_1 increases

$$\frac{\partial\Pi}{\partial\alpha_1} = \frac{(a-c)(a\alpha_2 - c\alpha_2 - 3a\alpha_1{\alpha_2}^2 + 3c\alpha_1{\alpha_2}^2 + 4a\alpha_1\alpha_2 + 4c\alpha_1\alpha_2 - a + c - a\alpha_1 - c\alpha_1)}{(3-\alpha_1-\alpha_2-\alpha_1\alpha_2)^3}$$

For the sake of simplicity, let's assume that the cost of producing is zero. This condition is needed to have a clear view about the sign of the derivative. Hence, the simplified version of the above equation is:

$$\frac{\partial\Pi}{\partial\alpha_1} = \frac{a(a\alpha_2 - 3a\alpha_1{\alpha_2}^2 + 4a\alpha_1\alpha_2 - a - a\alpha_1)}{(3-\alpha_1-\alpha_2-\alpha_1\alpha_2)^3} < 0 \tag{3.11}$$

By analyzing the equation (3.11), let's assume that that $0 < \alpha_1 < 1$ and $0 < \alpha_2 < 1$. It is clearly seen that denominator is always positive. However, the numerator has negative sign. In order to see, let's check its properties. The simple version of numerator is: $\alpha_2 - 3\alpha_1\alpha_2^2 + 4\alpha_1\alpha_2 - 1 - \alpha_1 < 0 \Rightarrow \alpha_1 < \frac{1-\alpha_2}{4\alpha_2 - 3\alpha_2^2 - 1}$. In this case, the numerator is positive and denominator has two roots $(\frac{1}{3}; 1)$, so if $\alpha_1 = \alpha_2 < \frac{1}{3}$ the derivative is negative. This finding supports the initial hypothesis that in Cournot Model the exogenous social preferences have a negative effect on profit.

3.2 Endogenous Social Preferences

I now explore the possibility that social preferences α_1, α_2 emerge as a choice of management or owners, who can influence the culture of the organization. I assume that each management makes individual firm choice with the aim of maximizing profits, and that the firms make their choices simultaneously. Moreover, firms observe each other choices of social preferences. One example is that companies observe managers that they

hire. As it was stated by Heidhues and Kőszegi (2018), the decision-making process starts from the board of directors who has interest only in maximizing the profit of the firm and managers they hire in order to do this. The problem lies in a proper motivation, an incentive for her to do her best, so that the expectations of main shareholders are satisfied.

As Heidhues and Kőszegi (2018) claims that the status is an important signal of managers to act more aggressively e.g. exhibiting the anti-social behavior, will surely lead to a profit maximizing. However, the board of directors are not necessarily have an appetite to have that manager.

This paper illustrates a probable continuation and the answer of why CEO doesn't want to step into the war with its competitors. My guess is that board of directors as known as " The Head" of the firm may have different social preferences towards their rivals and set the attitude towards them as a tool, pursuing the maximum profit outcome. This example clearly demonstrates the non-rationality bounded by the people who are responsible to reach the maximum profit outcome.

In this subsection I will illustrate a model in which the social parameter is chosen that way, so that the profit of the firm is maximized based on a social choice of " The Head". Once the culture is determined, employees of this firm choose prices with an intention to maximize the total utility of the firm, including the weight placed on the other firm.

Up to now, we know that there are two cases backed up by two different levels of quantity depending on the initial Lemmas about α. In order to critically evaluate the game described above, I will take the results from previous section, in which another type of game was solved and substitute them into profit function. As one may guess, the idea lies on the basis of the backward induction giving an opportunity to critically evaluate the effect of the social parameter "α".

Now, moving onto the next step of the model, let's evaluate the value of α accordingly to the result received from Lemma 2. Let's find the best response of the value of α_1 in which the equation is maximized. In order to do that we have to set equation (3.11) to zero and find the value of it. Hence, the value is:

$$\alpha_1 = \frac{1}{3\alpha_2 - 1}$$

This result is impressive, because as we may observe the social parameters of both firms are inversely related, meaning that if firm 1 exhibits pro-social activity, then firm 2 uses it, and hence epitomizes an anti-social behavior by pursuing the self interest outcome. However, this is not globally true. Since the game is symmetric, both firms are choosing same social attitude.

Now, considering the case of simultaneously choosing α, and following the symmetry of the model, we may see that by solving an equation $\alpha = \frac{1}{3\alpha-1}$, given that $\alpha_1 = \alpha_2 = \alpha*$, we receive two solutions: the first one is that $\alpha = \frac{1-\sqrt{13}}{6}$ and the second is $\alpha = \frac{1+\sqrt{13}}{6}$. Following the results, let's check the second order derivative:

$$\frac{\partial^2 \Pi}{\partial^2 \alpha} = \frac{a^2(3\alpha_2 - 6\alpha_2^3\alpha_1 + 2\alpha_2^2\alpha_1 - 10\alpha_2^2 + 6\alpha_1\alpha_2 + 13\alpha_2 - 2\alpha_1 - 6)}{(3 - \alpha_1\alpha_2 - \alpha_1 - \alpha_2)^4}$$

Then, by substituting the solutions $\alpha = \frac{1-\sqrt{13}}{6}$ and $\alpha = \frac{1+\sqrt{13}}{6}$, one may check that the derivative with the $\alpha = \frac{1-\sqrt{13}}{6}$ is negative.

Proposition 1

*The **Cultural Equilibrium** in a Cournot Oligopoly is an anti-social behavior.*

I have established that the *Cultural Equilibrium* expressed as the value of α is negative. Hence, the senior management chooses an anti-social behavior towards another firm. The result which I have received in the the section above may be considered as only one equilibrium in this setup,because each firm is better by choosing a negative α. As it was discussed, since both firms know the best response of each other they will choose a negative α. The positive parameter α is not an option, because both of them know that by choosing a positive α, the other firm will choose a negative. This may be seen as the phenomena of rationalizing the social preferences. Also, in the both of cases followed by different results received out from Lemma 1 and Lemma 2, assuming the simultaneous move game, it is clearly shown that the existence of pro-social behavior has a negative effect on both of firm's profit.

The result is supported by Tirole (1988), who mentions that the one criterion for a firm to be alive is the matter of non-negative profits. He says that regardless of other objectives that may be pursued from the side of managers or board of directors and complication to discover actions which maximize profit, not meeting the requirement will

lead to a shutdown of the firm. So, these are the cases when the anti-social behavior emerge, providing a solution to a firm be existed.

4 Bertrand Model with Social Preferences

The general game setup for this model is similar to Cournot Model described earlier. However, in contrast to Cournot Model, firms decide prices, rather quantities. In this setup, we have two firms which produce a homogeneous good.Firm 1 and firm 2 have *zero* cost of production, $c = 0$.

Firms cover the whole demand with no leftovers and compete on prices for the market share. Firms simultaneously choose the prices, resulting in the following levels of demand: $q_1 = 1 - p_1$ and $q_2 = 0$, if $p_1 < p_2$. For firm 2 is symmetrical:$q_2 = 1 - p_2$ and $q_1 = 0$, if $p_2 < p_1$. However, if $q_1 = q_2 = \frac{1-p}{2}$, meaning that the firms share the market demand equally. As we can see, the demand is fully controlled upon the prices that firms set.If the one firm will put a price a bit lower than the competitor, it captures the whole demand. Otherwise, it losing all consumers leaving the demand at zero. Moreover, throughout the model I assume that $\alpha_1 < 1$ and $\alpha_2 < 1$: a firm puts lower weight on its competitor's profits than on its own profits. This is a very plausible assumption in most circumstances.

Profit for firm 1 if $p_1 < p_2$ is given by:

$$\Pi_1(p_1, p_2) = (1 - p_1)p_1$$

and if $p_1 > p_2$, $\Pi_1(p_1, p_2) = 0$.

Profit for firm 2 if $p_2 < p_1$ is given by:

$$\Pi_2(p_1, p_2) = (1 - p_2)p_2$$

and if $p_2 > p_1$, $\Pi_2(p_1, p_2) = 0$.

However, considering the case when $p_1 = p_2$, profts are:

$$\Pi_1(p_1, p_2) = \Pi_2(p_1, p_2) = \frac{(1 - p)p}{2}$$

The utility of firm 1 is given by:

$$U_1 = \Pi_1(p_1, p_2) + \alpha_1 \Pi_2(p_1, p_2)$$

For firm 2:

$$U_2 = \Pi_2(p_1, p_2) + \alpha_2 \Pi_1(p_1, p_2)$$

Lemma 3 *There is no pure strategy equilibrium with positive profits.*

So far, we know that one firm may capture the whole market demand by undercutting the price.More specifically, let's assume that $p_2 \geq p_1 > 0$, then the utility of firm 2 is either $U_2 = \Pi_1(p_1, p_2)\alpha_2 = \alpha_2(1 - p_1)p_1$ if $p_2.p_1$ or $U_2 = \frac{1}{2}p(1 - p_1) + \frac{1}{2}\alpha_2(1 - p_1)p$ if $p_2 = p_1$, the latter is higher.

It is clearly seen that if firm 2 sets $p_2 = p_1 - \epsilon$, then its utility becomes

$$U_2^* = \Pi_2(p_1, p_2) = (p_1 - \epsilon)(1 - p_1 + \epsilon)$$

As we can see, $U_2^* > U_2$, for small enough ϵ because $\alpha_2 < 1$. Hence, firm 2 has a profitable deviation and if one firm will set a price which higher than the price of the competitor, it will shutdown because of the demand deficiency. In order for both firms be alive, the only price level on which they will safely maintain is the price which equals to marginal cost. Since, the marginal cost is zero, the price is equal to zero too. Moreover, it implies that profits of firms are equal zero too. Hence, the only pure-strategy Nash Equilibrium is given by zero-profit equilibrium.

Proposition 2

If firms are in the Bertrand Duopoly Competition, then the social preferences have no effect on price nor profit.

In this case, the logical consequence is that if the one firm has positive attitude, then it want to transfer some of the demand to the another firm. However, as we saw - it does not have any effect. The only way that it can do it is by putting a price a bit higher. Firm will shut down, because it will have no demand and zero profit. Moreover, even if the firm has anti-social behavior to another firm, we are observing the standard Bertrand Model without social preferences.

Nonetheless, Fehr and Schmidt (1999) state that social preferences do not matter in competitive markets. They made an experiment based on the ultimatum game and showed that whenever there is a responder or proposer and existence of the competition, agents construct their behavior based on a self-interest only.

5 Differentiated Bertrand Model with Social Preferences

5.1 Simple Model 2

In this section, I will illustrate a standard Bertrand model with differentiated products. As we have seen in the simple Bertrand setup, the social preferences do not matter at all, albeit they may exist. In Differentiated Bertrand oligopoly, in contrast, competition is not sharp, so there may be space for social preferences to be expressed.

Let me start from explaining the model itself. The demand for both of the firms are given as:

$$q_1 = a - bp_1 + bp_2 \to a - b(p_1 - p_2) \tag{5.1}$$

$$q_2 = a - bp_2 + bp_1 \to a - b(p_2 - p_1) \tag{5.2}$$

where $a > 0$ is the coefficient in the firms demand may be seen as the quantity firms sell if both of them have the same price. The coefficient b simply shows by how much price differences affect market share. Also, this is simultaneous move game, meaning that the symmetry of the best responses may be observed. The cost of production c for each firm is the same and it is constant, moreover, $a > c$. So, the profits for each firm are given by:

$$\Pi_1 = (p_1 - c)(a - b(p_1 - p_2))$$

and

$$\Pi_2 = (p_2 - c)(a - b(p_2 - p_1))$$

Following the general setup of the social preference model, I will start from evaluating the firm 1 and the utility of the firm is:

$$U_1 = \Pi_1(p_1; p_2) + \alpha_1 \Pi_2(p_1; p_2)$$

Again, the direction of the firm's utility depends whether it pro-social or anti-social towards the competitor. The *sociality* of the firm defines positive or negative α correspondingly. I

assume that $\alpha_1 < 1$ and $\alpha_2 < 1$.

I will start by evaluating and finding the best response for firm 1. The necessity of evaluating the firm 2 is falling off, because of the symmetrical responses. Now, just by maximizing the objective function it setting up it to zero, I show the best responses.

$$\max_{p_1} U_1 = (p_1 - c)(a - b(p_1 - p_2)) + \alpha_1(p_2 - c)(a - b(p_2 - p_1)) \tag{5.3}$$

$$FOC : \frac{\partial U_1}{\partial p_1} = 0 \Leftrightarrow 2bp_1 = a + bp_2 + bc + \alpha_1 bp_2 - \alpha_1 bc = 0$$

Then, just by solving a simple equation, one can receive that:

$$p_1 = \frac{a + bp_2 + bc + \alpha_1 bp_2 - \alpha_1 bc}{2b} \tag{5.4}$$

and

$$p_2 = \frac{a + bp_1 + bc + \alpha_2 bp_1 - \alpha_2 bc}{2b} \tag{5.5}$$

Lemma 4

If the social parameters α_1 and α_2 are equal, then the prices, p_1 and p_2 are equal too.

Using Lemma 3 as an instrument for showing the main results, and solving the equation received for p_1 by setting $p_1 = p_2$, I find that:

$$p = \frac{a + bp + c + \alpha_1 bp - \alpha_1 bc}{2b},$$

and hence, the prices are equal only in the case when social parameters are equal. So, now solving for price, given that $\alpha_1 = \alpha_2$, I receive that:

$$p = \frac{-bc - a + bc\alpha}{b(\alpha - 1)} > 0 \tag{5.6}$$

The price is positive, by checking the the expression above one can find that it holds, simply because $\alpha > \frac{a+bc}{bc}$ and $a > 0$. Moreover, the attitude of the firm may be considered as positive. Nevertheless, if we have a look on the demand function, we see that if the $p_1 = p_2$, the product differentiation disappears and the assumption getting us back to simple Bertrand model.

Lemma 5

If the social parameters of each firm do not equal, $\alpha_1 \neq \alpha_2$, then prices of them do not equal too, $p_1 \neq p_2$.

Lemma 4 is a reverse of Lemma 3 and leads us to a different outcome. In order to find an equilibrium best responses of each other, I substitute equation 5.4 to equation 5.5 for firm 1, and do the same, but vice versa, for the firm 2.
Using the method that I have described above, I find that the prices for both of the firms are:

$$p_1^* = -\frac{a\alpha_1 - bc\alpha_1 - bc\alpha_1\alpha_2 + 3a + 3bc - bc\alpha_2}{b(-3 + \alpha_1 + \alpha_2 + \alpha_1\alpha_2)}$$

and

$$p_2^* = -\frac{a\alpha_2 - bc\alpha_2 - bc\alpha_2\alpha_1 + 3a + 3bc - bc\alpha_1}{b(-3 + \alpha_1 + \alpha_2 + \alpha_1\alpha_1)}$$

As I have described in other sections, the effect of α should be examined in the profit function, because the profit of the firm is the crucial element in the firm's existence. In the next steps, I will substitute p_1 and p_2 into the profit function and take a derivative of it w.r.t α, to illustrate the value of social parameter α when its maximized.

$$\Pi_1 = (p_1 - c)(a - b(p_1 - p_2))$$

Then in order to simplify the expression, I calculate the longest part and receive:

$$p_1 - p_2 = \frac{a(\alpha_2 - \alpha_1)}{b(-3 + \alpha_1 + \alpha_2 + \alpha_1\alpha_2)},$$

so that the profit becomes,

$$\Pi_1 = (p_1 - c)(a - b(\frac{a(\alpha_2 - \alpha_1)}{b(-3 + \alpha_1 + \alpha_2 + \alpha_1\alpha_2)}),$$

then taking a derivative

$$\frac{\partial\Pi}{\partial\alpha_1} = \frac{-3a^2\alpha_2^2 + \alpha_2^2a^2\alpha_1 - 12\alpha_2a^2 + 8a^2\alpha_1\alpha_2 - 9a^2 + 15a^2\alpha_1}{b(-3 + \alpha_1 + \alpha_2 + \alpha_1\alpha_2)^3} > 0 \qquad (5.7)$$

In order to better understand what does the F.O.C. says to us, let's consider properties of it. If α_1 and α_2 are non-negative and less than one, i.e. $0 < \alpha_{1,2} < 1$, then the sign of

derivative is positive, meaning that the function is concave and the maximum is exist. In our case, it is the maximum value of α which is showing the upper-limit of pro-social activity of one firm to another such that the profit is maximized.

5.2 Endogenous Social Preferences

Function (5.7) is maximized, when the value of α_1 is $\frac{3(\alpha_2+1)}{\alpha_2+5}$. Since the game is symmetric, the symmetrical values apply to firm 2; hence, the profit function is maximized, when the value of $\alpha_2 = \frac{3(\alpha_1+1)}{\alpha_1+5}$. Considering the case of $\alpha_1 = \alpha_2 = 0$, we know that firms will want to deviate from it, pursuing the maximum value of the positive attitude. This means that with every additional increase of their kindness, their profit is increasing.

Now, let's find the equilibrium α_1 and α_2 when they are chosen endogenously. In order to do that, I will substitute the best response functions $\alpha_2 = \frac{3(\alpha_1+1)}{\alpha_1+5}$ and $\alpha_1 = \frac{3(\alpha_2+1)}{\alpha_2+5}$ to each other, so that

$$\alpha^* = \frac{3(\frac{3(\alpha_1+1}{\alpha_1+5} + 1)}{\frac{3\alpha_1+1}{\alpha_1+5} + 5},$$

after solving an equation we have two different values of $\alpha^* = (1; -3)$.As it may be observed the function is undefined within the values of $\alpha^* = (1; -3)$. However, as it was mentioned, the function is undefined on the turnover point of $\alpha = 1$. In order to have a well-defined game, therefore I assume that firms are restricted to choosing $\alpha_1, \alpha_2 \leq \overline{\alpha}$, where $0 < \overline{\alpha} < 1$ and $\overline{\alpha}$ could be arbitrarily close to 1.

Lemma 6

If there $\alpha_2 = \overline{\alpha}$, then $\alpha_1 = \overline{\alpha}$ is the global maximum of the profit function of firm 1.

At $\alpha_2 = \overline{\alpha}$ and $\alpha_1 \in (0; \overline{\alpha}]$, the function Π_1 is strictly increasing in α_1, since the first derivative is positive.

$$\frac{\partial \Pi}{\partial \alpha_1} = \frac{-3a^2\overline{\alpha}^2 + \overline{\alpha}^2 a^2 \alpha_1 - 12\overline{\alpha}a^2 + 8a^2\alpha_1\overline{\alpha} - 9a^2 + 15a^2\alpha_1}{b(-3 + \alpha_1 + \overline{\alpha} + \alpha_1\overline{\alpha})^3} > 0 \qquad (5.8)$$

Then it makes sense for firm 1 to choose the highest feasible α_1 which is $\overline{\alpha}$ to maximize Π_1. We need to show that if $\alpha_1 = \alpha_2 = \overline{\alpha}$, then neither firm has incentive to deviate from $\alpha_{1,2} = \overline{\alpha}$. In this setup, $\overline{\alpha}$ is the maximum value of social preference parameter. Without loss of generality, the profit of a firm with social parameter $\overline{\alpha} - \epsilon$ is lower compared when

$\overline{\alpha}$ chosen.

Proposition 3

*The **Cultural Equilibrium** with differentiated products is given by* $\alpha_1 = \alpha_2 = \overline{\alpha}$.

As it may be observed, the value of one social parameter is increasing in each other. The explanation for this phenomena is what I call *mutual altruism*, because as one firm tries to be good to another firm, then another firm does its best so that the first firm observes that the second firm also has positive attitude. The intuition is that both firms are responsive to each other positive attitude. So, if one firm is having good intentions to other firm, then other firm wants to respond in the same way. Moreover, it does not hurt their profit but opposite, pro-social behavior helps them to earn more.

Fehr and Fischbacher (2002) discussed why reciprocity is different from standard cooperation. First of all, each firm has to be sure that they are having positive intentions towards each other. This argument supports proposition 1, since for each of the firms the best response is to be nice to competitor.

6 Conclusion

Social preferences are an integral part of life. However, it is assumed that firms do not have social preferences and care only about their profits. This paper has illustrated that depending on market type of oligopolistic competition, firms with social preferences have different effects on profits. For instance, the Cournot model outcome is completely different from the Bertrand model with differentiated products. It is worth mentioning that by rationalizing social preferences via corporate culture, firms may increase their profits comparing to traditional outcomes. The Cournot model illustrated that the cultural equilibrium is to set behavior as an anti-social towards competitor, while the Differentiated Bertrand model adorned with pro-social behavior. Also, analysis of the Bertrand model revealed that social preferences do not matter in Bertrand type oligopoly. Firms undercut each other prices until they reach a price level, which equals to marginal cost.

Nevertheless, there are potential issues that need to be covered. For example, despite having social preferences, firms may have social preferences towards three types of price discrimination. One firm may like one type more than other. Alternatively, firms may exhibit social preferences in a way that they will not discriminate consumers. Various social preferences towards the strategy of firms may affect profit in different ways. According to Heidhues and Kőszegi (2017), firms exploit consumers by knowing their naivete towards the knowledge of produced products. However, firms might change their degree of exploitation by having social preferences. Moreover, this thesis did not cover potential theoretical issues such as analyzing firms behavior in a dynamic games. Firms may change their choice for social preference, because of reputational issues pursuing self-interest by maximizing profits. Moreover, the potential continuation of this paper is to check mixed-strategy equilibrium for different models affected by social preference parameters.

Finally, as we have seen, the combination of social preferences and competition has different results compared to neo-classical models. It is an important topic to study as firms are different by their nature as people and the behavior may be unpredictable, because it is almost impossible to gather an information about social preferences of firms and individuals in real world.

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