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Fairness and Emotions in the Ultimatum Game: Experimental Approach

Bachelor thesis

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Abstract

This bachelor thesis examines the role of emotions in the decision-making process by making individuals treated unfairly. We conducted a simple Ultimatum Game and measured emotional responses of Responders when the offer is displayed. We found significant positive relationship between the offer and intensity of neutrality and surprise experienced by Responders and significant negative effect of offer on intensity of experienced anger and disgust. Further examination also indicated significant negative relationship between the action taken by Responders (rejecting or accepting the offer) and intensity of experienced anger leading us to the conclusion about the correlation between this emotion and rejection. The analysis is also complemented by validation that behavior of our sample in the Ultimatum Game follows the robust behavioral pattern (frequent rejection of positive but low offers) in this experimental game.

Abstrakt

Tato bakalářská práce analyzuje roli emocí v procesu rozhodování se pomoci uvedení subjektů do situace, kdy se setkávají s nespravedlivým zacházením. Uspořádali jsme sérii her Ultimátum a měřili emoční reakce respondentů v okamžik zobrazení nabídky. Našli jsme signifikantní pozitivní vztah mezi nabídkou a intenzitou neutrality a překvapení, které cítili respondenti. Alternativně byl nalezen významný negativní efekt nabídky na sílu vzteku a znechucení. Další šetření vedlo k nálezu silného negativního vztahu mezi akcí, ke které se rozhodl respondent (přijmout či odmítnout nabídku) a intenzitou ucítěného vzteku, což nás vedlo k závěru o přítomnosti jisté korelace mezi touto emocí a odmítáním. Analýza je též doplněna o ověření, že chování subjektů ve hře

Ultimátum odpovídá robustnímu modelu chování (časté odmítání pozitivních, ale nízkých nabídek) v tomto experimentálním designu.

Klíčová slova

spravedlnost, emoce, hra Ultimátum, FaceReader, experiment

Keywords

fairness, emotions, Ultimatum Game, FaceReader, experiment

Range of thesis: 56 925

Declaration of Authorship

1. The author hereby declares that he compiled this thesis independently, using only the listed resources and literature.

2. The author hereby declares that all the sources and literature used have been properly cited.

3. The author hereby declares that the thesis has not been used to obtain a different or the same degree.

Prague, July, 25, 2017 Polina Fedosova

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Institute of Economic Studies
Bachelor thesis propsal

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Proposed topic: Fairness and Emotions in the Ultimatum Game: Experimental Approach

Preliminary scope of work:

The Ultimatum Game is one of the most famous experimental designs, which due to its simplicity and clear self-maximizing strategy allows for studying complex phenomena. We decided to apply this experimental design to investigate the role of emotions in decision-making process in the context of fairness. Two players A and B participate in the game, where the player A is given a positive fixed amount of money and has to divide it between himself and the player B. The player B can even accept or reject the offer, where in the former case both of the players are paid according to the offer and in the latter situation none of the players are paid anything.

According to standard economic theory, which assumes, that decisions of economic agents are driven solely by motivation to maximize their own well-being, the player A should transfer the lowest amount possible and the player B has to accept any positive amount. However, the empirical evidence provide, that players A transfer on average 30%-40% of the available surplus, while offers of les than 20% of the surplus are frequently rejected by players B. Moreover, such low offers are often accompanied by experience of strong negative emotions by players B, particularly anger. Anger is then expected to have destructive consequences, which is consistent with rejection of positive offers by players B.

The aim of the thesis is to indicate the role of emotions in the decision-making process when facing unfairness. We will focus on neutrality and 5 basic emotions: happiness, anger, sadness, surprise and disgust, which were detected using the FaceReader software. We will further discover the topic of anger in order to detect, whether there is an issue of “angry buttons”, which states for the destructive behavior of rejecting positive offers. We are particularly interested whether there is a difference in intensity of experienced anger not only among treatments, but also among actions undertaken by

participants. We will also examine whether the robust behavioral pattern in the Ultimatum Game can be also applied to the population of students living and/or studying in Prague.

Outline

1. Introduction
2. Concept of Reciprocity and Fairness in Economics
3. Emotions in Economics
4. Description of the data
5. Econometric Approach and Discussion of the Results
6. Conclusion

List of academic literature

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Contents

1. Introduction

Emotions play a very important role in our every-day life even though they are sometimes very painful. They might motivate you to act – for instance anger, which arose because you do not like an occurred situation, prompts you to act to change this situation. Similarly, experienced fear can lead you to fight or flight in order to survive. Moreover, emotions may have an impact on the physiological conditions of your body: anger leads to an increase in blood pressure, which consequently boosts the muscles and makes a person ready for action. Alternatively, emotional states serve as a tool to understand how to change an unpleasant situation so personal needs are satisfied (guilt might arise when you think you act contrary to your morals, anger can be experienced when you think you were treated unfairly). Therefore, emotions and decision-making process are closely linked together and may influence each other.

However, standard economic theory does not account for emotions and assumes that an economic agent is purely rational and makes decisions based only on his motivation to maximize his own well-being. Nevertheless, numerous empirical evidence provides, that people do not often behave as predicted by rationality. One of the key experimental games, which led to realization that common economic assumption that people exclusively follow their own material self-interest is problematic, is so-called Ultimatum Game by Güth, Schmittberger and Schwarze (1982). The simple Ultimatum Game requires two players, where one is chosen to be a Proposer and the second a Responder. The former is then asked to split a fixed amount of money between himself and Responder, who can consequently accept or reject the offer. In case of rejection none of the parties are paid any money and if the offer was accepted by the Responder, both are paid according to the split.

Standard economic theory predicts, that the Responder will accept any positive amount of division and since the Proposer anticipates that, he or she should transfer the lowest positive amount. However, robust evidence suggest, that the average offer transfers 30%-40% of the available surplus to Responder. Moreover, even positive offers (20% of the available surplus) are frequently rejected and the probability of rejection decreases as the size of the offer increases (Camerer and Thaler, 1995).

So why do Responders reject positive splits in the Ultimatum Game? Search for an answer evoked huge debates among experimental economists. Vast majority of them

agreed on that Responders' destructive behavior might express their "sense of fairness" – they evaluate receiving a low offer as damage of their own concerns, which leads them to rather reject a positive sum of money than being treated unfairly (Declerk et al., 2009). Acting against one's personal interest is associated with experiencing negative emotions, such as anger, while promoting of concerns results into positive emotions (Bosman and Winden, 2002). Hence, we might expect intensity of negative emotions (primarily anger) to depend not only on the offer assigned to Responder, but also on the action the Responder undertook regarding this offer (accepted or rejected). This idea is supported by numerous researches (Bosman et al., 2001; Grimm and Mengel, 2011; Oechssler et al., 2006; Sanfey et al., 2007; van't Wout et al., 2006; Van Leeuwen et al., 2016).

The main objective of this thesis is to determine whether emotions are involved in the decision-making process using the Ultimatum Game as a tool and if yes, how exactly. We examined neutrality, anger, happiness, surprise, disgust and sadness. We conducted simple Ultimatum Game and focused exclusively on the economic behavior and emotional states of Responders. We investigated relationship between an offer, Responder's action and intensity of each emotion. We detected significant positive effect of the offer assigned to the Responder on intensity of neutrality and surprise and alternatively, strong negative relationship between the offer and the strength of anger and disgust experienced by Responders. Moreover, we found a significant difference in intensity of anger depending on the action undertaken by the Responder. The analysis was complemented by checking whether individuals participated in the Ultimatum Game conducted by us follow the robust behavioral pattern in this economic game, which includes rejecting low unfair offers frequently.

The greatest contribution of the current thesis to already existing literature is usage of advanced methods for measuring emotions since majority of the researchers studying the link between emotions and fairness measured emotional responses by self-reports (i.e. participants were asked to fill the questionnaire and report which emotions did they experience and how strong they were). For this study, we used FaceReader software by Noldus, which is able to detect 5 basic emotions: anger, happiness, fear, surprise and disgust as well as neutrality.

The current thesis is structured as follows. Chapter 2 is divided into two major parts: the first defines the concept of reciprocity (fairness), points its distinction with simple altruism and provides an overview of empirical evidence of fairness. The second

part of the chapter introduces the concept of emotions in economic environment. The next chapter summarizes recent studies, which link emotions and fairness by focusing mainly on researches conducted through the Ultimatum Game. The chapter is complemented by stating specific research questions. Chapter 4 gives a detailed overview of how the experiment was run, as well as a brief summary about software used and consequently describes the data gained. Chapter 5 deals with the analysis itself. The first part examines whether the gained data match the robust behavioral pattern in the Ultimatum Game described in the chapter 1. The second part focuses on emotions and investigates the link between the offer assigned to Responder, his action and intensity of each emotion. The models are then complemented by adding different control variables and discussion of their effects on intensities of emotions. The thesis is concluded by chapter 6, where the key findings are summarized.

2. Literature review

The first part of this chapter discusses the topic of reciprocity (fairness) in the economic environment by defining it as well as providing empirical evidence including results in the Ultimatum Game. The second part turns it attention to emotions themselves and summarizes current emotion research in economics.

2.1. Fairness (reciprocity) in economics

Vast majority of current economic models are based on the self-interested hypothesis. The only deviation from self-oriented behavior that gained some attention by economists is pure altruism. Contrary to a self-interested economic agent, an altruistic person is expected to care not only about his own well-being but also about the well-being of other people. The simplest game for determining altruism is *Dictator Game*, which was first presented by Kahneman et. al (1986). The simple Dictator Game is designed for two players - the player A is given a specific amount of money *S* and is supposed to divide them between himself and his opponent – the player B has only a passive role in the game. Following the self-oriented hypothesis, the player A should transfer as lowest amount as possible; however, the actual behavior in hundreds Dictator Games contradicts the self-interested hypothesis. As reported by Engel (2010), who conducted a meta-analysis of 133 papers published between the years 1992 and 2010 each including modifications of the Dictator Game, on average Dictators transfer 30% of the available surplus. Even though altruistic preferences explain voluntary giving in Dictator and Public Good Games, it cannot capture behavioral difference in Public Good Games with and without punishment or rejections of positive offers in Ultimatum Games. Evidence from experiments dealing with cooperation (Prisoner's Dilemma, Public Good Game) provide, that the enthusiasms to sacrifice own well-being to the benefit of others is declining when people do not think that others have done their fair share (summary by Dawes and Thaler 1988). Indeed, there are key findings indicating that in several situations people will not only deny to help others, but even sacrifice to punish those who have been behaving unfairly (for example, Kahneman et. al 1986).

Rabin (1993), who made a significant contribution in incorporating reciprocity to the theory, defined the notion of fairness in three stylized facts:

1. People are willing to sacrifice their own well-being in order to help those who are being kind.
2. People are willing to sacrifice their own well-being in order to punish those who are being hostile.
3. Both facts 1 and 2 are having greater implication as the material cost of sacrifice becomes smaller.

The first motive is defined as positive reciprocity and stands for cooperative tendencies, while the second stylized fact is referred to negative reciprocity and covers aspects of penalizing.

2.1.1. Evidence of positive and negative reciprocity and material impact

Reciprocal behavior could be found all around. Increase in the employees' theft rates as a reaction on cut in employees' wages by firms (Giacalone and Greenberg, 1997) fits the concept of negative reciprocity well. Alternatively, evidence of positive reciprocity include smiling waitresses being tipped better compared to less friendly ones (Tidd and Lochard, 1978) or free samples of products in supermarkets leading customers to buy the product even without liking it much (Bowles and Gintis, 1998).

Evidence of reciprocal behavior in controlled laboratory experiments include robust findings in Ultimatum, Trust and Gift Games. The former captures the willingness to destroy own surplus in order to punish an unfair subject, which is consistent with the concept of negative reciprocity. There are two players in the *Ultimatum Game* - Proposer and Responder, where the former is endowed with a fixed amount of money *S*. In the first turn Proposer offers some division of money *S* to Responder. If the Responder accepts the offer, both of the players are paid accordingly to the split made by the Proposer. Alternatively, when the Responder rejects the split, both get no money. Self-maximizing strategy is clear: Proposer should offer the lowest amount possible and the Responder should accept any split greater than zero. However, numerous overviews of different Ultimatum Games report systematic deviations from selfish behavior. As reported by Camerer and Thaler (1995), offers of less than 20% of available surplus are frequently rejected, which captures negative reciprocal behavior.

Moreover, Proposers also do not behave in maximizing manner - on average they offer 30%-40% of the surplus with the equal split being the model offer. Beside results in Ultimatum Games showing consistent deviation from behavior predicted by classic economic theory, they also provide robust evidence. Experimental economists have studied numerous factors and their influence on the behavior in Ultimatum Games such as the size of stake (Hoffman et. al, 1996), nationality and "culture" (Roth et. al, 1991), degree of anonymity (Robert Forsythe et. al, 1994), context (Hoffman et al., 1994) etc. The vast majority of researches conclude, that these factors have just small or even no impact on players' behavior in the Ultimatum Game. This robust behavior pattern in Ultimatum Games called for developing of new theoretical concepts, which will incorporate the notion of fairness and desires for costly punishment in certain circumstances.

The idea of costly punishment of those who have behaved in a hostile manner is further explored in the *Third Party Punishment* (Fehr and Fischbacher 2004). There are three players A, B and C participating in a game, where A and B are playing a simple Dictator Game: the player A is given a fixed amount of money S and is asked to send any division of S to the player B. The player C is endowed with an amount of $S/2$, observes the game and has a possibility to punish the player A by assigning punishment points. However, the punishment of the player A is costly to the player C - three units of money as the punishment cost 1 unit to the player C. Since punishing yields some costs for the player C, self-interested hypothesis predicts no punishment at all. Nevertheless, the evidence by Fehr and Fischbacher claim, that in the situation where $S = 100$, 60% of players C punished A's transfers of less than 50 units and the less the transfer is, the strongest the punishment.

Alternatively, positive reciprocal preferences can be documented in the *Trust Game* developed by Berg et al. (1995). The player A is endowed with an amount of money S and is supposed to transfer any fraction of S to the player B, who consequently received a tripled amount of this fraction. The player B can then choose how much of this tripled amount he would like to keep and how much to transfer back to the player A. Self-oriented strategy dictates the player B to transfer back nothing and since the player A anticipates such selfish behavior, he should transfer zero in the first turn as well. However, the results by Berg et. al with the endowment of 10 dollars do not go in line with this prediction. 30 out of 32 players A transferred more than zero to player B he was paired with. Moreover, 11 out of 28 players B, who were sent more than 1

dollar, returned back more than they were sent resulting into positive net returns. Furthermore, investments of 5 dollars had an average payback of approximately 7 dollars.

Lastly, the third statement by Rabin (1993) provides, that the higher the material payoff is, the lower the willingness to maintain fairness and should be intuitively clear. Consider two Ultimatum Games with different surplus to divide. Suppose that the amount to divide in the first game equals $10 and in the second $1 million. The split ($1, $9) is expected to be rejected with much higher probability compared to the split ($100 000, $900 000). This behavioral pattern was also tested as well as partly proved by Leventhal and Anderson (1970).

2.2. Emotions in decision making process

Emotions form a key concept in economics, especially in relation to the utility theory. When revising the history of the utility concept, one might see that the role of emotions has been changing through time. While in classical economics utility was viewed as measurement of emotions, neoclassical approach ignores the presence of emotions and allows for predicting individual behavior without any concerns about feelings. The late concept of behavioral economics returns to the idea of classical utility concept seeking for such interpretation of utility, so emotions are also incorporated.

2.2.1. Current emotion research in economics

According to Bosman and Winden (2002), an individual perceives emotions when he evaluates an event as relevant to his preferences or concerns. When concerns are damaged, negative emotions are about to arise and alternatively, promotion of them should lead to positive emotions. Even though emotions were studied by both psychologists and economists, they focus on different types. Economists mainly place an emphasize on anticipated emotions, which are not perceived at the moment of making a choice but rather expected to be felt after the consequences resulting from making a choice arose. Alternatively, psychologists turned their attention to immediate emotions, which an individual experienced directly at the moment of making a choice.

As reported by Rick and Loewenstein (2008), emotions influence the process of decision-making in three different ways. First of all, emotions might be anticipated directly from the materialized outcome resulted from the choice made. To illustrate that, consider a potential investor deciding whether to buy a stock or not. The investor would anticipate feeling disappointed if the stock he bought declined in price and contrary happiness when the price increases. Moreover, he would imagine regretting not buying the stock if it increased in price or alternatively relief in case the price declined. These feelings are referred to as *expected* emotions. This type of emotions includes regret and rejoicing on the one hand and disappointment and elation on the other (Loomes and Sugden, 1982 and 1987). Both of these concepts assume an individual to compare the outcome resulted from the choice they made and some reference point. Study on regret and rejoicing (Loomes and Sugden, 1982) sets alternative choices as a reference point, so an individual's final utility experienced from making a particular choice is given as the sum of the utility resulted from this choice and regret or rejoicing relative to alternative choices. Alternatively, the concept of disappointment and elation (Loomes and Sugden, 1987) is based on the idea that an individual compares the outcome of the choice he made to the average utility arising from this choice.

Secondly, there are emotions, which are felt at the moment of making a decision and are directly referred to making a choice. Staying with the example of potential purchase of stock, the investor might feel immediate fear from the fact that the stock will lose its value. As a result, the investor might refuse to buy stock. Such emotions are referred to as *integral* and they could be interpreted as a tool to understand own tastes. Lastly, there are *incidental* emotions, which occur at the moment of making a choice but are not directly linked to the task. That means, that the investor might be simply sad due to the argument he had in the morning, happy because of the sunny weather outside etc. Given the standard economic theory such emotions should be irrelevant to the decision, however, there are many researches showing the opposite. For example, weather and more specifically, sunshine, which is associated with happiness, was shown to have an impact on stock market performance (Hirshleifer and Shumway 2003). Alternatively, elimination of the country's team from the World Cup was found to influence stock market returns negatively (Edmans, Garcia and Norli, 2007).

3. Emotions and fairness

The following chapter follows up on the topic of emotions and their link to fairness, respectively emotional responses to unfairness. It summarizes key findings in research papers dealing with emotions and fairness by mainly focusing on the Ultimatum Game. The chapter is concluded by stating the research question.

3.1. Experimental studies of emotional response to unfairness

Even though emotions are argued to have temporary duration (Elster, 1998), behavioral responses they produce are long-lasting and thus, have important consequences for individuals as well as for the society. According to Loewenstein (2000), people's bargaining behavior is strongly affected by different emotions including anger, fear and embarrassment. Individual belief that they were treated unfairly or anger towards their partners often lead people to action against their economic interest. Furthermore, it is reported by social scientists (Elster 1989, Frank 1988 and Hirshleifer 1987) that penalties, which enforce meeting social norms are resulted from intensive emotions and that these emotions are the drivers of behavior that satisfies social norms. To illustrate this complex phenomenon of emotional responses to unfairness there is a need of a simple environment, such as simple bargaining economic games.

Bosman and Winden (2002) conducted two-players *Power-to-Take Game* in order to indicate how emotions influence behavior in controlled laboratory experiments. Both Responder and Proposer are endowed with the certain amount Y_i, where the income differed based on the effort an individual made in a computer task. The game consists of two stages - in the first stage randomly chosen Proposer (or Take Authority) should come up with a take rate t, $t \in [0;1]$, which indicates a proportion of the Responder's income Y_{resp} that will be transferred to the Proposer in the second stage. In the second round the Responder is informed about the take rate t and has the possibility to destroy part of his income $d \in [0;1]$. Final payoffs of the Proposer and the Responder are $Y_{take} + t(1-d)Y_{resp}$ and $(1-t)(1-d)\ Y_{resp}$ respectively, where Y_{take} indicates Proposer's earned endowment. In this study, the authors were primarily interested in how emotions

shape Responder's behavior. Power-to-Take Games are suitable for studying punishing behavior and especially the trade off between emotional satisfaction resulting from punishing and monetary gain. It was found, that the intensity of Responder's negative emotions is positively related to the take rate and vice versa. That means that the higher the take rate is set, the more intensively the Responder is experiencing negative emotions. Negative emotions were also found to drive destruction, so the probability of the Responder to destroy his income is positively related to the intensity of negative emotions experienced by the Responder. Consequently, high negative emotional intensity is associated with destruction of the whole income.

Brief emotional analysis was also conducted by Fehr and Fischbacher (2004) in case of the Third Party Punishment Game, which was already introduced in the previous section. The results were consistent with the hypothesis that penalizing behavior enforcing social norms is caused by strong emotions.

Bosman, Sonnemans and Zeelenberg (2001) examined whether emotions do have an impact on economic decision in case of the Ultimatum Game. The evidence provide, that the smaller the split offered by the Proposer is, the more intensively the Responder experiences negative emotions such as anger, sadness, envy, contempt and irritation. Furthermore, negative emotions were reported to be positively related to Responder's expectations of Proposer's offer. In addition, intensity of negative emotions experienced by Responders are strongly positively correlated with the probability of rejecting an offer. The study was innovated by introducing the so-called cool-off treatment. Contrary to basic treatment, participants in cool-off treatment had 1-hour break between receiving an offer and making a decision. To maintain time balance between two treatments, the basic treatment had 1-hour break before receiving a proposal. As mentioned earlier, emotions are considered as short-lasting and thus one might expect their experience to become less intense when time passes. This comes from the idea that individuals may regulate their emotions and give priority to cognitive evaluation of the task rather than being driven by emotions. In case of the Ultimatum Game, this would be consistent with fewer rejections of unfair offers in cool-off treatment. Nevertheless, the evidence show, that 1-hour break did not affect neither the Responder's behavior nor intensity their experienced emotions. Indeed, it is more likely that Responders experienced negative emotions again at the moment they were asked to make a decision. Hence, it is claimed, that emotions are robust in terms of their impact

on economic behavior, which is in line with the psychological theory by Frijda (1988), who argues, that time does not weaken intensity of emotions but rather repetition does.

However, later studies focusing on behavior of Responders in the Ultimatum Game when giving them time to "cool off" and think about their choice and its consequences, report the opposite results (Grimm and Mengel, 2011; Oechssler et al., 2006). The latter study incorporates running an Ultimatum Game on internet and giving Responders 24-hours to change their decision about accepting or rejecting the offer. Conducting an experiment using internet allows for larger number of participants (650 compared to 76 participants in the study by Bosman et al.). Oechssler et al. (2006) provide, that after one-day cooling off period, the rejection rate of an unfair offer dropped from 27.7% to 20.5%. Alternatively, Grimm and Mengel (2011) argue, that Responders, who had to react to proposal after approximately 10-minutes break, are associated with drastically larger acceptance of unfair offers. As reported, while almost no unfair offers were accepted in treatment with no delay, an impressive share of such offers (60%-80%) were accepted when giving participants 10 minutes break before reacting to the proposal.

A step forward in the topic of emotions and fairness was made by Xiao and Houser (2005). Standard design of Ultimatum Game places constraints on Responders' emotion expression so they do not have a possibility to express negative emotions resulting from receiving an unfair offer, except through behaving in costly punishing manner. Beside control group, the authors also introduced treatment, where Responders could attach a message to Proposer to the accepting/rejecting decision. Consequently, the messages were evaluated by third parties and marked as positive, negative or neutral. The evidence provide, that there is significantly less rejections of unfair offers when Responders can express their emotions by sending a message to Proposer. Thus, one might think of rejections and expressions of negative emotions as substitutes to a certain degree. Giving the evidence by Xiao and Houser (2005) and extending them by findings about Responders' behavior when they are let to cool off before making a choice, it seems that both delay and possibility to express anger to the Proposer via messaging could soften emotions.

A highly important remark about early studies of the link between emotions and fairness by Bosman and Winden (2002), Fehr and Fischbacher (2004) and Bosman, Sonnemans and Zeelenberg (2001) has to be done. All mentioned papers measured emotions by self-reports, so participants were asked to fill the questionnaire and report

which emotions they experienced and how strong these emotions were. Such measurement should be treated with caution, since there is a possibility of systematic deviations from the emotions individuals actually experienced. However, later studies include advanced measurement tools such as magnetic resonance (Sanfey et al., 2007), skin conductance (van't Wout et al., 2006) or filming participants and consequent analysis of video records using emotion detecting software (Van Leeuwen et al., 2016). All these papers found similar results as predicted by robust behavioral pattern in Ultimatum Game found by numerous empirical evidence but provide more comprehensive evidence of emotions.

Sanfey et al. (2007) conducted Ultimatum provide neurological evidence about the role of emotions in decision-making process in case of the Ultimatum Game - the authors measured Responders' activity in brain areas responsible for emotional and cognitive processes when receiving fair or unfair offer. More intensive activity in part of the brain involved in emotional processes for rejected unfair offers suggest that emotions should not be ignored when studying the decision-making process.

Another scientific approach aiming to determine the impact of emotion followed the study by Sanfey et al. (2007) incorporates measuring skin conductance level, which served as physiological emotional response (van't Wout et al., 2006). The authors then investigated the hypothesis whether there is a relationship between rejections rates in the Ultimatum Game and phasic changes in skin conductance, which might illustrate involvement of emotional processes during decision-making well. More precisely, higher skin conductance was expected to yield higher rejection rate of unfair human offers. The authors found significantly higher level of skin conductance in Responders facing unfair offers compared to those receiving fair splits. This evidence suggest, that participants obtaining unfair offers experienced more intensive emotions than those, who were offered a fair split.

Beside different physiological tools allowing to measure emotions, there are also software allowing for detection of emotions from photos and video records. Van Leeuwen et al. (2016) conducted an Ultimatum Game and recorded Responders using a webcam for consequent analysis with software called FaceReader developed by Noldus.

3.2. Research question

The overall objective of the current thesis is researching whether emotions are involved in the decision-making process and if yes, in which direction. We will focus on 5 basic emotions - anger, happiness, sadness, disgust and surprise. The set of 5 basic emotions was complemented by neutrality. We made individuals face unfairness via the Ultimatum Game and observed their emotional responses and the FaceReader software served as the tool for detecting emotional states of individuals in this decision-making situation. We find using the FaceReader software a key contribution of the current thesis since most of researches dealing with emotions in context of fairness measured emotional responses by self-reports.

Our research is very close to the study by Van Leeuwen et al. (2016) by using another population and analyzing additional emotions. It is because study by Van Leeuwen et al. (2016) has not been published at the time of designing our experiment. We expect that a Responder in the Ultimatum Game will experience negative emotions (primarily anger) when receiving a low offer since it is a direct damage of his or her own concerns. Consequently, there is a tendency to react against an opponent, who holds responsibility for such behavior. In the Ultimatum Game, the only one possible reaction for the Responder is to reject an unfair offer. Therefore, we suppose, that intensity of experienced negative emotions is linked to individual reaction to the offer assigned. In other words, we expect that receiving lower offers will be accompanied by intense negative emotions by Responders and consequently, rejections of these unfair offers (in case of anger this issue is called "angry button hypothesis"[1]). A large set of different control variables allowed us to improve the models and give them more predictive power. We complemented the analysis by checking whether evidence from the Ultimatum Game arranged by us follow the behavior pattern in this experimental game.

[1] Van Leeuwen et al. (2016) formulated the „angry button hypothesis" by 2 basic assumptions: (1) angry buttons are observable, so the third parties can identify that an individual became angry because was badly treated and (2) anger has destructive manner. In the current thesis we will refer to the „angry button hypothesis" as to the second assumption only.

4. Experimental design, procedure and data

The following chapter will give the reader detailed information about the experiment and the participants. The first part describes the experimental design, which consisted of two consequent stages. The second part introduces the software we used for conducting of the experiment and analysis of the results. The last part is an overview of the participants of the experiment and list of the variables.

4.1. Experimental design

The experiment was run in Czech language and had two parts: in the first stage Proposers made an offer and in the second stage Responders made a decision whether to accept or reject the offer by the randomly assigned Proposer. The first part of the experiment took place on the 27th of April 2017 and was conducted in a pen and paper format with the sample of 14 people, who were recruited based on personal acquaintance with the author. There was no show-up fee for Proposers. There was no need for more detailed recruitment nor arranging this first stage of the experiment in a laboratory since the analysis focuses on behavior of Responders in the second stage. Proposers were read the instructions and informed, that the second stage of the experiment will take place in May 2017, thus the payment will be provided later after having decisions of Responders. Proposers were supposed to split 100 Czech crowns between themselves and their anonymous partner, who will enter the game in the second stage. Three possibilities of splitting were offered: (1) equal split of 50 Czech crowns, (2) keeping 65 Czech crowns and transferring 35 Czech crowns and (3) keeping 80 Czech crowns and transferring 20 Czech crowns. Distribution of chosen offers is the following - 7 Proposers chose an equal split, 3 participants decided to keep 65 Czech crowns and 4 Proposers picked an offer allowing for keeping 80 Czech crowns. To get enough observations in each treatment cell in the second phase, only splits (1) and (3) were decided to be taken into account and passed to Responders. Proposers were paid in cash in July and their final payment was done by random picking of a Responder receiving the split offered by this Proposer. Proposers who offered the eliminated split 65 x 35 were paid as this offer was accepted.

The second part of the experiment was computerized and programmed in the software zTree (Fischbacher, 2007). It was held in May 2017 during a two weeks period

in Laboratory of Experimental Economics (LEE) situated in University of Economics in Prague. There were 14 sessions with 8 participants expected to participate each session. Due to shortage of subjects arriving to two of these sessions, one session included 7 participants and one 6 only. All participants received a show-up fee of 150 CZK, which was paid by LEE. Each session was actually a sequence of sub-experiments, where the experiment, which is the part of the current thesis, was scheduled as the last one. However, it is important to emphasize that all sub-researches were mutually independent and so was the randomization procedure. Subjects were randomized into two treatments in terms of the offer they received - "fair" and "unfair". Each desk, where participants took the experiment, was equipped with privacy walls from each side so communication between participants is minimized. Before running the program. webcams were turned on.[2] In the first screen participants were given instructions to the Ultimatum Game (Appendix 1) and then supposed to answer control questions to make sure the rules of the experiment are clear (Appendix 2). The participant was not able to proceed to the experiment unless he answered control questions correctly (Appendix 3). Afterwards, participants received an offer depending on the treatment group they were randomized to and had to choose whether they want to accept or reject this offer (Appendix 4). In the last screen earnings of both Responder and Proposer were displayed (Appendix 5). The procedure finished with short questionnaire including basic questions about age, gender, education, monthly spending and monthly expenditures as well as questions relevant for another research running at the same time. There was also a question about weight an individual attached to 100 Czech crowns included as well as space for feedback about the experiment. At the time participants were answering the last questionnaire, individual payments were calculated and consequently, participants were privately paid in cash.

4.2. Utilized software: zTree and FaceReader

The zTree program is the widely used software for easily defining and conducting computerized experiments. The program's license is free of charge and can be obtained upon request within couple of days for academical purposes. Researcher writes the code in zTree and the subjects are consequently connected to the session via

[2] Participants signed an agreement form before the experiment started, which allowed us to record them using webcams. Video records were deleted as soon as the FaceReader analysis was finished.

zLeaf. The software contains all necessary features to conduct an experiment: time display, profit calculation, interaction between PCs, automatic data saving etc.

FaceReader is software for facial analysis, which is able to classify emotional expression into 7 groups: anger, sadness, disgust, fear, happiness, surprise and neutrality. FaceReader can work both online or offline by analyzing video records and photos. This software works as follows: (1) First of all, location of the face is detected and a rectangle is drawn around the face. (2) Afterwards, the face is modeled by identifying over 500 key points on the face. (3) These points allow the analysis itself to be conducted. FaceReader contains different face models, including Asian, elderly and children. Conclusions about facial expressions are then given by the software as a vector of values specifying the intensity of experience of above-mentioned emotions from 0 (absent) to 1 (fully present). Beside that, FaceReader also calculates valence, which is given by the difference between intensities of positive and negative emotions experienced and indicates whether emotions experienced by the subject are positive or negative. The only positive emotions from the list is happiness, negative emotions are made from anger, sadness, disgust and fear. Since surprise could be both positive and negative, it is excluded from the calculation of valence. Moreover, FaceReader's output also report arousal, which determines whether the participant is active (+1) or not (0). For example, closed eyes are associated with very low arousal. Typical FaceReader's visual output is illustrated by the Figure 3.2.1.

Figure 3.2.1: Graphical output of FaceReader

Source: De la Rosa Research, http://www.delarosaresearch.com/

4.3. Description of the data

Participants for the Ultimatum Game were recruited via LEE Database. In total, 109 subjects (61 men) in the age range of 19 to 29 years participated in the experiment. The vast majority of subjects reported their nationality as Czech (74 subjects), 16 individuals identified themselves as Slovaks and 10 as Russians. Reported nationalities of the remaining 9 participants is distributed as follows: 1 Albanian, 3 Kazakh, 1 Tatar, 3 Ukrainian and 1 Vietnamese. However, as soon as experiment was run in Czech language, all participants were fluent in Czech language. 101 subjects marked themselves as current students of under or postgraduate programs. More than half of participants (61) stated, that the highest education level they have achieved is secondary, 44 subjects reported, that they hold bachelor degree and 4 individuals answered, that they have already finished Master's degree studies. Almost 70% of participants (76) specified Economics and Management as their present or past study field, 10 subjects reported International Studies, 6 individuals stated to study Mathematics, Physics or IT. The rest 14 Proposers mentioned study fields such as Construction and Engineering (3), Humanities (4), Law (5), Marketing (1) and Medicine (1); 3 participants did not report anything. 68 subjects specified themselves as working with the average income of 13 050 CZK per month and average monthly spending of 10 570 CZK. Unemployed participants of the experiments reported on average to spend 8 230 CZK per month.

The final data set used for analysis includes 109 observations (105 for emotions) on following variables:

- *Accept* – the variable of our interest, used as a dependent variable in the first part of our analysis. This binary variable equals 1 if the offer was accepted by the Responder and 0 if rejected.
- *Offer* – this variable indicates the treatment an individual was randomized to in terms of a split assigned to the Responder given in Czech crowns. An unfair split is given by the value of 20, while a fair split is associated with the value of 50.
- *FR_N, FR_H, FR_SA, FR_A, FR_SU, FR_SC, FR_D* – set of the variables resulting from the emotional analysis in FaceReader - neutral, happy, sad, angry, surprised, scared and disgusted respectively. FaceReader's analysis was launched approximately 3 seconds after the split was displayed to the Responder (3

seconds' allowance is intended for giving participants space to read the short text coming before the offer) and lasted for the time it took the Responder to press OK button on the screen[3]. FaceReader analyzed 30 frames within a second assigning each of the emotional state a number between 0 and 1 indicating the intensity of this emotion. The output data for each emotional state were then averaged, multiplied by 100 and rounded to the nearest whole number to make the interpretation easier.

- *Age* – represents age of the subject measured in years.
- *Gender* – binary variable indicating subject's gender. It equals 1 if the subject reported himself as a male and 0 if a female.
- *Czech, Slovak, Russian, Other* – a set of binary variables reflecting nationality reported by the subject. The former variable equals 1 if the subject reported himself as Czech and 0 otherwise; the similar explanation applies for the variables *Slovak* and *Russian*. The variable *Other* equals 1 if the subject stated other nationality than Czech, Slovak or Russian.
- *Educ* – variable measuring subject's education in years.
- *Spend* – reflects reported monthly spending of subjects measured in Czech crowns.
- *Income* – indicates monthly income stated by the subject. If a subject does not have any personal income, it equals 0.
- *Ratio* – variable given by an individual income divided by spending. $Ratio = 1$ if and only if an individual is spending all the money he or she makes. The situations $Ratio > 1$ and $Ratio < 1$ reflect and individual spending less or more than earning respectively. $Ratio = 0$ occurs when an individual is not making any money.
- *Econ* – binary variable representing the field of subject's studies. It takes the value of 1 if the subject specified his present or past field of studies as Economics and Management or related ones and 0 otherwise.
- *Import* – weight assigned by the subject to the monetary amount of 100 Czech crowns on the scale from 1 (absolutely not important) to 10 (very important).
- *NEO_O, NEO_E, NEO_C, NEO_A, NEO_N* – a set of 5 variables identifying personal points gained in the Big Five trait, which is a test measuring 5

[3] Time interval between displaying the offer and deciding about how to react on it was calculated using time output from the zTree software.

dimensions of personality description: Openness to Experience *NEO_O*, Extraversion *NEO_E*, Conscientiousness *NEO_C*, Agreeableness *NEO_A* and Neuroticism *NEO_N*. Openness to Experience is measured on the scale from consistency and caution to curiosity and inventiveness. This dimension reflects individual attitude towards novelty and preferences for being active over experiencing strict routine. Extraversion indicates if an individual is talkative and sociable preferring being in a company or rather feeling well when doing alone activities and trying to avoid rush social events. Conscientiousness determines personal level of self-discipline - low scores in this dimension indicate spontaneous and to certain extent disorganized behavior whereas high scores reflect individual's preferences for planning and hardworking. Agreeableness determines personal willingness to cooperate, help and trust others. Lower scores are associated with uncooperative and hostile attitude. Neuroticism measures individual degree of emotional stability and ability to sustain negative emotions such as anger. Lower points in neuroticism reflect an individual being calm rather than impulsive. Whether an individual score should be reported as high or low results from comparing points to the average score within the sample of all participants.

- *MDMQ_GB, MDMQ_CN, MDMQ_AT* – are the variables reflecting personal score in Multidimensional Mood Questionnaire (Steyer et al., 1997) and identifying individual mood state in the beginning of the experiment. Current mood is measured by three dimensions - good/bad *MDMQ_GB*, calm/nervous *MDMQ_CN* and awake/tired *MDMQ_AT.* Lower score in good/bad dimension is associated with individual feeling bad - similarly low points in calm/nervous dimension stand for restlessness and in awake/tired for sleepiness.

5. Econometric approach and results

The following chapter contains the analysis, which is divided into three major parts. First of all, we will focus on the results in the Ultimatum Game itself and investigate whether the evidence from the experiment is in line with robust behavior in this famous economic game. Furthermore, we will add various control variables to determine their effect on the rejection behavior of the Responders. Consequently, we will add emotions to the analysis and indicate the relationship between emotional response and the offer assigned to a Responder. Finally, we will add control variables to the analysis and discuss the effect of control variables on intensity of emotions.

5.1. Behavioral pattern in the Ultimatum Game

Table 5.1.1 illustrates the individual behavior of Responders.

Table 5.1.1: Behavior of Responders

Offer	Responders	Accepted	Rejection rate
20	54	36	33.3%
50	55	55	0%

As reported by the data, tested Responders' dealing with unfair offers follows behavioral pattern in the Ultimatum Game. All fair offers of 50 Czech crowns were accepted by Responders, while 18 out of 54 Responders, who received an unfair offer of 20 Czech crowns, rejected the split. To further investigate Responder's behavior a binary response model was estimated.

In our analysis, we started with estimating a simple probit model with the decision of the Responder *Accept* as a dependent variable and *Offer* as an explanatory variable, which was consequently complemented by other control variables described in Chapter 4.[4] The results are illustrated by the Table 5.1.2.

[4] Since we are interested in the effects on the probability to accept an offer rather than on the effect on latent propensity, we will report marginal effects only.

Table 5.1.2: Marginal effects in probit model explaining *Offer*[5] [6]

	Model (1)	Model (2)
Offer	0.33333*** (0.06415)	0.336610*** (0.072428)
Age	-	0.000019 (0.010104)
Gender	-	0.000129 (0.069337)
Slovak	-	0.000195 (0.108095)
Russian	-	-0.000662 (0.334762)
Other	-	0.000196 (0.109638)
Educ	-	0.000077 (0.041362)
Econ	-	0.000328 (0.172811)
Ratio	-	-0.000313 (0.169068)
pseudo R squared	0.2962664	0.3560974

*Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1, Std. Errors in brackets ().*

The simple regression, which explains *Accept* in terms of *Offer* only obviously provide us with the same effect as displayed in Table 5.1.1 – the offer of 50 Czech crowns is predicted to be accepted with response probability 1, while a low offer of 20 Czech crowns with 0.667.

We extended the model by adding control variables *Age, Gender,* set of nationality binary variables *Slovak, Russian* and *Other* as well as *Educ, Econ* and *Ratio.* We were forced to exclude the variable *Import*, which indicates the importance an individual assigned to the amount of 100 Czech crowns on the scale from 0 to 10. Even though this variable seems to be relevant for the current analysis, it might suffer from endogeneity.[7] Also we did not include explanatory variables indicating individual current mood and personality since it does not seem relevant for analysis, where no emotions are present.

[5] To measure goodness of fit we used pseudo R squared proposed by McFadden (1974): $R^2 = 1 - L_{ur} / L_0$

[6] Homoskedasticity was not rejected in the Model (1) via LR test. The same procedure failed to make any conclusion about the Model (2). See Appendix 6.

[7] It might serve as rationalization for non-rejecting action: a person did not reject an unfair offer because he or she simply needs this money.

Estimated marginal effects for the extended probit model complemented by control variables is displayed in the Table 5.2.1 in the column Model (2). As expected, the variable *Offer* remained very statistically significant and moreover, the effect of *Offer* became a little bit stronger. As for control variables, effects of these on the probability to accept an offer are very small. None of the variables are individually statistically significant and furthermore, LR (Likelihood-ratio) test for joint significance did not reject the null hypothesis that control variables *Age, Gender, Slovak, Russian, Other, Educ, Econ* and *Ratio* have no effect on probability of acceptance an offer.[8] However, one can observe a slight increase in pseudo R squared indicating better predictive power of the model.

There are no intuitive expectations about the direction of effects of control variables except for *Ratio*. Since this variable indicates personal situation in saving money, we might expect that a person, whose financial surplus[9] measured by the variable *Ratio* is high, will reject a low offer of 20 Czech crowns rather than an individual with lower *Ratio*, since rejecting 20 Czech crowns will hurt financial situation of the former less than of the latter. In all remaining control variables both positive and negative effects can be argued.

Overview of key findings in the current section contains the following: behavior of Responders in the current Ultimatum Game experiment is in line with robust behavioral pattern in the Ultimatum Game. We detected very significant positive relationship between the offer assigned to the Responder and his or her reaction to this offer (accepting or rejecting it). Adding control variables did not have any impact on effect of the offer nor on its statistical significance. The effects of control variables on the probability of acceptance the offer are very small and furthermore, none of control variables were found individually nor jointly significant.

5.2. Analysis of emotions

As was already mentioned earlier, we measured emotions using the FaceReader software developed by Noldus. The FaceReader's output contained intensities measured

[8] $L = 5.8445$, p-value = 0.6646. The test is performed in Appendix 7.

[9] Difference between reported monthly income and spending.

each emotional state (neutral, happy, sad, angry, scare, surprised and disgusted) by assigning the number from 0 (no emotions detected) to 1 (full intensity) for each frame analyzed (30 frames per second) to each emotion. Since sometimes individuals experienced more than one intense emotion simultaneously, the sum of intensities of all emotions does not have to equal to 1. The intensities were consequently averaged to result in a single number for each emotional state for an individual. To make the further interpretation easier, we multiplied the average by 100 and rounded to the nearest whole number. Hence, the intensity of emotion is now given as the number from 0 to 100.

Summary statistics of intensity of emotional responses by Responders is given by the Table 5.2.1. In 4 out of 109 subjects we failed to analyze emotions - in one case the video was not even recorded and in three others due to quality of the video, subjects' head position or hands hiding the face we were not able to conduct an emotion analysis.

To investigate emotions, we have to get familiar with the data first. Given the summary statistics presented in the Table 5.2.1 we can see that the most intense emotion experienced is anger. However, an important remark should be made about this particular emotion. As was already described in the experimental design, the experiment was conducted on computers so the participants had to read the instructions on the screen. During the analysis of the video records it was noted that many individuals looked very concentrated when reading the instructions knitting their brows, which was sometimes evaluated by the FaceReader software as a sign of anger. These moments were manually eliminated from the analysis, but one cannot exclude that some of such frames were left in the analysis.

Table 5.2.1: Summary statistics of emotions

Emotion	Mean	Std. Deviation	Minimum	Maximum
Neutral	33.700	21.951	0.000	96.000
Happy	4.276	12.264	0.000	79.000
Sad	3.867	9.649	0.000	45.000
Angry	26.810	31.640	0.000	99.000
Surprised	10.660	16.956	0.000	71.000
Scared	3.086	8.510	0.000	55.000
Disgusted	10.130	16.103	0.000	79.000

We also report average intensities of emotions according to the treatment, which is illustrated by the Table 5.2.2. Given this output, the difference among treatments is clear: there is a radical difference in neutrality and anger as well as significant distinction in disgust and surprise. Therefore, there is definitely a reason to study the topic further.

Table 5.2.2: Table of average intensities of emotions according to treatment

	Fair treatment	**Unfair treatment**
Neutral	40.25	26.85
Happy	5.84	2.70
Sad	4.57	3.18
Angry	16.17	38.1
Surprised	12.81	8.45
Scared	3.46	2.81
Disgusted	6.39	14.17

As was already introduced in Description of the data, we measure emotions using their intensity on the scale from 0 (no emotions detected) to 100 (full intensity). Complemented by the fact, that all emotional states take their minimum value at zero, it might be useful to check data characteristics around zero, i.e. whether the variables take the value of zero with non-trivial probability. The Table 5.2.3 summarizes observations with zero intensity of each emotion.

As it shows, this is an issue for all emotions except for neutrality (only one individual has scored zero points in neutrality). In this case the OLS (Ordinary Least Squares) procedure might be misleading since it could result into obtaining negative fitted values leading to negative prediction of a dependent variable, which contradicts the distribution of this variable. We decided to apply OLS procedure to Neutrality and Anger and use Tobit approach for happiness, sadness, surprise and disgust (Appendix 7). As for fear, this emotion does not seem relevant in the environment of the Ultimatum Game and hence, we can eliminate it from the analysis since it will not yield any informative results.

Table 5.2.3: Summary of observations with zero scores for each emotion (*n* = 105)

Emotion	Number of zero observations	Ratio of zero observations
Neutral	1	0.01
Happy	65	0.62
Sad	69	0.66
Angry	14	0.13
Surprised	48	0.46
Scared	72	0.69
Disgusted	41	0.39

First of all we estimated simple models for each emotion.[10] Intensity of emotional response is explained by an offer assigned to the Responder and his or her reaction to this offer only. The estimates are illustrated by the Table 5.2.4.

Significant positive relationship between an offer and intensity of neutrality and surprise was detected (t statistics of 2.553 and 1.645 respectively) and similarly, significant negative relationship between the split assigned to the Responder and Anger and Disgust he or she experienced (t statistics of -2.775 and -2.102 respectively). An increase in offer by 30 Czech crowns (moving from unfair to fair offer) is associated with 11.7 points increase in score in neutral dimension and 10.5 points in surprise. Alternatively, there is a decline expected in intensity of experienced anger by 18 points and by 10.8 in disgust. Offer turned out to be insignificant in regressions with happiness and sadness as dependent variables. Moreover, the effect of offer on intensity of sadness is not as expected: one would probably expect a person to become less sad as the offer increases. However, the following estimates show the opposite.

Individual reaction to the offer (variable *Accept*) turned out to be insignificant in all these simple regressions. An individual, who accepted an offer, is estimated to gain 5 additional points in anger and almost 6 in happiness compared to one who rejected an offer. Alternatively, acceptance of an offer is expected to yield 2.76 decline in sadness, 11.32 in anger, 7.94 in surprise and 2.52 in disgust measured in points.

[10] R squared reported in tobit regressions is pseudo R squared proposed by MacFadden. Since pseudo R squared penalizes the model for including too many predictors, we report adjusted R squared in OLS cases, which does the same. Reporting classical R squared might be misleading when comparing goodness of fit of different types of models.

Table 5.2.4: OLS and tobit estimations for intensities of emotions [11]

	(1) Neutral	(2) Happy	(3) Sad	(4) Angry	(5) Surprised	(6) Disgusted
Offer	0.39*	0.02	0.04	-0.60**	0.35 .	-0.36*
	(0.15)	(0.20)	(0.18)	(0.22)	(0.21)	(0.17)
Accept	5.00	5.98	-2.76	-11.32	-7.94	-2.52
	(6.25)	(8.34)	(7.22)	(8.83)	(8.61)	(6.92)
Constant	15.64**	-15.50	-8.42	57.63***	-4.78	18.52**
	(5.95)	(8.19)	(7.11)	(8.42)	(8.22)	(6.64)
R squared	0.0822	0.0017	0.0045	0.1171	0.0046	0.0099
Method	OLS	Tobit	Tobit	OLS	Tobit	Tobit

*Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1, Std. Errors in brackets ().*

Given the estimates we predicted the intensity of each emotional state for three of the following situations: (1) Responder accepted an unfair offer, (2) Responder rejected an unfair offer and (3) Responder accepted a fair offer. Estimated intensities of emotions based on simple regressions from Table 5.2.4 are illustrated by the Table 5.2.5.

Table 5.2.5: Estimated intensities of experienced emotions [12]

	Neutral	Happy	Sad	Angry	Surprised	Disgusted
Accepted a high offer (Offer=50, Accept=1)	40.22	5.66	4.32	16.20	13.14	7.78
Rejected a low offer (Offer=20, Accept=0)	23.47	3.62	4.87	45.49	11.67	15.58
Accepted a low offer (Offer=20, Accept=1)	28.47	5.42	3.96	34.26	7.90	13.88

Except for sadness and happiness all results seem to be intuitive. We would probably expect the difference in intensity of experienced happiness among treatments to be more drastic (the difference between the situation of receiving fair offer and

[11] Test for homoskedasticity is performed in Appendix 8.

[12] Procedure of point estimations in tobit model is explained in Appendix 9.

accepting low offer is only 0.24 points). As for sadness, the estimates do not seem to match realistic expectations at all. Intuitively, one would rank individuals, who received a high offer as the least sad ones. However, estimation procedure ranked subjects accepting a low offer as the least sad. As for hypothesis about negative emotions driving the rejection rate in the Ultimatum Game, results suggest, that this seems to be true, however, the effects are insignificant, and so final conclusions cannot be completed so far.

In the next part of our analysis we decided to add control variables, described in the Chapter 4, to regressions.[13] The only variable we did not include to the regression is *Import*, due to the same reasons as we described earlier in this chapter when analyzing economic behavior of Responders. The estimates are displayed in the Table 5.2.6.

First of all, we can see that offer remains significant in all extended regressions where it was significant in simplified case. However, the effect of offer in regressions with happiness and sadness as dependent variables has changed. In the latter case the effect became intuitive: an increase in offer is now accompanied by a decrease in intensity of sadness. At the same time, effect of offer on happiness lost its intuitiveness since the extended model predicts lower intensity of happiness as the offer increases. In all other cases the effect does not differ a lot compared to coefficient estimated by simple regressions without control variables.

Variable *Accept* identifying Responders' reaction to the offer made, became significant on 90% level in relation to anger and also the effect turned out to be stronger compared to the relevant simplified regression. An individual, who decided to accept an offer is now estimated to score approximately 17 points less in angry dimension as compared to one, who rejected the offer. This is evidence in favor of "angry button hypothesis", which assumes destructive nature of anger.[14] In regression with disgust as a dependent variable the variable *Accept* changed the direction of its effect as compared to the regression without control variables. In the simplified case an individual, who accepted an offer was associated with 2.52 points lower score in disgust. However, adding control variables results into conclusion, that a subject accepting an offer is estimated to experience 1.37 points more intense disgust compared to Responder who rejected an offer. In all other regressions the effect of Responder's reaction to an offer

[13] CLM assumptions for OLS models are discussed in Appendix 10.

[14] Or, at least, presence of correlation between rejecting and intensity of anger.

remained its direction. Even though it did not gain significance, it has also stronger effects in case of neutrality and surprise. Alternatively, the effect became smaller in case of happiness and sadness.

Complementing regressions with control variables definitely improved all the models, which is indicated by significant increase in adjusted R squared for OLS cases and pseudo R squared for tobit procedures. Moreover, many control variables turned out to be significant. We will briefly discuss significant control variables in each regression in the following section.

5.2.1. Control variables

Estimates in OLS regression with neutrality as a dependent variable suggest, that an individual, who reported his or her nationality as Russian, is associated with almost 19 points higher score in neutrality compared to individuals who reported their nationality as Czech[15] and this effect is statistically significant on 95% significance level (t statistics of 2.023). Should this indicate strong evidence of Russians being calmer than Czech? Unfortunately, we are not able to do such conclusions since we have lack of observations for this kind of analysis (only 10 participants out of 109 identified themselves as Russians).

Even though our main explanatory variables *Offer* an *Accept* ended up insignificant in regression of happy emotion, it has many control variables, which are significant – *Age, Educ, Econ, NEO_O, NEO_C* and *NEO_A* on the 90% significance level, while *Gender* and *MDMQ_AT* on the 95% significance level. An additional year of life is estimated to lead to almost 4 points drop in intensity of happiness. Alternatively, an additional year of education yields to 5.15 points increase in feeling happy.[16] Moreover, students of economics are estimated to be happier compared to students of other field by approximately 12 points. As for gender differences, males are estimated to experience happiness with almost 15 points lower intensity than females. In the currently discussed regression there were also significant variables indicating current mood of an individual and his or her personality itself. As for Big-Five test,

[15] Interpretation of any binary variable from the nationality set is done relative to the base group, which is Czech in our case.

[16] One might argue, that education and age are closely linked together, so an increase in education is accompanied by increase in age as well. This might lead to problems with ceteris paribus issue.

personal openness to experience, conscientiousness and agreeableness are individually statistically significant and their effects on strength of happiness are negative, so as an individual is more curious, hard working and uncooperative, he or she experiences happiness in a less intensive way. Awake/tired dimension of personal current mood is the last individually statistically significant control variable and the effect is estimated to be positive: hence, as an individual is feeling more awake than sleepy, he or she is about to experience happiness more intensively.

The same mood control variable is also significant on the 95% level in the regression with sadness, however, with the opposite effect: as an individual feels less sleepy, he is estimated to experience less sadness. Binary variable indicating personal reported gender is again associated with significant negative effect marking males to experience sadness with approximately 11 points lower intensity as compared to females. The variable *Slovak* indication whether an individual reported his or her nationality as Slovak or not suggest in the current regression that a subject, who reported his nationality as Slovak is about to feel sad more intensively than Czech, which is measured by approximately 11 points.

In case of anger, it turned out that age is very individually statistically significant (99% significance level). The effect is positive, so an additional year of life yields an increase of experienced anger by approximately 7 points. Another significant effect was detected in case of personal savings, which is measured by the variable *Ratio*. As individual saving abilities increase (he or she is making more money or/and spending less money), anger he or she experiences is less intense. The variable we definitely expected to have a strong effect on intensity of anger is *NEO_N*, which measures personal ability to sustain negative emotions. Even though the effect is positive as intuitively expected (the more impulsive an individual is, the stronger the anger he or she feels), it is statistically insignificant (t statistics of 1.362).

While we expected neuroticism to have a significant effect on strength of anger, it turned out that it is significant in case of surprise, however, with unintuitive direction of the effect. One will expect a more impulsive individual to experience basically all emotions intensively. Nevertheless, the effect of neuroticism on strength of surprise is estimated to be negative, so the calmer the person is, the more surprised he feels. This emotional state seems to be also significantly affected by gender (males are estimated to feel 13.38 points less surprised than females) and nationalities (Russians are associated with 33 points lower scores in surprise than Czech and individuals, who reported any

other nationality than Czech, Slovak and Russian are expected to feel surprised almost 17 points less intensively than individuals reported their nationality as Czech).

Gender again is estimated to have a negative significant on intensity of disgust leading us to overall conclusion, that males seem to feel disgusted 12 points less than females. Also, significant negative effect of *Slovak* was detected – an individual, who reported his or her nationality as Slovak is estimated to score almost 14 points less in disgust than Czech.

To summarize the effects of control variables, we can state that males are estimated to experience all emotions except for anger with less intensity than females and that this effect is statistically significant (except for anger). This statement is also supported by positive coefficient on *Gender* in the model explaining intensity of neutrality. We have also indicated significant effects of nationalities on intensity of emotions but again, these results cannot serve as strong evidence due to the lack of observations. We expected more significant estimates by control variables standing for individual mood and personality characteristics, since we suppose it is directly referred to intensity of emotions.

As the overall key finding we indicate the estimation, that both offer and the fact whether the offer was accepted or not has a significant negative impact on individual experience of anger. This evidence goes in line with already existing literature about destructive nature of anger.

Table 5.2.6: OLS and tobit estimations for emotions with control variables

	(1) Neutral	(2) Happy	(3) Sad	(4) Angry	(5) Surprised	(6) Disgusted
Offer	0.33*	-0.03	-0.05	-0.58**	0.48*	-0.33 .
	(0.16)	(0.19)	(0.15)	(0.21)	(0.20)	(.17)
Accept	9.94	5.46	-1.93	-17.05 .	-9.70	1.37
	(6.76)	(8.58)	(6.37)	(8.80)	(8.03)	(7.07)
Age	-1.46	-3.93 .	0.97	7.12***	-2.90	-2.33
	(1.47)	(2.24)	(1.38)	(1.92)	(1.82)	(1.74)
Gender	1.40	-14.78*	-11.28*	9.55	-13.38*	-12.09*
	(5.03)	(6.57)	(4.71)	(6.55)	(5.86)	(5.18)
Other	13.04	-7.77	12.27	-4.79	-16.80 .	1.42
	(8.51)	(10.36)	(7.65)	(11.07)	(10.01)	(8.54)
Slovak	9.53	-6.54	10.79 .	-10.25	-6.04	-13.73 .
	(6.22)	(8.15)	(5.67)	(8.10)	(7.27)	(7.47)
Russian	18.79*	-1.15	-0.89	-10.37	-33.14**	9.69
	(9.29)	(10.77)	(8.73)	(12.10)	(11.23)	(9.46)
Educ	-0.12	5.15 .	0.10	-2.51	0.36	2.89
	(1.85)	(2.89)	(1.74)	(2.41)	(2.32)	(2.17)
Econ	-0.93	11.83 .	-6.86	-0.58	0.13	6.57
	(4.90)	(6.31)	(4.70)	(6.38)	(5.88)	(5.13)
Ratio	2.83	2.08	3.34	-8.41*	1.56	2.85
	(2.81)	(3.20)	(2.66)	(3.66)	(3.38)	(3.02)
NEO_O	0.45	-0.84 .	0.33	-0.36	0.21	-0.22
	(0.36)	(0.45)	(0.36)	(0.47)	(0.42)	(0.38)
NEO_E	0.04	-0.57	0.14	0.30	-0.33	0.19
	(0.39)	(0.51)	(0.39)	(0.51)	(0.47)	(0.42)
NEO_C	0.21	-0.57 .	0.23	0.13	0.31	-0.16
	(0.29)	(0.34)	(0.29)	(0.38)	(0.34)	(0.30)
NEO_A	0.33	-0.84 .	-0.04	-0.34	-0.18	0.45
	(0.38)	(0.46)	(0.60)	(0.49)	(0.45)	(0.40)
NEO_N	0.18	-0.47	-0.42	0.58	-0.98*	0.04
	(0.32)	(0.42)	(0.34)	(0.42)	(0.40)	(0.33)
MDMQ_GB	-0.77	-0.06	-0.43	0.91	0.23	-0.66
	(0.60)	(0.71)	(0.60)	(0.78)	(0.69)	(0.64)
MDMQ_CN	-0.06	-0.01	-0.04	0.71	-0.88	0.25
	(0.61)	(0.75)	(0.61)	(0.79)	(0.72)	(0.64)
MDMQ_AT	0.08	1.14*	-0.90*	-0.28	-0.12	0.10
	(0.49)	(0.58)	(0.43)	(0.64)	(0.57)	(0.50)
Constant	31.56	66.20	-5.70	-93.71 .	102.72*	31.77
	(39.11)	(48.24)	(38.75)	(50.93)	(48.11)	(40.65)
R squared	0.0990	0.0610	0.0826	0.2648	0.0450	0.0499
Method	OLS	Tobit	Tobit	OLS	Tobit	Tobit

*Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1, Std. Errors in brackets ()*

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6. Conclusion

Long-lasting economic tradition views people as being motivated solely by maximizing their own material interest. However, even though it might correspond to reality in some (probably many) cases, it definitely does not reflect the whole population and this idea is supported by numerous evidence. The only deviation from self-maximizing behavioral pattern that gained some attention by economists is pure altruism, which is characterized by unconditional desire to help other people, however, not all evidence could be explained by altruistic preferences. It turned out, that altruistic behavior is more complex – people are motivated to help those, who treat them kindly and oppositely, hurt those, who behave in a hostile manner. These two stylized facts form the concept of reciprocity (fairness).

Evidence of reciprocal behavior in controlled laboratory experiments includes robust results from the Ultimatum Game. Moreover, this experimental design was widely applied when studying the link between emotions and fairness. According to Bosman and Winden (2002), an individual perceives emotions when he evaluates an event as relevant for his preferences or concerns – damage of personal concerns induces negative emotions and vice versa. In the Ultimatum Game, one might evaluate that his or her concerns are damaged when he or she receives a low offer as Responder. Many studies provided, that lower offers are associated with strong negative emotions (primarily anger) and moreover, sometimes these emotions lead to destructive behavior, which in case of the Ultimatum Game is associated with rejections of low offers.

For the current thesis we conducted simple Ultimatum Game and focused on the behavior and emotional states of Responders. We were interested, whether emotions are involved in the decision-making process when individuals are exposed to the situation, when they were treated unfairly. Namely, we were researching whether there is an effect of the offer assigned to the Responder and the action he or she took as respond to the offer on the intensity of certain emotion. We tested 5 basic emotions including happiness, fear, anger, disgust and surprise as well as neutrality, which were detected by FaceReader software.

We detected strong negative relationship between the offer assigned to the Responder and intensity of anger and disgust the Responder experienced. Alternatively, significant positive effect of the offer was found in case of surprise and neutrality.

Individual reaction to the offer assigned turned out to be significant only in relation to anger and the effect is negative, which provides evidence for “angry button hypothesis” that anger has destructive consequences. We have also tested whether the overall behavioral pattern is also applied for our sample and got supportive results – approximately 33% of Responders, who were assigned an unfair offer of 20 Czech crowns, rejected it.

Obviously, this piece of work gives only a basic overview of emotional responses in case of the Ultimatum Game. In this context we can see some directions for further investigation. First of all, it might be interesting to investigate the effect of nationality on intensities of emotions in case of the Ultimatum Game. In our analysis we have detected significant effect of certain nationalities on the most of emotional states, however, small sample size did not allow us to make any conclusions about the effect. Moreover, adding personal expectations could also yield interesting results in context with emotions, i.e.: ask individuals before they were assigned an offer about what amount they expect their counter players have sent them. This can further clarify why some people accept a low offer and other reject it as well as why their emotional intensities differ. Finally, since we observed only correlation between emotions (particularly anger) and personal decisions, one might find challenging to focus on casual effect of emotions on decision-making process, i.e.: make people angry externally (not resulting from the offer assigned) and then observe rejection rates.

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List of appendices

Appendices

Appendix 1: Experiment instructions

Source: Author. Utilized software: zTree version 3.5.2.

Translated from Czech: **INSTRUCTIONS**

Now you are going to participate in the experiment, where you will have to decide about an offer coming from a real partner, who took part in the first stage of this experiment few days before. Your counterplayer will be assigned to you randomly.

Each participant of the first stage of the experiment was given 100 Czech crowns and was told to divide this sum of money between himself and his opponent, who will enter the game later on.

Participants were given two options how to divide 100 Czech crowns:

1. Keep 50 Czech crowns for himself and transfer 50 Czech crowns to his opponent
2. Keep 80 Czech crowns for himself and transfer 20 Czech crowns to his opponent

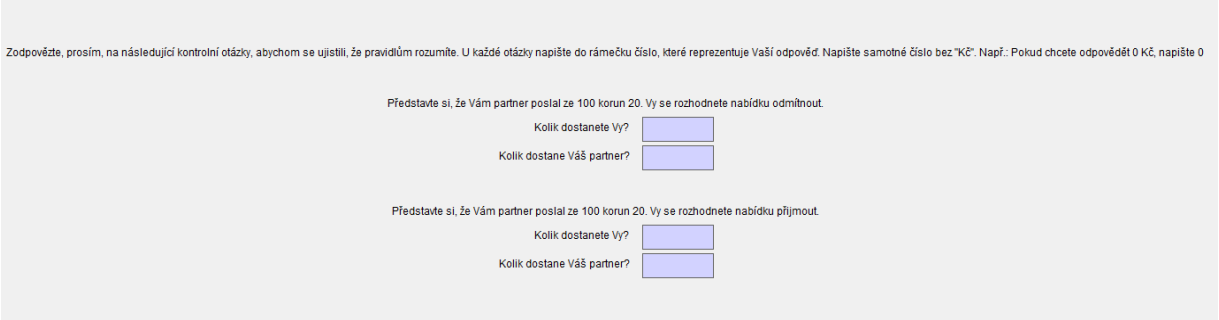
The amount of money your counter player decided to transfer to you will be displayed on your screen. Ex.: if the number 20 is displayed, this means that the player, who was assigned to you decided to keep 80 Czech crowns for himself and transfer 20 Czech crowns to you.

As soon as you receive the offer, you have two possibilities: you can accept or reject. Your partner's offer will be assigned to you randomly.

Should you accept, both you and your partner will be paid according to the offer. Alternatively, if you decide to reject the offer, neither you nor your partner will be paid any money.

If everything is clear to you, press OK.

Appendix 2: Control questions



Source: Author. Utilized software: zTree version 3.5.2.

Translated from Czech: Please, answer the following control questions so we are sure that you understand the rules. Write the number, which is consistent with your answer, in the box. Write the number without "Czech crowns". Ex.: If you want to answer "0 Czech crowns", write 0.

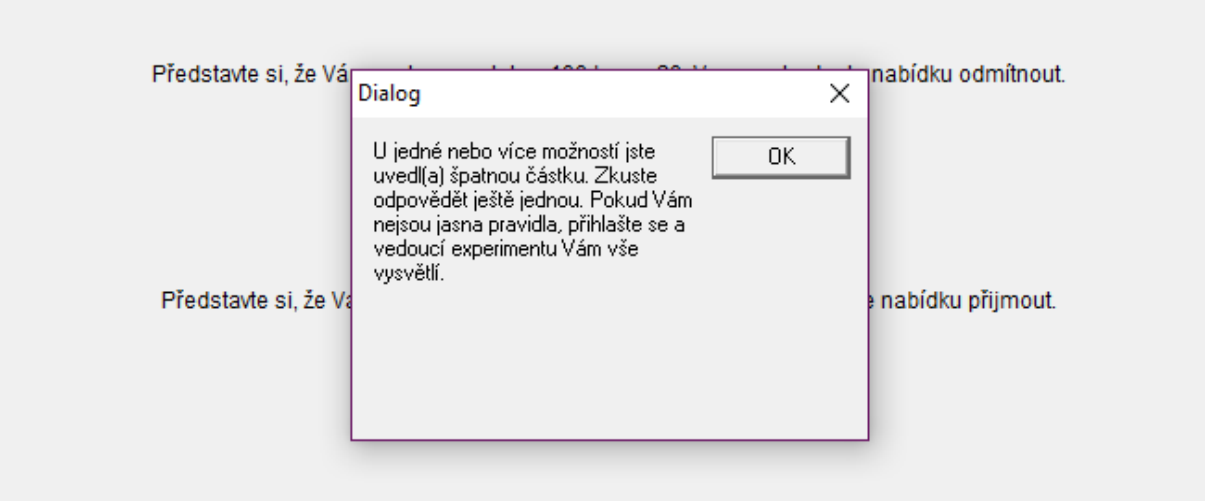
Imagine, that your partner decided to transfer 20 Czech crowns out of 100 Czech Crowns. You decided to reject the offer.

How much will you get? How much will your partner get?

Imagine, that your partner decided to transfer 20 Czech crowns out of 100 Czech Crowns. You decided to accept the offer.

How much will you get? How much will your partner get?

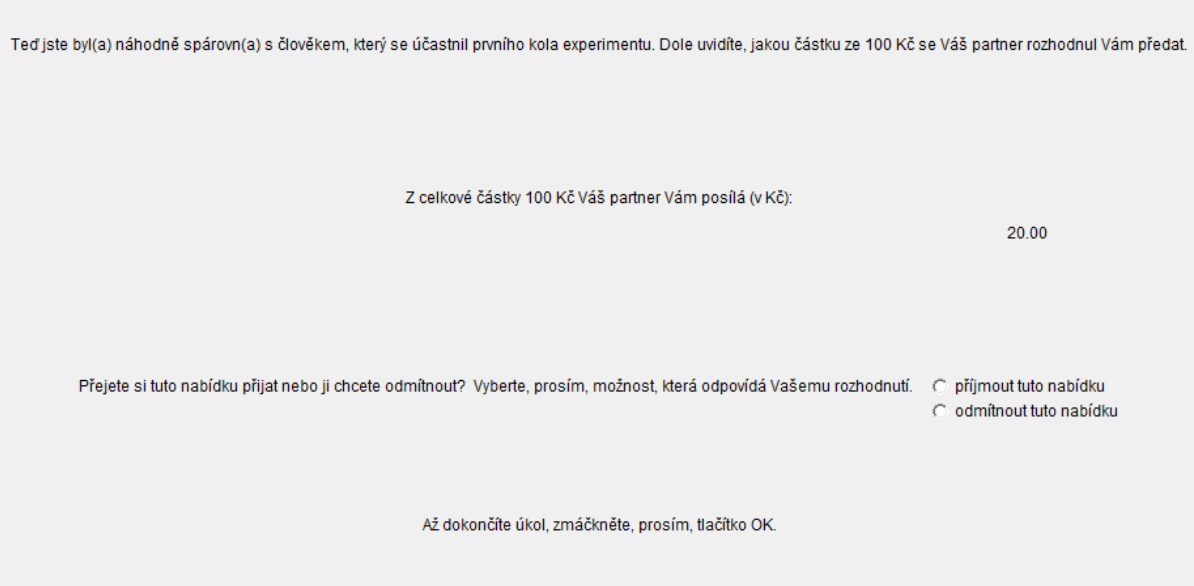
Appendix 3: Warning box



Source: Author. Utilized software: zTree version 3.5.2.

Translated from Czech: You provided an incorrect amount in one or more possibilities. Try to answer again. If you do not understand the rules, raise your hand and supervisor of the experiment will explain everything to you.

Appendix 4: Offer



Source: Author. Utilized software: zTree version 3.5.2.

Translated from Czech: Now you have been randomly paired with a person, who participated in the first stage of the experiment. You can see below what amount out of 100 Czech crowns your partner decided to transfer to you.

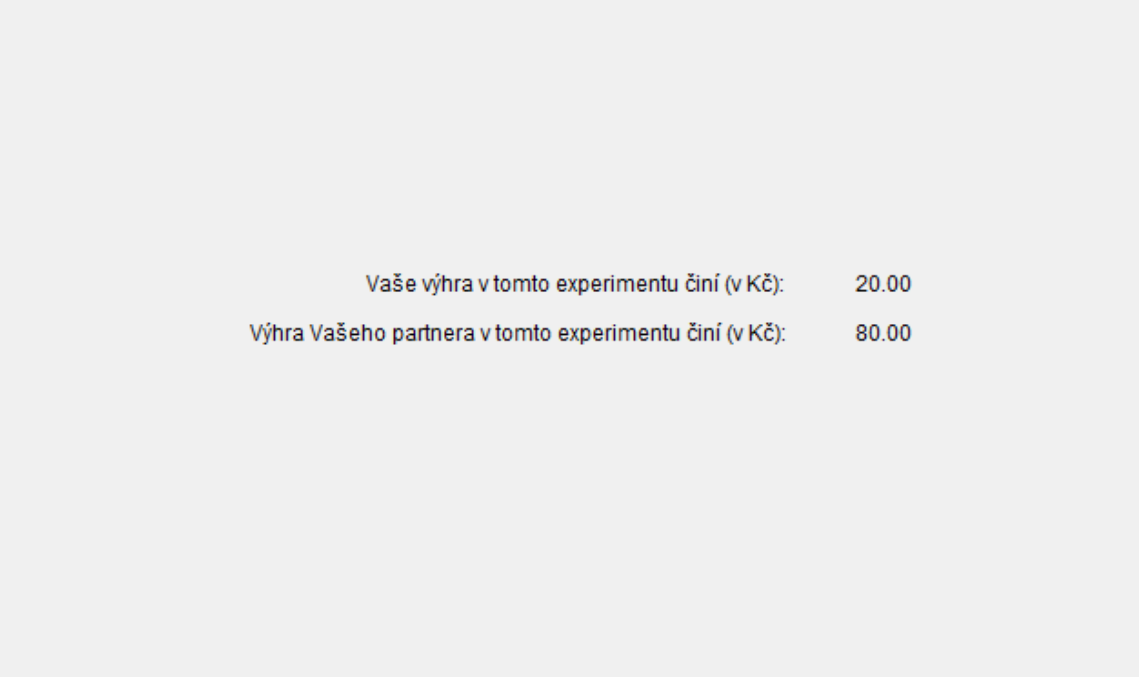
Out of the total sum of 100 Czech crowns your partner transfers to you (in Czech crowns): 20.00.

Would you like to accept or reject the offer? Please, choose the alternative, which is consistent with your decision:

- accept this offer
- reject this offer

As soon as you are done with the task, press OK button.

Appendix 5: Profits



Source: Author. Utilized software: zTree version 3.5.2.

Translated from Czech:

Your prize in this experiment is (in Czech crowns): 20.00

Your partner's prize in this experiment is (in Czech crowns): 80.00

Appendix 6: Homoskedasticity in probit model

hetglm(formula = accept ~ offer, family = binomial("probit"))

LR test for homoskedasticity: 1.769e-07 on 1 Df, p-value: 0.9997

Appendix 7: LR test for joint significance

Likelihood ratio test

Model 1: accept ~ offer

Model 2: accept ~ offer + controll

L_{ur} = -34.372, L_{res} = -31.449

LR = 5.8445, *p-value* = 0.6646

Appendix 7: Checking specification of tobit models

In order to make sure whether the Tobit model is appropriate for our data, we tested the Tobit model specification with its probit part. Generally, we compared coefficients from Tobit model (after scaling) to estimated coefficients by probit model with the dependent variable *Emotion* > 0, where Emotion stands for all emotional states except for neutrality (only one observation with zero intensity in neutrality does not make this data suspicious of left-censoring). If the coefficients in Tobit and probit model differ a lot, Tobit approach is concluded to be inappropriate for such data. The comparison of probit and scaled Tobit coefficients is given by the Table A6.1.

As we see, the coefficients are very close for happy, a little bit further but still acceptable for sad, surprised and disgusted but very different for angry. Therefore, we will apply classical OLS procedure when analysing angry and neutral. Alternatively, Tobit approach will be used when dealing with emotions as happy, sad, surprised and disgusted. As argued earlier, fear can be eliminated from the analysis.

Table A7.1: Comparison of scaled tobit and probit estimates

Emotion	Tobit scaled			Probit		
	Constant	Offer	Accept	Constant	Offer	Accept
Happy	-0.668	0.001	0.258	-0.222	-0.008	0.229
Sad	-0.413	0.002	-0.135	-0.255	-0.006	0.078
Angry	1.816	-0.021	-0.410	5.770	-0.010	-4.390
Surprised	-0.182	0.013	-0.302	-0.032	0.013	-0.371
Disgusted	0.834	-0.016	-0.113	0.676	-0.015	0.164

Appendix 8: Homoskedasticity in tobit models

General idea of testing homoskedasticity in tobit model sis to estimate an appropriate probit model and test homoskedasticity there. We managed to test homoskedasticity by applying this approach only in case of happiness. To get at least some results for homoskedasticity in other models we conducted Breusch Pagan test for relevant OLS regressions. In all models even LR test for homoskedasticity or BP test did not reject the null hypothesis of homoskedasticity. Luckily, there is no need to worry about heteroskedasticity since we have very similar treatment averages.

hetglm(formula = (FR_U > 0) ~ offer + accept, family = binomial("probit"))
LR test for homoskedasticity: -0 on 2 Df, p-value: 1

studentized Breusch-Pagan test
data: lm(P.FR_H. ~ offer + accept)
BP = 0.5311, df = 2, p-value = 0.7668

data: lm((FR_SA > 0) ~ offer + accept)
BP = 0.3981, df = 2, p-value = 0.8195

data: (FR_U > 0) ~ offer + accept
BP = 0.0858, df = 2, p-value = 0.958

Appendix 9: Calculating effects in tobit model

Calculation of estimated intensity of each emotion experienced given particular values of explanatory variables is not that simple as in the OLS case since in Tobit model the expected value of the dependent variable given the explanatory variable is given as a product of the probability of the dependent variable being positive and expected value of the dependent variable given that this dependent variable is positive both conditional on the set of explanatory variables. Effects should be calculated by using the following formula:

$$E(y|x) = x\hat{\beta}\Phi(x\hat{\beta}/\hat{\sigma})x\hat{\beta} + \hat{\sigma}\phi(x\hat{\beta}/\hat{\sigma}),$$

where Φ is standard normal cumulative distribution function, φ is the standard normal density function and $\sigma\hat{}$ is the estimated standard error of the regression.

Appendix 10: CLM (Classical Linear Model) Assumptions

1. Linear in parameters: We will assume that the population relationship, which we are interested to estimate, is linear (i.e.: there is a linear relationship between dependent and explanatory variables).
2. Random sampling: In order to indicate whether randomization assumption is satisfied, we have to make sure that observed characteristics (age, education, etc.) are

similar for both treatment and control groups. As reported by Table A10.1, there are no radical differences in treatment averages, hence, we can conclude that randomization is satisfied.

Table A10.1: Treatment averages

	Control Group *(Offer = 50)*	**Treatment Group** *(Offer = 20)*
Age	23,02	22,76
Gender	0,53	0,59
Czech	0,58	0,78
Slovak	0,18	0,11
Russian	0,15	0,04
Other	0,09	0,07
Educ	16,18	16,30
Spend	10278,18	9098,15
Income	9509,09	6750,00
Ratio	0,85	0,72
Econ	0,65	0,74
Import	2,85	2,91
NEO_O	29,24	30,22
NEO_E	31,80	31,24
NEO_C	30,82	29,85
NEO_A	28,60	30,20
NEO_N	20,35	22,00
MDMQ_GB	24,42	22,96
MDMO_CN	24,18	23,22
MDMQ_AT	20,29	19,30

3. No perfect collinearity: Violation of this assumption occurs, if there is a constant explanatory variables or there is an exact linear relationship between independent variables (one variable is another one but multiplicated by a constant). This does not seem to be a problem in our case. To support it, we have calculated a correlation matrix among all explanatory variables (Table A10.2).

4. Zero conditional mean: If error term's expected value given the set of explanatory variables is not zero (i.e. explanatory variables are not correlated with the error term), the endogeneity occurs. This might happen in three basic situations: there is

an omitted variable in the regression, measurement error in independent variables or simultaneity (i.e. independent variable is jointly determined with a dependent variable). Measurement error should not be the case in the regression since values of explanatory variables are coming from even self reports (age, gender, etc.) or are determined by the randomization process (offer) or measure directly actions of participants (accept). To discuss simultaneity we have to think whether any of explanatory variables can be explained by dependent variable. The only suspicious pair is *Emotion* and *Accept* and one might think that these two variables could be mutually explained. However, we suppose that the action of an individual explains his intensity of experienced emotion rather than emotion explains rejection rate. Obviously, acceptance rate is explained solely by the offer made and adding any further explanatory variables turned out to be redundant. The omitted variable problem in final regressions also does not seem to be an issue. As we are measuring anger and neutrality as a reaction on the specific situation, the key explanatory variables are those reflecting this situation (offer, accept). It is also important to control personal characteristic of an individual (i.e. how easily he becomes angry), but we solved it by adding variables from Big-Five test and Multidimensional Mood Questionnaire to the regressions.

Table A10.2: Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1) offer	1,00																	
(2) accept	0,45	1,00																
(3) age	0,06	0,03	1,00															
(4) gender	-0,07	0,00	0,18	1,00														
(5) slovak	0,10	0,11	0,09	0,11	1,00													
(6) russian	0,19	0,06	-0,32	-0,29	-0,46	1,00												
(7) other	0,03	0,04	-0,34	-0,14	-0,44	-0,12	1,00											
(8) educ	-0,04	0,05	0,66	0,03	0,25	0,13	-0,31	1,00										
(9) econ	-0,09	0,03	-0,13	0,14	-0,03	0,05	0,00	-0,02	1,00									
(10) ratio	0,07	-0,11	0,44	0,00	0,22	-0,04	-0,18	-0,13	0,23	1,00								
(11) NEO_O	-0,08	-0,14	-0,08	-0,05	0,00	-0,09	0,05	0,06	-0,11	0,05	1,00							
(12) NEO_E	0,04	0,19	-0,02	-0,17	-0,01	0,00	0,02	0,00	0,02	0,23	0,27	1,00						
(13) NEO_C	0,05	0,04	-0,14	0,01	-0,15	0,00	0,17	0,07	-0,18	0,13	0,10	0,16	1,00					
(14) NEO_A	-0,13	-0,11	-0,03	-0,16	0,21	-0,15	-0,20	0,04	0,15	-0,20	0,07	0,08	0,12	1,00				
(15) NEO_N	-0,10	-0,22	0,06	-0,10	0,02	-0,04	0,02	-0,01	0,00	-0,18	-0,22	-0,05	-0,13	-0,01	1,00			
(16) MDMQ_GB	0,13	0,17	-0,16	0,03	-0,04	-0,13	0,18	0,05	-0,13	0,11	0,10	0,06	0,12	-0,11	0,09	1,00		
(17) MDMQ_CN	0,11	0,05	-0,14	0,03	-0,14	-0,02	0,11	0,14	-0,06	0,13	0,07	0,00	0,04	-0,11	0,13	0,28	1,00	
(18) MDMQ_AT	0,11	0,06	-0,03	0,18	0,18	-0,17	-0,04	-0,04	0,02	-0,06	-0,12	-0,08	-0,06	-0,04	0,15	0,01	0,06	1,00

5. Homoskedasticity: To test whether error term has a constant variance given any values of explanatory variables we conducted Breusch-Pagan test.

studentized Breusch-Pagan test

data: lm(FR_A ~ offer + accept + control)

BP = 10.2411, df = 18, p-value = 0.9238

studentized Breusch-Pagan test

data: lm(FR_N ~ offer + accept + control)

BP = 22.6194, df = 18, p-value = 0.2056

Sufficiently large p-value did not allow us to reject the null hypothesis of homoskedasticity in both cases.

6. Normality: The following assumptions require population error terms to be independent on explanatory variables included in the model and normally distributed. Luckily, this assumption could be dropped when the sample is sufficiently large. Since we have over 100 observations, we can easily use usual statistical inference procedures.