

**THE APPLICATION OF RATIONAL CHOICE THEORY IN ANALYZIS OF
ADDICTION BEHAVIOUR**

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THE APPLICATION OF RATIONAL CHOICE THEORY IN ANALYZIS OF ADDICTION BEHAVIOUR*

ABSTRACT: *The rational choice theory assumes that people when deciding whether to smoke cigarettes or not, use the mathematical analysis in order to estimate the values of indicators of individual preferences. There are risk and time preferences. The former shows aversion (or inclination) to a risk and is expressed through coefficient of risk aversion (indicator of risk preferences). For the higher coefficient of risk aversion, the risk aversion is greater. The latter measures the degree of preference for present satisfaction in relation to the same satisfaction in the future or, in other words, shows the extent to which individuals prefer to satisfy their needs today, instead in the future. The degree of preference for present satisfaction with regard to the same satisfaction in the future is expressed as the rate of time preference (indicator of time preferences). The results of Ida's and Gato's researches clearly indicated that the risk aversion coefficient and the time preference rate can predict successful cessation. Smokers who achieved a low time preference rate and a high level the risk aversion coefficient can be expected to be successful in cessation. All this suggests that these parameters are not only important predictors for succesful cesssation, but also factors of individual rationality. Taking into account this finding, rational choice theory, assumes that people will use the risk aversion coefficient and the time preference rate to calculate utility of alternatives. The aim of this paper is the styding of smokers from the perspective of rational choice theory, in order to detect facts and factors that explain the behaviour of smokers.*

KEY WORDS: *rational choice theory, the risk aversion coefficient, the time preference rate, theory of rational addiction, nicotine addiction.*

JEL CLASSIFICATION: A12, C12

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1. INTRODUCTION

For decades, it was believed that economic analysis should only be applied to economic phenomena – to the factors of production and their allocation, explicit markets, factor income and its distribution, and consumption. Everything else was outside the explanatory domain of rational choice theory (Begović, 2004, p. 76).

For a long time, the analysis of addictive behaviour was reserved for other non-economic fields, primarily for sociology and psychology. The usual sociological standpoint is that addictive behaviour is unwise, excessive, compulsive, destructive, and, of course, irrational. However, for the proponents of rational choice theory, addictive behavior is like any other economic behaviour – economically rational (Tomer, 2001, p. 243). Rational choice theorists believe that addicts try to maximize the utility of their enjoyment. In other words, potential addicts make very rational decision whether to use addictive commodities or not.

This paper has two main purposes. One is to explain why addictive behaviour is not rational. The other is to develop a socio-economic model of addictive behaviour that is an alternative to the economic theory of rational addiction. Moreover, our special intention was to determine the facts and factors that explain the behaviour of smokers, by using of the rational choice model.

The explanation and the model were drawn upon the insights of a variety of behavioural disciplines, especially psychologists, and combine these with economic concepts. It is hoped that these interdisciplinary theoretical perspectives will help us see addiction in its true light and help us connect to our natural intuition and wisdom with respect to these matters. The plan of this paper is as follows: Section One reviews the basic features of rational choice theory; Section Two introduces the concept of addiction in the theory of rational addiction; Section Three explains the socio-economic model of addictive behaviour; Section Four is devoted to revising the basic assumption of the model of rational choice, which means analysing the results of researches and statistical testing realistically. The last section of this paper is focused on the analysis of smokers' preferences with the aim of discovering some new facts about human behaviour.

2. RATIONAL CHOICE THEORY

The consequences of selecting alternatives spurred scientists to create theories of rational decision-making. Until the 20th century, there were a relatively small number of decision-making and rational choice theories. This pattern was changed radically in the 20th century when the first models of rational behaviour emerged, primarily in the theory of operational researches, and then in rational choice theory.

The advocates and critics of rational choice theory emphasise that it is psychological, individualistic and reductionist (Golubović, 2011, p. 131). It is psychological because it explains the actors' procedures by starting from their mental states. Rational choice is the choice in which actors choose the best available alternative, based on their desires and beliefs. The theory is individualistic because it is applied to the behaviour of individual actors. Finally, rational choice theory is reductionist or deterministic because the explanations of the differentiated aspects of a

complex process are reduced to a series of fundamental causes (actors) or to a single social subsystem (i.e. the economic one) (Hafner and Krstić, 2011, p. 38). Rational choice theory deals with rational human behaviour. In the context of the theory, the principle of rationality is characterized by subjectivity and narrowness.

Subjectivity In comparison with the neoclassical direction, rational choice theory fundamentally changed the paradigm of rationality. Supporters of rational choice theory renounced the useless “demarcation” between the rationality and irrationality (logical/ illogical) of behavior and focused on the subjective determination of rationality. If children prefer to watch TV and not to study, they act subjectively and rationally, although in 10 years’ time they will have a different opinion. After all, there are potentially as many “rationalities” as there are people on the Earth (Швери, 1997, p. 40).

A. Downs points out that his definition of man’s rationality refers to an individual who strives to reach its objectives in a way that (according to him) causes the lowest cost. “The monk deliberately chooses as its target the achievement of the state of mythical perception of objective reality. To accomplish that, you need to free your mind from all logical thoughts and conscious goal setting. From the economic point of view, such liberation is completely rational, though it can be described as irrational and ultimately too irrational according to some non-economic definitions of rationality” (Downs, 1957, p. 5).

Unlike the subjective type of rationality, aggregation logic often leads to a subconscious, objective rationality. This can be illustrated in the modified example by R. Bound (Budon, 1992, p. 126): An individual has to guess the outcome of toss-up game, in which a coin is bound to fall on its either side with the likelihood of 0.8. In this game, the majority of individuals, acting correctly from the standpoint of aggregation logic, predict results with the likelihood of $0.68 = (0.82^2 + 0.22^2)$, not apprehending that the coin will fall on the reverse side with the likelihood of 0.8. In this case, we talk about subjective rationality providing we have a serious reason to predict certain behaviour, which can be irrational in an objective sense.

The constraint Neoclassical theory has two fundamental deficits. Firstly, it assumes that the expenditure of obtaining information equals zero or nearly zero. Secondly, it ignores the transaction costs which are related to: 1) research and subjective views of the parties 2) the contract 3) the control of their execution and 4) the legal compensation for the damage of contract breaking. Even famous philosophers, such as Weber and Schumpeter, presumably did not pay attention to these moments. According to Weber’s typology (Швери, 1997, p. 40), only conscious focusing on the ultimate goal and conscious choice of means of its realisation are considered to be rational. Therefore, Weber makes a distinction between the “traditionally rational” behaviour on the one hand, and “traditionally irrational and affective behavior”, on the other. Nevertheless, both “traditionally irrational” behaviour and partly affective behaviour can be rational (Weber, 1978, p. 24).

If the analysis includes the time constraint, it becomes clear that in some trivial situations it is often more rational to make a decision immediately, and then to behave irrationally, provided there is no reasonable cause for rational behaviour. No matter whether we talk about eating with a fork and a knife, or with chopsticks, combing our hair in the morning or tidying our room, etc.,

these are all cases where traditional behaviour is rational. Just as M. Weber, Schumpeter could not bring the principles of rationality to a logical end. Schumpeter, for example, kept on using the term “field of rationality” in explaining entrepreneurs’ behaviour. Furthermore, he confused the term “rationality in conditions of incomplete information” with the term “irrational and variable behaviour” (Швери, 1997, p. 40).

The theory of rational choice have made up for all those flaws concerning the definition of rationality, and it has brought the rationality principle to its logical end, recognising the important role that time, transaction costs, expenses and information have in everyday decisions.

K. Menger, J. Commons, R. Coase and F. Hayek were the first to include transaction costs in economic analysis. Besides, F. Noyt and J. M. Keynes analysed some aspects of uncertainty (Швери, 1997, p. 43). Their concept of uncertainty is based primarily on the analysis of monetary and fiscal policy and the manufacturing process. H. Simon was the first to formulate the general principle of bounded rationality that is applicable to all social sciences (Швери, 1997, p. 43). He strongly denied the neoclassical unrealistic assumption and developed the concept of rationality that takes into account the role of uncertainty factors and uneven distribution of information in a number of choice-making situations. The next important step was made by G. Stigler, who showed that incomplete information can often be included in the economic analysis of the maximisation process (Stigler, 1961, p. 69). According to him, the degree of interest in search of information depends on costs. G. Stigler’s denoted that a subject (consciously or unconsciously) maximizes the amount of information collected, so the ultimate gain of additional information equals its final expenditure.

In “A Treatise on the Family”, G. Becker explores family relationships by using the principle of uncertainty. He tries to understand the logic according to which people choose partners in terms of time constraints and dangers that uncertainty and risk imply. He concludes: “If the potential benefit of additional information exceeds the costs of collecting the information about a partner or obtaining ideas about other potential partners, the search for the information continues. It will stop when marginal costs equal marginal revenue” (Becker, 1991, p. 325).

H. Simon, G. Stigler and G. Becker’s researches showed that theorists of rational choices had reviewed the spheres of social life in which they focused their attention to the assumption of constraint (Швери, 1997, p. 43). O. Williamson identifies three levels of rationality (Уильямсон, 1993, p. 40):

1) Rationality can be used in the strict form as a principle of maximisation. Neoclassicists and followers of the Chicago’s School (J. Stigler, G. Becher and others) were inclined to the principle of rationality in the strict form. Rationality in the strict form is defined as a purposeful activity of the enterprise focused on the realisation of goals that are consistent with its internal hierarchy of preferences. This goal realisation ensures the stakeholder’s maximum benefit level, and therefore in literature rationality in the strict form is also referred to as the principle of maximisation. In other words, neoclassicists and followers of the Chicago’s School recognize rationality as a maximising process within certain limits. As an example, they used the behaviour of households aimed at the maximisation of profits. Households have a budget that is used for purchasing a variety of products. According to the principle of maximisation, product selection is

done so that all the items are equally useful. Regardless of the benefits of this ancient method, it lacks the essential principle of maximisation, which is based on the stability, consistency, transitivity principles and the principle of irrelevant alternatives. These principles represent “the Achilles heel” of any principle of maximizing personal utility (Stigler and Becker, 1977, p. 76-90).

2) Rationality can also be formulated in a less strict form. H. Simon is the most consistent supporter of the concept of this form of rationality (Уильямсон, 1993, p. 41). He notes that we do not have a lifetime to spend on decision-making, so people generally do not maximise, but they set a level of personal satisfaction. If such a level is reached, they cease to look for other alternatives. The problem is that it is difficult to determine the level of satisfaction that represents an unstable variable. Consequently, in comparison with the principle of maximising, they lose confidence in forecasting.

3) Rationality can be observed in an organic form (Уильямсон, 1993, p. 42). The conception of “an invisible hand” is a good example of organic rationality. Following the example of A. Smith, the organic school and different evolutionary directions actively represented the organic form of rationality. From the perspective of organic rationality, maximisation of satisfaction is realised by trial and error.

The first and the third principle of rationality are very similar and a famous French proverb is valid for them – “The extremes touch each other” (“les extremes se touchent”). In contemporary literature devoted to rational choice, the organic and strict forms of rationality always coexist side by side.

Despite criticism based on valid arguments, rational choice theory has been proven to be very useful in certain situations. The key advantage of this theory is reflected in the use of rational choice as an important analytical tool. Rational choice creates the opportunity to place social sciences at the same analytical level at which the natural ones are. More precisely, rational choice provides conditions for bringing down various systems to a basic unit of analysis. The basic unit of analysis – an individual actor – is characterized by features that allow the prediction of influence of individual behaviour on social and political systems. “The predictive power of economic models based on rational choice allows social scientists to imitate some of the most respected skills in natural science. This makes the theory of rational choice a very effective instrument of economic analysis” (Golubović, 2011, p. 160).

3. THEORY OF RATIONAL ADDICTION

Rational choice theory is the “standard language” of contemporary economics. Under the influence of the attitudes and ideas of the supporters of this theory the theory of rational addiction emerged. The theory of rational addiction tries to attempting to explain addictive behaviour. When examining addictive behaviour excessive desires have the crucial role. According to Ruden, they remove the ability to make rational decisions about our actions (Ruden, 1997, p. 105). People in the throes of unnecessary desires are not able to consider the information, consult their preferences, and make decisions (that are) in the best way for their interests. These people can be rational when excessive desires are not present.

Behavioral decision theory of Daniel Kahneman has accumulated a huge amount of evidence showing the limitations because of which the actor's behaviour is not coherent with standard model of rationality. Constraints of actor are determined by two effects: on the one hand, the effect of loss aversion, which shows some mistakes because of which "losses loom larger than corresponding gains" (Kahneman, 1994, p. 22) , on the other hand, the framing effects , which show that the equivalent lotteries are presented in different ways, and valued differently (Kahneman, 1994, p.22). "Kahneman also finds evidence that people have 1) an inability to predict accurately their future utility from using goods, 2) an inability to predict changes in their tastes, and 3) an inability to accurately evaluate how much utility they have gained from an experience" (Kahneman, 1994, p. 22-32). In addition, it is believed that it will be greater inefficiency in the consumption of dependent goods than in consumption of food supplies.

While for solving the problems above, it is enough to make drug treatment, there are many fundamental problems with the theory of rational addiction. This theory assumes the invariance of personality and preferences. Specific personality, according to the theorists of rational addiction, will always be able to work with dignity. But these assumptions represent an inversion of the truth. Firstly, the addict, by definition, features dependency, and not stability. They tend to have volatile and non-genuine meaning of life. Far beyond the capabilities of consistent action and self-control, the addict, in the attempt to achieve and maintain a certain sense of life, always depends on the consumption of psychoactive substances. The addicts constantly look for carnal pleasures what makes them continually unsatisfied. Hence, the addicts tend to forget themselves in smoking and drunkenness (drinking). For being the man that can give up smoking and drinking, that can stay calmed before the dangers of health-risk behaviour, one has to make efforts.

The broader message of the previous analysis of rational addiction suggests that addicts are something more than the standard rational economic man. In order to understand better what addiction is for people, it is necessary to have a broader and quite different approach to economic behaviour. "Real economic actors" are not always rational. They often suffer from spiritual imbalance which reduces their abilities. For all these reasons, both the conception of humane man and the new conception of economic rationality are necessary for understanding addiction and human behaviour in modern economic analysis.

4. THE SOCIO-ECONOMIC MODEL OF ADDICTIVE BEHAVIOUR

Psychology developed a number of models for studying addictive behaviour and accumulated a large body of evidence showing a surprising departure from rationality. Crystallization of vague idea of the model changes the perception of the cardinal problems of addictive behaviour and allows it to be easily accessible and exposed. Noting the important phenomena and discarding less important features in a given context, the models provide us an opportunity of looking with "the naked eye" on the impact of personal, social and consumer capital on one's decision whether to consume psychoactive substances or not.

4.1. THE PERSONAL CAPITAL

Personal capital, the type of human capital can be defined as the capacity that stems from the basic qualities of the individual (Tomer, 1996, pp. 626–627). It is a “mirror” of one’s internal biochemical balance, one’s physical health and fitness, psychological strength and endurance, and purpose in life. The stock of capital reflects one’s personal genetic heritage and the events that shaped one’s life, but also reflects a person’s self-improvement activities, including psychotherapy/counseling, reading books, listening to or viewing audio and video tapes, attending seminars, seeking advice and wisdom from gurus or other religious/spiritual people, engaging in practices such as meditation and yoga, as well as undertaking various other therapies and gaining other experiences (Tomer, 2001, p. 251).

The physiological aspects of psychological functioning of the individual are another element of personal capital. According to Ronald Ruden (Ruden, 1997, p. 113), indicators of early addiction can be the sensitivity of the nucleus acumbens and serotonin levels in the blood. If the sensitivity of nucleus acumbens is low and serotonin levels are high, the risk factor of abusing and drug addiction is lower. Taking into account all aspects of the emotional life of the individual, Goleman (Goleman, 1994, pp. 13–29) emphasizes the crucial role of amygdala (part of the human limbic system) and the prefrontal lobe in people’s behaviour. The amygdala produces emotional reactions. that can be very powerful. However, the role of the prefrontal lobe is the interpretation of the situation and to coordinate, design and regulate emotional responses to action, in order actors to be rational and appropriate. Complementary functioning of the prefrontal lobe and amygdala is a prerequisite for emotionally intelligent behaviour. When one adopts better ways to manage their own emotions, new brain pathways, patterns of desired complementarity and so much needed spiritual balance are constantly created.

The core of socio-economic model of addictive behaviour is the idea that addiction is characterized by significant internal disbalance that will affect ones ability for perfecting ourselves and the world. When the degree of internal balance exceeds a certain limit, and the individual finds an addictive good for which he is bound in order to restore a sense of balance and control, it is likely that his personality will be changed under the influence of the consumption of psychoactive substances. The addict uses harmful goods to calm the feeling of anxiety, anger or depression. In the fifties the professional journals of Western Europe and North America begun to publish the results of *case-control* studies, which indicated higher level of distress in academic population. In these young subjects were later identified high level of psychoactive substance abuse. This can explain why youngs, without thinking about dangerous possibility to become addicts, experimentate with substances that can cause addiction, in long term.

According to Goleman (Goleman, 1994, pp. 254–255), different patterns of addictive behaviour lead to the consumption of various substances. There are two types of alcoholics. In the first case was observed chronically high levels of anxiety. Another were with the high level of agitation, impulsivity and apathy. People with this pattern of behaviour turns to alcohol to calm their fears and kindness in agitation. Such emotional and spiritual imbalances, and other types of internal imbalances can cause addiction. These include: the lack of proper nutrition, excessive levels of histamine, etc.

4.2 THE SOCIAL CAPITAL

The social capital represents the total actual or potential resources which associated with membership in a social group. Affiliation to a group provides individuals support through the access to resources of the group. The individual uses the social ties as means that allow him the access to resources of group, and as the final result of the use of these resources occurs the economic benefits. Social capital in the form of a tangle of social connections and relationships is not something that is given and it exists independently of our will, but it is rather a product of conscious human behavior (individual or collective), that is directed towards establishing or reproducing social relationships that individuals and groups can use in order to achieve a brief or long term objectives (Golubović and Golubović, 2007, p. 154).

Sandra Japuntic (Japuntic et al., 2011, p. 291) and colleagues in their theoretical and empirical studies of nicotine dependence dedicated huge space to the impact of social capital in the form of social networks on smoking cessation. They discovered that there was less chance for those participants who had a higher proportion of smokers in their social network to abstain during the six-month follow-up period and that they had a higher risk of regression.

Fukuyama occupies a particular position in the debate on social capital. Here, basically, it should be considered implementing Fukuyama's social capital in explaining the causes of the drastic increase in socially inconsistent outcomes in America during the 60es of the 20th century. In Fukuyama's opinion, the increase in female labor force and the availability of better birth control measures caused a dramatic decrease of succinct family social capital, which changed the norms governing marriage and responsibilities of spouses. The most significant was the decline in the strength of norms that regulate wife's responsibilities for establishing and maintaining harmonious and productive relationship between the spouses. All this led to a lack of harmony in the home, which was the husband's the main responsibility. From Fukuyama's perspective, the decline in family social capital produced a plethora of negative outcomes such as: increase of divorce rate and the number of children born out of wedlock, violent and property crime, child abuse, alcoholism, drug addiction, etc (Fukuyama, 1997, p. 30).

4.3 THE CONSUMER CAPITAL

Stigler and Becker (George and Becker, 1977, p. 78) proposed the theory of rational addiction, which was improved by Becker and Murphy (Becker and Murphy, 1988, p. 675). In this theory, "a person is potentially addicted to [some good] c if an increase in his current consumption of c increases his future consumption of c " (Becker and Murphy, 1988, p. 681). A key feature of these models is that the utility of the consumer at any given time depends not only on consumption in the period but also on "consumption capital". Consumer capital is, basically, the consumer's ability to enjoy in certain good, which depends on previous consumption, and perhaps some other factors.

If the previous consumption increases the ongoing ability of enjoyment, the addition is *beneficial*. It may be the case, for example with listening to the classical music. Scientific researches shows that listening to classical music has a positive effect on the ability to enjoy classical music (Green, 2002, p. 29). Furthermore, on proper capital spending from external

influences, education also can have great importance (Stigler and Becker). College-educated individuals (especially lawyers, journalists, professors and artists) have the ability to enjoy things like are classical music, opera and art. If the previous consumption reduces the ongoing ability to enjoy, the addiction is *harmful*. This is the case with substances like heroin and other substances that are usually thought to be addictive. If consumption heroin is higher in the present, the enjoyment of any quantity of the substance in the future will be less.

The formal setup in Stigler and Becker (Stigler, Becker, 1977, p. 78) is relatively simple. First consider beneficial addiction – to, say, classical music. Consumer utility (U) depends positively on two goods, M (music appreciation) and Z (other goods): $U = U(M, Z)$. Music appreciation depends positively on the time allocated to music listening (t_m) and on music consumption capital (S_m): $M = M(t_m, S_m)$. Music consumption capital at date j , S_{mj} , depends positively on the time allocated to music consumption in the past, M_{j-1}, M_{j-2}, \dots , and positively (perhaps) on the person's level of education at time j (denoted E_j): $S_{mj} = S(M_{j-1}, M_{j-2}, \dots, E_j)$. The addition is beneficial if S_{mj} depends on *positively* on the past values of M .

Alternatively, for harmful addition we may replace M with H , where H denotes the consumption of a good such as heroin. In this case, consumption capital S depends *negatively* on past values of H .

Becker and Murphy (Becker and Murphy, 1988, p. 675-700) define addictive behavior as a situation in which the consumption of a addictive (illegal) good increases rapidly. Size of the demand depends, in the first place, from the permanent changes in price (where the “price” of illegal goods is the expected cost of making judicial convictions, as well as all foregone earnings that may result from becoming addicted and, say, unable to work). A second implication is that strong addictions, if they are to end, must end suddenly (“cold turkey”). “Rational persons end stronger addictions more rapidly than weaker ones” (Becker and Murphy, 1988, p. 692). Other implications are that “addicts often go on binges” (Becker and Murphy, 1988, p. 675), “present-oriented individuals are potentially more addicted to harmful goods than future-oriented individuals” (Becker and Murphy, 1988, p. 682), and “temporary events can permanently ‘hook’ rational persons to addictive goods” (Becker and Murphy, 1988, p. 691).

It should be mentioned that Becker and Murphy had the intention to confirm the predictions of the economic theory of rational addiction. Unlike them, the scientists performed the experiments focused on the fundamental assumptions of the theory of rational addiction. Thus Keeler and Grossman (Keeler et al., 1993, pp.1-8) initiated laboratory experiments on the consumption of tobacco, while Olekalns and Bardsley (Olekalns and Bardsley, 1996, p. 1100-1104) has conducted hundreds of experiments on the effects of caffeine on the judgment and decision making. These experiments confirmed the results of the theory of rational addiction.

Becker and Murphy note that, with the simple extension of the model, cycles of overeating and dieting can be explained. The basic analysis assumes that there is only one type of consumption capital. Taking this into account, the authors assume two subtypes of consumption capital. One is related to weight. This phenomenon is known as “health capital”. The second regards to a eating. This phenomenon is known as “eating capital”. Eating can be bouth harmful and beneficial. As

consumption of food increases, health capital decreases, and eating capital increases. Under certain conditions, utility maximization can result in cycles of overeating and restrictive eating.

Iannaccone and colleagues believe that rational choice theory can be applied to the behaviour of believers (Iannaccone, 1990; Durkin and Greeley, 1991). According to Iannaccone utility depends on the inheritance of the religion. That is from the value of "religious human capital." Stock of "religious human capital" depends, in the first place, on the time and money invested in religious activities. Iannaccones' applying of the rational choice model gave the following consistent results (Iannaccone, 1998, p. 1481):

- Individuals while still very young tend to follow the ideas and attitudes of parents about religion, without critically evaluating and skeptically reviewing adopted attitudes. Unlike children, adults make their own decisions about religion.
- Changing of religion is more likely in younger age.
- People tend to marry within religions; if they do not, one spouse is likely to adopt the religion of the other.

5. THE STUDY OF NICOTINE ADDICTION

Rational choice theory assumes that people when deciding whether to smoke cigarettes or not, use the mathematical analysis in order to estimate the values of indicators of individual preferences.

There are risk and time preferences. The former shows aversion (or inclination) to a risk and is expressed through coefficient of risk aversion (indicator of risk preferences). For the higher coefficient of risk aversion, the risk aversion is greater. The latter measures the degree of preference for present satisfaction in relation to the same satisfaction in the future or, in other words, shows the extent to which individuals prefer to satisfy their needs today, instead in the future (Stojanović, 2010, p. 68). The degree of preference for present satisfaction with regard to the same satisfaction in the future is expressed as the rate of time preference (indicator of time preferences).

In order to determine the risk aversion coefficient and time preference rate of the respondents we used Ida's and Gato's, (Ida et al., 2008, p. 6) list of alternatives for the measurement of risk and time preferences:

Alternative 1

Reward : 100 000, Winning probability: 100%, Time delay: Now.

Alternative 2:

Reward: 150 000, Winning probability: 90%, Time delay: The month.

Alternative 3

Reward: 200 000, Winning probability: 80%, Time delay: Six months.

Alternative 4

Reward: 250 000, Winning probability: 60%, Time delay: The year.

Alternative 5

Reward: 300 000, Winning probability: 40%, Time delay: 5 years.

The sum of the probability of all possible outcomes (profit and loss) equals one, so the risk aversion coefficient equals total probability minus the losing probability (the risk). This means that the risk aversion coefficient equals winning probability.

Time delay is used to determine the time preference rate . if the time delay is longer, the actors are more impatient and expect a higher reward in the future. For examples if the reward of 100 000 that the individual will get for year, worths 250 000 (Alternative 4), the time preference rate, in this case, is 150% (Ida et al., 2008, p. 8).

Besides the list of alternatives for the measurement of risk and time preferences, Ida's and Gato's (Ida et al, 2008, p. 4) work pointed on the connection between the risk aversion coefficient and the time preference rate, on the one hand, and the successful cessation in the initial and final phase of the study, on the other hand. In both phases, smokers used the same technique to quit smoking and filled in a questionnaire that, among other things, contained a conjoint analysis to measure a risk aversion coefficient and a time preference rate. Results showed that there are two groups of respondents (smokers): respondents with a high the risk coefficient and a low the time rate preferences rate and respondents with a low the risk aversion coefficient and a high time preference rate . In the initial phase of the study, persons successful in quitting showed greater risk aversion (a higher the risk aversion coefficient). In the final phase, persons were more patient (had a lower the time preference rate) and had a higher aversion to risk than respondents failed in quitting. Therefore, the results of Ida's and Gato's (Ida et al., 2008, p. 4) researches clearly indicated that the risk aversion coefficient and the time preference rate can predict successful cessation . Japanese scientists also discovered that respondents successful in quitting became more patient between the initial and final stages of survey and respondents failed in quitting became more impatient. Smokers who achieved a low time preference rate and a high level the risk aversion coefficient can be expected to be successful in cessation. All this suggests that these parameters are not only important predictors for successful cessation, but also factors of individual rationality.

Taking into account this finding, rational choice model, assumes that people will use the risk aversion coefficient and the time preference rate to calculate utility of alternatives. Let the utility of alternative i be V_i . In the rational choice model, the utility of alternative is calculated based on the equation of discounted and expected utility (Ida et al., 2008, pp. 7-8):

$$\text{Discounted utility: } \exp(-TIME * \text{timedelay}_i) * \text{utility}(\text{reward}_i), \quad (1)$$

where parameter $TIME$ denotes the time preference rate.

$$\text{Expected utility : } \text{probability}_i * \text{utility}(\text{reward}_i). \quad (2)$$

Accordingly, rewriting V_i , we obtain:

$$V_i(\text{reward}_i, \text{probability}_i, \text{timedelay}_i) = \exp(-TIME * \text{timedelay}_i) * \text{probability}_i * \text{utility}(\text{reward}_i). \quad (3)$$

At this point, we simply specify the functional form of utility as the $RISK$ -th power of reward. Such a utility function is called the constant relatively risk-averse form, where the coefficient of the relative risk aversion is denoted by $1-RISK$. Taking logarithms of both sides, we obtain:

$$\ln V_i(\text{reward}_i, \text{probability}_i, \text{timedelay}_i) = -TIME * \text{timedelay}_i + \ln \text{probability}_i + RISK * \ln \text{reward}_i. \quad (4)$$

Formula (4) was used (in the survey) to measure the net utility (rationality) of current and former smokers.

Although the mathematical rational choice model is principally distinguished by its greater clarity and consistency than other techniques commonly used by researchers in the social sciences, the rational choice model is to some extent “deficient” to convey the complexity of reality. This model lacks the analysis of the impact of nicotine dependence and demographic and contextual variables on smokers. Sandra Japuntić and her colleagues (Japuntic et al., 2011, p. 286) were the ones who analysed the effects of these factors on the behaviour of smokers.

Analyses were conducted using SAS, version 9.2 (Japuntic et al., 2011, p. 289). For analyses of initial and point-prevalence abstinence the researchers used logistic regression. Their analysis of lapse and relapse used Cox proportional hazards regression survival analysis. The analysis (except initial abstinence) were conducted during the 6-month follow-up period.

Daily smoking data were collected with a smoking calendar using timeline follow-back. The maximum amount of time for recall was 6 weeks. The maximum amount of time for recall was 6 weeks. Seven-day point-prevalence abstinence was assessed during a 6-month follow-up call and biochemically confirmed (Japuntic et al., 2011, p. 287). The three milestone variables were computed using smoking calendar data: the initial abstinence variable, the lapse variable, and the relapse variable. The initial abstinence variable indicated whether participants reported smoking zero cigarettes on at least 1 day in the first 14 days of the study. The lapse variable, coded for those who achieved initial abstinence, was the number of days between the first day where participants smoked zero cigarettes and the first day where they smoked any amount (Japuntic et al., 2011, p. 287). Finally, the relapse variable, computed for participants who lapsed, was

defined as the number of days from the lapse day until relapse (the first of 7 consecutive days of smoking). If participants did not reach a milestone (e.g., lapse/relapse), their milestone variable indicated the number of days from their last milestone until the end of follow-up (Japuntic et al., 2011, p. 289). If they withdrew from the study before reaching a milestone, their milestone variable indicated the number of days from their last milestone until their withdrawal date.

Besides nicotine addiction, S.Japuntic's and et al. survey found that the significant predictors of short-term and initial abstinence, lapse and lapse-relapse transition were: demographic and contextual variables.

The results also showed that contextual and demographic variables tend to reduce initial abstinence probability. The available data did not indicate the mechanism of causal relationship, but a candidate can react to the stimulus, which could worsen the withdrawal syndrome.

5.1 THE AIM OF THE RESEARCH

The aim of the research is that, based on collected data, to determine whether economic, demographic and contextual variables can influence smoking cessation. The use of mathematical model had special purpose to determine whether are smokers more rational than non-smokers (ex-smokers).

5.2. THE HYPOTHESES

Hypothesis 1: Individuals successful in smoking cessation are more risk-averse than individuals who did not quit smoking.

Hypothesis 2: Individuals successful in smoking cessation were more patient than those who failed in smoking cessation.

Hypothesis 3: Ex-smokers (those successful in smoking cessation) are more rational than the current smokers (people unsuccessful in smoking cessation).

Hypothesis 4: A middle-aged smokers have the largest (highest) daily consumption of cigarettes, and they will be the most motivated to quit smoking.

Hypothesis 5: Women stop smoking in the same extent as men.

For the purposes of this research were selected one contextual, two economics, three demographics and variables (economic variables: the time preference rate, the coefficient of risk aversion; demographic variables: gender, education, age; contextual variable: cigarettes per day). Variables used in this research can be (conditionally) divided on independent and dependent.

INDEPENDENT: smoking cessation with two categories (current smokers or persons who have not quit smoking smokers and ex-smokers or persons successful in smoking cessation or non-smokers), age (younger ones, middle aged, and old age), sex (male and female)

DEPEDENT: the risk aversion coefficient , the time preference rate , rationality (net utility), cigarettes per day.

5.3 RESEARCH INSTRUMENTS

For analyzes of the relationships between this variables and smoking cessation, we used the following instruments: questionnaire, Fagestrom’s test for Nicotine Dependence and rational choice model.

QUESTIONNAIRE: Questionnaire has 23 questions. Most of questions (14) are closed questions (have offered a response). Questions asked at the beginning of the questionnaire (the first 7) are concerning personal data of respondents . The next 16 are asked in order to find: the smoking habits of the respondents, their knowledge about the tabacco and its harmful effects and also if they have direct experience with some of tabacco’s harmful effects.

FAGERSTRÖM’S TEST OF NICOTINE DEPENDENCE. Fagerström’s test measures the degree of nicotine dependence. It consists of 6 questions. Maximum number of points is 10.

Table 1. The level of dependence on nicotine

Results on Fagerström’s test of nicotine dependence	The level of dependence on nicotine
0-2	Very low dependence
3-4	Low dependence
5	Medium dependence
6-7	High dependence
8-10	Very high dependence

RATIONAL CHOICE MODEL. The core of rational choice model makes the risk aversion coefficient and time preference rate . The risk aversion coefficient depends negatively on the time preference rate. If the respondent with a high the risk aversion coefficient chos alternative 1 from the list of alternatives for the measurement of risk and time preferences (the risk aversion coefficient is 100%), he will be paid off at the same moment (the time preference rate is 0%) .

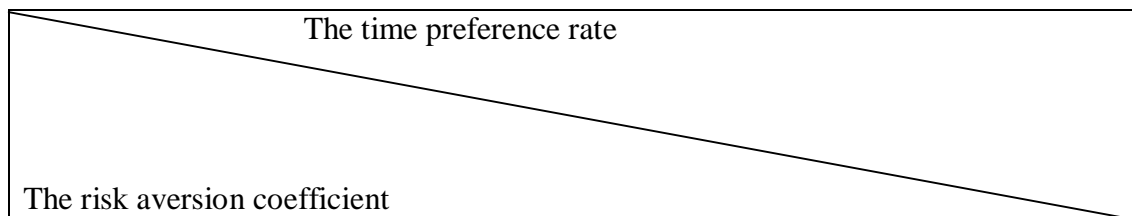


Figure 1. The inverse proportionality the risk aversion coefficient and the time preference rate

The results of Ida's and Gato's researches clearly indicated that individuals successful in smoking cessation were more patient than those who failed in smoking cessation (Ida et al., 2008, p. 11). This means that individuals successful in smoking cessation have a higher values of risk aversion coefficient. Considering that the risk aversion coefficient depends negatively on the time preference rate, it follows that individuals successful in smoking cessation have a lower time preference rate. Thus, the time preference rate is patience (im) patient indicator. The higher it is, the higher is the impatience of smokers.

In order to obtain a more realistic picture of weightiness of variables, we prepared databases and performed the factor analysis of variance (ANOVA) in SPSS.

5.4 THE SAMPLE

The sample consists of 487 respondents, the citizens of the City of Niš. We surveyed current smokers and non-smokers – former smokers. Demographic and contextual characteristics of the participants are shown in Table 2.

Table 2. Demographics and descriptive statistics

Measure	Total
Gender	
Female	44.8
Male	55.2
Education	
<High School	3.0
High School	57.0
College	40.0
Marital Status	
Partner/ Widowed	3.5
Married/Live-in	45.9
Divorced/Separated	5.8
Never Married	44.8
Age	39.5(15.4)
FTND	4.2(2.7)
Time preference rate	46.7 (60.6)
The risk aversion coefficient	88.1 (17.2)

The results of the Fagerström test for nicotine dependence show a low degree of dependence of the respondents, with the average value of 3.93. Same ratio was 3.7 for the successful and 4.2 for person unsuccessful in quitting. People successful in quitting (person with a low degree of nicotine dependence) think that they can quit smoking at every moment (Ida et al., 2008, p. 6),

and they are more patient than people with a higher level nicotine dependence (individuals who did not quit smoking). Their time preference rate were 37%. On the other hand, the time preference rate of smokers with higher levels of nicotine dependence, which obviously became physical and mental addicts (Ida et al., 2008, p. 6), were 57%. Exactly, the patience (endurance) of people with lower levels of nicotine dependence provides a higher the risk aversion coefficient. The coefficient of aversion for people with low levels of nicotine dependence were 88% for those with a high degree of nicotine dependence 84%. The average of risk aversion coefficient in the sample was 86%.

On the basis of analysis of the answers of 11th question in the Fagerström's test for nicotine dependence (How many cigarettes per day do you smoke: 9 or less, 10-15, 16-20, 21 or more), it was found that from the total number of respondents (N = 487), 175 of them consumed up to nine cigarettes per day. Moreover, additional analysis of the same answers (answers on the 11th question) showed that people who smoked daily 16-20 cigarettes made up 33% of the surveyed subjects (Table 3).

Table 3. The percent of respondents according to cigarettes per day

Cigarettes per day	The number of all respondents according to cigarettes per day	%
< 9	175	36
10 – 15	83	17
16 – 20	161	33
>21	68	14
N	487	100

5.5. THE ANALYSIS OF RESULTS

ANOVA pointed out on 4 statistically significant differences.

The hypothesis that persons successful in quitting are more risk-averse than individuals who stopped smoking was conformed.

The results of factorial of analysis showed that people who stopped smoking are more composed than those prone to failure in smoking cessation.

The hypothesis concerning the middle age and consumption of cigarettes was confirmed. The analysis in SPSS showed that those in the age of 30-44 recorded the highest daily consumption. On the other hand, middle-aged smokers had higher rate of abstinence, the average number of attempts to quit smoking was larger.

It was found that women stopped smoking in the same extent as men. The results of this study showed that women make up 48.5% of successful and 45.8% of persons failed to quit. Similarly, the research of Sandra Japuntic and associates detected that women stopped smoking in the same extent as men, but it is more likely that women, after initial abstinence, re-light a cigarette, and then intensify its consumption (Japuntic et al., 2011, p. 291).

The hypothesis that refers to the connection between success in quitting and rational behavior of participants (smokers and ex-smokers), was not confirmed. Those who were either successful or unsuccessful in quitting smoking were not statistically significantly different when it came to rational behaviour. Having considered the nicotine dependence and economic variables it was found that, from 487 participants, 364 of them (75% of current and former smokers) preferred safe profit (or the alternative with the losing probability (see the list of alternatives on page 12). The average of risk aversion coefficients in a sample of smokers and ex-smokers was 86%. All this suggests that rational behaviour is not correlated with smoking behaviour.

S. Japuntic's broader analysis of the demographic characteristics of smokers indicates that highly educated individuals were more likely to abstain during the six-month follow-up period, to achieve initial abstinence, and to have a lower risk of regression than those without high education (Japuntic et al., 2011, p. 289).

The confirmation of this research can be found in Harris and Harris's papers. As the higher level of education provides higher income and generally increases the efficiency consumption of all goods, Harris and Harris believe that an increase in wages (which can be understood as the result of a higher level of education) in the future will provide a greater incentive to quit smoking. The results of Harris's and Harris's survey of bad (smoking) habits in residents of Maryland showed that highly educated smokers had a strong and reasonable need for smoking cessation, since they found motivation in pursuing to maximization profit, and irrational spending money on tobacco certainly was not the way to achieve the goal (Harris and Harris, 1996, p. 616).

Jones, on the basis of a sample of current and former smokers in the UK, concluded that the number of attempts to quit smoking increases the level of the whole population, but successful cessation concentrates on the members of high social classes who are high educated. Based on Jones's analysis also emerges the fact that the self-control assumptions are better for explaining the process of smoking cessation than the assumptions of rational behavior (Jones, 1994, p. 101).

6. CONCLUSION

Modern researches, combining economics and psychology, show that regularity results, from the viewpoint of the generally accepted theories, are incorrect. This fact, on the one hand, certainly enriches our conception of the nature of human rationality; on the other hand, it gives theorists the task to describe and explain these anomalies.

Kahneman, Becker, Murphy and others, in their own way, were faced with the very source of the fundamental programme for empirical and experimental researches on economics as a scientific discipline. Presenting different academic disciplines, these scientists only discovered lots of facts and phenomena, previously not known, but which explained the behaviour of people and

enriched the instrumentation of economic science with numerous new methods. Something else is much more important: their work laid the foundation principle of the new reciprocity model between representatives of various scientific disciplines and reinforced mutual connections between empirical and theoretical researches. It is this interdisciplinary collaboration and continuous creative contact between researchers who determine the experimental facts and scientists who propose their theoretical explanation that will almost certainly become both the collateral and driving mechanism of the progress of economic science in the 21st century.

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