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SOCIAL PREFERENCES AND SUPPLY CHAIN TRANSACTIONS: AN ANALYSIS WITH BRAZILIAN DECISION MAKERS

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ABSTRACT

Supply contracts amongst suppliers and buyers can be used as powerful mechanisms to manage trade-offs between risks and costs in negotiations amid the constituent parts of the supply chain. In decentralized decision-making, as a trade transaction between a wholesaler and a retailer, social preferences can influence behavior of these decision makers. The objective of this study was to verify the effect of social preferences on transactions in supply chains, using Brazilian individuals with the purpose of comparing the results with those obtained in other countries. The methodology proposed in this study was quantitative, as variables already studied by previous studies were investigated. An experiment was conducted with three handlings (normal, status and relationship) simulating buying and selling situations in a supply chain. The results indicated that highlighting the performance status of a supply chain improves the efficiency of the chain when compared to normal transactions, or when there is a relationship between the links.

Keywords: behavior; contracts in supply chains; production

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1. INTRODUCTION

The purpose of supply chains according to Chopra and Meindl (2003) is to boost the value generated by this chain, which, according to the authors, means the difference between the value of the final product delivered to the customer and the effort employed by the chain to serve it.

For superior performance to be achieved, supply chain constituencies must work together and coordinate to pursue an overall goal aligned with the objectives of each link (CACHON, 2003).

Transactions in supply chains between suppliers and buyers can be carried out by a single decision maker who has all the necessary information, which refers to a centralized or integrated supply chain. Another way is when there are multiple decision makers with diverse incentives and information, which is the decentralized supply chain.

For coordination, contracts are used in supply chains, with the objective to optimize chain performance. Contracts also allow the risk arising from supply chain uncertainty to be shared between the parties (HÖHN, 2010).

Social objectives, such as justice, status and reciprocity, are social preferences sought by decision-makers in supply chain contracts (LEE; SEO; SIEMSEN, 2018). These social preferences influence trades in supply chain transactions (LOCH; WU, 2008).

In studies carried out abroad on supply contracts (LOCH; WU, 2008), it was found that social preferences affect decision-making in negotiations of decentralized supply chains, influencing the individual behavior of decision-makers. In this way, this study aims to investigate the effect of social preferences on supply chain transactions in Brazilian individuals and to compare them with studies conducted abroad, verifying whether there is a difference in the amplitude of the bias.

Initially, a review of the literature on behavioral operations, an approach on contracts and coordination in supply chains and social preferences, and transactions in supply chains was carried out.

The present work is organized in seven parts: introduction, where the objective of the study is mapped out; theoretical reference; methodology used and

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characteristics of the sample; analysis and discussion of results; the final considerations, limitations and suggestions for future work;

2. LITERATURE REVIEW

Behavioral operations, procurement and supply chain coordination, and social preferences and supply chain transactions will be addressed in this section.

2.1. Behavioral operations

Behavioral Operations is a sub-area of Production and Operations Management that has gained prominence abroad, however, in Brazil, it is still absent from studies (DA SILVA, 2015).

This investigative area makes it possible to understand the relationship between the field of operations and people, and how this interface impacts operational performance in organizations (SILVA, 2015).

According to the research by articles published in six renowned journals on the subject behavioral operations carried out by Bendoly, Donohue and Schultz (2006), there has been a record of publications since 1985.

The influence of behavioral issues in relation to economic activities has been researched in many fields of study, such as marketing, accounting, management and economics, however, in Operations Management, research is still scarce (BENDOLY; DONOHUE; SCHULTZ, 2006).

A study carried out by Da Silva (2015) proposes suggestions of potential areas of production management and operations where behavioral analysis can be applied, based on previous studies.

Ribbink and Grimm's (2014) study came to the conclusion that, as is often the case in day-to-day supply chain operations, cultural differences also have a significant impact on negotiations.

The article elaborated by Silva (2015) pointed out that there is a strong tendency on studies regarding decision making, where biases and heuristics make decisions subject to errors, and that there are cognitive factors, such as the social and individual understanding involved. It also states that motivation may be the reason for numerous operational problems, because people are motivated for various reasons.

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The field of study of behavioral operations has advanced in three levels: individual, group and organizational, having relation between them. Therefore, managers must take into account behavioral factors so that the best decisions are made, discovering reasons for possible errors in the process and acting effectively in operational practices.

Several aspects of behavioral operation such as social behavior, relationships, rewards, interaction, emotions, and motivation are similar to the issues raised in human relations theory. Although it is a developing area of study, the behavioral operations field addresses a questioning about the mechanistic view that exists in operations management. In this way, the differential consists in admitting that human behavior must be aggregated in processes and decisions, since all actions practiced in organizations are subject to it (SILVA, 2015).

Based on an article by Lee, Seo and Siemsen (2018), which analyzed experimental studies in the context of behavioral laboratory operations from 2006 to 2016, the three most researched experiments in operations were the newsvendor model, the auction and supply chain contracts. The newsvendor model can be found in a nationwide study by Ota and Da Silva (2017), in which the authors replicated the experiment conducted by Bolton and Katok (2008) and Feng, Keller and Zheng (2011), with the purpose of comparing their results with those obtained in surveys conducted abroad.

Thus, this study addresses the experiment of supply chain contracts.

2.2. Supply chain contracts and coordination

According to Simchi-Levi, Kaminky and Simchi-Levi (2010), in a common supply chain with two negotiators; a supplier and a buyer, the following order of events follows: the buyer, based on a demand forecast, decides the quantity of products that will optimize profit and makes the request to the supplier, who reacts to the order made by the buyer. In this way, this order of events represents a decision-making process in sequence, and thus, this chain is called a sequential supply chain, where each subject establishes his actions, regardless of the effects of his decisions in other parts. The authors say that this tactic does not benefit all members in the chain, so it is not effective.

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Optimum supply chain performance can be achieved if organizations work together in a coordinated way, although this does not always happen because of the concern of the members in optimizing their own goals, resulting in inferior performance. In order to achieve the best performance, it is necessary for companies to work in a coordinated way, aligning the objectives of each chain link with the overall desired goal (CACHON, 2003).

Supply chain coordination, according to Giannoccaro and Pontrandolfo (2004), can be achieved by adopting a centralized or decentralized decision-making process. The first case occurs when there is only one decision-maker in the supply chain, who has all the information necessary and important for the decision-making process and also the power to implement these decisions; however, in this case, there is the hypothesis that this control is not realistic. According to Höhn (2010), decentralized control occurs when there are several independent decision-makers deciding at different stages of the supply chain, with different information and incentives. Currently, decentralized chains are a majority, as a result of outsourcing and globalization. The production sector, when outsourced, automatically distributes decision-making powers among various subjects.

Giannoccaro and Pontrandolfo (2002) affirm that contracts in the supply chain operated in decentralized decision-making are a tool to achieve coordination and to obtain coherent behaviors of decision-making subjects in a decentralized environment, as if the chain were being operated centrally, and another important objective is to optimize system performance (HÖHN, 2010).

Likewise, Simchi-Levi, Kaminsky and Simchi-Levi (2010) reiterate the use of supply contracts as important mechanisms to achieve global optimization and better management of trade-offs between risk and cost and also likely benefits.

The study presents several types of contracts, which differ based on the clauses that are celebrated between suppliers and buyers, which include how risks arising from uncertainty are shared between the parties in the supply chain (HÖHN, 2010).

A type of contract that seeks coordination in the supply chain is called wholesale-price, which, according to Cachon (2003), occurs when the supplier charges the retailer for a unit purchased at a fixed price. According to the author, the wholesale price contract is not normally considered a co-ordination contract because

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the supplier prefers a higher value in the price of its products, but this type of contract is often observed in the practice.

Another type of contract is buyback, where the vendor charges the retailer a value per unit bought at a fixed price, but returns the retailer a portion of the value per unit not sold at the end.

In the revenue-sharing contract, the vendor charges the retailer a value per unit purchased, and the retailer gives the vendor a percentage of their revenue.

The contract of quantity-flexibility, according to Cachon (2003), operates as follows: the supplier charges a fixed value for units purchased; however, it reinstates the retailer for the units that were not sold. In this way, this type of contract offers complete protection to the retailer, while the buyback contract does so in a partial way.

In the sales-rebate contract, the author states that the supplier charges a fixed value per unit purchased; on the other hand, grants the retailer a discount for each unit sold that exceeds a limit x, in order to encourage the effort to increase demand.

Finally, there is the quantity-discount contract, which, according to Cachon (2003), is a type of contract where the supplier grants the retailer a discount in the purchase of larger quantities. Coordination per unit purchased; while granting the retailer a discount for each unit sold that is obtained when the marginal revenue and marginal cost curves are in the ideal quantity.

According to their research, Cachon (2003) concluded that coordination in supply chains can be obtained by different types of contract. According to each organization, there is a form of contract that can suit your needs.

On the other hand, Katok and Wu (2009) based on their experiment with some types of contract, pointed out that the efficiency obtained was lower than the theory predicts.

2.3. Social preferences and supply chain transactions

Current research on hiring, according to Lee, Seo and Siemsen (2018), points out that decision-makers seek to achieve reciprocity, justice, and status, which are social goals, as well as economic factors. These social preferences, according to Loch and Wu (2008), influence supply chain negotiations.

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According to Rabin (1993), in contemporary economics it is inferred that subjects strive to achieve their own material advantages. But there was one exception to this kind of behavior that attracted the attention of economics studies: people who care about the well-being of the other, as well as their own well-being. However, this altruism, according to psychology, is more complicated, because it is not a continuous behavior, the subjects help when they are helped and are cruel with the people who hurt them, thus pointing out a concern of the subjects with justice. In his study, the author also noticed a possible reciprocity between the participants of the game.

The approach based on the Game Theory proposes to study problems where decision making occurs between individuals, in a situation of interaction, in which the decision of one affects and is affected by the other party (VASCONCELLOS, 2011).

The study of Loch and Wu (2008) was elaborated creating a sequential game where two players (player A and player B) choose a price. The two sums together determine the market price of a product (p = pA + pB). Player B determines its value from player A. The demand for this product is determined by the linear function of the price of that product q = 16-p.

If the cost of the product is zero, the profit of the first player in one round is given by πA = pA (16-pA-pB), and the second player's profit is πB = pB (16-pA-pB).

In the experiment made by Loch and Wu (2008), they randomly selected participants that played for 15 rounds.

At the end of the game, for a perfect balance, player A should choose p*A=8 and player B's preference should be p*B=4, where player A's profit would be π*A=32 and player B's profit would be π*B=16, which would result in an efficiency of 75%.

In the experiment conducted by Loch and Wu (2008), three conducts were studied: control, relationship and status. Each round of the game, the prices and profits of the two participants were displayed on each player's screen. In the control treatment, the players were chosen randomly and anonymously, and participated in the game without having any type of communication. In the relationship treatment, before starting the game, the participants stood face to face, introduced themselves and shook hands. Finally, in the treatment of status, at the end of each round the winner was announced that surpassed his opponent in the profits.

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According to hypothesis 1 raised by Loch and Wu (2008), the decisions of the values of the two players would be smaller in the treatment of relationship and greater in the treatment of status, in relation to the treatment of control. On the other hand, in hypothesis 2, player A's value decision could increase based on the value decision determined by player B in the previous round (by reciprocity), or player A's value may decrease if his pay in the previous period is greater (by status), and the same condition applies to player B.

The results of the experiment indicated that the social preferences modify the behavior and that, between the conducts there are significant differences.

3. METHODOLOGY

In order to reach the objectives proposed by this study, whose variables have already been studied previously, the applied sample was non-probabilistic and for convenience. Students from graduate level in logistics of a public higher education institution participated in the study. A total of 58 students (29 pairs) participated in this experiment, being 13 pairs in the Control dealing, 8 pairs in the Relationship dealing and 8 pairs in the Status dealing.

An experiment was carried out based on the methodology applied in the studies of Loch and Wu (2008), with the objective of identifying the behavior of the Brazilian decision makers represented here by the students of the upper level classes.

The design of the experiment was 3x1 in which the three treatments (control, relationship and status) were manipulated by a student profile (graduate level). In the Loch and Wu (2008) experiment, the randomly selected participants played for 15 rounds and made price decisions according to a demand function defined according to Equation 1.

$$q=16-p \quad (1)$$

Where:

q = demanded quantity

p = price

The tools used for the experiment (procedures, descriptions, instructions) were similar to previous studies, so that the results could be compared. However, unlike the

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original work, this experiment was performed in a classroom, by hand, and no software was used in the application of the experiment. We used LibreOffice Calc only for the calculations of demand, participants' profits and graphics.

In the application of the experiment, initially, the instructions of how the activity would be performed were informed to the students by the instructors. The students who participated in the control treatment were randomly divided, obeying the criteria of balancing gender and age for all treatments, and arranged in the classroom so that players A stayed in one extreme and players B in the other end of the room so that they could not discover the identity of their partner in the pair during the experiment.

The game instructions were given to each participant, as well as a 20 rounds sheet block (so that the study participants did not know when the experiment would end) to player A of each pair, containing the round number, price of player A and price of player B, and also a result sheet to each participant, for individual control of results.

Players A decided on their price of the product, the instructors picked up the sheets from that pairs' round, shuffled and then handed the sheets to their corresponding pair on the other side of the room, so they didn't find the identity of the other player. After player B decides on the price, based on the price that player A decided, the sheets were collected, and then the instructors made the prices of each player available on the board, the demand of that product in the market and the profits of each player of that round, so that the students could write down in their result sheets. Then the next round started, subsequently ending in round 15.

In the Status dealing, there was also no interaction of the pairs during the game, and the difference was the delivery of only one results sheet, who took turns between player A and player B of each pair during the game through the instructors, in addition to having the winner of each round announced on the board, in order to encourage competition between players. Already in the relationship dealing, before the beginning of the game, the doubles were introduced and shook hands, and it was emphasized that they (player A and player B) cared about each other. However, during the game, there was no interaction between the members, and each pair was assigned only a player's results sheet as well.

Hypothesis 1 of the theory raised by the studies of authors Loch and Wu (2008) predicts that decisions on player A and player B's price would be lower in Relationship

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and higher in Status, relative to Control. If social preference conditions do not have an effect, the three conducts of the experiment should show results that resemble the theories of rationality and selfishness, where pA=8 and pB=4, during all periods. In hypothesis 2, player A's price decision increases with player B's price decision in the previous round (reciprocity), and player A's price decreases if his win in the previous round is higher (status). The same goes for Player B.

4. ANALYSIS OF RESULTS AND DISCUSSION

As in the studies of Loch and Wu (2008), the impact of social preferences in the different treatments of this experiment was verified. Prices, decisions and evolution during the rounds were also checked.

Table 1 shows the prices, profits and efficiency of the doubles in the three types of treatment.

Table 1: Descriptive statistics in 15 rounds

Treatment	Average	Standard	Median
Control			
Price of A	5,4974	2,9574	5
Price of B	5,7333	3,2413	5
Profit of A	21,2	15,5483	24
Profit of B	20,2872	14,8951	22
Efficiency	64,82%		
Relationship			
Price of A	6,1083	3,5142	5
Price of B	5,2	3,3895	5
Profit of A	21,5583	14,8606	24
Profit of B	17,8583	13,5301	16
Efficiency	61,59%		
Status			
Price of A	5,3750	2,8845	5
Price of B	5,4583	2,8606	5
Profit of A	21,3333	14,7108	20,5
Profit of **B**	21,9500	14,5035	23
Efficiency	67,63%		

Source: Authors (2018)

The results indicate that different types of treatment are effective and change behavior in decision making, that is, people behave according to the environment in which they are.

This study showed that profits in the treatment of Status were slightly higher than in the Control and Relationship treatment, unlike the study conducted by Loch

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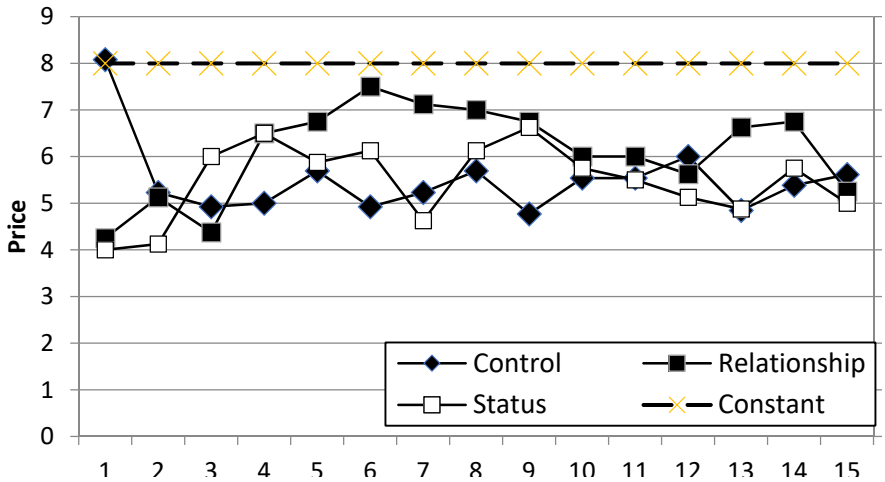
and Wu, where the profits were higher in the Relationship treatment and lower in the Treatment status, than in the Control treatment.

Next, player A's average price decisions in the 15 rounds are shown in Figure 1 along with the best responses (which would be the rational decision that would maximize the profit).



Graph 1: Price of player A for 15 rounds in the different treatments
Source: Authors (2018)

According to the revised theory, rational and selfish players should make the same price decision throughout the game, and this is not what happened in this study. An interesting fact is that even in the Control treatment, where the participants did not have any type of interaction, their decisions were lower than their best answer (Graph 3), as well as the decisions of player A (Graph 1).

It can also be noticed that the average decisions of the subjects do not change considerably over periods, which reinforces that the effects of the treatments remain stable throughout the game.

Still in the analysis of Table 1, it can be noted that the prices of the Status treatment are lower than in the Control treatment, and higher in the Relationship Treatment.

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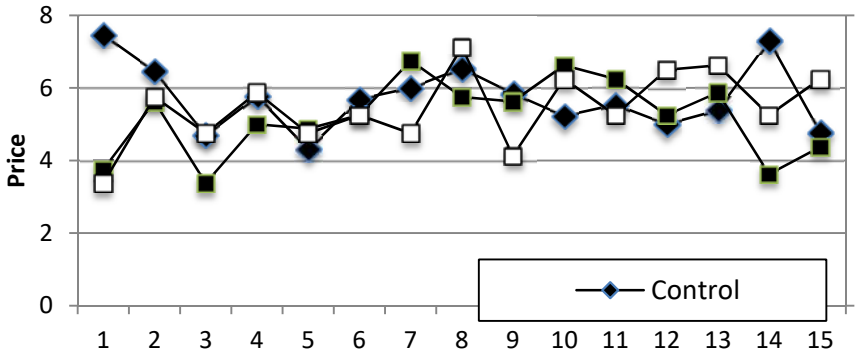
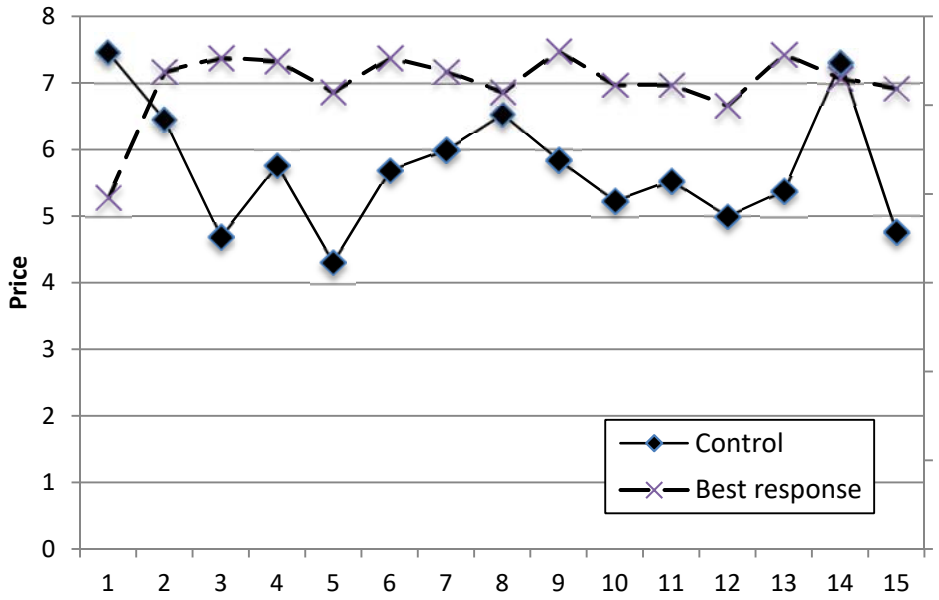


Graph 2: Price of player B and comparisons with the best price response
Source: Authors (2018)

Graph 3 shows that in the Control treatment, player B's price falls below the best rational response, contrary to the results of Loch and Wu (2008).



Graph 3: Price vs. Best Response in Control Treatment
Source: Authors (2018)

In the Status treatment, decisions of player B almost reach the best response (Graph 4), and in the experiment of Loch and Wu the response of player B is higher than the best answer.

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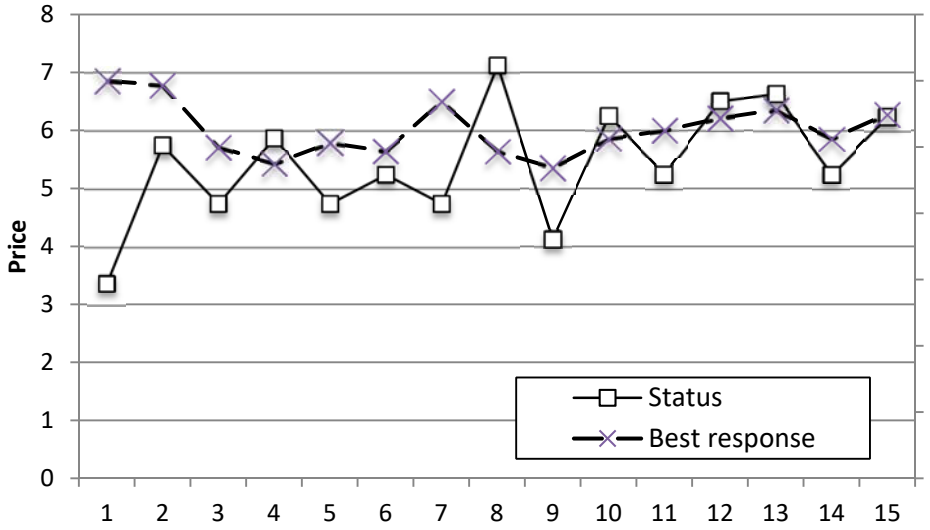
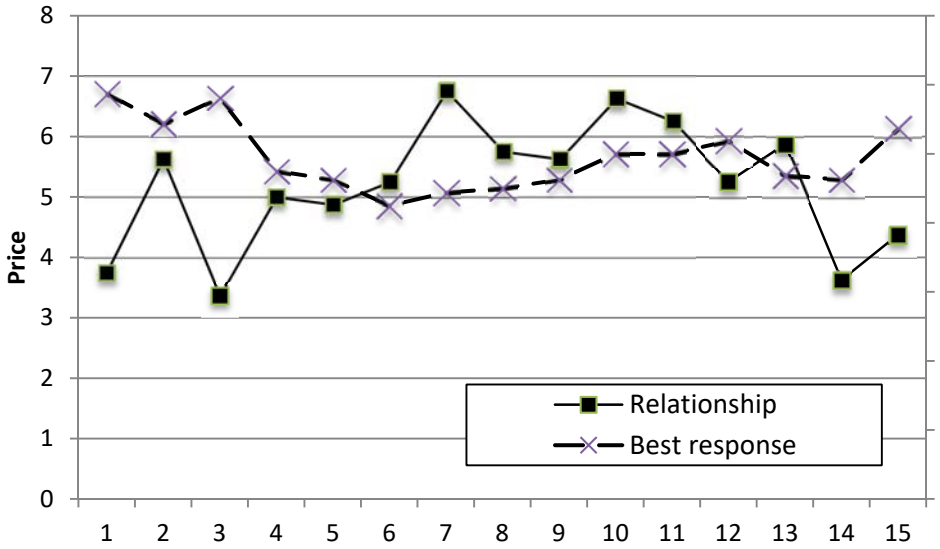


Graph 4: Price vs. Best response in Status Treatment
Source: Authors (2018)

In the Relationship treatment, shown in Figure 5, player B's decisions fluctuate strongly around the best answer, unlike the work of Loch and Wu (2008), where decisions remained below the best answer.



Graph 5: Price vs. Best response in Relationship Treatment
Source: Authors (2018)

Graph 6 presents the accumulated frequencies of the price decisions of player A (Graph 2) and player B (Chart 3) over the 15 rounds, in the three conducts. It can be seen from the graph that the social preferences in the different treatments change the behavior of the decision-making subjects.

In both graphics, the Control Treatment has its distribution on the left side, while the Status treatment has its distribution in the middle for player A, and to the right on

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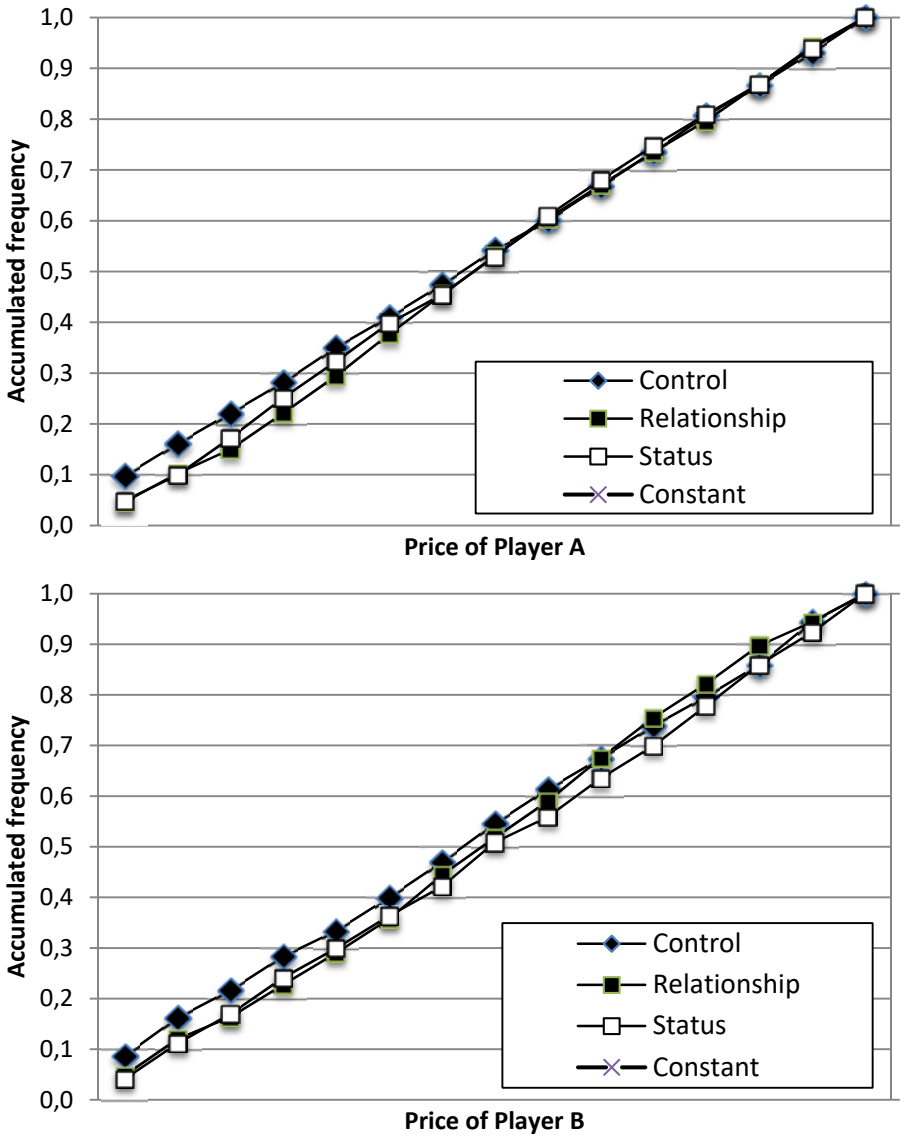
player B. Already in the Relationship treatment, in the decisions of player A, he remains on the right, and decisions of player B's stay in the middle.



Graph 6: Cumulative frequency of price decisions in all rounds
Source: Authors (2018)

Graph 7 shows the profit of players A and B respectively during the rounds.

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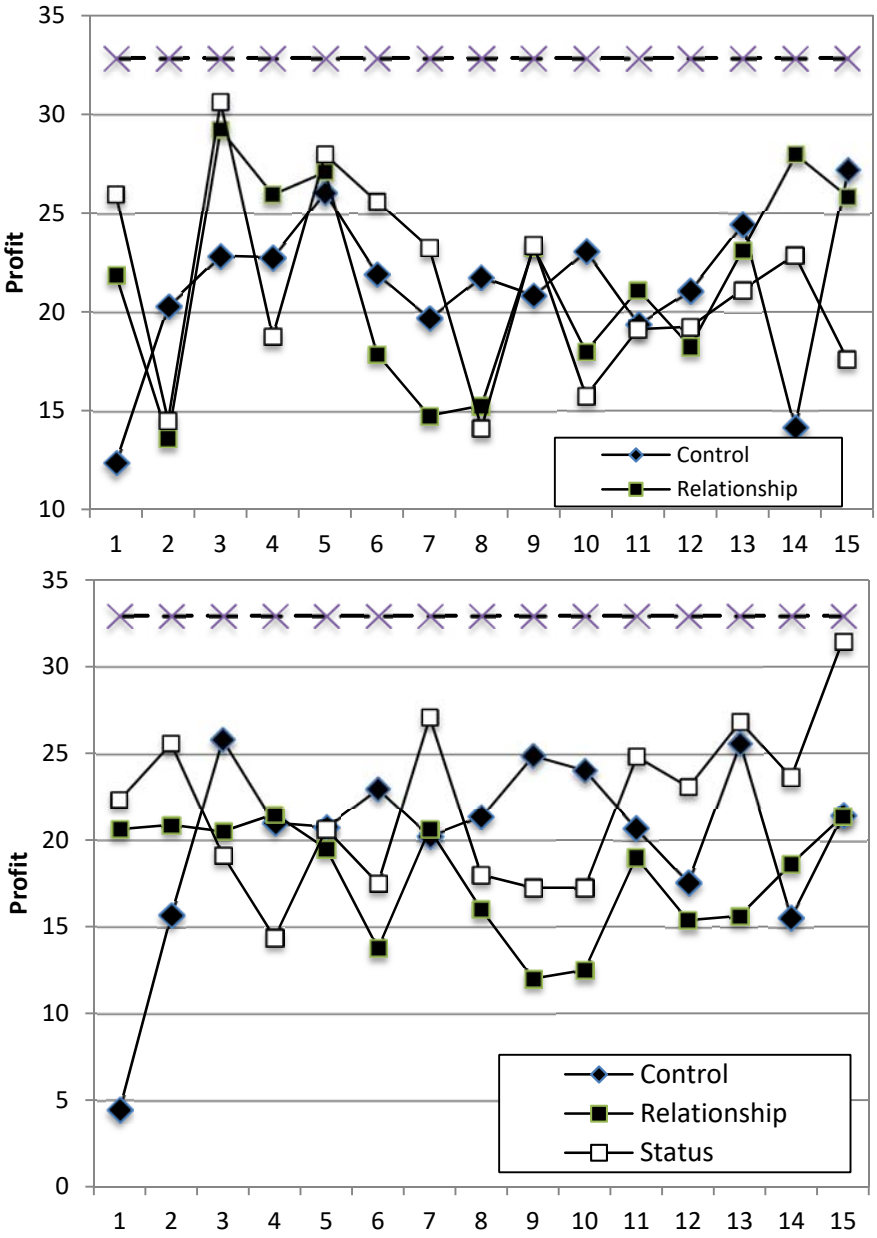

Graph 7: Profit of players A and B in the 15 rounds
Source: Authors (2018)

The efficiency achieved in the treatments shows that in Status an efficiency of 67.63% was reached, in Control 64.82% and in Relationship efficiency was 61.59%.

5. CONCLUSION

Most of the studies on supply chain contracting converge in negotiations with rational subjects and disregard the impact of behavior in this type of scenario (LOCH, WU, 2008). The present study aimed to verify the effect of social preferences in decision making in negotiations in a supply chain.

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According to the results of the experiment, it was verified that the subjects deviate from the quantity that maximizes the profit due to the effects of the social preferences. The greatest difference found was in the average player B's profit in the Status and Relationship treatments, where the average profit difference between these two conditions was 18.63%, affirming the best efficiency of the Status treatment in our study, with 67.63 %, unlike the work done by Loch and Wu (2008), where it was found that the Relationship treatment had the highest efficiency in relation to the other conditions.

Loch and Wu (2008) reiterated the importance of social preferences, which can both encourage cooperative behavior between the parties, but also produce the opposite effect by undermining profits. They also affirmed that another study on this theme pointed to social preferences as being as or more effective than contracts.

This study can be considered innovative in the national context, because it was the first to analyze social preferences in contracts and compare it with other work done abroad.

As a limitation to the study, the fact that the participants are not completely foreign to each other is highlighted, although there was no contact during the experiment, they study in the same teaching institution; another limiting factor was the number of students recruited in the research, as well as the fact that the experiment was applied manually.

Thus, as a suggestion for future research, it is recommended to replicate this study with a larger number of participants.

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