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Cheap Talk and Conflicts: a Laboratory Experiment

Master's Thesis

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Annotation

This thesis deals with the concept of non-binding claims (henceforth labeled as cheap-talk) and their effect on the outcome in situations exhibiting characteristics of conflict which might involve desire for coordination between subjects. Using a controlled experiment, this thesis brings an evidence that the possibility of cheap-talk might increase effectiveness of coordination in such situations.

Experiment was conducted using the strategy method of evaluation via game constructed according to stag-hunt schema. My findings are unique in the employed principle of modelling where subjects possess private information. However, it can be said that the results are generally consistent with existing findings in the experimental and theoretical literature on the effect of cheap-talk.

Declaration

Hereby I declare that this paper is my original authorial work, which I have worked out on my own. All sources, references, and literature used or excerpted during elaboration of this work are properly cited and listed in complete reference to the due source.

Brno, 3. January 2024

Author's signature

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I wish to convey my sincere appreciation to all people who have contributed to rendering my university studies not only enjoyable but also intellectually and skill-wise enriching experience.

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Introduction

While honesty and transparency are generally considered to be essential building blocks for trust and cooperation, there are certain cases where effective coordination can be reached by using even deceptive claims. In 2009, participant in the English TV show Golden Balls amazed the audience by his extraordinary strategy which helped her to coordinate with his opponent.

In the final stage of an episode, he and his opponent had to choose whether they play the action Steal or the action Split. Had both of the players played *steal*, none of them would get any portion of the reward. Had both played the action *split*, the reward would've been split into halves. Had the players played contrary actions, the one who played *steal* would receive the whole reward, leaving nothing to the opponent. By claiming he would steal under any circumstances the jackpot, yet assuring his opponent he would split the prize afterwards, he shrank the opponent's hypothetical rational pool of actions. The only chance for the opponent was to believe his intentions and play the action *split*, hoping he would get a half of the reward after the game's end. Once the players had revealed their choices, spectators were shocked he chose the *split* action as well. Using non-binding claims to which I'll further refer as *cheap-talk*, he was able to coordinate with his opponent and yet abide by his own moral standard and do the "right thing".

The need for coordination as well as the use of cheap-talk is, however, reflected in the history of humankind in more serious manner than solely via TV-shows. History is shaped by significant conflicts emerging from the lack of trust between national leaders, such as the First World War or Cuban Missile Crisis. Therefore, relevance of research in this field goes beyond people's mere entertainment. In the article which provides the theoretical foundation for this thesis, Baliga (2004) present mathematical proofs that non-binding claims (henceforth labelled as cheap-talk) might help to establish a Nash equilibrium in a game which is otherwise not expected to have one, as concluded by . Given the fact that authors' formalisation of the game, using random parameter values, has not been tested in the experimental literature so far, I would like to test their conclusions in a laboratory experiment.

The data was collected using strategy method where participants have revealed a whole pool of their choices. This way, I was able to analyse the data directly and also to simulate any number of rounds of experiment, allowing to also check how often did the game end up in Nash-equilibrium and Pareto-efficient state. Results show that cheap-talk has positive impact on all variables of interest, i.e. average payoff, probability of attaining Nash equilibria and Pareto-efficient outcome of the game. Additionally, I have shown that whereas players themselves are influenced by message of other player, they do not believe in such effect of their own action. Based on the data obtained from experimental sessions which were conducted using strategy-method, I formulate additional research questions about the effect of cheap talk, i.e. whether cheap-talk might increase the probability of attaining Nash equilibria and Pareto-efficient outcome of the game. I also quantify to which extent players believe about effect of non-binding message on their opponent's actions.

1 Review of Literature

This chapter provides a summary of relevant literature on cheap talk from three main perspectives. At first At first, I would like to lay down theoretical reasoning for the relevance of cheap talk in social sciences. After this initial explanation, I would like to elaborate on the work of Baliga (2004) whose theoretical conclusions about the effect of cheap talk serve as a basis for the construction of our experiment. Last but not least, I also review the existent literature dealing with the concept of cheap talk in laboratory experiments.

1.1 Concept of Cheap Talk in the Context of Theories of Conflict

To my best knowledge, the concept of cheap-talk, i.e. sending *noisy, non-binding and non-verifiable information* to increase one's utility, can be traced back to Crawford and Sobel (1982). Authors are explicitly mentioning strategic situation where the sender of information might be interested in sending *noisy, non-binding and non-verifiable information*. Authors define real-world applications involving a better-informed individual (an equivalent of sender) who might be interested in sending information which may or may not be true to some extent to a less informed individual, the receiver. Real-world examples defined by the authors are e.g. business partnership, lawyer-client, doctor-patient and also principal-agent problems which exhibit characteristics of a sender-receiver schema. substantially differs from the stag-hunt schema used in my thesis.

Regarding the concept of conflict in social sciences, Schelling (1980) attempted to explain real-world problems (represented by historical events, such as Cold War) using concepts of game-theory. Even though author does not specifically mention cheap-talk, he is aware of the threatening messages which agents (e.g. world leaders in his examples) might be sending to coordinate with opponents. In chapter dedicated to deception Schelling (1980), author also describes how uncertainty about the opponent's intentions might cause a spiral of mutually threatening actions which might eventually end up in the worst possible outcome (e.g. a nuclear war). Character of situations sketched in this chapter resemble to the ones used in my thesis as a basis for the experiment, i.e. situations where agents hold symmetric positions with varying assets they might be willing to sacrifice in order to reach the best outcome.

Generally speaking, the concept of cheap-talk is relevant to a broad range of effect observable in the history of humankind. Events such as wars or industrial contracts can be modelled using concepts derived from game theory. This conceptual similarity supports the argument of relevance of cheap-talk as an object of scientific interest.

1.2 Summary of Baliga and Sjörström (2004)

Given the central focus of this thesis on the conclusions drawn from Baliga (2004), I decided to summarise its key features in a separate section. Authors of the paper aim to explain a phenomenon of arms-race using mathematical and conceptual apparatus of the Game Theory. While the arms-race concepts help to visualise the concepts used

Table 1: Baliga & Sjörström Payoff Matrix

	A	B
A	$-c_i$	$\mu - c_i$
B	$-d$	0

Source: Baliga (2004, p. 357), own notation of actions for unification

the model is applicable also to other phenomena, e.g. to bank runs. Authors begin with summary of concepts not formalised yet or formalised only to limited extent and use 1 to formalise the game .

Baliga (2004, p. 357) show that under condition that $d > c_i > \mu$ for each $i \in 1, 2$, the game has 2 Nash-equilibria where equilibrium [N, N] is also Pareto-efficient. One of key concepts analysed by the authors is the *multiplier effect*, i.e. a situation where mutual distrust leads to Pareto-inefficient outcome. Authors hypothesise that probability of its emergence (in the form of arms race) is increasing in the convexity of the distribution of c_i. At the beginning, let's imagine that the fraction of strictly dominant strategy type is relatively low. Knowing that certain players are strictly dominant strategy types, some other players who prefer to arm if opponent arms as well, hence increase the proportion of dominant types. However, knowing that these initially non-strictly dominant types would arm as well, also less dominant types arm. This spiral of is spinning and in the end, unique Bayesian-Nash equilibrium where all players prefer to arm emerges.

Baliga (2004, p. 352). This form of reasoning where players try to anticipate the reasoning of opponents to different levels of abstraction is studied by Ellingsen and Östling (2010) and is further described in the 1.3.1 section.

Baliga (2004, pp. 359–363) hypothesise that allowing for any type of communication might revert the inefficient outcome by reducing players' uncertainty about the opponent's action. Naturally, messages cannot be uniform and must conditionally change upon player type. At this point, I would like to point that contrary to real world situations, authors base their analysis on the supposition of types' homogeneity, i.e. they expect fixed behavior across agents for given costs. A structure of the game is extended by Jelnov, Tauman, and Zhao (2021) who show that multiplier effect can be mitigated in a game where positive probability of repeating the game against the same opponent exists.

Having summarised the setup authors use to prove the existence of different Nash-equilibria, I would like to formulate following research questions to be addressed in this thesis. The first 3 points will be covered in the chapter on data exploration. Last research question will be formalised to greater extent and also quantified more precisely. The reason for this are limited resources which could be used to hold experimental sessions. It was not possible to run experiments with varying specifications of parameters, so the focus will be shifted mainly to the isolated effect of cheap talk, namely whether it helps to prevent the emergence of conflict in certain situations.

1. Does the multiplier effect occur?

2. What is the value of c with the cutoff property?

3. What are the statistical properties of the distribution of player types?

4. How does the possibility of communication affect the outcome of the game?

1.3 Relevant Empirical Literature

This section provides a summary of hitherto publish scientific work on the topic of cheap-talk with special emphasis on situations where agents are facing a coordination problem. As the empirically derived conclusions should have some underlying theory, I present the relevant experimental work in the context of theory it refers to.

The emergence of experimental literature on cheap-talk coincides with rise in popularity of experimental economics in general and can be traced back to the beginning of 1990s. Early experimental works on cheap-talk, e.g. Cooper et al. (1992) constructs his experiments upon the theory of coordination games as elaborated by Harsanyi and Selten (1988), whose concept of risk-dominance of equilibrium in coordination games was further elaborated in Aumann (1990).

Author's concept of conjecture (labelled as Aumann's conjecture by other authors) dismisses cheap-talk as an efficient tool for coordination in stag-hunt based games which exhibit risk-dominant equilibrium.

1.3.1 Risk Dominance and Aumann's Conjecture

Majority of empirical literature on cheap talk in the context of coordination games is to significant extent focusing on the concept of Aumann's conjecture which is deemed to cause the inefficiency of cheap talk which was formalised by Aumann (1990, pp. 615–621). It is based on the supposition that the player's preference over co-player's action does not imply his intention to choose the dovish action himself. As players might try to reason just like their co-player, risk-dominant equilibria are chosen regardless of their Pareto-inefficiency due to the fact that risk-averse players tend to prefer lower dependence of their payoffs on other player's actions. Author shows that for stag-hunt schema, cheap talk bears no additional information which could influence players' actions if the game exhibits the so called risk-dominant equilibrium.

Given the rather complementary relation of risk-dominant equilibrium to my thesis, I will introduce it only briefly. Suppose there are 4 unique payoffs in the stag-hunt schema. Payoff A is the Pareto-efficient one, Payoff B is Pareto sub-optimal Nash Equilibrium. Payoff C is yielded if opponent chooses hawkish action whereas co-player chooses dovish action. Payoff D is yielded under the exact opposite situation than C, i.e. dovish-hawkish pair. Under condition that $A > C, B > D, A > B, C > B$, it was shown by Reinhard Selten (1995) that risk-dominance emerges if $log(\frac{b-d}{a-c}) > 0$. Game formalised via payoff-matrix in table 2 is an example of risk-dominance as the risk-dominance coefficient is greater than zero.

Both players prefer the opponent to choose action A. However, action B is deemed to be safer regardless of the opponent action. Even if the pre-game communication is allowed, risk-averse subjects have incentives to signal action A whilst choosing B instead.

Table 2: Aumann's Payoff Matrix

		P_2	
		A	B
P_1	A	9, 9	0, 8
	B	8, 0	7, 7

Source: Aumann (1990, p. 616)

Aumann (1990, p. 616) shows that regardless of the difference between the $[A, A]$ and $[B, B]$, pre-game communication bears no information and players choose the $[B, B]$.

The first aim to empirically test the effect of cheap talk on effectiveness in a stag-hunt schema can be traced to Clark, Kay, and Sefton (2001). Authors set up two types of game using different payoff structures of which only one corresponds to the risk-dominant schema as introduced by Aumann (1990) . Results conform to the conclusions drawn by Aumann (1990). The form of cheap talk was restricted, using intention-based messages which has been later marked by Dugar and Shahriar (2018) as insufficient.

The concept of agents trying to reason as their opponents (which is essential to the emergence of Aumann's Conjecture) is related to the concept of k-level reasoning which is based in the suppositions that players in strategic situations try to think as their opponent. Given the fact that even opponent might be thinking as player 1 himself, reasoning is moved the the k-level 1 and so on. In the context of cheap-talk, k-level problematics was scrutinised by Ellingsen and Östling (2010, pp. 1696–1697). Important contribution of this article is that sending false messages might be caused by an incorrect anticipation of opponent's k-level rather than pure intention to lie.

1.3.2 Evidence on the Positive Effect of Cheap Talk

The inability to prove that cheap-talk might be an effective tool for the attainment of Pareto-optimality was the main motivation for Dugar and Shahriar (2018) in their study of unrestricted cheap talk. Authors' main research question is whether free-form communication might help to overcome the Aumann's conjecture. Authors use two specifications of the stag-hunt game which differs in the difference between $[A, A]$ and $[B, B]$ payoffs analogically to the Aumann (1990, p. 620)). It is naturally hard to categorise the free-form messages, however authors have arbitrarily labelled the messages as *non-informative, intention-based and reasoning-based*. Experimental results suggest that whereas restricted cheap talk using intention-based-messages does not help to escape the Aumann's conjecture, free communication helps to coordinate the agents. Additionally, authors show that even with restricted communication, Aumann's conjecture can be avoided if the messages inform about players' reasoning rather than intention signalling. High importance of reasoning-based messages can be found also in Cooper and Kühn (2014), whose empirical study of repeated Bertrand oligopoly game shows similar effects.

None of the aforementioned experimental articles introduced private information as considered in Baliga (2004) and to my best knowledge, none of the existent experimental literature considering private information studies its effect in a stag-hunt schema. For this reason, I survey 2 articles on the effect of cheap=talk in a battle of the sexes game. [1].

Li, Yang, and Zhang (2019) study the effect of cheap talk in a modified version of the Battle of Sexes game. Unlike in the standard BoS, players have no utility from the coordination on other player's action. Pre-game communication is here based on sending pre-defined messages stating how much utility (which is randomly assigned as player's type) is the player gaining from his preferred action. Therefore, players tend to overstate their types which hardens the coordination. Authors show that coordination via cheap-talk is possible as players coordinate on action indicated with higher utility for one of the players. Another finding is that treatment effect grows in the cost of miscoordination. Interestingly, authors show that for cheap talk o be effective, it is needed to be made simultaneously prior to the actual round of the game. Similar approach is applied in Hu et al. (2020) who also identify the treatment effect to be positive.

1.4 Aimed Contribution to Scientific Literature

In this chapter, I have summarised both theoretical and experimental literature dealing with the concept of cheap talk. Results show that coordination might fail under cheap-talk if messages sent inform merely about sender's action, rather than his reasoning. Effectiveness of cheap talk in a stag-hunt schema might also be sensitive to the ratio of payoffs for particular actions. If the payoff in Pareto-optimal state is not significantly higher than in the other Nash equilibrium, players might prefer to choose less risky Pareto-sub-optimal.

Whereas different specifications of the stag-hunt schema in terms of risk-dominance have been assessed both theoretically and experimentally, there is (to my best knowledge) no article studying the effect of cheap-talk under conditions where players' payoffs are also based on randomly generated value as concerned in Baliga (2004). The possession of private information which uncertain payoffs makes my experiment a relevant contribution to the literature dealing with cheap-talk in conflict situations. In my view, this renders my thesis a valuable contribution.

1. In the BoS, participants are interested in mutual coordination, yet their preferences are different. This game is used e.g. to model social groups bargaining or decision making under social dilemmas

2 Experimental Design and Hypotheses

In this section, I describe the experimental design. The main goal of the experiment was to test whether the possibility of cheap talk might alter the equilibrium of a game with stag-hunt-schema.

2.1 Formalising the Game

In this section, I would like to formalise the game in a structure used for the actual experiment. The design of experiment was driven by 3 main factors - the definition of game in Baliga (2004), approach used in the existent literature as discussed in 1.3.1 and also the resources available (both external in terms of budget and intenal in terms of the typical scope of a diploma thesis).

I would like to begin the formalisation by referring back to 1. To obtain the equation of player's indifference in Bayesian Nash equilibria, following equation can be formed:

$$-c_i p_{2A} + (\mu - c_i)(1 - p_{2A}) = -d p_{2A} + 0 \tag{2.1}$$

For the purposes of the experiment, it was needed to assign exact values to parameters d and μ, and define distribution for parameter c. As already outlined, resources for the experiment were rather limited, hence we have decided to hold parameters constant except for the parameter c_i for all sessions (ideally, we would vary e.g. the distribution of c_i to study the emergence of multiplier effect circle and also vary other parameters to study the Aumann's conjecture). In the end, values were assigned as shown in the 2.2.

$$c_i \sim \mathcal{U}(10, 190) \quad p \in \langle 0; 1 \rangle \quad \mu = 250 \quad d = 50 \tag{2.2}$$

The payoff matrix, derived from the original Baliga (2004), is shown in the table 3

Table 3: Payoff Matrix of the Experiment Game

		A	B
P_1	A	$(200 - c_1) \times p_{2a}$	$(250 - c_x) \times 1 - p_{2a}$
	B	$50 \times p_{2a}$	$200 \times 1 - p_{2a}$

I obtain the point of player's indifference between the 2 actions in mixed strategies using the equation 2.3. Payoff function is visualised in the plot 1.

$$(200 - c_1) \times p_a + (250 - c_1) \times (1 - p_a) = 50 \times p_a + 200 \times (1 - p_a) \tag{2.3}$$

$$\text{s.t.} \quad p_a \in [0, 1] \quad \text{and} \quad c_i \sim \mathcal{U}(10, 190)$$

$$c_1 = 100 p_a + 50 \tag{2.4}$$

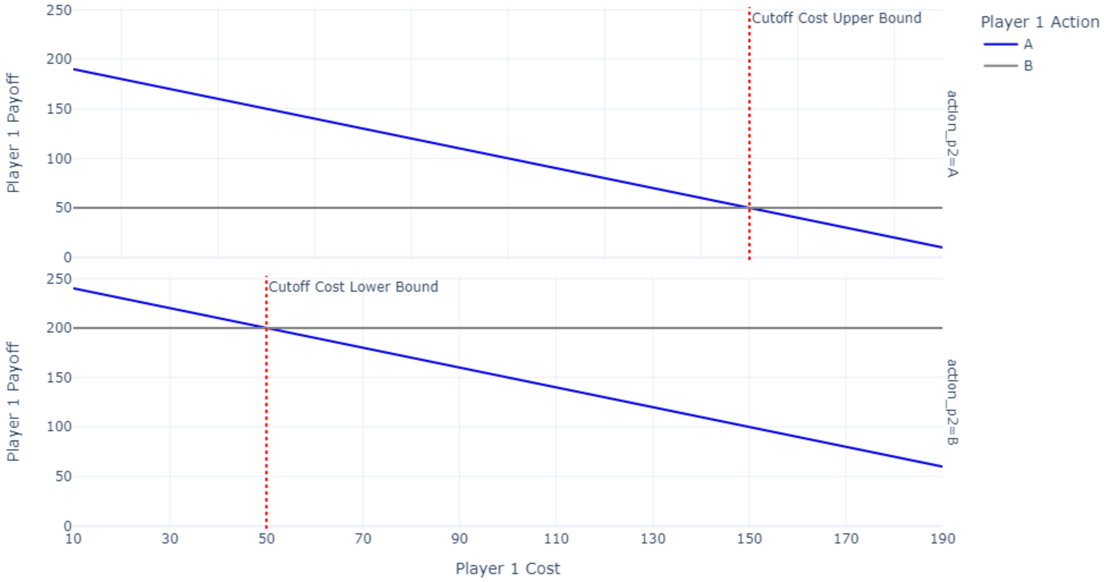

Figure 1: Payoff Function

At both ends of the distribution of p_i, points beyond which only one action is deemed to be rational can be found. In the section 2.3, I use the upper bound to identify non-compliers as they simply hurt themselves as well as the opponent by their action. On the other hand, I decided to allow players to behave irrationally, yet altruistically.

Last point I would like to cover in this section is the concept of risk-dominance. Referring back to the Reinhard Selten (1995), it can be shown that value of c_i parameter ensures that game exhibits the risk dominance as shown in the following equation.

$$R = \log\left(\frac{b-d}{a-c}\right) \tag{2.5}$$

Since the positive value of R indicates risk dominance, separating equilibrium can be formulated as

$$200 - c - 50 = 200 - (250 - c) \tag{2.6}$$
$$c_i = 100 = \mathbb{E}[c_i] \quad \text{where} \quad c_i \sim \mathcal{U}(10, 190) \tag{2.7}$$

2.2 Experiment Method

In this section, I would like to discuss the experimental method used in the context of other existent methods of data collection. One of the most comprehensive reviews of possible enquiry about participants' actions is presented in Brandts and Charness (2011) who distinguishes 4 main approaches:

2.2.1 Method Selection

1. Protocol Method - players note explain the reasons for particular choice

2. Selten Strategy Method - at first, players are acquainted with the game itself in 'mock rounds', then direct-response method follows. It is effectively a mixture of strategy and direct-response methods

3. Strategy Method - players reveal their choices hypothetically, without participating in the actual round of experiment

4. Direct-response Method - participants are paired with each other and reveal their choices in real time

The so called protocol method is the oldest experimental method which was criticised by Reinhardt Selten (1965) due to unnecessary complexity. Under this method, players not only reveal their actions, but also note down their reasoning. This reasoning is further qualitatively analysed along with decisions in the actual experiment. Author dismisses the method for its unnecessary complexity which cannot be properly categorized. As the only two benefits, he acknowledges the ex-post validation of conclusions derived from the results of experiment and possibility to detect participants who have not understood the instructions to the full extent.

Due to the above mentioned drawbacks, author proposes a new method (now called Selten Strategy) Brandts and Charness (2011, p. 376). It is a mixture of strategy method and direct-response method. At first, subjects become familiar with the game itself by playing mock rounds of the game. In the next phase, subjects formulate their complete strategy (also with possibility of consulting with experimenters). In the last phase, subjects are finally let alone playing the game against other real world participants. As the pros, Brandts and Charness (2011, p. 376) mention especially the fact that it induces more thoughtful actions and data collection is more economical than direct-response method. The simple strategy method does not involve direct exposure to other participants as players only record their actions for given costs. It is usually easier to implement and conduct than protocol and Selten-strategy methods. For simple games, recording participants actions via this method should be sufficient. Key benefit is the fact that players' actions are revealed for all hypothetical values (for instance, if distribution of parameters is not uniform, some edge cases might not be covered in direct response method at all). The most serious con of this method is that players are typically less emotions-driven than in case of direct responses. This might be contrary to some real world examples (e.g. situations where concepts of guilt, jealousy, honesty might play significant role, as concluded in Brandts and Charness (2011)).

Last method is the direct respond method which is the least economic one in terms of data collection. Since players reveal only subset of their eventual actions, especially if distribution of parameters of the game is non-uniform, edge cases might not be documented thoroughly. On the other hand, this method is the closest one to real-world situations where players respond to events which happen only once, often impulsively, without thorough exploration of the environment.

Overall, it can be said that Brandts and Charness (2011, pp. 387–391) does not conclude that one of the methods would be superior as evidence from studies where authors have used both methods rather shows that no difference can be reliably identified.

2.2.2 Our Method's Key Characteristics

Our experimental session was facing several limitations, especially the number of participants who were about to receive payoff exceeding 200 CZK each. For this reason, we have decided to use strategy method which allowed to collect much richer data set. The actual setup of experiment was following:

Two separate sessions were held, one for control (i.e. without the possibility of cheap talk), one as a treatment with restricted communication. Although the empirical literature favors the non-restricted communication, we have decided to use the restricted and intention-based form of communication. Given the fact that other methods seem to outperform this form of cheap-talk, it is quite reasonable to expect this method to provide the most conservative estimate of the actual effect of cheap-talk in our case. Both sessions were held in the Masaryk University's Economic Laboratory [1] in November of 2022 whereas each hosted exactly 22 participants. Instructions for participants can be found in the Appendix - A, B.

At this point, I would like to emphasise that we have decided to make the instructions as neutral as possible. This meant to replace players' actions labeled as "build new weapons" and "refrain from building" in Baliga (2004) simply by "A" and "B". The tendency of neutral instructions is quite common, yet still disputed. As shown e.g. in Abbink and Hennig-Schmidt (2006), in experiments dealing with morality, it might be even desirable to frame the actions in real-world terms which bear certain connotations. However, given the global political situation at the time our experiment was conducted (i.e. ongoing war in Ukraine), we decided to keep instructions neutral, not framing the actions e.g. in terms of conflict.In the instructions, we have also labeled opposing player as "other player" instead of "opponent" to lessen the impulsiveness of players' behavior.

Experiment walk-through was rather simple for the control group. After having time to get acquainted with the instructions, players were shown screens with certain value of cost for which they were required to reveal their action. Additionally, participants were also asked about their expectation of how would opponent choose in the particular situation. This way, participants were asked for gradually increasing costs (ranging from 10 to 190, incremented by 20). The payoff was determined followingly: For each player, costs were randomly drawn. In the next step, this player was paired with another participant using random unweighted uniform draw without replacement. In te next step. it was randomly determined whether player would be paid out based on action or prediction. Payoff based on prediction yielded either 50 CZK (incorrect) or 200 CZK (correct). Payoff based on player's action was determined by player's yield based on the payoff matrix.

For the treatment group, procedure was analogical, yet the number of revealed choices was larger. For each cost, players chose the message sent to their opponent, action for each possible message received from the opponent and prediction about

1. MUEEL Web Page

opponent's action for each possible message sent. At the end, participants were paired and randomly assigned costs. Based on the message sent by both players, columns for action and prediction were determined. In the last step, it was randomly selected whether players would be paid of based on action or prediction. This way, we have endured conscious choices of all variables.

2.3 Detecting the Non-Compliance

Before I proceed with the actual analysis, I would like to describe the procedure of the identification of participants who apparently did not understand the instructions to a full extent. These observations could negatively influence the results of experiment.

One such method could be the introduction of *control questions* where participants should prove their ability to select a rational question. However, I decided for a different approach and as a determinant of the participants' rationality and understanding to the instructions, I use 2 attributes of player's response. At first, I checked the monotonicity of player's action, i.e. whether player did not switch his actions more than once. This assumption is derived from Baliga (2004, p. 357) stating that

> *"Any equilibrium will have a cut-off property: if type c_i builds new weapons, then any type $c_0' < c_i$ will also build"*

It was also need to determine on which variables this criterion would be applied. I decided to filter participants based only on their actions, allowing the assumption of monotonicity to be violated for prediction and message sent.

Second criterion is based on the irrationality of choices as described in equation 2.3. However, it turned out that filtering participants based on the former also removed irrational participants who would've been filtered also by latter. In the end, after detecting non-compliants, the number of observations was

3 Exploratory Data Analysis

Before I proceed with the analysis, I would like to comment on the tools I have used. The data pre-processing as well as plotting was performed using Python programming language, predominantly the plotly and pandas libraries. Once the data was prepared for further analysis, I switched to R language as its econometric libraries offer broader flexibility in terms of which methods a researcher might want to employ, e.g. directly computing robust standard errors and using mixed models for repeated measures. All code and data (both raw and processed) can be found in my GitHub Repository. I am convinced this way of sharing the code is more convenient than including the code in appendix. In case of any questions regarding code and data, please refer to README file of the repository.

3.1 Distribution of Players' Actions

In this section, I present the most relevant features of the data set which was obtained from the experiment sessions. The O-Tree software typically produces many predefined variables which bear no information about the actual experiment session. The first step was to clean the data set and obtain only the relevant variables. Both data sets contain information on which action had particular experiment subject chosen for the given costs. For the demonstrative purposes, I present a subset of responses for one participant, final data was simply an extended version for all IDs.

Table 4: Control Data Example

ID	Action	Prediction	Cost
0	A	A	10
0	B	B	30
0	B	B	50
0	B	B	70
0	B	B	90
0	B	B	110
0	B	B	130
0	B	B	150
0	B	B	170
0	B	B	190

For the control data set, we have obtained two variables of interest, i.e. subjects' action and her/his prediction about the opponent's action. At this point, I would like to stress that subjects did not know the identity of the opponent, hence the prediction reflects the most probable action of an average opponent.

Full range of responses is more comprehensively communicated in the following bar plot where each row facet represents different "choice" variable, i.e. player's own action and prediction about opponent.

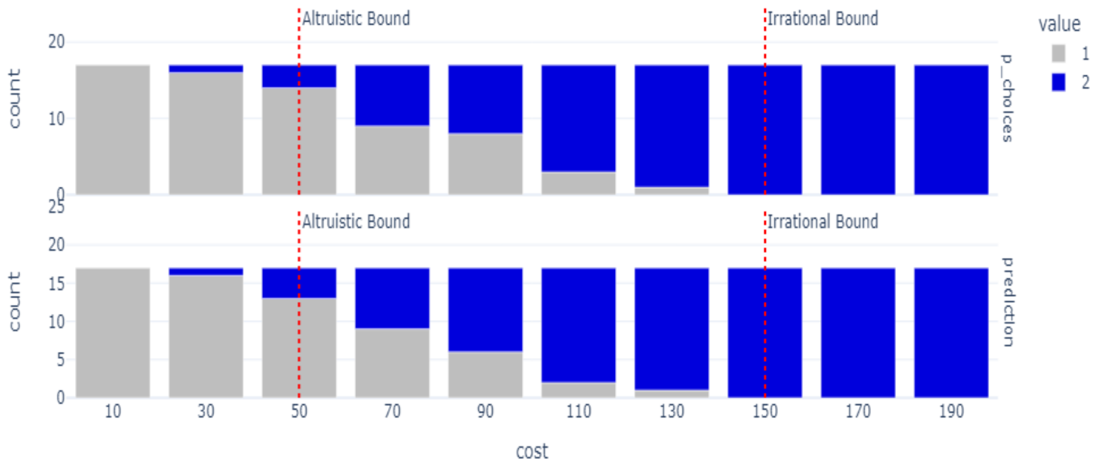

Figure 2: Distribution of Players' Choices, Control Data Set

I present analogical table and bar plot also for the treatment data set. Naturally, the treatment data set contains more information as the possibility of cheap talk has extended the pool of actions, e.g. that players could alter their actions based on the message they received from the opponent.

Table 5: Treatment Data Example

ID	Act|MessA	Pred|MessA	Act|MessB	Pred|MessB	Mess	Cost
0	A	A	A	A	2	10
0	A	A	A	B	2	30
0	B	B	B	B	2	50
0	B	B	B	B	2	70
0	B	B	B	B	2	90
0	B	B	B	B	2	110
0	B	B	B	B	2	130
0	B	B	B	B	2	150
0	B	B	B	B	2	170
0	B	B	B	B	2	190

Following figure visualises the treatment data set in a similar manner:

Interestingly, in case of treatment data set, the distribution of choices starts to differentiate for given costs. Whereas distribution of *Action* | *Message A Received*, *Prediction* | *Message A Sent* and *Prediction* | *Message B Sent* exhibits certain resemblance, variables *Message* and *Action* | *Message B Received* seem to be distributed differently.

From the plot, interesting phenomena stand out:

1. None of the players plays exclusively the action A, i.e. hawkish one

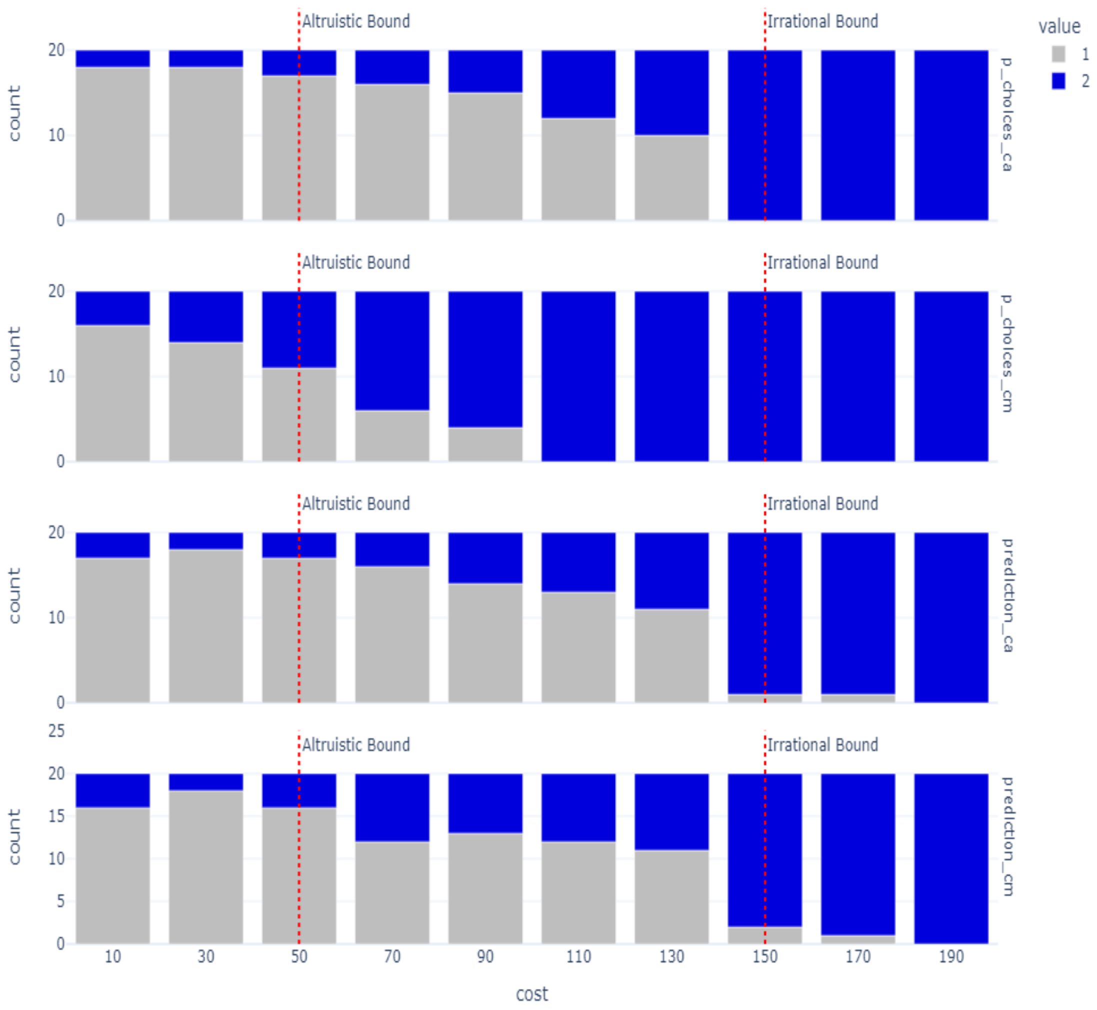

Figure 3: Distribution of Players' Choices, Control Data Set

2. It seems that players do not expect the opponents to be affected by their own message, yet their actions are affected by opponent's message (see different distribution of p_choices_ca vs. p_choices_cm)

3. From the distribution of Message, it seems that some players typically send "dovish" message despite actually playing hawkish action for lower costs

3.2 Game Outcome Properties

It is apparent that for lower costs, players do often signal their intention to play action A. This might point to the fact that players tend to be honest in their signalling. But how is this "honesty" related to the opponent's message? Plot 4 shows the proportion of

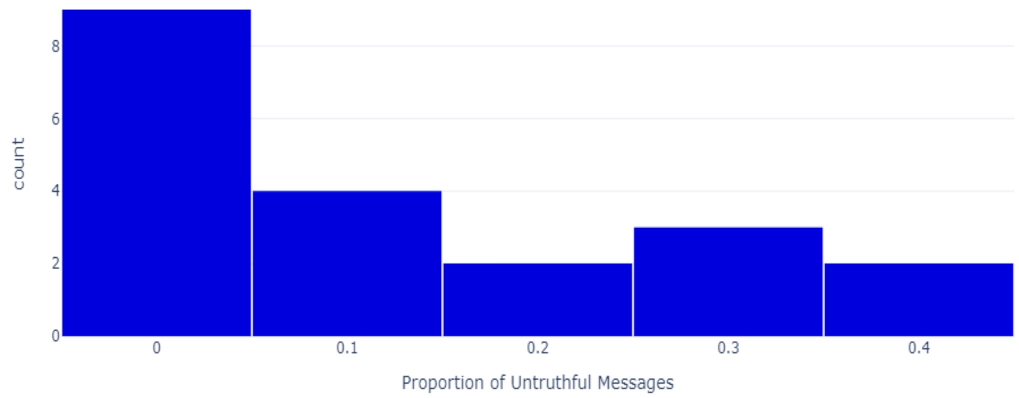

Figure 4: Proportion of False Messages

messages which simply cannot be truth as neither Action|Message A nor Action|Message B corresponds to the message sent [1].

Last feature of the data set I would like to visualise is the cost with cutoff property as discussed in (Baliga 2004). Cutoff property is defined simply as a value of cost at which subject changes his action. There are two essential limitations to the property. Firstly, some subjects might switch their strategy in different direction which hardens the message conveyed by the cutoff property itself. Secondly, there are subjects who do switch their strategy multiple times throughout the game. This was already discussed in **??**. As I am mainly concerned with the properties of players' actions, I have dropped subjects who have changed their own actions more than once. This way, I have dropped 3 subjects from control group while dropping only 1 from the treatment group. Cutoffs are visualised in the plot 5.

Apparently, distribution of cutoffs differs substantially for observed variables. Whereas control data set seems to have both action and prediction variables distributed similarly, situation substantially differs for the treatment group where following patterns might be observed. Firstly that "prediction" variables seem to be distributed similarly, i.e. players do not expect the opponent to be sensitive to the message received. Secondly, players' actions seems to be significantly affected by the opponents' actions which is reflected in the difference between distribution of both "action" variables.

3.3 Categorization of Players based on their Strategy

Baliga (2004, pp. 357, 361) attempt to categorize players based on their strategies for given costs. I replicate their categorization also for experimental data, albeit with slight

1. Proportion of false messages is shown on the x-axis, absolute count of the proportion is shown on the y-axis Whereas majority of the participants have sent truthful messages, some participants have used the cheap talk to deceive their opponent in up to 40 % of cost pool. It is not surprising that the only kind of deception was "signal dovish, play hawkish"

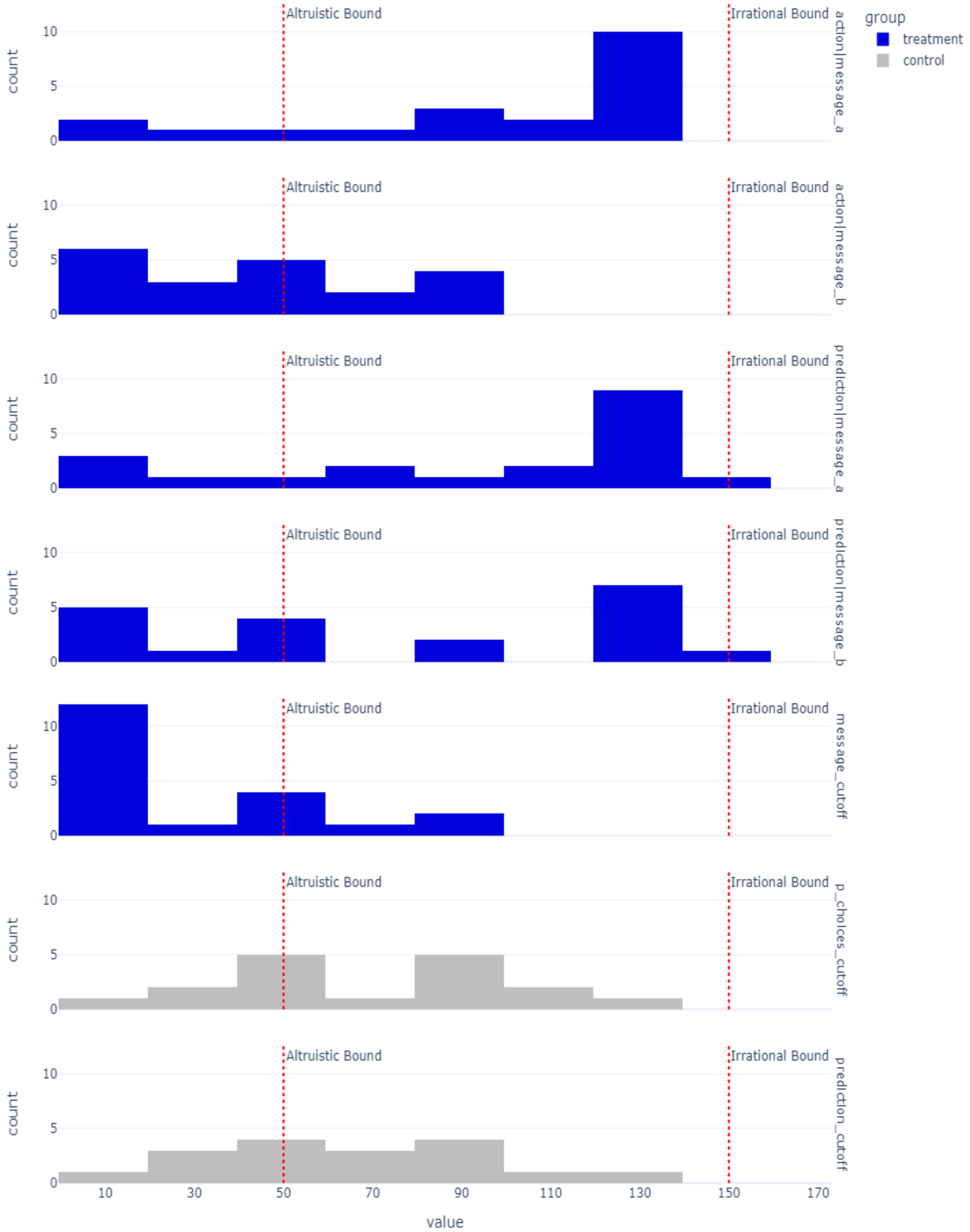

Figure 5: Cutoff Histogram

modifications to the number of categories. The maximum total number of categories cannot exceed $2^{n_{variables}} + m_{rules_{b}ased_{o}n_{c}osts}$ given that variables are binary and there is no interaction between cost and binary variables. Given that the aim of this thesis is to

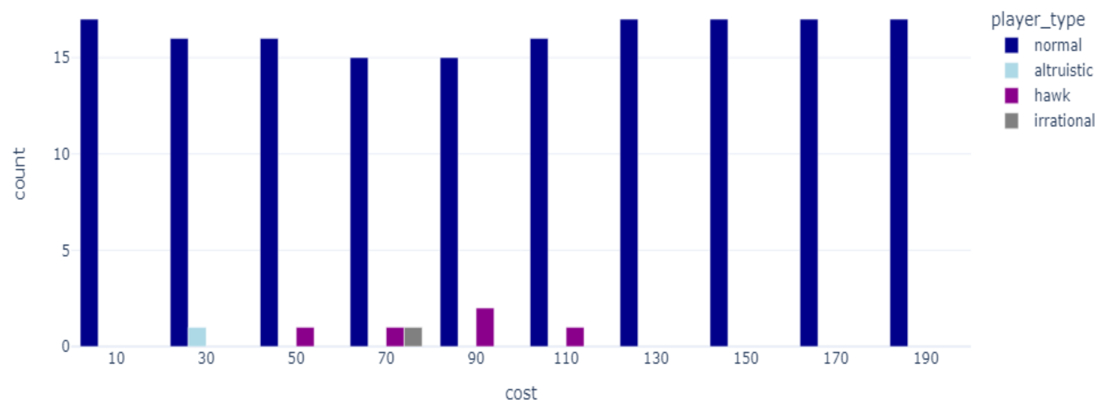

Figure 6: Player Types in the Control Group

scrutinize conclusions drawn by Baliga (2004) or at least explore the data in the context of original article, I decided to define following categories.

For the control group, rules are presented in the table 6.

Table 6: Control Data Set Player Types

Player Type	Rule	Description
Altruistic	cost < 50 and action $=$ B	Player who is concerned also about the opponent's outcome, despite lower yield of his own
Normal	choice $=$ prediction	Player who does not want to profit on opponent's account, yet mainly follows his own interest
Hawk	choice $=$ A and prediction $=$ B	Player who follows only his own interest without being concerned about opponent at all
Irrational	(choice $=$ B and prediction $=$ A) or (cost > 150 and choice $=$ A)	Player who harms herself as well as opponent via irrational choice

Relative proportion of player types is shown in the 6 bar plot. It is clear that normal type dominates.

Rules for the treatment data set are summarised in the 7

Analogically to control data set, following plot 7 shows the proportion of player types. The proportion of types is more diversified. Whereas the normal type dominates, also dove type emerges especially in the upper-middle part of the cost pool. On the other hand, for lower part of the cost pool, some players prefer the hawkish strategy.

Table 7: Treatment Data Set Player Types

Player Type	Rule	Description
Altruistic	cost $<$ 50, action = B	Player who is concerned also about the opponent's outcome, despite lower yield of his own
Normal	choice = prediction	Player who does not want to profit on opponent's account, yet mainly follows his own interest. Aims at coordination with other player
Dove	(message sent = B and choice = B) given that message received = B	Player who does not want to profit on opponent's account, yet mainly follows his own interest
Hawk	message = B and choice = A	Player who follows only his own interest, aiming at deception of the opponent
Irrational	(choice = B and prediction = A) or (cost $>$ 150 and choice = A)	Player who harms herself as well as opponent via an irrational choice

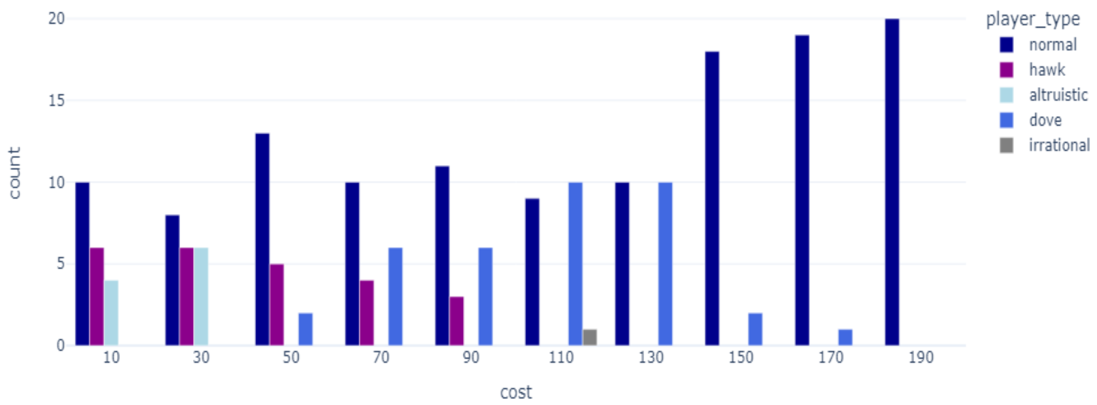

Figure 7: Player Types in the Treatment Group

3.4 Game Simulation

Given the strategy method used to collect data (see 2.2.1), no direct interactions of participants were studied. Therefore, I decided to simulate the game to be able to evaluate the effect of cheap-talk on the outcome of the game. This approach allows to compare the two groups in more straightforward as outcomes of the game are identical for both groups.

The strategy for simulation was quite simple. For each group, I have randomly paired (without replacement) players for each round. From the players' responses, it was possible to construct the game as if the experiment was conducted in the direct response setup. I decided to repeat this simulation 5000 times in order to ensure that mean cost (which is the only variable influenced by randomness) would be approximately the same for all players and also centered around the mean value of its distribution, i.e. 100. There are now 3 variables of interest further analysed in the results section, namely the payoff, proportion of Nash equilibrium state and proportion of Pareto-efficient state. Mean values are shown in the table 8

Table 8: Mean of Covariates by Group

treatment	payoff	nash	pareto
0	157.85	0.54	0.38
1	170.93	0.64	0.55
difference	13.08	0.09	0.17

It is apparent that treatment improves the results on all observed variables. It increases the mean payoff on average by 13.08 CZK, increases the probability that game would end up in a Nash Equilibrium by 9 % and increases the probability of reaching Pareto-efficient state by 16 %.

The distribution of costs is visualised using kernel density estimate, both for absolute payoffs (where each observation contributes to the density) 8 and for payoffs grouped by id, categorised by treatment status 9.

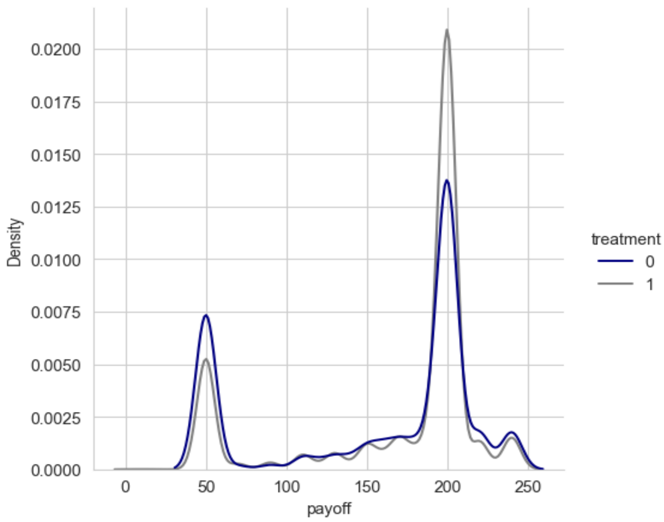

Figure 8: KDE Plot of Absolute Payoffs

The difference in both groups is apparent (proper statistical methods are employed in the section 4.2.5). Whereas the proportion of minimal payoff is higher in the control group, proportion of payoffs in the Pareto-efficient state, i.e. exactly 200, is higher in the treatment group.

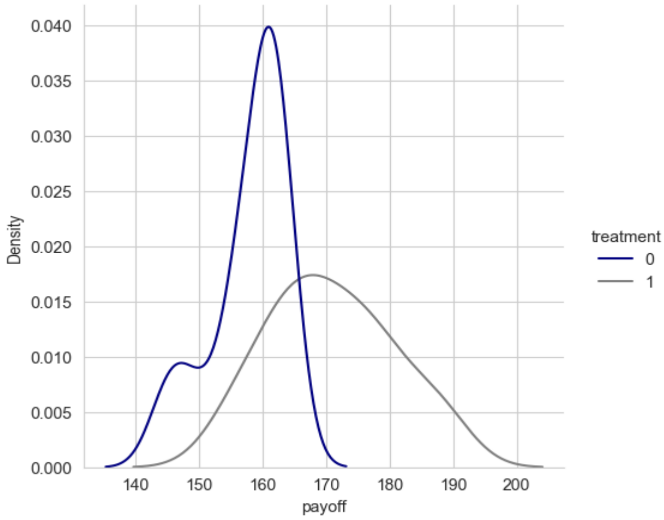

Figure 9: KDE Plot of Mean Payoffs per Participant

The aggregated KDE plot also shows positive treatment effect on payoffs as the mean of distribution (which is now mono-modal) is shifted positively. To estimate the effect more precisely, controlling also for other variables, such as opponent's actions, I will focus on the simulated data also in the next section.

3.5 Key findings from EDA

I have shown that *multiplier effect* does not occur as part of the experiment. At least for higher costs, there are players who choose the dovish action and also expect the same from their opponent. Regarding the costs with the *cutoff property*, these were shown to substantially differ both between the treatment groups and also within treatment group based on the message received. Their distribution also exhibits multi-modality. Last research question, i.e. estimating the effect of cheap talk on variables of interest, will be addressed in the next chapter.

4 Results

This chapter aims at the quantification of the effect of cheap talk. I will analyse the treatment effect from two main perspectives. In the first section, I analyse the treatment effect by looking at the data as it was collected via strategy-method. Variable of interest is the probability of playing action B for given covariates. Second part of the analysis will focus on the simulated data, namely how cheap talk influences the payoffs, attainment of Pareto-optimal outcome and Nash equilibrium.

4.1 Calculating the effect of cheap-talk on Choices of players

In this section, I analyse the effect of belonging to the treatment group on players' action as well as his expectation about the action of his opponent. Using several regression models, I would like to answer the following research questions:

1. Does the opponents' message have an effect on players' own action?

2. Does the added condition of sending messages affect the opponent's probability

3. Do players expect their message to have an effect on the opponent's action?

4.1.1 Selection of Appropriate Methods for ATE Evaluation

Simple comparison of means between groups bears certain limitations as it does not account for variance in both classes. Also this method cannot account for nonlinear relationships between the variables. Therefore, I use a generalised linear model to test isolated effect of message-sending on the outcome. For the purpose of interpretability, I also construct a linear probability models to express the ATE in more easily imaginable terms.

Before I proceed with the actual modelling, I would like to explain transformations of the data set which were needed to get respective coefficients. As might be seen in tables 4 and 5, each experiment group produced unique "choice" variables. [1] It was therefore needed to convert the data set to a long format. Applying this transformation yields a new column "variable" which now has 7 different levels which can be passed as dummy-encoded to regression models.

To obtain an unbiased estimate, I use both Ordinary Least Square model and Generalised Least Squares models. Given my interest solely on the effect of cheap talk, the OLS method should be sufficient as proposed by Deke (2014). Additionally, I estimate the effects also using logit model via maximum likelihood method to support the conclusion. In both types of models, I control for basic personal characteristics and game attributes of the particular observation, as shown in the table 9. [2]

1. Choice variables are choice and prediction for control group, message, two prediction variables for each type of message sent and two action variables for each type of message received

2. Type of variable or respective transformation is shown in parentheses next to the variable name. I use the z-score standardised *age* instead of plain years. This approach is quite common due to natural properties

Table 9: Expected Effects of Covariates

Variable	Effect	Explanation
Age (z-score)	No Effect	Not relevant for our hypothesis
Male (dummy)	No Effect	Not relevant for our hypothesis
Economics Student (dummy)	No Effect	Not relevant for our hypothesis
Cost (discrete numeric)	Positive Effect	The expected payoff from action B relatively increases in costs
Choice (dummy)	No Effect	These estimated effects would answer the research questions stated above. Based on the existing research, I assume the actions from treatment group have different effect on the outcome

Variable which I would explain in more detail is the dummy-encoded Choice Type. To be able to estimate the effect of cheap talk, it was needed to pass all possible actions to one model. Because I would like to analyse actions and predictions separately, it is more convenient to split the data set in long format into two subsets. First subset includes variables *action of control, action|message A received and action|message B received of treatment* and is used to test the hypothesis of cheap-talk effect on action. Second subset includes variables *prediction of control group, prediction|message A sent and prediction|message B sent of treatment group*. The level *message* is ultimately excluded from both data subsets used for regression as it is not relevant for any of hypotheses formulated above.

4.1.2 Construction of Models

There are 2 possible methods of the ATE identification. The first approach would use a subset of our data where control group would be accompanied by treatment group represented either by action after receiving message A (further noted as Action|MA) or action after receiving a message B (further as Action|MB, same logic applies for Prediction variables - Prediction|MA, Prediction|MB). This model would also contain the *treatment* covariate on which the ATE would be evaluated for both model specifications

Other possibility would be to one-hot-encode the category of Choice variable, splitting the data set into prediction and action subsets. Model would contain the choice of control group within intercept and choice variables as dummy variables.

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of age which naturally cannot be negative and also cannot exceed natural physiological boundaries. One might ask why the same approach was not imposed on the variable *cost*. This was due to the fact that this variable was taken from the uniform distribution of which subjects were aware

I decided to use both approaches and evaluate whether ATE is estimated with negligible differences in respective coefficients. Above described models are formalised using following equations. The first one stands for model where ATE is evaluated on treatment dummy variable, second one uses one-hot-encoding of choice category

$$Y = \beta_{intercept} + \beta_{male} + \beta_{econ} + \beta_{age} + \beta_{cost} + \beta_{treatment} + \epsilon \tag{4.1}$$

$$Y = \beta_{intercept} + \beta_{male} + \beta_{econ} + \beta_{age} + \beta_{cost} + \beta_{choice|mesA} + \beta_{choice|mesB} + \epsilon \tag{4.2}$$

Using the above defined regression model, I can test following hypotheses by asserting the coefficients of respective regressors as shown in the table 10.

Table 10: Table of Tested Hypotheses and Coefficients

Statement	**Null Hypothesis (H_0)**
$\beta_{\text{action\|mesA}} = \beta_{\text{action\|mesB}}$	Opponents' message effect is zero
$\beta_{\text{action\|mesA}} = 0$ $\beta_{\text{action\|mesB}} = 0$	The added condition of sending messages does not affect the probability of choice B.
$\beta_{\text{prediction\|mesA}} = \beta_{\text{prediction\|mesB}}$	Expected effect of the message on the opponent's action is 0.

Hypotheses expressed by coefficients' equality can be tested using F-test whilst hypotheses of coefficients' zero effect can be assessed directly from their respective p-values. The coefficients are shown in the table 11 [3]:

4.1.3 Results and Discussion

At first, I would like to make few remarks on the estimated models' correctness. First point is that I have checked for residuals which exhibit normality. I have used standard errors clustered around the participants' ID to account for auto-correlation of the residuals (which is a plausible assumption, given that we observe each participants' choices over the whole cost pool). I have also checked that covariates do not exhibit multicollinearity, hence the estimated effects should be unbiased. I repeated the procedure for all models and respective assumption hold. Please find respective tests in the appended R script. In the next step, I would like to comment on the estimated effects and decide on the above stated hypotheses

It is clear that regardless how the ATE is evaluated, the treatment effect is identified, showing that it is important which message a player had received. Whereas receiving message of action A decreases log-odds ratio of playing action B on average by 1.356, receiving message B increases this probability by about 1.497. Similar value of about ± 1.3 is obtained from the coefficients of second model. This way, I can reject the hypothesis

3. The p-values notation used in my thesis is following: +: p<0.1, *: p<0.05, **: p<0.01, ***: p<0.001

Table 11: Models of Action B Probability

	ATE|MesA	ATE|MesB	ATE|MesA + MesB	Linear
Intercept	−4.661***	−3.228***	−3.556***	0.046
	(0.665)	(0.620)	(0.491)	(0.048)
Cost	0.050***	0.055***	0.047***	0.006***
	(0.005)	(0.006)	(0.004)	(0.000)
Treatment	−1.356***	1.497***		
	(0.361)	(0.383)		
Male	1.373***	−0.225	0.419	0.042
	(0.367)	(0.363)	(0.272)	(0.029)
Age	0.707***	0.059	0.385**	0.039**
	(0.192)	(0.190)	(0.141)	(0.015)
Economics	−0.210	−1.295**	−0.589+	−0.059+
	(0.408)	(0.453)	(0.308)	(0.033)
Action | Message A Received			−1.318***	−0.136***
			(0.341)	(0.036)
Action | Message B Received			1.386***	0.139***
			(0.346)	(0.036)
Num.Obs.	370	370	570	570
AIC	243.7	219.7	380.7	395.8
BIC	267.1	243.2	411.1	430.6
Log.Lik.	−115.827	−103.862	−183.333	−189.923
RMSE	0.31	0.30	0.32	0.34

that ATE is 0, i.e. I have rejected the hypothesis that the added possibility of cheap talk would not influence the probability of choosing action B.

Since the log-odds ratio is hard to imagine in the real-world terms, I also estimate a linear probability model which is not advised to use in classification tasks. However, since our objective is to estimate the ATE, its use might be at least to some extent justified. Its coefficients seem to conform with the logit-models coefficients, i.e. effect of messages is significant in different directions based on the message player had received.

The only hypothesis which cannot be asserted from this regression table is the test of coefficients' equality which has to be tested using F-test of constrained vs. the full model. Very low p value shown in the following table allows to reject the hypothesis that effect of receiving a message A can be equal to the effect of receiving message B.

Table 12: F-Test of Coefficients' equality - Effect of message received

	Deg. of Freedom	Chi-squared	p_value
1	1	76.42	$2.2e^{-16}$

Last hypothesis left to test is the hypothesis stating that players expect their own messages to have zero effect on opponent. Not rejecting this hypothesis would mean that players' perception of messages is not symmetrical, i.e. while players are affected by opponents' message, they do not expect opponents to be affected by their message. Results are shown in the following table.

Table 13: Models of Prediction B Probability

	ATE|MesA	ATE|MesB	ATE|MesA + MesB	OLS
Intercept	−4.036***	−3.619***	−3.487***	−0.018
	(0.606)	(0.574)	(0.458)	(0.051)
Cost	0.045***	0.042***	0.039***	0.006***
	(0.005)	(0.004)	(0.003)	(0.000)
Treatment	−1.513***	−1.164***		
	(0.349)	(0.329)		
Male	1.061**	1.266***	1.122***	0.136***
	(0.342)	(0.337)	(0.260)	(0.031)
Age	0.768***	0.805***	0.744***	0.089***
	(0.186)	(0.183)	(0.138)	(0.016)
Economics	0.058	−0.274	−0.095	−0.009
	(0.389)	(0.378)	(0.277)	(0.034)
Prediction | Message A Sent			−1.373***	−0.164***
			(0.318)	(0.038)
Prediction | Message B Sent			−1.082***	−0.129***
			(0.313)	(0.038)
Num.Obs.	370	370	570	570
AIC	264.1	277.9	445.1	457.7
BIC	287.6	301.3	475.6	492.4
Log.Lik.	−126.060	−132.930	−215.568	−220.842
RMSE	0.32	0.34	0.34	0.36

I repeat the procedure of using F-Test to test the linear hypothesis of coefficients' equality:

Table 14: F-Test of Coefficients' equality - Expected Effect of Message Sent

	Res.Df	Df	Chisq	Pr(>Chisq)
1	564			
2	563	1	1.01	0.3142

P-value of the test does not allow to reject the hypothesis of equality of both coefficients. This result is of interest as it shows that players do not expect their action to have significant impact on the opponents' decision.

4.2 Treatment Effect Analysis via Simulation

Since the participants have revealed a whole pool of their actions, also differentiated by the opponent's message, I was able to perform simulation of our game. For each round, costs were randomly generated from a uniform distribution, I simulated 5000 rounds of our experiment to stabilise costs for each player at the mean of their distribution $= 100$. Using this simulation, I would like to test the following hypotheses:

1. Treatment has no effect on the probability of attaining the Nash equilibrium
2. Treatment has no effect on the probability of reaching the Pareto-efficient state
3. Treatment has no effect on players' payoffs.

4.2.1 Employed Methods

The most straightforward way to test hypotheses in this case would be to simply compare the means between the two groups. However, this approach exhibits certain limitations of which perhaps the most serious one would be ignoring the variability within groups. Another suitable method would be multivariate linear regression which would account for other characteristics of our participants. However, this method would omit one serious assumption imposed on the linear regression - the absence of auto-correlation. Since the data comprises from repeatedly measured individuals, the most suitable method seems to be the use of Mixed Models. Their use lifts the assumption of independence between observations. Despite having rejected the comparison of means between groups as appropriate for the identification of treatment effect, I find it useful to view these data in a the following table:

4.2.2 Selection of Covariates

To correctly estimate the causal effect of cheap-talk, it is needed to ensure that

From the diagram, there are not control variables which would bias the estimate when being controlled for, i.e. as a collider. Since the only coefficient of our interest is the *treatment* variable, its magnitude will be correctly estimated by controlling for other covariates. I present the variables as well as their expected effect in the following table:

I would like to stress that I use the very same set of covariates to answer all 3 research questions relevant for this section

4.2.3 Treatment effect on Nash-equilibrium attainment

Nash equilibrium refers to such state in the game where neither of the players could rationally deviate ex-post from his original action in order to receive higher gain. To obtain the variable, I simply recompute the counterfactual-gains for each participant. If at least one of these counterfactual gains is higher than the recorded ones, the round did not end in a Nash equilibrium.

I use a mixed logit model in total of 3 specifications - the baseline model only with varying intercepts, full model and restrained model with the missing *treatment* covariate to test the treatment effect using Likelihood-ratio test. Results are summarised in the following table.

The first metric of interest is intra-class correlation. It measures the proportion of variance that is captured by clustering. The interpretation of a very low value in our case

Table 15: Variables' Effects and Descriptions

Variable	Effect	Description
p_choices	Positive	Binary variable denoting that player plays action **B** if 1, **A** if 0. Derived for given costs and message
male	No Effect	Binary variable denoting Player's gender, no effect expected
econ_study	No Effect	Binary variable denoting whether participant's main field of study is economics-related. Even though certain studies have shown that such economical education might affect the outcome, I do not expect any effect
treatment	Positive	Binary variable denoting which group does the participant belong to, expected positive effect
cost	Negative on Payoff, Positive on Pareto-efficiency	Variable denoting players' costs for the given round. Since the variable directly affects payoff from action A, I expect a negative effect on payoff, yet positive effect on Pareto-efficiency
age	No Effect	Z-score transformed variable denoting players' age, no effect expected
opp	Negative on Payoff, Positive on Pareto-efficiency	Variable denoting opponent's costs, I expect reversed effects compared to the player's own costs, i.e., negative effect on payoff and positive effect on Pareto-efficiency
correct	Positive	Binary variable denoting whether players' prediction about opponents' action corresponds to an action actually chosen in the particular round. Expected positive effect on both variables
id	Not measured by definition	Clustering variable

is that effect of other variables typically does not differ very much between individuals. This is perhaps not that surprising, given that Pareto-efficiency is influenced also by opponent's action which is not reflected in the player's ID.

Information criteria favour the full model against the constrained one which might also indicate that the treatment effect is significant. This significance is apparent by looking at the coefficients of the treatment variable and its significance at the $\alpha = 0.001$ level. The actual value of 0.437 might be interpreted in the following manner: Belonging to the treatment group increases the log-odds that the game would end up in a Pareto-

Table 16: Regression of Nash Equilibrium Attainment - Table of Coefficients

	Baseline Model	Full Model	Constrained Model	OLS
Intercept	0.424***	−1.750***	−1.438***	0.124***
	(0.037)	(0.101)	(0.118)	(0.022)
Male		−0.133+	−0.142	−0.031*
		(0.073)	(0.100)	(0.016)
Age (Z-Score)		−0.025	−0.046	−0.009
		(0.038)	(0.052)	(0.008)
Economics Student		−0.060	−0.146	−0.002
		(0.088)	(0.119)	(0.019)
Treatment		0.437***		0.078***
		(0.072)		(0.016)
Cost		0.013***	0.013***	0.002***
		(0.000)	(0.000)	(0.000)
Opponent Cost		0.008***	0.008***	0.001***
		(0.000)	(0.000)	(0.000)
Correct Prediction		0.742***	0.742***	0.167***
		(0.012)	(0.012)	(0.003)
Action B		−0.801***	−0.801***	
		(0.015)	(0.015)	
SD (Intercept id)	0.227	0.220	0.306	0.047
SD (Observations)				0.461
Num.Obs.	190 000	190 000	190 000	190 000
R2 Marg.	0.000	0.162	0.156	0.106
R2 Cond.	0.015	0.174	0.180	0.115
AIC	253 006.4	230 057.3	230 080.9	245 054.4
BIC	253 026.7	230 158.8	230 172.3	245 155.9
ICC	0.0	0.0	0.0	0.0
RMSE	0.49	0.46	0.46	0.46

effective state by 0.437 on average which is the Average Treatment effect which I wanted to compute.

However, Bates et al. (2015, p. 27) suggest the likelihood ratio test between the full and constrained model as more appropriate for hypotheses testing in mixed models. It simply compares log likelihoods of two models and its low p-value provides base for rejection of hypothesis that both models are equally good in terms of predictive power. The results of likelihood test are shown in the following table where the likelihood-ratio-test favours the full model.

In the next step, I would like to comment on remaining coefficients. Personal characteristics are not significant. Costs increase the probability of reaching the Pareto-efficient state. Opponent costs also increase the probability. Correct expectations about opponent's action also increase this probability. Only coefficient with opposite effect than expected is the p_choices which has a negative effect on probability of reaching the

Pareto-efficient outcome. This might be interpreted that player could unilaterally increase his payoffs by playing action A instead of B.

Table 17: Nash Model Likelihood Ratio Test

	Df	LogLik	Df diff	ChiSq	p_value
Full Model	10	-115018.63			
Constrained Model	9	-115031.43	-1.00	25.60	4.2e-07 ***

4.2.4 Treatment effect on Pareto-efficiency of the Outcome

In this subsection, I would like to repeat the procedure applied in the previous case to estimate the ATE on the probability of reaching a Pareto-efficient state. Pareto efficient state is the state where player would decrease other player's (or even his own) payoff, should he change his action. In our case, there is a unique Pareto-efficient state where both players play the action *B*. Since the Pareto efficiency is directly affected by player's choice, I omit this variable as a look at residuals had suggested an incorrect specification of a model.

Unlike in the previous case, we see a higher proportion of variance in the data captured via clustering, it is about 0.2 in this case. This points at the necessity of mixed-models approach. As in the previous case, I use likelihood ratio test to test the significance of *treatment*.

From the tab

However, Bates et al. (2015) suggest the likelihood ratio test between the full and constrained model as more appropriate for hypotheses testing in mixed models. It simply compares log likelihoods of two models and its low p-value provides base for rejection of hypothesis that both models are equally good in terms of predictive power. The likelihood test's results are shown in the following table where the likelihood-ratio-test favours the full model.

In the next step, I would like to comment on remaining coefficients. Personal characteristics are not significant. Costs increase the probability of reaching the Pareto-efficient state. Opponent costs also increase the probability. Correct expectations about opponent's action also increase this probability. Only coefficient with opposite effect than expected is the p_choices which has a negative effect on probability of reaching the Pareto-efficient outcome. This might be interpreted that player could one-sidedly increase his payoffs by playing action A instead of B.

4.2.5 Treatment effect on Players' Payoffs

In this subsection, I would like to test the effect of treatment on players' payoff. As in the previous case, I use a mixed model to estimate the treatment effect on costs, given that comparison of mean between groups might be insufficient. Unlike in the previous, I use the Ordinary Least Squares which are more appropriate given that the payoff is expected to follow a normal distribution. Results of this regression are shown in the following table:

Table 18: Regression of Pareto-efficiency of the outcome - Table of Coefficients

	Baseline Model	Full Model	Constrained Model	OLS
Intercept	-0.147	-5.783***	-4.837***	-0.263***
	(0.091)	(0.308)	(0.383)	(0.049)
Male		0.176	0.149	0.020
		(0.246)	(0.327)	(0.035)
Age		0.134	0.071	0.017
		(0.131)	(0.174)	(0.019)
Economics Student		-0.371	$-0.635+$	-0.048
		(0.283)	(0.383)	(0.043)
Treatment		1.323***		0.170***
		(0.244)		(0.035)
Cost		0.027***	0.027***	0.004***
		(0.000)	(0.000)	(0.000)
Opponent Cost		0.029***	0.029***	0.004***
		(0.000)	(0.000)	(0.000)
Correct Prediction		-0.980***	-0.981***	-0.129***
		(0.016)	(0.016)	(0.002)
SD (Intercept id)	0.614	0.801	1.030	0.107
SD (Observations)				0.368
Num.Obs.	190 000	190 000	190 000	190 000
R2 Marg.	0.000	0.599	0.554	0.414
R2 Cond.	0.103	0.664	0.663	0.460
AIC	247 037.3	148 536.8	148 554.4	159 549.2
BIC	247 057.6	148 628.2	148 635.6	159 650.7
ICC	0.1	0.2	0.2	0.1
RMSE	0.48	0.35	0.35	0.37

Just like in the previous case, personal characteristics of participants have no proven effect on the payoff at the level of significance at the $\alpha = 0.01$ level. Information criteria have again favoured the full model against the constrained one. Average Treatment Effect is 13.03, i.e. belonging to the treatment group increases payoffs on average by 13.03 which comparable to the difference in mean for both groups which is 13.6. I also test the significance of belonging to the treatment group via likelihood ratio test. The Likelihood ratio test rejects that treatment variable is insignificant.

4.3 Discussion

Given the extensive amount models I have run in this section, I find it useful to summarise the results in a comprehensive manner. In total, I ran 3 series of models aiming at the identification of the ATE on variables of interest - players' payoffs, probability of reaching a Pareto-efficient outcome of the game and probability of reaching the Nash equilibrium. Results are summarised in the following table:

Table 19: Nash Model Likelihood Ratio Test

	Df	LogLik	Df diff	ChiSq	p_value
Full Model	9	-74259			
Constrained Model	8	-74269	-1	25.60	9.9e-06 ***

Table 20: Logit Model Likelihood Ratio Test

	Df	LogLik	Df diff	ChiSq	p_value
Full Model	10	-115018.63			
Constrained Model	9	-115031.43	-1.00	25.60	4.2e-07 ***

Generally speaking, even though the results seem to confirm the treatment effect, there are still many serious limits, mostly determined by resources and possibilities the experimental setting had to operate with.

Although the estimated ATE is quite robust and estimates seem to be correct, overly specific socio-demographic structure of experiment subjects makes any generalising assumptions look far fetched due to sampling bias. Also, 44 observations in total undermine the possibility to generalise the results of experiment quite heavily. Furthermore, I cannot guarantee the subjects in the group had not been coordinating themselves (no matter if consciously or not) before the experiment started. Since they have been recruited in large part from students of the same faculty, it is very likely they knew each other. This additional knowledge might have e.g. altered their likelihood to choose more altruistic actions.

Another issue is the nature of laboratory experiment itself. It remains unclear how much can be the results generalized to real-life situations as these are far more complex and peoples' interactions are richer than mere sending of intention-based messages. Of the most serious factors which might affect the outcome in real world, I would like to mention more complex means of communication as well as repetition of such situations where players might adjust their hypothetical options with view to the fact they might eventually meet their opponent in the future. Also the fact that players did not know the opponent's identity might alter the outcome in real world.

Nonetheless, I would like to stress that the main goal was to empirically test conclusions of Baliga (2004). Since the results seem to confirm their expectations of the effect of cheap-talk, I believe the purpose of this thesis is fulfilled. Furthermore, I have shown that Aumann's conjecture is broken in case of varying parameter of the game.

Table 21: Mean Payoff Group Comparison

	treatment	mean
1	0	157.28
2	1	170.93

Table 22: Payoff Regression - Table of Coefficient

	Baseline Model	Full Model	Restrained Model
Intercept	164.983***	139.605***	148.926***
	(1.640)	(4.248)	(4.451)
Male		2.394	2.125
		(3.063)	(3.743)
Age (z-score standardised)		0.290	−0.325
		(1.603)	(1.951)
Economics Student		−1.989	−4.583
		(3.707)	(4.469)
Treatment		13.032***	
		(3.049)	
Costs		−0.199***	−0.199***
		(0.003)	(0.003)
Opponent Costs		0.649***	0.649***
		(0.002)	(0.002)
Correct prediction		−20.767***	−20.775***
		(0.255)	(0.255)
Action B		−17.364***	−17.361***
		(0.318)	(0.318)
SD (Intercept id)	10.202	9.290	11.362
SD (Observations)	60.187	45.077	45.077
Num.Obs.	190 000	190 000	190 000
R2 Marg.	0.000	0.437	0.426
R2 Cond.	0.028	0.460	0.460
AIC	2 096 424.9	1 986 603.9	1 986 621.0
BIC	2 096 455.4	1 986 715.6	1 986 722.6
ICC	0.0	0.0	0.1
RMSE	60.18	45.07	45.07

Table 23: Likelihood Ratio Test of Treatment Effect

	Df	LogLik	Df	ChiSq	p_value
1	11.00	-993290.96			
2	10.00	-993300.52	-1.00	19.11	0.00

Table 24: Summary of ATE on Selected Variables

Variable Tested	Logit	OLS	Significance
Payoff		13.032	***
Pareto-Efficiency	1.323	0.17	***
Nash-Equilibrium	0.437	0.078	***

Conclusion

Insufficient communication might harm relationships both on micro- and macro-level. People who have endured relationship crises as well as significant historical figures would confirm that many conflicts can be resolved by signalling and carefully listening to other side's plans, reasons and arguments.

The aim of this thesis was to test whether possibility of cheap talk decreases probability of the emergence of conflict using a controlled experiment. Quantification of the effect was based on comparison between control group where cheap talk was not possible against the treatment group with added restricted, intention-based cheap-talk possibility. The data was collected using strategy method where participants have revealed their actions, predictions about their opponent and in case of treatment group, also the message sent to their opponent. This way, it was possible to analyse the data both statically, looking at their strategy in the given situation, but also via simulation of the game based on their choices.

At first, I have checked how does the possibility of cheap talk affect the probability that conflict emerges. It was shown that possibility of cheap talk significantly reduces the probability of the emergence of conflict. It was also shown that players are affected by the message received from the other player. Interestingly, they do not expect this effect of their own messages.

Secondly, I have analysed the data by assessing results of simulation. Hereby it was possible to assess the effect of cheap talk on 3 additional variables of interest - Pareto-efficiency of the outcome, attainment of the Nash equilibrium and payoff of players. Cheap talk was shown to have positive impact on all observed variables.

Overall, the estimated effect of cheap-talk conforms to other experimental and also theoretical literature. For the real-world implications, it is worth noting that to prevent conflict situations, even limited form of communication might help to coordinate parties involved. Conclusions of (Baliga 2004) were confirmed to the extent in which our experiment was set up. Contrary to the expectations, results have shown that participants have behaved altruistically even in the control session, i.e. without cheap talk. Interestingly, I have shown that even restricted communication used for the treatment group might help to evade the conjecture of non-effectiveness defined by Aumann (1990).

Any generalisation of a controlled experiment is hard in social sciences due to countless biases. On one hand, there are biases which might be introduced into the experimental session via e.g. non-representative as well as correlated sample. On the other hand, problem of limited external validity emerges. It is hard to imagine that participants who are paid marginal amount of money for their actions would act the same, should they make a decision from the position of statesmen, affecting millions of lives. Any generalisation must therefore be done with a vast caution. Main contribution of this thesis as well as of literature mentioned in the review section is the description of cheap talk as an easily accessible channel which might help to prevent conflict.

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A Control Session Instructions

This section contains instructions for particpants of the control session. It was not translated from the original Czech language.

Úvod V tomto experimentu zkoumáme rozhodování lidí ve strategických situacích. Na vašich rozhodnutích bude záviset, kolik si vyděláte peněz. Proto vám doporučujeme si následující instrukce důkladně prostudovat. Vydělané peníze vám vyplatíme na konci experimentu v hotovosti a v soukromí.

Pokud vás při čtení instrukcí nebo později při samotné hře napadne nějaký dotaz, prosíme, zvedněte ruku a moderátor experimentu k vám přijde a dotaz zodpoví.

Během celého experimentu nekomunikujte s ostatními účastníky, nepoužívejte mobilní telefon ani jiná elektronická zařízení vyjma počítače, u kterého jste usazeni, a věnujte svoji pozornost výhradně experimentu. V případě neuposlechnutí budete vyloučeni z experimentu bez nároku na odměnu.

A.1 Experiment

Během celého experimentu budete spárovaní s jedním účastníkem tohoto sezení, kterého budeme nazývat „druhý hráč“. Identitu druhého hráče vám nesdělíme. Budete se rozhodovat v následující situaci.

A.2 Popis situace

Rozhodnutí v této situaci spočívá ve volbě akce A nebo B. Možné výsledky vašeho rozhodnutí znázorňuje tabulka dole. Vaše akce se odráží ve volbě řádku: Podle toho, zda zvolíte A nebo B, budou vaše výhry pocházet z prvního nebo druhého řádku. Akce druhého hráče se odráží ve volbě sloupce: podle toho, zda zvolí A nebo B, budou jeho výhry pocházet z prvního nebo druhého sloupce.

		Druhý hráč	
		A	B
Já	A	Já: 200 - c, Druhý hráč: 200 - c	Já: 250 - c, Druhý hráč: 50
	B	Já: 50, Druhý hráč: 250 - c	Já: 200, Druhý hráč: 200

Pole ukazují možné výhry v korunách. Pokud tedy oba hráči zvolí A (pole vlevo nahoře), oba získají výplatu 200 – C Kč. Pokud jeden z hráčů zvolí A a druhý B, první hráč získá výplatu 250 – C Kč a druhý hráč získá 50 Kč. Pokud oba hráči zvolí B, každý získá výplatu 200 Kč.

Parametr C představuje náklad akce A. Může nabývat jakékoli z těchto hodnot: 10, 30, 50, 70, ..., 150, 170, 190, přičemž všechna čísla jsou stejně pravděpodobná. Hodnota C se losuje pro každého hráče zvlášť a může být tedy pro vás a druhého hráče jiná. Při rozhodování znáte svoji hodnotu C, ale neznáte hodnotu C druhého hráče. Co ovlivní výše nákladu C?

Hodnota C udává vaše náklady akce A. Čím je vyšší, tím je pro vás akce A méně výhodná. Pokud je vaše C mezi 0 a 50 Kč, je akce A výhodnější bez ohledu na akci druhého hráče. V tabulce dole vidíte situaci, kdy se vaše C rovná 25 Kč. Kdyby druhý hráč zvolil A (levý sloupec), získali byste volbou A 175 Kč a volbou B 50 Kč. Kdyby druhý hráč zvolil B (pravý sloupec), získali byste volbou A 225 Kč a volbou B 200 Kč. Vaše výplata z akce A je vyšší v obou sloupcích.

		Druhý hráč	
		A	B
Já	A	Já: 175, Druhý hráč: 200 - c	Já: 225, Druhý hráč: 50
	B	Já: 50, Druhý hráč: 250 - c	Já: 200, Druhý hráč: 200

Pokud jsou vaše náklady C mezi 50 a 150 Kč, je pro vás výhodné mít stejnou akci jako druhý hráč. V tabulce dole vidíte situaci, kdy se vaše C rovná 100 Kč. Kdyby druhý hráč zvolil A (levý sloupec), získali byste volbou A 100 Kč a volbou B 50 Kč. Kdyby druhý hráč zvolil B (pravý sloupec), získali byste volbou A 150 Kč a volbou B 200 Kč. Vaše výplata z akce A je vyšší ve sloupci, kde druhý hráč hraje A, a vaše výplata z akce B je vyšší v sloupci, kde druhý hráč hraje B.

		Druhý hráč	
		A	B
Já	A	Já: 100, Druhý hráč: 200 - c	Já: 150, Druhý hráč: 50
	B	Já: 50, Druhý hráč: 250 - c	Já: 200, Druhý hráč: 200

Pokud jsou vaše náklady C mezi 150 a 200 Kč, je pro vás akce B výhodnější bez ohledu na akci druhého hráče. V tabulce dole vidíte situaci, kdy se vaše C rovná 175 Kč. Kdyby druhý hráč zvolil A (levý sloupec), získali byste volbou A odměnu 25 Kč a volbou B odměnu 50 Kč. Kdyby druhý hráč zvolil A (pravý sloupec), získali byste volbou A odměnu 75 Kč a volbou B odměnu 200 Kč. Vaše výplata z akce B je vyšší v obou sloupcích.

		Druhý hráč	
		A	B
Já	A	Já: 25, Druhý hráč: 200 - c	Já: 75, Druhý hráč: 50
	B	Já: 50, Druhý hráč: 250 - c	Já: 200, Druhý hráč: 200

A.3 Jak budete odpovídat?

Posbíráme od vás odpovědi pro všechny možné hodnoty C. Budete uvádět odpovědi na 10 obrazovkách, ve kterých se bude měnit vaše hodnota C. Začneme hodnotou C = 10, pak postoupíme na 30, pak na 50, až nakonec skončíme u hodnoty C = 190. Na každé obrazovce uvedete svoji akci a svůj odhad akce druhého hráče, který odpovídá na stejnou otázku, tedy má stejné náklady.

A.4 Výplata

Při výběru rozhodnutí k výplatě budeme postupovat v těchto krocích:

1. Počítač náhodně vylosuje vaši hodnotu C z možností: 10, 30, 50, 70, ..., 150, 170, 190. Každá z těchto 10 hodnot bude vybrána se stejnou pravděpodobností. Pak provede druhé losování, ze kterého vzejde hodnota C druhého hráče. Obě hodnoty se losují nezávisle, mohou se lišit.

2. Dále zjistíte, jakou akci jste zvolili pro svoje C a jakou akci si pro svoje C vybral druhý hráč.

3. Pro variantu danou vylosovanými C budete placeni buď za svoji akci nebo za odhad akce druhého hráče. Obě možnosti budou vylosovány se stejnou pravděpodobností. Budete-li placeni za svoji akci, obdržíte výplatu odpovídající poli tabulky, ve kterém se protne vaše akce s akcí druhého hráče. Budete-li placeni za odhad, dostanete 200 Kč, pokud bude váš odhad akce druhého hráče správný, a 50 Kč, pokud bude mylný.

Při rozhodování je potřeba mít na paměti, že jakákoli situace, na kterou se ptáme, může nastat. Každé vaše rozhodnutí tedy může ovlivnit vaši výplatu. Kromě výplaty, jejíž výše závisí na vašich odpovědích, dostanete ještě fixní částku 80 Kč.

B Treatment Session Instructions

B.1 Úvod

V tomto experimentu zkoumáme rozhodování lidí ve strategických situacích. Na vašich rozhodnutích bude záviset, kolik si vyděláte peněz. Proto vám doporučujeme si následující instrukce důkladně prostudovat. Vydělané peníze vám vyplatíme na konci experimentu v hotovosti a v soukromí.

Pokud vás při čtení instrukcí nebo později při samotné hře napadne nějaký dotaz, prosíme, zvedněte ruku a moderátor experimentu k vám přijde a dotaz zodpoví.

Během celého experimentu nekomunikujte s ostatními účastníky, nepoužívejte mobilní telefon ani jiná elektronická zařízení vyjma počítače, u kterého jste usazeni, a věnujte svoji pozornost výhradně experimentu. V případě neuposlechnutí budete vyloučeni z experimentu bez nároku na odměnu.

B.2 Experiment

Během celého experimentu budete spárovaní s jedním účastníkem tohoto sezení, kterého budeme nazývat „druhý hráč". Identitu druhého hráče vám nesdělíme.

B.3 Popis situace

Vaše rozhodnutí bude mít dvě fáze:

1. Ve fázi 1 zašlete druhému hráči zprávu o tom, jakou akci zvolíte ve fázi 2. Tato zpráva není závazná.

2. Ve fázi 2 se rozhodnete, jakou akci zvolíte v následující situaci.

Rozhodnutí v této situaci spočívá ve volbě akce A nebo B. Možné výsledky vašeho rozhodnutí znázorňuje tabulka dole. Vaše akce se odráží ve volbě řádku: Podle toho, zda zvolíte A nebo B, budou vaše výhry pocházet z prvního nebo druhého řádku. Akce druhého hráče se odráží ve volbě sloupce: podle toho, zda zvolí A nebo B, budou jeho výhry pocházet z prvního nebo druhého sloupce.

		Druhý hráč	
		A	B
Já	A	Já: 200 - c, Druhý hráč: 200 - c	Já: 250 - c, Druhý hráč: 50
	B	Já: 50, Druhý hráč: 250 - c	Já: 200, Druhý hráč: 200

Pole ukazují možné výhry v korunách. Pokud tedy oba hráči zvolí A (pole vlevo nahoře), oba získají výplatu 200 – C Kč. Pokud jeden z hráčů zvolí A a druhý B, první hráč získá výplatu 250 – C Kč a druhý hráč získá 50 Kč. Pokud oba hráči zvolí B, každý získá výplatu 200 Kč. Parametr C představuje náklad akce A. Může nabývat jakékoli z těchto hodnot: 10, 30, 50, 70, . . . , 150, 170, 190, přičemž všechna čísla jsou stejně pravděpodobná. Hodnota C se losuje pro každého hráče zvlášť a může být tedy pro vás a druhého hráče jiná. Při rozhodování znáte svoji hodnotu C, ale neznáte hodnotu C druhého hráče.

B.4 Co ovlivní výše nákladu C?

Hodnota C udává vaše náklady akce A. Čím je vyšší, tím je pro vás akce A méně výhodná. Pokud je vaše C mezi 0 a 50 Kč, je akce A výhodnější bez ohledu na akci druhého hráče. V tabulce dole vidíte situaci, kdy se vaše C rovná 25 Kč. Kdyby druhý hráč zvolil A (levý sloupec), získali byste volbou A 175 Kč a volbou B 50 Kč. Kdyby druhý hráč zvolil B (pravý sloupec), získali byste volbou A 225 Kč a volbou B 200 Kč. Vaše výplata z akce A je vyšší v obou sloupcích.

		Druhý hráč	
		A	B
Já	A	Já: 175, Druhý hráč: 200 - c	Já: 225, Druhý hráč: 50
	B	Já: 50, Druhý hráč: 250 - c	Já: 200, Druhý hráč: 200

Pokud jsou vaše náklady C mezi 50 a 150 Kč, je pro vás výhodné mít stejnou akci jako druhý hráč. V tabulce dole vidíte situaci, kdy se vaše C rovná 100 Kč. Kdyby druhý hráč zvolil A (levý sloupec), získali byste volbou A 100 Kč a volbou B 50 Kč. Kdyby druhý hráč zvolil B (pravý sloupec), získali byste volbou A 150 Kč a volbou B 200 Kč. Vaše výplata z akce A je vyšší ve sloupci, kde druhý hráč hraje A, a vaše výplata z akce B je vyšší v sloupci, kde druhý hráč hraje B.

		Druhý hráč	
		A	B
Já	A	Já: 100, Druhý hráč: 200 - c	Já: 150, Druhý hráč: 50
	B	Já: 50, Druhý hráč: 250 - c	Já: 200, Druhý hráč: 200

Pokud jsou vaše náklady C mezi 150 a 200 Kč, je pro vás akce B výhodnější bez ohledu na akci druhého hráče. V tabulce dole vidíte situaci, kdy se vaše C rovná 175 Kč. Kdyby druhý hráč zvolil A (levý sloupec), získali byste volbou A odměnu 25 Kč a volbou B odměnu 50 Kč. Kdyby druhý hráč zvolil A (pravý sloupec), získali byste volbou A odměnu 75 Kč a volbou B odměnu 200 Kč. Vaše výplata z akce B je vyšší v obou sloupcích.

		Druhý hráč	
		A	B
Já	A	Já: 25, Druhý hráč: 200 - c	Já: 75, Druhý hráč: 50
	B	Já: 50, Druhý hráč: 250 - c	Já: 200, Druhý hráč: 200

B.5 Jak budete odpovídat?

Jak jsme již uvedli, rozhodujete se ve dvou fázích:

1. Ve fázi 1 pošlete druhému hráči zprávu o tom, jakou akci zvolíte ve fázi 2. Tato zpráva není závazná.
2. Ve fázi 2 děláte rozhodnutí. Zde se vás budeme ptát nejen na vaši akci, ale i na to, jakou akci podle Vás zvolí druhý hráč.

Vaše odpovědi od vás posbíráme pro všechny možné varianty nákladů a zpráv od druhého hráče. Dotazováni budete ve třech blocích. Každý z těchto bloků se skládá z 10 obrazovek, ve kterých se bude měnit vaše hodnota C. Začneme hodnotou C = 10, pak postoupíme na 30, pak na 50, až nakonec skončíme u hodnoty C = 190. Bloky budete vyplňovat v tomto pořadí:

1. V prvním bloku se vás zeptáme na vaše rozhodnutí ve fázi 2 pro dané náklady C a pro konkrétní obdrženou zprávu. Vaše náklady budou postupně narůstat. Obdržená zpráva zůstane v celém bloku stejná. Na každé obrazovce uvedete svoji akci a svůj odhad akce druhého hráče, který odpovídá na stejnou otázku, tedy má stejné náklady C a obdržel stejnou zprávu.
2. Rozhodnutí v druhém bloku se liší od těch z prvního bloku v jediném aspektu, a tím je obdržená zpráva. V tomto bloku budeme předpokládat, že jste obdrželi opačnou zprávu.
3. V třetím bloku se budete rozhodovat, jakou zprávu zašlete druhému hráči. Toto rozhodnutí uděláte také desetkrát, pro všechny úrovně vašich nákladů C.

B.6 Výplata

Při výběru rozhodnutí k výplatě budeme postupovat v těchto krocích:

1. Počítač náhodně vylosuje vaši hodnotu C z těchto deseti možností: 10, 30, 50, 70, . . . , 150, 170, 190. Každá z těchto hodnot může být vybrána se stejnou pravděpodobností. Pak provede druhé losování, ze kterého vzejde hodnota C druhého hráče. Obě hodnoty se losují nezávisle, mohou se tedy lišit.
2. Vyhledáme, jakou zprávu jste zaslali pro svoje C a jakou zprávu zaslal druhý hráč pro svoje C. Dále se podíváme, jakou akci jste pro svoje C a pro zprávu zaslanou druhým hráčem vybrali vy a jakou akci vybral pro svoje C a zprávu zaslanou od vás druhý hráč.
3. Pro variantu danou vylosovanými C a odeslanými zprávami budete placeni buď za svoji akci nebo za odhad akce druhého hráče. Obě možnosti budou vylosovány se stejnou pravděpodobností. Budete-li placeni za svoji akci, obdržíte výplatu odpovídající poli tabulky, ve kterém se protne vaše akce s akcí druhého hráče. Budete-li placeni za odhad, dostanete 200 Kč, pokud bude váš odhad akce druhého hráče správný, a 50 Kč, pokud bude mylný.

Při rozhodování je potřeba mít na paměti, že jakákoli situace, na kterou se ptáme, může nastat. Každé vaše rozhodnutí tedy může ovlivnit vaši výplatu. Kromě výplaty, jejíž výše závisí na vašich odpovědích, dostanete ještě fixní částku 80 Kč.