

**Czech University of Life Sciences Prague**  
**Faculty of Economics and Management**  
**Department of Economics**



**Bachelor Thesis**

**Application of Behavioral Economics to Addiction**

**Problems: A Case Study**

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**CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE**

Department of Economics

Faculty of Economics and Management

# **BACHELOR THESIS ASSIGNMENT**

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Economics and Management

Thesis title

**Application of behavioral economics to addiction problems: A Case Study**

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## **Objectives of thesis**

The aim of this study is to identify and evaluate major characteristics of the behavioural economics and how it can explain the addiction problems. Hence, the conducted case-study supports this goal by interpreting addiction using the tools and theories of the behavioral economics.

## **Methodology**

Literature review is conducted using methods of synthesis, induction, deduction and extraction. Analytical section will be done through a case study and some of the methods applicable to behavioral economics.

**The proposed extent of the thesis**

40 pages

**Keywords**

Behavioural Economics, Addiction, Case Study, Opportunity Costs, Preferences., Illusion of Control, Behavioural Processes , Consumption, Rationality

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**Recommended information sources**

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## Declaration

I declare that the bachelor thesis called “Application of Behavioral Economics to Addictive Problems: A Case Study” has been generated by me as the result of my own original research. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.

In Prague on

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Kseniya Kvolyek

## Acknowledgment

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# Application of Behavioral Economics to Addiction Problems: A Case Study

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## Aplikace Behaviorální Ekonomie na Problémy Závislosti: Případová Studie

### Summary

This thesis examines theories and assumptions, developed by leading behavioral economists, on addiction appearance and following problems.

Literature review offers a descriptive account of behavioral economics and addictiveness. It introduces the combined ideas of economics and psychology, and how they influence everyday human decision-making, as well as, features that are present in the cycle of addiction. As prior studies show that behavioral economics can explain the dependency as an outcome of certain cognitive biases, it was decided to test hypotheses regarding the relationship of loss aversion and addicts' preferences. For the sake of this observation, there was designed a case study that was similar to previous scientific researches, but required more precise sampling. Data was collected by personal interviewing and filling in online survey. Afterwards, all responses were statistically verified and explained on the basis of early notions described in the theoretical part of this work.

Key words: Behavioral Economics, Addiction, Loss Aversion, Prospect Theory, Case Study, Preferences, Rationality

## Sourhn

Tato práce se zabývá teoriemi a předpoklady o závislostech a dalších problémech vyvinutých předními behaviorálními ekonomy.

Přehled literatury nabízí popisnou úvahu behaviorální ekonomie a návykovosti. Také představuje kombinované myšlenky o ekonomii a psychologii a ukazuje, jak ovlivňují každodenní proces rozhodování, jakož i rysy, které jsou přítomny v cyklu závislosti. Jelikož předchozí studie naznačují, že behaviorální ekonomie může vysvětlit závislost jako výsledek určitých kognitivních předsudků, byla stanovena hypotéza zabývající se averzí vůči ztrátě a preferencí lidí trpících závislostí. Pro účely tohoto pozorování byla vytvořena případová studie, která byla obdobná jako předchozí vědecké výzkumy, ale vyžadovala přesnější vzorkování. Data byla získána formou osobního rozhovoru a online dotazníku. Následně byly všechny odpovědi statisticky ověřeny a vysvětleny na bázi základních pojmů, popsaných v teoretické části.

Klíčová slova: Behaviorální Ekonomie, Závislost, Averze Vůči Ztrátě, Prospektová Teorie, Případová Studie, Preference, Racionálnost

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# 1. Introduction

Standard economics assumes that all people are unemotional maximizers by their nature. Keeping this idea in mind, many researchers tend to regard a human being as Economic Man who always think logically, act rationally and make decisions to fulfill self-interest. He takes into account all opportunities to maximize his profit and utility. In short, Economic Man is a smart, selfish and analytical thinking individual. And the questions is: Does such a person really exist?

Behavioral economics is a study that tries to open people's eyes to see how they are bounded and biased. It is a science that outlines how individuals make choices and what influences their decision-making and preferences. Behavioral economics is a quite new and dogmatic field of study, however, there are already many empirical researches and following findings, carried out by behavioral economists, which question common economic theories.

If smokers know that smoking is bad for their health, why do they continue to buy cigarettes? If gamblers know that there is a bigger risk of loss rather than gain, why do they continue to bet? If shopaholics know that the number of bought items will not change their life, why do they continue to spend money on unnecessary stuff? From the perspective of the neoclassic school of economics, these situations cannot occur in the world, as they assume that all people are agents of rational thinking and act for their own utility, interest and benefits. Nevertheless, behavioral economics found answers for these questions and proofs that people and their way of thinking is affected by cognitive biases and other limitations that deceive perception and evaluation criteria for efficient decision-making.

This particular thesis introduces the concept of behavioral economics and some of its crucial theories. It extends prior works on addiction problems and describes their features and possible reasons why people become addictive. To answer the research question of this work, there was conducted a special research aiming to assess the impact of the fundamental behavioral economics discovery – loss aversion – on addictive people.

## **2. Thesis Objectives and Methodology**

Further on, there are listed objectives and methodology used in this thesis.

### **2.1 Objectives**

The research question of this thesis is to identify the major characteristics of behavioral economics and how it can explain addictive issues by providing a real-life research of loss aversion using a case study structure. The initial supposition is that addictive people are strongly biased and loss averse. Hence, the provided in-depth observation of addicts' preferences in riskless choice model interprets the sense of addiction by tools and theories of behavioral economics.

Originally, the problems and ideas discussed below give profound understanding of what role and to which extent behavioral economics plays in everyday human life. Moreover, there are listed the main attributes of addiction and few hypotheses of how addictive people behave in terms of economics. This thesis is written to provide an access to and explanation of theoretical ideas developed by behavioral economists. These concepts take into consideration the prior researches, assumptions worked out by classic economists, psychological frameworks and nature of the human psyche.

### **2.2 Methodology**

To fulfill the objectives of this work and illustrate evidences that confirm the theoretical part, basically consisted of literature review, there was provided a case study with certain sample criteria. The respondents answer one or two questions that determine their willingness to purchase and/or sell the object of their addiction. The case study was divided into two interconnected studies – within-subject and between-subject tasks.

When data were collected, there were provided statistical methods to check if this specific observation confirms the initial theoretical hypothesis. For this, there were used tests:

- Two-sample T-test for independent sample – to compare the means of two samples in the first study; and in the second one, it was checked if two valuation problems had impact on each other or not;
- Kolmogorov-Smirnov test – to identify if datasets are different from each other by comparing cumulative frequencies.

All calculations, tables and statistical tests were created in Microsoft Excel 2013 program.

Literature review was conducted by using methods of synthesis, induction, deduction and extraction. Chosen resources were carefully studied to provide a foundation and support for the theoretical background of the research question.

## 2.3 The importance of study

Behavioral economics does not apply only elements of psychology and economics but also sociology, anthropology, neurology, statistics and finances. It combines all these studies and check how they are involved in thinking process directed to economic decisions. In essence, behavioral economics is a meaningful and crucial science – such as medicine, biology, physics, etc. – that integrates numerous techniques, methods and observations and uses them to depict problem-solving and decision-making (McAuley, 2010).

Must be remembered, nobody doubted the existence of Economic Man before behavioral economists started to set new hypotheses and look for alternative concepts, which could explain the errors in rational thinking. Behavioral economics, by its empirical evidences, may be regarded as an effective guide for more efficient public policies, better decision-making, understanding of true preferences and avoiding other behavioral mistakes.

In this particular work, it is highlighted how behavioral economics can predict and explain problems of addictiveness. Knowing the basic concepts of this science, addictive people may look at their objects of desire through other lens and become more prone to avoid temptations. Behavioral economists in cooperation with psychologists may design a totally new therapy for addictive people and try to find ways to predict the occurrence of addictive behavior.

### **3. Literature Review**

Literature review was done by examining articles, books, research papers that the author of this thesis considered as relevant. All resources mentioned below were published by accredited scholars and researchers. Chosen literature disposes the research topic within the context of the previous academic findings and sets the background for further studies.

#### **3.1 Behavioral Economics**

Behavioral economics is a branch of the economic theory that takes into account the psychological characteristics of human perception, judgments and behavior. The assumptions and investigations, conducted by behavioral economists, specify a framework to observe and interpret how really people make decisions, choices and mistakes (Ariely, 2008).

This discipline combines two fields of studies – Psychology and Economics. Such a combination of sciences makes it easier to investigate human economic behavior regarding the main principles of psychological foundation. Hence, psychology enlightens economics through examining real behavior of economic agents that is much deeper and closer to reality than usual models used by mainstream economists (Camerer, Loewenstein and Rabin, 2004). The behavioral theory is not limited to a concrete number of descriptive methods but it tries to build up a generalized model of decision-making that may help individuals and collective institutions to better allocate resources and establish profitable economic strategies.

##### **3.1.1 A Brief History of Behavioral Economics**

On the basis of the evidence currently available, it seems fair to assume that psychology did not exist as a field of study, meanwhile, economics was regarded as one of the most essential disciplines. However, many economists linked their works tight to psychology and constituted a contemporary background for developing of a separate behavioral science. For instance, the first published work written by Adam Smith was *The Theory of Moral Sentiments* (1759), which was not popular among economists and undervalued undeservedly, described individual

behavior within social relationships and norms in certain economic conditions (Ashraf, Camerer, and Loewenstein, 2005). Furthermore, in 1999 a recent American author and behavioral economist, George Fred Loewenstein, emphasized the role of Jeremy Bentham, one of founders of the neoclassic model of economics, who described his utility concept broadly using psychological underpinnings of utility (Camerer and Loewenstein, 2004).

At the beginning of the 20<sup>th</sup> century, during the neoclassical revolution, economists tried to distinguish their area of study as a natural science and, as a result, they worked up the concept of homo-economicus<sup>1</sup>, which was assumed to be totally rational. The talented thinkers of that time, such as John Richard Hicks, Paul Anthony Samuelson, Kenneth Joseph Arrow and many others, rejected psychological suppositions as absolutely unnecessary to build a harmonious logical economic theory<sup>2</sup>. Indeed, the most important findings of the 20<sup>th</sup> century did not require any additional knowledge except assumptions of individual self-interest, maximization of utility function and profitability.

That is to say, that many economic theories were developed but still many questions were not answered. Supposedly, it was partly a consequence of insufficient degree of compliance with the proposed theoretical models and their application in reality (Camerer and Loewenstein, 2004). Therefore, scientists began to search for non-economic variables to explain certain phenomena (Caldwell, 1986).

One of the reasons of emerging behavioral economics was acceptance of the expected utility and discounted utility models which develop testable hypotheses about decision-making (Mishra, 2008). These foundations led to further researches and criticism of the standard economic theory (Allais, 1953; Ellsberg, 1961; Strotz, 1955; Kahneman and Tversky, 1979; Loewenstein and Prelec, 1992; and others).

Behavioral economics is still developing nowadays. Uri Gneezy, Dan Ariely, Daniel Kahneman, Matthew Joel Rabin, Richard Thaler are few of many who dedicate their current

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<sup>1</sup> The term "homo-economicus" firstly was used by John Steward Mills. He explained this concept as a person "who inevitably does that by which he may obtain the greatest amount of necessities, conveniences, and luxuries, with the smallest quantity of labor and physical self-denial with which they can be obtained."

<sup>2</sup> However, over time many neoclassic economists moved away from their original way of thinking and admitted the importance of psychology in economics.

researches to behavioral economics and try to figure out and test the real relationship between psychology and economics.

### 3.1.2 Behavioral versus Neoclassical Economics

As it was mentioned before, in the traditional economic theory, a human being is described as a logically thinking agent. Such a rational person is always expected to correctly distribute and assign available resources, value all benefits, realize personal needs and preferences, and do not doubt made choice. Neoclassical economics supposes that human beings take into account all provided information and alternatives, and use them as a base for decision-making, that guarantees self-interest and benefits while all risks are considered (Levitt and List, 2008; McDonald, 2008; Altman 2006; Dawnay and Shah, 2005). Traditional economists, keeping in mind these assumptions, have formed models of supply and demand, inflation and deflation, life-cycles and margins, utilities and many other.

In 1979, Daniel Kahneman and Amos Tversky created a work called "Prospect Theory: An Analysis of Decision under Risk"<sup>3</sup>. They published and developed the results of conducted researches proving that neoclassic models were wrong and it was characteristic for human beings to behave irrationally.

Indeed, behavioral economists emerged with an idea to challenge the rational choice model, used by mainstream economists. Empirical evidences, collected by behaviorists, show that an ordinary human being has problems with self-control and is not aware of his future and even current preferences (Rubinstein, 2005). Behavioral economics tries to understand real human behavior and describe these phenomena to review existing theories and models. Focusing on mistakes and biases, it can also help policy makers to reestablish existing settings and states to leverage better public courses of action (Sunstein, 2014). Researchers attempt to open "black boxes" of households and firms, and find out how the real process of decision-making comes to life, and observe its patterns.

It is assumed that it is necessary to deny the framework of maximization and profitability and change it to more realistic behavioral suppositions (Camerer, 2002). Correspondingly,

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<sup>3</sup> Prospect theory describes decision making between alternatives with the probability of some risks.



followers of behavioral economics clearly understand that economists will not rethink the traditional neoclassic microeconomic theories without any necessity, though, behaviorists consider that if there is any significant difference between old-fashioned and realistic models, the more precise theory must be accepted (considering that neoclassic model is not appropriate and behavioral model is the best fitting one) (Tomer, 2007).

In fact, behavioral economics tries to find solutions of how to use and predict human imperfectness. Nowadays, the mainstream model of Economic Man stops to exist and this novel idea of Irrational Man is getting more and more followers. The behavioral approach may revolutionary turn into totally brand new way of how people think of economics (Simon, 1947; Altman, 2011; Kahneman and Thaler, 2006).

### 3.1.3 Cognitive Biases

Findings from psychology and neuroscience prove that people are mentally biased and these inherent biases lead to wrong decision-making and severe errors even if a person is thinking that he has done his best and put efforts in decision process (Baron, 2007; Ariely; 2008). In other words, cognitive biases represent a methodical inclination to unconscious creating of a deviation from rationality. They are actual failures influenced by miscounts, impacts of environment, and individual attainments. However, there is a contradicting point that, actually, biases cause faster information processing and make thinking process much more effective and quicker, especially, in a crisis or situations with a high level of risks (Gigerenzer and Goldstein, 1996).

The supremacy of biases in conjoint decision-making is an intermixture of habits, beliefs and generic culture. Basically, biases are so penetrating and profound because they are a creation of human nature. Nevertheless, according to some researches, biases are also observed in animal behavior (e.g. rats, monkeys)<sup>4</sup>.

Despite being well-disciplined and discreet, human beings most often act according to emotions and prejudices. And this fact explains why there are so a lot of different types of biases that affect daily preferences, economic and general behavior.

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<sup>4</sup> Harding1, Paul1 and Mendl, Animal behavior: Cognitive bias and affective state, 2004; Richter, Schick, Hoyer et al., A glass full of optimism: enrichment effects on cognitive bias in a rat model of depression, 2012; etc.

One of the most widespread theory, that is commonly used nowadays, is the idea of bounded rationality. This concept points out that individuals are irrational because of uncertainty and limit of information that they maintain. It regards rationality as an optimization function that is working under certain inevitable restraints, which include following facts:

- People are not able to evaluate and process all disposable information;
- The time for decision-making is finite;
- Usually the obtained information is not complete and may be untrustworthy.

The findings, made from these assumptions, confirm that all people are bounded to choose satisfactory alternatives rather than seek for optimal ones (Simon, 1982).

There are a lot of different types of cognitive biases that transcend each other in different situations and tasks. From a focusing effect – when people tend to exaggerate the importance of one subject or event and do not take into an account the utility of future outcome (Vass, 2013) – to a confirmation bias – which shows that human beings blindly believe in information that matches their actual beliefs (Plous, 1993) – the real number of such biases is overwhelming and stunning.

Furthermore, some of the cognitive observations can also help to interpret human tendency to be addictive. For instance, a backfire effect does not let people accept data that are different from their worldviews (even if they know that their opinion is wrong) – in other words, if a person is thinking that continuous smoking helps him to overcome stress situations, none of empirical evidences will be able to change his mind. Another example is a bandwagon effect. It demonstrates that most humans tend to be influenced by a herd-effect – this bias assumes that if many people think that something is good, likely other individuals will also start to share this belief – people tend to follow others and over time forget their real preferences. Further on, there many other biases (e.g. IKEA effect, impact bias, framing affect, gamblers' fallacy etc.) that cause defaults and errors in everyday decision-making and make people feel addictive to certain actions and entities (Ariely, 2008; Kahneman, and Tversky, 1996).

In essence, Haselton and his colleagues (2005) claim that cognitive biases are not random and, actually, it is possible to control and mitigate them. There is no one coherent technique for such processes, however, psychologists develop certain methods for cognitive bias conversion. For depressed, addictive and anxious people, there is created a special treatment called

Cognitive Bias Modification Therapy. This technique teaches to alter attentional biases and be more aware of present prejudgments that mislead perceptions.

### 3.1.4 Preferences

Economists suppose that individuals have fixed preferences – people like what they like and understand how much they value something in comparison to other objects. The conventional preference theory acknowledges that human behavior is determined by a hedonic utility - an amount of happiness and pain that is received from every event and entity that an individual faces (Kahneman, 1997). In other words, people are influenced by transient situational factors and act according to their previous experiences and levels of utility.

On the contrary, psychologists believe that people generally are not able to formulate preferences, though, they create new ones under certain conditions (Payne et al. 1993; Shafir et al. 1993; Slovic, 1995). Many researches indicate that positive and negative features are mainly imperfect predictors of behavior. Such finding is “a clear indicator of the less-than-perfect relationship between utilities and actions” (Ariely and Norton, 2007).

Behavioral economics combines these two points of view. It suggests that individuals consolidate a hedonic utility and past memories (that probably are biased). Both these factors cause future behavior. Although experience from previous actions, that can play a crucial role in decision-making, over some time can be replaced by new functions of utility.

Behavioral economics is still challenging the conventional preference theory by many researches and hypotheses. Cognitive biases (described in previous sub-topic of this work) also influence and cause preferences of particular individuals. One of the classic examples of biased influence on utility was worked out by Festinger and Carlsmith (1959). Participants were paid randomly (a small or large sum of money) and asked to do a boring task within some time and then those people had to do the same task but pretend that they were highly enjoying this process. Such frame confronted negative utility with factitious behavior. It was observed that people, who got less money for lying, tended to like the process more, as they were paid not enough money to excuse their lies and this fact led them to gain false utility from the boring task.

Some of biases that violates standard preference theory are<sup>5</sup>:

- Framing Effect: decisions are made upon formulation of choice – whether it is shown as a gain or loss;
- Anchoring Effect: making judgments rather than choices;
- Context Effect: regarding preferences with influence of environmental factors (a choice is framed inside of a particular option set);
- Loss Aversion<sup>6</sup>;
- Endowment Effect: people value more the things that they actually own (a desire to retain property);
- Mental Accounting: tendency to categorize current and future assets, and divide them into different levels of utility;
- Status Quo Bias: a continuous preference for a current and actual frame.

All these observations imply that preferences are not outlined series of indifference curves described in mainstream economics. Thus, they are ill-defined, uncompliant and dependent on situational factors. Slovic (1995) described such bad-defined preferences as “constructing preferences”. Behavioral economists found out that constructing preferences are resulted from the evidence that some variables, that are not really significant, actually, affect decision making. However, sometimes when it is needed to make a decision in an economic aspect - such as choosing a brand, where to study or work, where to go for holidays and so on – people do some rational decision making and value additional factors but these situations are more an exception than a rule.

Summing it all up, most people are limited to gains and losses from a reference scope, framework of preference sets, choosing from a confined frame of objects, as well as, evaluating them according to different aspects and biases. Even though human beings often repeat or develop incoherent preferences, time to time they obey to general neoclassic economic theory (when the situations and actions are clear and compelling). However, there is no a unique theory why people have these or those preferences, and which can introduce an optimal way to utility maximization (Camerer and Loewenstein, 2004; Ariely, 2008).

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<sup>5</sup> All these biases are the part of Prospect Theory described by Daniel Kahneman and Amos Tversky in 1979.

<sup>6</sup> Is described in details in a following point and case study.

### 3.1.5 Criticism of Behavioral Economics

As every theory, behavioral economics faces criticism. Followers of the neoclassic model of rational behavior emphasize that findings and observations that were done during hundreds of years and used by many generations cannot be totally wrong. They argue that data about individual economic behavior, which was collected from the observing experiments, cannot be completely reliable and trustworthy in a context of real market (Lunn, 2008; Rubinstein, 2006).

One of the most problematic sides of behavioral researches is that they are mostly conducted in laboratories and with certain specified conditions. For instance, most often subjects are warned that they are observed. Examining economic behavior, researchers try to figure out if human beings make deliberate or wealth and utility maximizing decisions under different economic circumstances. However, it is not taken into account that people are easily influenced and biased if they realize that they are in an imitative situation. Humans are more attentive and prepared to act morally if they are being evaluated, while, in essence, they are more egocentric and less rational (Rubinstein, 2006; Levitt and List, 2007).

It is globally known that communities differ from each other in significant way. Therefore, it is inappropriate to assume that all people are equal and that received results from all researches can be applied to different ranges of individuals. All communities have their own peculiar properties – some of them are more profit maximizing and selfish, while others are generally eager to share and act morally – that must be considered by experimenters and be evaluated as exclusive variables and possible errors.

Other failure of behavior economics is a scale. Behavioral economists explore the behavior of specific sample of people under conditions with psychological and economic evaluation. Such observations cannot be applicable to all human beings, as economics tries to explain how the group of people react but not the individual characteristics and responses (Camerer, Loewenstein and Rabin, 2003). From this point of view, it is supposed that people, who act irrationally, are in balance with individuals that are rational thinkers.

Further on, critics argue that cognitive theories, which are widely used in behavioral economics, cannot be vital models for real market behavior. It is believed that these models may be applied only to certain conditions and scenarios (that mainly are proposed to respondents during experiments or surveys). Some of the followers of mainstream economic science do not relate behavioral economists' techniques of doing experiments – surveys, questionnaires, case studies, etc. – to serious and trustworthy methods. However, it is agreed that common economics should extent its traditional assumptions and models without diminishing its standards and norms.

To conclude, it is important to not exaggerate the possibilities of behavioral economics. So far, it is just a mix of unconnected facts that were found during organized experiments. The biggest criticized thing is that there is no a single generalizing system that would contain all causes and cognitive biases that affect human behavior and irrationality in decision-making. However, behavioral economics is able to enrich and modify neoclassic models. Most of behavioral theories are able not only to show similar results as general models, but also show answers why in some cases neoclassic economics fails (Rubinstein, 2006, Ariely, 2008). Behavioral economics is a new revolutionary set of theories and ideas, so that it should continue to stay highly open-minded, understandable and critical of itself in some points.

## 3.2 Addiction

Most of habits and “fashions”, which penetrate everyday life, can truly represent addictive activities. Whereas a level of addiction varies from action to action and person to person, many hard dependences, such as smoking, drinking alcohol, gluttony and others, are influenced by two properties. The first one is a reinforcement – the more an individual gets involved in an activity, the more he wants to continue to repeat the process – and the second one is negative internalities – the more an individual gets involved in an activity, the lower following utility will be during future continuous consumption (Becker and Murphy, 1988).

Over the years, many scientists try to understand why human beings are prone to fall for addictive inclinations. Economists were trying to explain this phenomenon using the rational-choice models of addiction. These theories supposed that people are self-controlled and able to

recognize and evaluate outcomes that an addictiveness will result in the future. However, these assumptions require people to be totally rational subjects, what cannot be easily achieved (as it was discussed in the previous section).

### 3.2.1 Definition and Features

Addictiveness is characterized by any activity, object, habit, or behavior, which plays a significant role in human life (in comparison to other activities), harms and influences an individual's life – as well as people around – in physical, social, psychological and spiritual aspects (Engs, 1987). Addiction represents an inability to set limits, illusion or loss of self-control, and absence of true identification of real problems.

There are distinguished two types of addiction: psychical and psychological ones. Psychical addictiveness is characterized by addiction to various chemicals and substances (such as alcohol, tobacco, heavy drugs); psychological dependence is a dependency on various activities (such as gambling, sex, shopping, starvation, etc.). Nevertheless, many scientists believe that any of activities, caused by these two dependencies, may produce beta-endorphins, which make a person feel good, happy, or “high”. If a human steadily continues to partake in such behavior, he enters the addictive cycle, which involves relapse and remission (Engs, 1987).

Many psychologists prove that some physical addictions can also have a psychological impact. For instance, a smoker, who has not smoked for several years, may still want to taste a cigarette from time to time. Hence, there is a division of opinions. Some of researches claim that it is necessary to observe both physical and psychological components, as they have more similarities than dissimilarities (Leshner, 1997; Waldorf, 1983; Gawin 1991; etc).

Griffiths (1995) defined that there are other two sub-types of addiction – primary and secondary. Primary addiction is explained as an activity in which an individual likes to be involved, it makes a person to feel good and relaxed (for example, gambling, dependence of fashion, playing online or video games, etc.). Correspondingly, secondary addictions are illustrated as actions that help people to escape from reality, or help to cope with other problems (drinking, smoking etc.).<sup>7</sup>

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<sup>7</sup> This concept is similar to Skog's theory of addiction distinction that divides dependent people into “happy” and “clinical” addicts (2003).

In essence, addictive people are often viewed as weak-minded and immoral creatures. Ironically, human beings possess feelings of guilt, dishonor and anxiety that are resulted from the conflict of addictiveness and personal values. Such contradicting insights lead to inner stress and emotional instability that make a person be even much deeper stuck in the addictive cycle and hold back from an idea to overcome addiction behavior because of the high possibility of more intense negative feelings (Suomi, Dowling and Jackson, 2014; Engs, 1987).

As it was mentioned before, there is no precise consensus why and how addictiveness appears. Though there are many inner and environmental factors that may formulate a passion and dependence, and some of these factors cannot be directly linked to addictive behavior. Additionally, because of total disagreement among different specialists there is no a single system of prevention and treatment. For example, experts argue whether it is more rational to achieve a complete absence of use of substances or actions, or it is more valuable to be able to use only a limited, small amount that will be entirely controlled. However, the approach of advocated absence cannot be used with the eating disorders or sport dependence (Engs, 1987). Other experts are trying to figure out if medication is a good way of treatment or not - the possibility of getting psychically or mentally obsessed of these specific drugs exists in certain situations. Nonetheless, there are a lot of different applicable methods that can help a person with addictive behavior. The best ways to fight with addictiveness are developed self-management, cooperative support, and professional consultations that are provided by well-trained and diplomaed experts.

### 3.2.2 The 3Cs of Addiction

In general use, the 3Cs are three certain characteristics that distinguish addictive behavior from habits and passion. They are applicable for both types of addictiveness: substance and process dependencies (Harvard Medical School Special Health Report, 2008).

The 3Cs of addiction are:

- Compulsive Use: “I did not cause it”;
- Control: “I cannot control it”;
- Consequences: “I cannot cure it”.



Compulsion is the particular obsessive behavior that humans manifest in the beginning of the addiction cycle. It has three components: reinforcement, desire, and habit.

Reinforcement stands for feelings of substance/process that a subject has experienced before. Fairly, positive emotional experiences – such as increased pleasure and reduced stress or pain – can be a crucial factor of becoming addictive (Koob and Simon, 2009). Tolerance and craving are about a need that is starting to become highly unbearable. An individual starts to desire the increased amount of wanted substance or behavior (depends on the situation). So that human brain does not try to compensate the effect from addictive process any more but starts to require it for normal functioning (Harris and Buck, 1990). In other words, craving refers to psychological desire. So that on this stage, both body and brain are signaling for repeating of the process. Meanwhile, habit is an automatic behavioral disposition that starts to reveal poor self-control: brain sends pleasant feelings while an individual consumes the desire substance and these signals keep the person to continue this certain addictive behavior. When the habit penetrates a person's everyday life, the loss or illusion of control appears.

Loss of control is assumed to be one of the central or even fundamental components of addictiveness. It typically means the loss of ability to control one's behavior and choose among other behavioral options. Hence, a person is not able to set limits on the amount of desired "drug" and starts to use it more than it was intended at first. In addition, the time, which person spends on his addictiveness, increases due to inability to stop. In some cases, an addict stops to think and consider basic commitments such as hygiene, work, family and others, therefore, the addiction becomes risky and highly harmful for the addict and people around (Griffiths, 2005).

In essence, science defines its theories using probabilities, so from this point of view, the word "loss" of control means "decrease" but not the total absence of it. For instance, workaholics may be addictive but not show the signs of loss of control, whereas anorexics are highly dependent on their ability to control their addiction, otherwise, they will appear in a fatal situation (Griffiths, 2013). In any case, people are trying to find and achieve control, and this is only the matter of addict's will and cognitive abilities.

The last but not the least C of addiction is a consequence. It refers to a compelling willingness to continue addictive behavior, even if a person is determined to stop or reduce a usage of desired substance. Some of addicts may not know an amount of harm, which the

addictiveness causes to their organism, environment and everyday life, however, even the knowledge of this may not prevent a human being to continue addictive consumption. From this it follows that an individual may spend all money on addiction, be rejected by his family and community, be warned by doctors or therapists about possible deathly outcomes and still keep satisfying his desires despite all circumstances.

The C's of addiction are used as a test for understanding if a person is really addictive or it is just abusing a substance or certain behavior. Usually, when a person has only abuse of certain action and in the point, when this behavior starts to harm his life, this individual is able to stop this process, whereas, an addict cannot do it so easily and fast.

### 3.2.3 Opportunity Cost Neglect

To clearly realize opportunity costs of an addictive behavior, a person must take into account all possible alternatives that will be missed because of his addictiveness. The researches confirm that addicts are not able to consider opportunity costs and this fact worsens their dependence (Frederick, et al., 2009). In a word, even if a human being is making some cognitive efforts to overcome this particular biased problem, still there are other cues that prevent the individual from correct evaluation of total real costs.

For effective consideration of opportunity costs, it is needed to think about options that are not apparent or connected to addictive behavior. In the previous discussions, it was mentioned that people are doing judgments and decision-making only according to information that they obtain at the particular period, however, with addicts it looks much simpler, as their unbearable craving is the whole cognitive source of information that they have during the whole cycle of addictiveness.

The numerous findings show that generally humans focus only on obviously presented alternatives and do not seek for other opportunities for better being. Although most people fail to be rational in considering opportunities costs, they tend to neglect them rather than reject. Therefore, salesmen or therapists (in case of addicts) should generate and supply additional prospective alternatives to their clients.

The assumption, that most human beings often are not aware of possible opportunity costs, may be viewed as a contradiction to various claims that people are price-sensitive. However,

scientists proved that opportunity cost is not only component on which it is need to rely while studying human price sensitivity (Frederick, et al., 2009, Ariely, 2008). In fact, a price of a substance, object or service may influence individuals' choices and preferences respectively to a price reference level, and the difference of prices and actual quality (if the less cost product differs a lot in quality), and an amount of "happiness", as well as, "pain" – that will be persuaded after making the certain decision or choice. Nevertheless, for addicts a reference level stops to be regarded and the only thing about which they care is another "doze".

As it can be seen, people with high addictiveness are not considering things that they sacrifice towards their weaknesses and imperative desires. One of the treatments of addiction can be a development of the skill to recognize opportunity costs. When an addict is able to realize that money, efforts and time spent on his addiction may be used much more effectively and, only in this case, it will be possible to be cured, or be able to struggle with a continuous craving.

### 3.2.4 Rational Addiction

In 1988 Kevin M. Murphy and Gary S. Becker worked out one of the most criticized theories. They made certain researches and concluded that addictive people are rational, forward-looking and pragmatic. As it was explained in previous sections, strong addiction is caused by a certain positive effect of earlier consumption of particular object, substance, or process. And this situation may lead to "unstable steady states"<sup>8</sup> that extremely influence addictive consumption and preferences. Thus, the theory shows that addicts are generally rational beings in case of farsighted maximization of utility with constant preferences. From this point of view, it is possible to say that rationalism may explain addictiveness in certain way. This theory became a background for the series of empirical observations concerning all different types of consumption that lead to addictiveness<sup>9</sup>.

As it was explained before, people are becoming addictive not only to alcohol, smoking, or drugs but also, for instance, music, TV-shows, or soft drinks. The theory of rational addiction

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<sup>8</sup> This expression was used by Becker and Murphy and explained in their work "A Theory of Rational Addiction", 1988.

<sup>9</sup> E.g. Caulkins and Jonathan "Thinking About Displacement in Drug Markets: Why Observing Change of Venue Isn't Enough." 1992; Chaloupka and Suffer "The Demand for Illicit Drugs", 1995 etc.

is applicable to all types of addictive way of living. Nevertheless, not all goods or behaviors can become a matter of addictiveness. Addiction demands reciprocity between an individual and an object. Murphy and Becker showed that people, who discount the future hardly, are more prone to become addicted. In addition, they checked which variables can describe a human tendency to be dependent on something.

According to proposed models, a level of income and prices, as well as, negative stressful life events may push a person to addictiveness. Further on, the authors of rational addiction model found out that in the short run regular changes in prices cannot influence addict's preferences, however, in the long run such differences in prices show that the demand for addictive objects may be more elastic than the demand for non-addictive objects (Orphanides and Zervos, 1995).

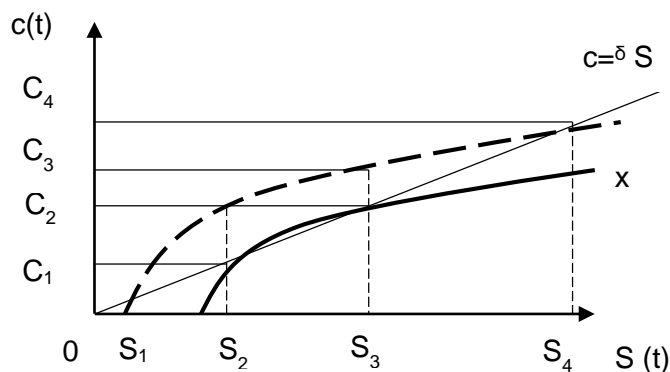
The model, created by Murphy and Becker, shows that instantaneous utility function depends on the consumption of two objects  $c$  and  $y$  at the given time  $t$ :

$$U(t) = U[c(t); S(t); y(t)],$$

where  $U(t)$  is utility,  $c(t)$  is consumption of an object of addiction,  $y(t)$  is consumption of object of non-addiction, and  $S(t)$  is "addictive capital" that represents previous consumption of  $c$  and is a result of "learning by doing".

The graphical representation of the model is shown as a concave utility function:

Figure 1 Model of Addictive Behavior



Source: Adapted from the original by Becker G., Grossman M., Murphy K.M., 1988

As the case-study in this paper is about addictive consumption of cigarettes, the further explanation of the rational addiction model will be described by an example of continuing smoking habit.

In Figure 1, the line  $C = \delta S$  is representing an addict's steady-state. A curve  $x$  shows the connection between addictive consumption and "addictive capital". If a person is in the interval  $[S_1, S_4]$ , he will continue the addictive behavior as a number of smoked cigarettes is steadily increasing and enjoyment from smoking process is also increasing. However, if a person did not reach  $S_1$  and stay in the same point smoking more cigarettes, in this case, the curve  $x$  is below the steady-state and in some time the rational addict will decrease the smoking habit.

The point, where  $S_2$  intersect with  $x$ , is the unstable-state - it means that if, for example, an addictive individual loses a job or is affected by personal worries, he is likely to smoke more cigarettes than before, but as his habit is not strong (below  $S_1$ ), over some time this individual will stop such consumption. In other words, it may explain a concept of conventional smoking. The point, where  $S_3$  intersects with  $x$ , is the locally stable-state meaning that if an individual gets positive turnings in his life (e.g. good job, new achievement, recognition etc.) and he may smoke less cigarettes, however, over certain period of time, he will be back to a previous level of addictive behavior  $C_2$  as his addictive capital already reached  $S_1$  state.

The results and following observations from the rational addiction model confirm the aforesaid assertions that people – who are not taking into account further adverse effects, minimize understanding of harmful influences and are not long-term utility maximizers but would rather prefer immediate utility regardless future benefits – are more likely to become addictive (Gruber and Koszegi, 2000).

The Murphy and Becker's model assumes that addicts' choices and decision-making are influenced by future changes in prices, taxation and legislation. Many other economists supported this theory with their empirical researches and, moreover, they developed the original model. However, there are also critics who claim that the rational addiction model cannot take into account all aspects of human preferences and describe drug-taking behavior.

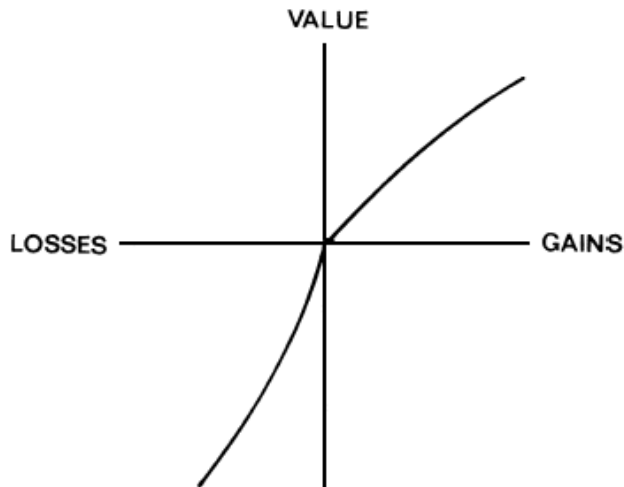
### 3.3 Loss Aversion

Loss Aversion is a concept assuming that people are more sensitive to losses rather than gains (Tversky and Kahneman, 1991). In other words, human beings are afraid of giving up an object and this fear exceeds the utility of acquiring a new one.

People are emotional creatures, hence, they discover the world through their feelings, prejudices and previous experiences. As it was stated before, human beings are more prone to make emotion-based decisions and snap judgments. Such way of thinking excludes rationality. People's preferences are often framed by their predictions and anticipation of how they will react to their choices and what kind of feelings other alternatives may cause (Loewenstein and Rabin, 2003; Wilson and Gilbert, 2003). Correspondingly, loss aversion is one of emotional tools that affects everyday decision-making.

The principle of loss aversion is an element of Prospect Theory by Kahneman and Tversky (mentioned above). The milestone of this theory is that all individuals think about one thing differently and it is strongly depended on a design of option sets – if an object or process is perceived either as a gain or as a loss. Kahneman and Tversky discovered that losses are twice as essential as gains. In rational view, such finding has no sense, however, it is confirmed that losses affect human lives in a more intense way than gains. People tend to think that the asymmetry of all possible feelings from gains and losses is equal, but such belief is wrong because people are not able to rationalize their choices and due to it they overvalue the hedonic impact of losses (Wilson and Gilbert, 2003; Kahneman and Snell, 1992). From this, it follows that people are trying to avoid losses over gains. The value function affected by a perception of losses or gains is represented in Figure 2:

Figure 2 Value Function



Source: Tversky and Kahneman, 1991

In the figure above, it is clearly seen that the same value of x-axis has significantly different values on y-axis. From this, it follows that most choices are made regardless the utility gained from the feeling of wealth or welfare, but the reference point serves as a framework for decision-making (Tversky and Kahneman, 1991). Hence, choices result a rough change of a slope of the value function at the neutral initial point (Kahneman, Knetsch and Thaler, 1991).

Loss Aversion is a hedonic psychological technique that derives a sense of gains or losses referring to a reference point that is created naturally (seen in the Figure 2). Prospect theory shows that people are quite indifferent to changes that may be created by increasing a loss or gain scale. And one of the explanation of loss aversion is that people tend to prefer to take risks because it may bring them to a reference point much quicker. Colin Camerer mentioned in his work of 2005 that animals are trying to maximize their utility that results in survival. In other words, it is an instinctive behavior to switch to a risk-preference option to “come back” to usual environment and feeling state.

For now, it is undoubted that loss aversion is an empirical element, which does not dependent only on aversion to loss or risk, but it also implies that gains and losses resulted from one particular object or process must be on the same local level. The biases in such application may be presented by “focusing illusion” suggesting that specific choices loom larger other ones (Camerer, 2000).

For a long time, many researchers try to find a reason why loss aversion occurs in human life. They question if loss aversion is a consequence of stable and determined preferences, fear, emotions or other variables, as well as, they try to find out to what extent the endowment and status-quo effects and mental accounting influence the intensity of aversion (Camerer, 2005). However, some behavioral economists think that loss aversion is a result of fear. Human beings do not like losing their workplaces or family, delaying of rewards or significant changes in their everyday life. So from this point, it follows that people exaggerate fear as an emotion and try to avoid it by sacrificing potential gains (Camerer, Loewenstein and Prelec, 2005; Loewenstein et al, 2001).

### 3.3.1 Endowment Effect and Application of Prospect Theory

Behavioral economists describe endowment effect as the essential theory that supposed that individuals value things that they own much more than the real value of these objects is (Roeckelein, 2006). So it means that a person requires more for his property than he would be ready to pay for its acquisition.

Endowment effect is tightly connected to loss aversion. These two hypotheses supplement each other. From this, it follows that, in some cases, it is possible to explain loss averse behavior by the mentally increased worth of an object, that also increases the unwillingness of losing it (Kahneman, Knetsch, and Thaler, 1990). Both loss aversion and endowment effect are very strong cognitive biases that distort thinking process and decision-making, additionally, they may create false preferences that lead to wrong interpretation of personal desires.<sup>10</sup>

Prospect Theory – mentioned several times in the previous topics of discussion – also implements endowment effect in its framework. Daniel Kahneman – the author of this theory – questioned the principles of neoclassic economics. Many people think that his work overthrows decades of years of mainstream beliefs and models (The Economist, 2003).

What is vital to mention is that Prospect Theory is able to explain the biased behavior of a common man. The market segment, that represents everymen who do not take into account the main principles of psychology and economics in routine transactions and lifestyle, is the

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<sup>10</sup> Discussed in more details in the chapter 3.1.3 Cognitive Biases.



common and biggest one, however, some researches doubted that Prospect Theory can interpret a behavior of selling-buying professionals, whose job is to evaluate all alternatives and find the best and most effective deal, may influence other markers (The Economist, 2003; List, 2004).

Generally, still there is no a single united opinion about Prospect Theory, as well as, all other cognitive biases that mislead human preferences. However, within last years, many researchers have come to the same conclusion that a traditional belief that the net effect of gains and losses – that is an essential part of any choice – does not match to the modern world and people behavior tendencies. Nevertheless, knowing the main principles of possible biases and how Prospect theory comes real, it is possible to be as rational as neoclassic economics assume. Such understanding of the problem may make people to be aware of their real preferences and market better.

## 4. Practical Part

The following chapter describes a practical part of the research. For this purpose, author used a case study as a method for observation and statistical approaches to draw a conclusion.

### 4.1 Executive Summary

Up to the present time, many researches wonder in which conditions loss aversion is more intensive. Generally, behavioral economists divided their research spheres into situations using selections of riskless and risky choices. However, there is not a clear evidence that these two states have any connection (Gächter, Johnson and Herrmann, 2007).

The studies, conducted by behavioral researchers, show that impact of endowment effect on loss aversion is more complex and essential than it was previously assumed. For instance, in observations that were designed in such a way that participants were not concerned by any risks, loss aversion was explained only by endowment effect (this fact empirically supports the theoretical ideas described earlier). In a conventional study of those effects, observed individuals are given certain objects and asked for which price they are willing to sell these objects and other part of group is asked for how much they are willing to buy these objects (Kahneman et al., 1990; Gächter, Johnson and Herrmann, 2007).

To examine all ideas discussed above and provide proofs for uncertain statements, a detailed case study of riskless choices was employed, as well as, to come up with a practical background for this work. The design for this case study was taken from a previous researches based on WTA and WTP structure<sup>11</sup>.

WTA is meant by the “willingness-to-accept” and, correspondingly, WTP represents the “willingness-to-purchase”. In a riskless choice situation, an individual is asked to participate in both observations. Eventually, the difference between both responses is served as an approval of loss aversion in a particular case (Tversky and Kahneman, 1991). Furthermore, in a sake of deeper observation of loss aversion, the separate test is provided to specify human heterogeneity

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<sup>11</sup> Such method was used in observations of loss aversion by Coombs, Bezebinder and Goode, 1967; Slovic and Lichtenstein, 1968; Carmon and Ariely, 2000; Kahneman, Knetsch and Thaler, 1990; Gächter, Johnson and Herrmann, 2007 and others.

in riskless choice situations. This time, participants were asked to answer either WTA or WTP task. Henceforth, the individual differences in loss aversion are studied. To sum up, from the first study the aggregate index is found, respectively, from the second one it is possible to observe an individual reaction on the appearance of two sets of contradicting choices (Abdellaoui, 2000; Booij and van de Kuilen 2009).

What makes the study described in this work differential from all others is that WTP/WTA scenario is conducted among people with smoking addiction, while other researchers observed people, who did not have such a tight interconnection and similarity.

Such an idea to connect problems of addictiveness and behavioral economics is not a brand new. As a consequence, there is an ample evidence, formulated by behavioral researchers, that addicts' behavior and decision-making is bounded by a cognitive bias called "delay discounting". In essence, this concept refers to the decreasing a present value of a reward when it is not immediately occurred but will be presented in the future. From this, it follows that addictive people prefer gains and pleasure right at the moment rather than bigger rewards over certain time (Ainslie, 2005; Bickel and Marsch, 2001; Matta, Gonçalves and Bizarro, 2012; Odum, 2011). This aspect described why people suffering from strong dependency are prone to make quick decisions, which may be bounded by other biases.

The purpose of this case study is to put loss aversion and endowment effect another way and check if addictive human beings response to these biases differently from others in terms of selling-buying scenario or not. The result may be vital because then it is possible to explain addictive behavior not only by delay discounting but also what is going on when they choose immediate action and which biases occur in this case.

## 4.2 Case Study: Loss Aversion of Riskless Choices

As it was said before, there were two components of the case study interpreting the role of loss aversion and endowment effect on people with continuing addiction. So that this observation was divided into Study 1 and Study 2.

### 4.2.1 Sampling, Methods and Data

Using a sample of students living in Prague, the data was collected via questioning WTP and WTA tasks. To participate in the research, people, who wanted to take part in this observation, were obliged to satisfy certain criteria:

- Be a continuously addictive smoker for minimum one year;
- Be an expatriate student living in Prague for minimum one year;
- Be 18-26 year-old;
- Be able to communicate in fluent English so as completely understand questions.

Data collection was done by personal interviewing and online survey. Online Google form, describing the whole situation with all details and precisely formulated questions, was uploaded on Facebook and VK that are main social networks where Prague expatriate students exchange information and communicate. Personal interviews were taken place at Czech University of Life Sciences with people who are enrolled to a life-long or regular study of Economics and Management, Bachelor degree. All interviews were going on in a friendly atmosphere and out of laboratory conditions so that interviewees felt relaxed and informal. Only one researcher carried out the interviews and was fully aware of the goal of the study. Besides, all participants were naïve about observing behavior and reactions, and had no idea about the hypothesis of the research. All respondents were face-to-face with the experimenter and were unaware of other participants. Only the interviewer had an access to collected data which was not distributed or shown to observed people after the completion of WTA and WTP research.

The final results may not represent the whole population in a full degree because of the small number of participants. This is explained by the fact that:

- Interviewer did not have enough time for interviewing a larger number of people;
- Not all expatriate students were willing to participate in an online survey;
- There was no possibility to provide intrinsic or extrinsic rewards (such as monetary remuneration, acknowledgment, challenge etc.);
- Some interviewees misunderstood questions and checked only one option while many alternatives were possible;

- Some participants were not fully attached to the objects because of the absence of an opportunity to provide real items for more precise evaluation task.

To remember, there were two different elements of the case study. These two studies involved two separate groups of participants with the same criteria. Nevertheless, both observations were based on WTA and WTP tasks that embodied the questions regarding a package of cigarettes as an object of evaluation.

### 4.2.2 Study 1

Study 1 is providing an aggregate rate of loss aversion. It assesses an impact of cognitive biases on decision-making while no risk is occurred. The design of this study is taken from an original WTA-WTP research used by Daniel Kahneman, Jack Knetsch and Richard Thaler in 1990. In this work, Kahneman and his colleagues used coffee mugs as objects for the evaluation task by undergraduate Cornell students. This observation was to investigate the occurrence of endowment effect in certain market situations and refute the Coase theorem<sup>12</sup>.

In essence, for Study 1, the half of the sample was asked to imagine that the interviewer gave the package of their preferable cigarettes to them for free. Namely, people believed that this package is their property. Later, they were asked to think about price for which they are willing to sell cigarettes (with the condition that they did not have any other cigarettes at that moment). They were shown a list of possible prices, which were from 10 to 120 CZK with 10 CZK difference. There was also offered an option “TO NOT SELL”. Eventually, participants had to choose all possible variants from a given list.

The second half of interviewees for Study 1 was only shown (or asked to imagine) the package of their preferable cigarettes. And then, they were asked for what price they are willing to buy this package. The WTP method is similar to WTA questioning and uses the same list of prices for evaluation. There was also offered an option “TO NOT BUY”.

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<sup>12</sup> Coase theorem asserts that when property rights are involved, parties naturally gravitate toward the most efficient and mutually beneficial outcome (Investopedia.com)

### 4.2.3 Study 2

For Study 2, there was questioned an additional sample of people with smoking addiction. This time, there was a purpose to investigate individual tendency of being loss averse. For examining a personal level of cognitive biases, it was needed to obtain participants' responses to both WTA and WTP tasks. The WTA and WTP questions were randomly occurred, so that the sequence of tasks varied from person to person. The procedure of interviewing was designed in an alike way as the questioning for Study 1. The questions were the same with the identical list of options.

For Study 2, there was provided a larger sample, and it was more carefully observed, as findings from this experiment are vital for this research paper.

Appendix 1 represents the online form that was designed for the research purpose. It shows both WTA and WTP questions. This forms were used for Study 1 and Study 2, so as there was no difference in a design of questioning.

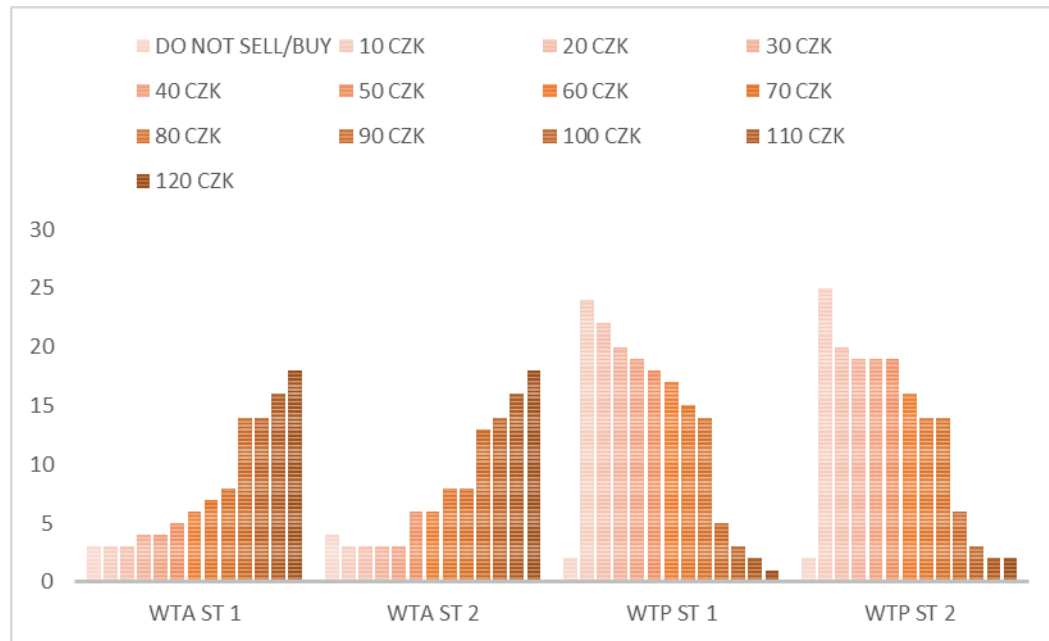
## 4.3 Findings

As a result of the conducted case study, there were observed several tendencies. To illustrate antecedents and consequences of loss aversion and endowment effect in addictive behavior, the received data was carefully examined. There were three procedures, which were used to test the initial hypothesis:

- Check the difference between WTA and WTP responses;
- Check if responses to WTA and WTP tasks were different in Study 1 and Study 2;
- Find a WTA/WTP ratio in Study 2 to evaluate loss aversion effect on people's decision-making.

In total, 80 people participated in this study. Generally, 25 respondents answered only WTA question, other 25 answered WTP question and remaining 30 were asked to give their opinion about both tasks.

Figure 3 Collected Data

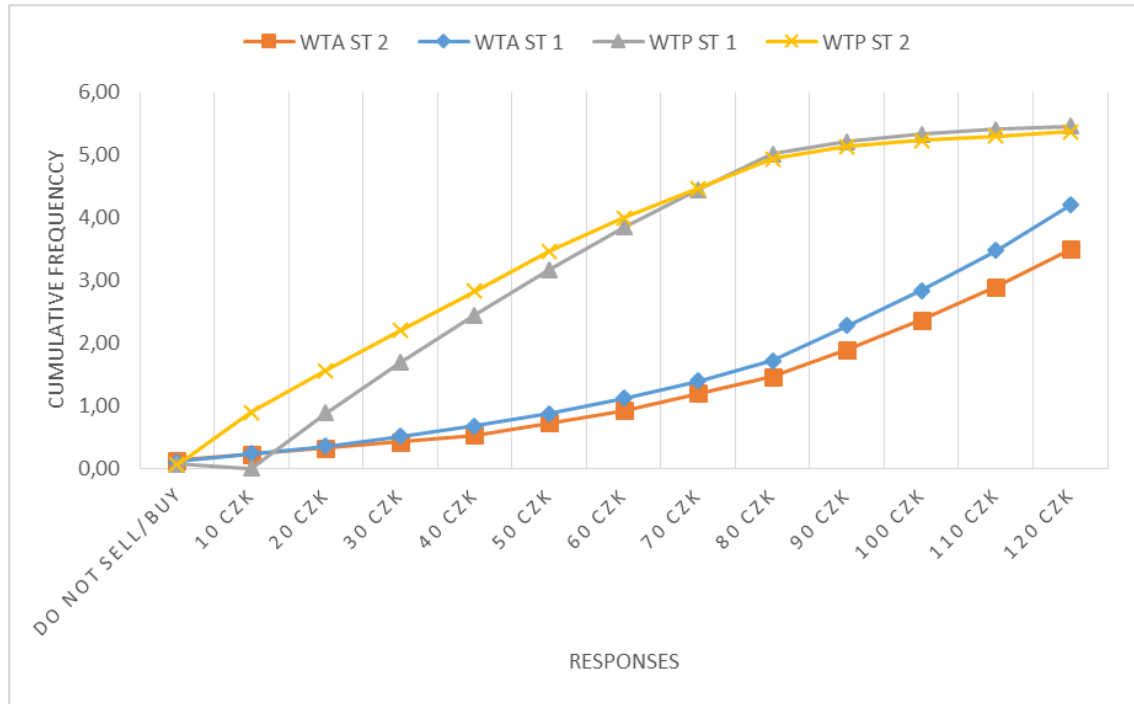


The table, presented in Appendix 2, shows all received responses from participants (including received answers from online form and personal interviewing). However, in Table 1, there are seen the full sets of the collected data from both studies, which is shown in a graph for better understanding. There are represented all choices made by participants. The histograms display the number of people who prefer to buy or sell for the particular price, so as it was more possible to compare samples and questions with the naked eye.

As it was mentioned before, there are possible some calculating defaults because some of interviewees chose only one option because of misunderstanding the tasks (75% of data were received from online surveys). That is why the number of responses and number of respondents vary across both studies and evaluation tasks.

Further on, it was decided to find the frequencies that will show the percent representation of obtained data. Afterwards, there were found the cumulative frequencies. The frequencies were calculated separately for every sample and every task. The cumulative frequency distribution points out the relations of WTA and WTP responses between two studies. In the Figure 3, it is abstractly seen that both tasks are not very different between two separated studies.

Figure 4 Cumulative Frequencies of Collected Data



### 4.3.1 Result 1

As it was said, the first task was to check if WTA and WTP differ from one study to another one. Firstly, it was decided to check if distributions of participants' responses to WTA/WTP tasks were the same in the both studies. For this sake, Two-sample Kolmogorov-Smirnov test was used. Since  $D\text{-statistical} = 0,009 < 0,184 = D\text{-critical}$  in WTA responses, and  $D\text{-stat.} = 0,013 < 0,148 = D\text{-crit.}$  in WTP, it was concluded that there is not a difference between people, who answered only WTA or WTP question, and people who were assigned to response to both tasks (to check the calculations, see Appendix 3).

To illustrate an additional evidence for this result, Two-sample T-test for comparing means was used. In Table 2 and Table 3, there are short statistical descriptions of samples, as well, as the results according to provided test. The computed  $t$  of 0.0811 (WTA) and 0.2338 (WTP) does not exceed the tabled value, so the null hypothesis  $H_0: \mu_1 = \mu_2$  cannot be rejected. And as calculated  $p$ -values are much higher than the significance level, it is possible to say that the results are quite precise and accurate. In addition, F-test was provided to check if both



samples have the same variance, that also showed that there is no any significant difference in WTA and WTP in the Study 1 and Study 2.

To sum up, the described results state that there is no difference in distributions and means and variance of WTA and WTP answers between two studies.

Table 1 Two-sample T-test for WTA

<b>Group</b>	<b>Study 1</b>	<b>Study 2</b>	<b>t-value 0.0811</b>
<i>Mean</i>	82.76	82.38	<b>degrees of freedom 207.9584</b>
<i>SD</i>	33.70	34.18	<b>two-tailed p-value 0.9354</b>
<i>SEM</i>	3.29	3.34	<b>95% confidence intervals &lt;-8.8548; 9.6148&gt;</b>
<i>N</i>	105	105	

Table 2 Two-sample T-test for WTP

<b>Group</b>	<b>Study 1</b>	<b>Study 2</b>	<b>t-value 0.2338</b>
<i>Mean</i>	44.57	45.28	<b>degrees of freedom 320.5616</b>
<i>SD</i>	26.87	27.71	<b>two-tailed p-value 0.8153</b>
<i>SEM</i>	2.11	2.18	<b>95% confidence intervals &lt; -6.6858; 5.2658&gt;</b>
<i>N</i>	162	161	

### 4.3.2 Result 2

In Figure 4, it is also observable that the difference between WTA and WTP in both studies is considerably high. This assumption was tested by Two-sample T-test.

In Study 1, the mean of WTA responses is 82.76 and the mean of WTP is 44.57 that implies the ratio of WTA/WTP is 1.85 that is a quite high indicator. In Table 3, the results of statistical test are provided. As t-obtained value is much higher than t-critical in two possible scenarios (equal and unequal variances), it is determined that the difference between WTA and WTP experiments in Study 1 is significantly large.

For Study 2, it was decided to use Two-sample T-test for independent samples as well. Although in this study same people answered WTA and WTP valuation problems, for the initial hypothesis it was assumed that the participants' answers to both tasks were not connected and

the order of questions did not play any significant role in interviewing, in addition, participants tended to give different numbers of answers to both questions that explains different number of observations. The received result in Study 2 is similar to the statistical evidences from Study 1, that points out that there is a great difference between WTA and WTP responses (see Table 5).

Table 3 Two-sample T-test (Study 1)

T Test: Two Independent Samples									
SUMMARY				Hyp Mean	0				
Groups	Count	Mean	Variance	Cohen d					
WTA	105	82,7619	1135,568						
WTP	162	44,5679	721,8618						
Pooled			884,2219	1,284442					
T TEST: Equal Variances				Alpha	0,05				
	std err	t-stat	df	p-value	t-crit	lower	upper	sig	effect r
One Tail	3,725496	10,25206	265	2,72E-21	1,650624			yes	0,532904
Two Tail	3,725496	10,25206	265	5,45E-21	1,968956	30,85866	45,52934	yes	0,532904
T TEST: Unequal Variances				Alpha	0,05				
	std err	t-stat	df	p-value	t-crit	lower	upper	sig	effect r
One Tail	3,907796	9,773797	186,8634	8,73E-19	1,653043			yes	0,581619
Two Tail	3,907796	9,773797	186,8634	1,75E-18	1,972731	30,48497	45,90303	yes	0,581619

Table 4 Two-sample T-test (Study 2)

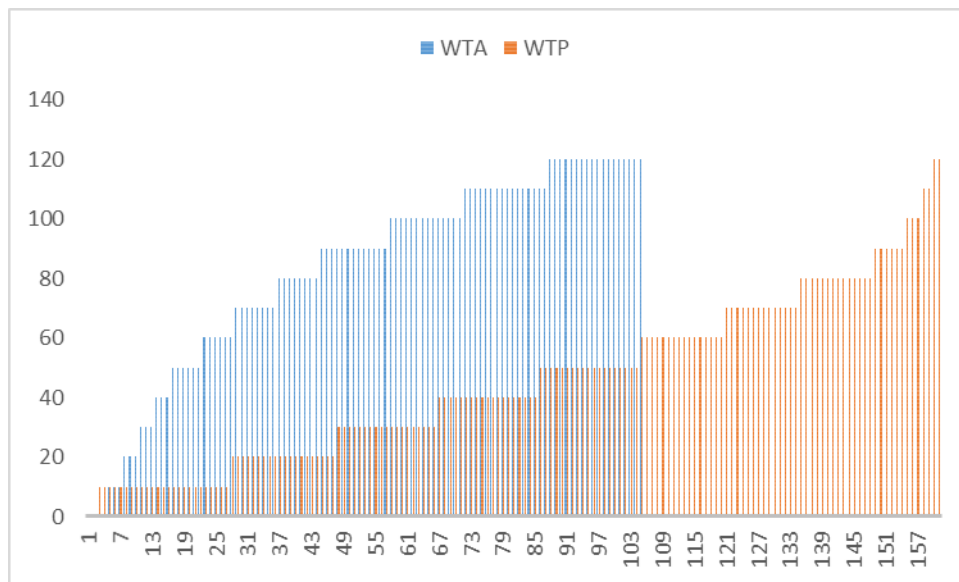
T Test: Two Independent Samples									
SUMMARY				Hyp Mean	0				
Groups	Count	Mean	Variance	Cohen d					
WTA	105	82,38095	1168,315						
WTP	161	45,2795	767,5776						
Pooled			925,4439	1,219596					
T TEST: Equal Variances				Alpha	0,05				
	std err	t-stat	df	p-value	t-crit	lower	upper	sig	effect r
One Tail	3,815999	9,722604	264	1,35E-19	1,650646			yes	0,513476
Two Tail	3,815999	9,722604	264	2,69E-19	1,96899	29,58778	44,61512	yes	0,513476
T TEST: Unequal Variances				Alpha	0,05				
	std err	t-stat	df	p-value	t-crit	lower	upper	sig	effect r
One Tail	3,986775	9,306131	189,5916	1,66E-17	1,652913			yes	0,559965
Two Tail	3,986775	9,306131	189,5916	3,31E-17	1,972528	29,23742	44,96547	yes	0,559965

### 4.3.3 Result 3

From the given outcomes in Table 4, the aggregate ratio WTA / WTP was found (the mean of WTA 82.38 divided by the mean of WTP 45.28 is equal to 1.82). Referring to available literature and earlier observations, it may be said that the result of calculated ratios is not significantly different to other studies and the evidences obtained from this survey are also confirmed by previous researches<sup>13</sup>.

High p-values in both tests tell that there is no any convincing evidences that the means of both experiments differ.

Figure 5 Collected Responses to WTA and WTP (Study 2)



In Figure 5, there is a distribution of responses to WTA and WTP questions across the members of the study. Thus, it is observable that people, who had to solve both valuation problems regarding selling and buying, were more willing to set different price level for purchasing, as in this case they feel more flexible and think about more alternatives. Asking interviewees for what price they are ready to sell the item of their addiction, it was possible to observe that people are likely to be more precise in decision-making and pricing their property.

<sup>13</sup> Kahneman et al.(1991) find WTA/WTP relations of 2.21 in their mug experiments. Knetsch (1989) reports a WTA/WTP relation of 2.09

## 4.4 Summarized Outcome

The received responses from people, who agreed to participate in this case study to check the null hypothesis that addictive people are more loss averse, were collected and examined by statistical tests.

Due to basic tools of statistics, it was proved that there is no any vital difference between two samples of Study 1 and Study 2. And there were found main parameters of whole population using Two-sample T-test. However, there was investigated a considerable difference between two valuation tasks in between-subject and within-subject studies.

For the sake of the research question of this work, it was decided that the WTA/WTP ratio in Study 2 will be assumed as a rate of loss aversion effect. Hence, if a respondent to the survey is loss averse, then his willingness to accept the price for selling the object of addiction must be greater than his willingness to purchase it, as a person is anchored with this particular item. And if an individual is not loss averse, than WTA must be equal to WTP. In short, loss aversion is determined by  $WTA > WTP$  while  $WTP > 0$ , while this scenario is occurred than a person is influenced by cognitive bias. The 80% of the sample reported WTP bigger than 0 and WTA larger than WTP, therefore, it was proved that most people are loss averse.

## 5. Conclusion

The main goal of this work was to find the testimonies of how behavioral economics can explain addiction problems. From theoretical aspect, many researchers set a wide range of hypotheses and assumptions of how addiction occur, and later on they found empirical evidences that addiction is a consequence of cognitive biases and misunderstanding of personal preferences and true desires, moreover, this opinion does not exclude physical dependency as well. As an example, there were presented such concepts as mental discounting, framing effect, besides, loss aversion and endowment effect that were observed more in details in the practical part of this research work.

Loss aversion was widely examined and studied by behavioral economists Kahneman and Tversky, and on the basis of their researches there was created a case study. Despite the fact, that this case study was different to original loss aversion observations (mainly by providing online survey and using addictive people as representatives of the target population), the received results were similar to previous studies. When interviewees possessed the valuation object, they were much less willing to give it away than they were willing to buy it. In other words, the key assumption – people value losses much more than they value gains – was proved.

The samples for both elements of the whole observation were carefully chosen. As criterion to participate in the interviewing was not only addictiveness to any substance or process, but also all respondents were from different countries with different lifestyles. All of them are students, however, all other attributes were varying (income, age, period of living abroad, race, etc). However, the results gained from interviewees' responses and their statistical verification proved that all of people may fall for addictive inclinations and the intensity of dependency do not vary among addicts with a continuous addiction to smoking.

There are still many elements of behavioral economics occurred in addictive behavior left to observe. However, the other crucial aim of this thesis was to make people doubt their rationality and look at their decisions from other perspective. The behavioral choice theory of addiction is still testing, though, only time and more accurate observations can explain addiction phenomenon for the full degree.

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## 7. Appendices

### Appendix 1: Online Survey

#### Prague Expats with Smoking Addiction

In the following questions there are no correct or wrong answers. You do not need to do any problem-solving or thinking, you need only imagination. The result of this survey will be examined for understanding decision-making and preferences.

#### Willingness-to-accept

Imagine that you were given a full package of cigarettes (the ones that you usually smoke). Try to imagine this package in your hands and convince yourself that it is completely and only yours (this moment you do not have any other cigarettes). Check ALL POSSIBLE BOXES with the price for which you are willing to sell this package.

- DO NOT SELL
- 10 CZK
- 20 CZK
- 30 CZK
- 40 CZK
- 50 CZK
- 60 CZK
- 70 CZK
- 80 CZK
- 90 CZK
- 100 CZK
- 110 CZK
- 120 CZK

#### Willingness-to-purchase

Imagine that you were shown a package of your favourite cigarettes. Currently, you do not have other cigarettes to smoke. Check ALL POSSIBLE BOXES with the price for which you are ready to pay to purchase this package.

- DO NOT BUY
- 10 CZK
- 20 CZK
- 30 CZK
- 40 CZK
- 50 CZK
- 60 CZK

- 70 CZK
- 80 CZK
- 90 CZK
- 100 CZK
- 110 CZK
- 120 CZK

## Appendix 2: Collected Responses

Case Study - Loss Aversion in Riskless Choices				
	WTA		WTP	
	ST 1	ST 2	ST 1	ST 2
DO NOT SELL/BUY	3	4	2	2
10 CZK	3	3	24	25
20 CZK	3	3	22	20
30 CZK	4	3	20	19
40 CZK	4	3	19	19
50 CZK	5	6	18	19
60 CZK	6	6	17	16
70 CZK	7	8	15	14
80 CZK	8	8	14	14
90 CZK	14	13	5	6
100 CZK	14	14	3	3
110 CZK	16	16	2	2
120 CZK	18	18	1	2
	n=25	n=30	n=25	n=30
ST 1 - Study №1				
ST 2 - Study №2				
n - number of participants				
CZK - czech crowns				

### Appendix 3: Two-sample Kolmogorov-Smirnov Test of WTA and WTP (calculated manually)

Alpha =	0,05		Two-Sample K-S test		
	WTA		Cumulative Frequences		
	ST 1	ST 2	ST 1 Cum%	ST 2 Cum%	Diff
DO NOT SELL/BUY	3	4	0,03	0,04	0,009524
10 CZK	3	3	0,06	0,07	0,009524
20 CZK	3	3	0,09	0,10	0,009524
30 CZK	4	3	0,12	0,12	1,39E-17
40 CZK	4	3	0,16	0,15	0,009524
50 CZK	5	6	0,21	0,21	2,78E-17
60 CZK	6	6	0,27	0,27	0
70 CZK	7	8	0,33	0,34	0,009524
80 CZK	8	8	0,41	0,42	0,009524
90 CZK	14	13	0,54	0,54	1,11E-16
100 CZK	14	14	0,68	0,68	1,11E-16
110 CZK	16	16	0,83	0,83	1,11E-16
120 CZK	18	18	1,00	1,00	0
	105	105		D-stat	0,009524
				D-crit	0,184003
				Significance	No

Alpha =	0,05		Two-sample K-S test		
	WTP		Cumulative frequencies		
	ST 1	ST 2	ST 1 Cum%	ST 2 Cum%	Diff
DO NOT SELL/BUY	2	2	0,01	0,01	7,66812E-05
10 CZK	24	25	0,16	0,17	0,007208036
20 CZK	22	20	0,30	0,29	0,00437083
30 CZK	20	19	0,42	0,41	0,009815198
40 CZK	19	19	0,54	0,53	0,009086726
50 CZK	18	19	0,65	0,65	0,002185415
60 CZK	17	16	0,75	0,75	0,007744805
70 CZK	15	14	0,85	0,83	0,013380876
80 CZK	14	14	0,93	0,92	0,012844107
90 CZK	5	6	0,96	0,96	0,006441224
100 CZK	3	3	0,98	0,98	0,006326202
110 CZK	2	2	0,99	0,99	0,006249521
120 CZK	1	2	1,00	1,00	0
	162	161		D-stat	0,013380876
				D-crit	0,148942112
				Significance	No