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**Economic analysis of human behavior in terms of health promotion concept**

**Abstract:**
The Health promotion is being described as a process of illness prevention conducted by keeping the healthy lifestyle. It primarily provides more time to use and increase individual’s human capital and maximize personal income. Individuals may employ two different ways to minimize their sick leave. Actively, by the health promotion or in the passive way by the treatment of and recovery after illness. Both alternatives of individual behaviour can be shown using the model of demand for health by Grossman (1972).
The growing incidence of mostly incurable and chronical non-communicable diseases (NCD) rules out the passive approach as irrational choice. Adoption of proactive approach to health prevents behaviour with bounded rationality. The cause for this behaviour can be explained by the behavioral economics analysis, specifically by the effects of insufficient self-control, procrastination, framing, status quo bias or loss aversion effect. Economic interpretation of individual approach to own health offers significant improvement of the health promotion concept, its scope and efficiency.

**Key words:** health promotion, the demand for health, healthy lifestyle, behavior economics, bounded racionality

**JEL classification:** I 15, I 18, I 19

**Introduction**
One of the most significant social and economic problems in the developed countries is the ageing of the population. In the coming decades, this will pose a threat, particularly for the economic development of the Western World, the USA and Europe. The population of western countries is ageing rapidly. According to all socio-demographic forecasts, there is no realistic chance of this trend's changing in the near future. The increase in the number of elderly people, in relation with the size of the population in the productive age, threatens the
sustainability of the social and healthcare systems. The EU governments are solving this problem by increasing the age of retirement.

**Figure 1** Expected share of 65+ group in Japan, Germany and the Czech Republic in 2050

![Graph showing expected share of 65+ group in Japan, Germany and the Czech Republic in 2050.](image)

However, this policy has several limitations and conditions. Ageing itself is not the main problem; the main problem is the bad health of the older generation. The state of the health of people older than 60 is decisive for the success of the policies of extending the productive age. Poor health creates a handicap for older applicants in the job market. The reduced ability to work full-time as a result of disease also prevents the use and growth of the people's capital in the older generation. Therefore, employers are reluctant to give work to people older than 60, because many of them are not able to be fully productive any more. The state of the health of the older generation in the US and the EU is developing in an alarming way as a result of the spread of non-communicable diseases, NCD. Healthy Ageing has become a major factor in the sustainability of the social and healthcare systems.

Health is affected, and not only in old age, by the management of the so called health determinants: (i) lifestyle 50 – 60%, (ii) health care 15 – 20%, (iii) environment 10 – 15%, (iv) genetic predispositions 10 - 15% (Lalonde, 1974). These factors affect people's health throughout their lives. The main factor is lifestyle. It is an important factor in the prevention of infectious diseases, but also a decisive one in the prevention of NCD's. In the last three decades there has been a explosive growth of NCD's on a global level. The causes are risk factors in people's lifestyles. In particular, smoking, improper diet, lack of physical activity,
alcohol consumption, drugs, stress and insufficient sleep (SZU, 2012). After an outbreak, NCD's are incurable, or they are, but only to a certain extent. The only way to reduce their incidence in the population is to prevent them by following the principles of a healthy lifestyle. The spread of NCD's is rapidly increasing, in particular in the USA and the EU. An important aspect of NCD's is the sharp increase of their incidence in older age. This trend is in complete contrast with that of the most common infectious diseases (influenza, injuries, digestive and urinary diseases).

Figure 2  Percentage of persons affected by NCD's in the Czech Republic (2011)

Even a small, positive change in lifestyles, according to the concept of health promotion, can produce important results in the decrease of the incidence of NCD's.

Second)

Another significant cause for the incidence of NCD's is overweight and obesity. This is not an aesthetic defect, but a serious NCD and the cause many other diseases. Obesity is a very reliable cause for other NCD's like diabetes, cardiovascular and musculoskeletal diseases.
The incidence of new cases of NCD’s grows significantly in older age. In the Czech Republic, within the 29-60 age groups, the growth rate of new cases of NCD's is 16.5% in musculoskeletal diseases, 12% in cardiovascular diseases and 1.7% in cancer (Klesla, 2012). This shows a deepening trend in the Czech Republic in the loss of health as a result of NCD's in older age, starting in the middle-aged category. The cause is an unhealthy lifestyle. A significant part of the Czech population is not willing to adopt a healthy lifestyle of their own. The main tool to change this widespread negative attitude is the concept of Health Promotion. It is defined as: “The process of enabling people to increase control over, and to improve, their health“ (Ottawa Charter, WHO, 1986). The main goal is to prevent disease, in particular NCD's, by strengthening health promoting behaviour and promoting healthy lifestyles in the population. Health promotion works within public policies and programs in three basic forms (I) health protection (ii) preventive interventions and (iii) education (Tannahill, 1985). The set of tools of the Health Promotion concept aims to change negative habits in lifestyles. In the last few years, the paradigm of the whole concept has shifted to a socio-economic and psychosocial approach. However, these modern approaches still lack the economic perspective on people's decisions when it comes to their health and lifestyles. Lifestyle choices can be better understood and interpreted with the help of economic analyses of behaviour. The economic approach increases the efficiency of policies, programs and interventions in the field of health promotion. In the last years, their results have not been too convincing, in particular in terms of the promotion of healthy lifestyles as the sole effective solution to the threat of the growing incidence of NCD's. Therefore, we are believe that an economic approach and tools to analyse behaviour can provide a better understanding of
human behaviour, which will increase the efficiency of health promotion to the level of public health.

The model of demand for health
The theoretical basis of the analysis of individual behavior in terms of health promotion is the theory of demand for health (Grossman 1972). This model of the demand for the commodity "good health" is based on Becker (1993) and Schultz (1961), the concept of human capital.

An important prerequisite is the active role of the individual who purchases goods and creates health. To refer to the investment in health, he uses the term health capital, which equates to health, as a part of the human capital's supplies. The model is based on the consumer's utility functions, which Grossman (1972) formulated as

\[ U = U (\phi_0 H_0, \ldots, \phi_n H_n, Z_0, \ldots, Z_n) \]

Where \( H_0 \) is the initial supply of health, \( H_i \) is the stock of health in time \( i \), \( \phi_i \) is the number of services per unit of health, \( \phi_i H_i \) shows the total amount of health that has been consumed or invested in time \( i \), \( Z_i \) is the total consumption of the other commodities in time \( i \).

Grossmann (1972) sees the demanding individual as someone who at birth receives a "stock" of health, which deteriorates and decreases more rapidly with time, which in turn reflects the exponential function of time. The reduction of the health stock is expressed as

\[ H_{i+1} - H_i = I_i - \delta_i H_i, \]

where \( H_i \) is the current stock of health, \( I_i \) are the gross investments in health and \( \delta_i H_i \) is the wear (depreciation) of health.

![Figure 4 The curve of demand for health](image)

Source: Grossman, 1972

The demand for health is illustrated with a Keynesian Marginal Efficiency of Capital curve, \( MEC=W*G/C \), where \( W \) is the wage rate, \( G \) is the rate or return on investments in health, \( C \) are the direct costs of the investments in health. The y axis shows the marginal capital costs, consisting on the rate of time preference costs on the health capital \( r \), increasing according to the age related increase in the consumption of health, from \( \delta_i \) to \( \delta_n \) (Grossman, 1972).

In terms of the economic approach to health promotion is extremely important that Grossman's (1972) concept of gross investment in health does not only health care in terms of...
treatment of diseases. It combines consumption of market goods with their time and produces (restores supply) health. In addition to health care (medical care) model also assumes consumption goods for a healthy lifestyle, such as diet, exercise, recreation, and housing (Grossman, 1972). Making health and is based on two sources. Of health care and health promotion, which is part of a healthy lifestyle. The key moment for the application of the model in the field of health promotion is that the demand curve reflects lower stocks $H_{min}$ health in old age and high wear of body $\delta_0$, which is expressed by an index according to the periods of human life. Convex shape of the demand curve for health therefore expresses the assumption that deterioration of the body due to aging, expressed as $\delta_i$, accelerates the increasing demand for health.

**The model of demand for health in terms of health promotion.**

According to Grossman (1972) individuals recover the stock of health in order to (i)) achieve personal well-being, (ii) perform bussines and non-bussines activities. Grossman (1972) differentiated to basic approaches to demand for health. People fail to fulfill both roles with the same intensity. Each of them can be represented by one of two types, based on the dominant behavior. The first type represent people who are trying to maintain their health. They want to keep their personal well-being. They are renewing their stock of health for present and future active economic and social life (WHO, 1981). They realize that the better restore your health, the better they will serve in future for their continued business and non business activities. The second type are those who are content just to restore their sense of personal well-being and ignore the effect of the gradual deterioration of his health with increasing age.

Two types of this basic behavior can be differentiated on the basis of our model – Investor and Consumer (Klesla, 2012). Their behavior is different especially in terms of their approach to promoting their own health.

Type A, Investor. Follows a healthy lifestyle, uses prevention and seeks to avoid illness and stay healthy into old age,

Type B, Consumer Focuses only on treatment, does not follow a healthy lifestyle. Suffers by diseases in old age and soon loses the ability to work.

The main differences between the two basic types of behavior we interpret as different convexity of demand curves for health.
Figure 5  
Two approaches to individual health promotion

\[ r + \delta \]
\[ Hi \]

Source: Grossman, 1972, own design

On the x and y axes are the indicators of the Grossman’s (1972) model, health \( Hi \) and the tenure costs of capital \( r \), multiplied by the coefficient of health wear \( \delta i \). The difference in the effectiveness of the costs of health maintenance, which increase with age, between the behaviours type A and B lies on the difference between the amounts of health \( Hi \) at the same price for its renewal.

We therefore prepared the mathematical model of demand curve for the both types of behavior.
We are looking for two convex functions \( f_1(H_i), f_2(H_i) \) at interval \((0, \infty)\) which meets:

\[
\begin{align*}
f_1(H_i) &\leq f_2(H_i) \quad \text{pro } H_i \in (0; H_1) \\
f_1(H_i) &\geq f_2(H_i) \quad \text{pro } H_i \in (0; H_1 \times x \in (x_{\text{min}}; \infty))
\end{align*}
\]

General form the functions: \( f_1(H_i) = \frac{A}{H_i} \), \( f_2(H_i) = e^{A - H_i} \)

Solution of the equation \( \frac{A}{H_i} = e^{A - H_i} \) get the intersections of these two curves. One is trivial \([A; 1]\), the second solve from

\[
A - \ln(A) = H_i - \ln(H_i)
\]

Curves are intersected by two secant: \( y_1 = k_1 H_i + q_1 \), \( y_2 = k_2 H_i + q_2 \)

such that: \( k \ll 0 \quad q \gg 0 \quad |q| \gg |k| \)

Secant \( y_1 \) intersects the curve \( f_1(H_i) \) a \( f_2(H_i) \) in points \( H_1 \), \( H_{\text{max}} \); secant \( y_2 \) intersects curves \( f_1(H_i) \) a \( f_2(H_i) \) at points \( H_{\text{min}} \), \( H_{\text{max}} \)

For practical reasons, we convert explicit measurements (result morbidity statistics, consumption of drugs, depens on the age of salary…) in standardized form.

And we restrict the interval \( x \in (0, 4) \).

Then we obtain \( f_1(H_i) = \frac{A}{H_i} \), \( f_2(H_i) = e^{A - H_i} \)

with intersections \([2; 1] \) a \([0,4 ; 5]\)

Secants \( y_1 = 6 - 2.5*H_i \), \( y_2 = 6.5 - 2.75*H_i \)

Which can also have the graphical representation
Two secants have been added to the original graph according to Grossman; they join the starting point of the intersection of the two curves that illustrate the demand of both behavioural types, A – Investor, B – Consumer, at the point of the highest possible health, which is understood as the starting point of life with the lowest possible level of health loss, at the point of birth. The secant line represents an auxiliary function to express the difference between both functions.

For illustrative purposes, we have established the health supplies (Hi) at 100 points. The linear loss in health is shown by the secant line y2. The behavioural models of the persons are shown with the functions f1, f2.
The \( f_1 \) function represents the behaviour of a person who does not care too much about about their health and invests less (interval \( \langle H_1 ; H_{max} \rangle \)) – type B Consumer. The intersection of \( f_1 \) and the secant line \( y_2 \) shows the increase of the price of health in the interval \( \langle H_{min1} ; H_1 \rangle \).

Point \( H_1 \) is the intersection of \( y_1 \) with both function curves, it is the point from where a healthy lifestyle is cheaper (and longer), than in a mere consumption of health. Point \( H_{1 \text{ min}} \) is the intersection of tangent \( y_2 \) and function \( f_1 \) and shows the life expectancy and the price for health care that the Consumer should pay during the last years of their life in order to reach the maximum life expectancy in relation with the deterioration of their health. Point \( H_{2 \text{ min}} \) is the intersection of tangent \( y_2 \) and function \( f_2 \), which represents the life expectancy and the scope of demand and purchase of health care and other assets of Investor. From the graph, it is clear that type Investor lives longer and the unit costs are lower than at Consumer's.

The difference between both functions expresses the different amounts of demanded health by Investor (type A – green curve) and Consumer (type B – red curve) at the same costs and rate of health loss. Both behavioural types can be found within the Czech population, and there is always a combination of both behaviours in each individual. The prevailing type is the one that decides the resulting behaviour.

Type A – Investor represents the minority of the population, but the proportion of this type of behaviour is growing. This is the prevailing behavioural type among the younger population with higher education. These people are not satisfied only with the immediate relief in their well-being as a result of a treatment for a disease. They prevent disease and rehabilitate after them. They use the same level of offer when demanding and purchasing other assets. They demand not only healthcare, but mainly other assets that are necessary for a healthy lifestyle (physical exercise, healthy diet). Their rational consumption generates greater benefits in the form of (renewal) of more health (supplies). The goal of the Health Promotion concept is to promote this behavioural type to a greater extent among the population.

Unfortunately, most people rely on treatment and, therefore, the prevailing behavioural type is B – Consumer. Consumer lives in a health illusion, they behave inefficiently and is under greater risk of incurable NCD's. Consumer neither does not acknowledge this serious fact, nor has insufficient information or limited possibilities to treat NCD's. If we assume that, in the 21st century, the Czech public is sufficiently informed about the health risks of NCD's, including their incurability, when people ignore the high and real health risks, we have a breach in the conditions of rational choice. An important reason why people often behave prevailingly consuming their health, i.e. as type B, is the illusion of health, which is a result of
several factors. The basis for this illusion is the mistaken interpretation of the theory of health safety (Menahem, 1999). This theory of reduced risk by the availability of treatment on the basis of a health insurance system, together with a significant progress in the treatment of infectious diseases and neoplasms, has caused in recent years in large part of the public opinion believing the myth of self-saving modern medicine. Another source of the health illusion is the principal-agent effect (Stieglitz, 1987). People increasingly entrust their health to a doctor. This reinforces the health illusion by creating the wrong impression that there is a way to solve all health risks, including the management of risk factors that lead to NCD's. The health illusion is based on the absolutization of the treatment potential of modern medicine, together with the guaranteed availability of treatment and the principal-agent effect; this weakens the responsibility of the individual over their own health and the adoption of the healthy lifestyle that can be found in the behavioural type A - Investor. In fact, it strengthens the passive health behaviour of type Consumer, according to variable B. At the same time, it explains why people are increasingly relying on treatment instead of adopting healthy lifestyles and active approach to their health.

Preferences, utility and rational choice in terms of healthy lifestyle

Consumers choose among assets so that the decision for the asset that offers the highest expected benefit among the available alternatives is the optimal choice. The individual recognises which benefits are better than others, and chooses based on that. The standard economy addresses only the measurable consequences of these choices on behaviour. People reveal their choices only through their behaviour. The standard economy understands the benefit as deciding benefit, for instance, the ownership of the asset with the highest probability of being chosen. The preferences of individuals can be determined from the choices made through the deciding benefit. Within the interpretation of the standard economy, the decisions are based only on manifest, otherwise, hidden preferences that have apparently caused a given choice. The method of choice is explained by the four normative axioms of rational decisions of individuals (von Neumann, Morgenstern, 2004, s. 8, 22).

Irrationality (in the economic sense of the world) is represented by the behaviour of a person that is not consistent with the axioms of rational decisions. From the results of statistical analyses we argue that the choices of people, in relation with following the principles of a healthy lifestyle and the promotion of their own health, show considerable irrationality. This type of behaviour can be defined the following way: people prefer health (Investor), but are not able to keep this preference in all situations (Consumer). For example, a heavy smoker expresses the preference for this utility over others, despite being aware of the increased risk.
of cancer, which can kill them. They risk cancer beyond the rational, even though their highest preference is to stay healthy. Therefore, this is, in the short term, in total conflict with their long term and evident interest.

However, in terms of health promotion, this problem, is not addressed by how standard economy analyses human behaviour on the basis of rational choice. According to Becker and Murphy (1983), even the consumption of goods harmful to the health is the result of a rational choice, since the individual has chosen this goods instead of others. Standard economy is not able to explain this conflict because, using the so-called decision utility, it cannot explain the choice of an individual in all situations.

**Bounded Rationality in terms of health promotion**

Behaviours with limited rationality are characterised by a conflict between the rationality of the choice of the best benefit according to individual preferences, and its realisation through actual behaviour. Behavioral economics examines and explains this type of behaviour using the so-called psychological expected utility. Based on the results of long term surveys that show that most people do not have enough time, motivation or ability to consider their options. Decisions are subconsciously simplified and they are made inaccurately and more or less erroneously. The founders of this direction of economic thought, Kahneman etc. (1991), called this method of decision making heuristics. Besides the analysis of this group of imprecise decision making, behavioral economics also brings an approach to the analysis and understanding of the origin of the erroneous decision. These anomalies of rationality are characterised by a person's irrational choice when making a decision. We believe that the methods to analyse anomalies of rationality can reveal and explain irrational cases of human behaviour in relation with health promotion that cannot be explained with the methods of standard economy. The methods and processes of behavioral economics when analysing human behaviour can provide new approaches and solutions that will support a socio-economic approach to the global concept of health promotion. For a better understanding of the possibilities that behavioral economics has to analyse and explain anomalous cases of irrational choices in relation with following the principles of a healthy lifestyle:

**Lack of self-control.** This is the case of an individual's inconsistent preferences over time and context (Ainslie, 1975). Rationality assumes the uniformity and invariability of the preferences (Becker, 1997). Inconsistent preferences break this assumption and establish a conflict among preferences. The ability to control this conflict of preferences is a sign of self-control, and indicates that the stabilisation of all areas of preference in our minds has been
mastered. Cases of obesity and overweight show a failure in self-control when it comes to following the principles of a healthy lifestyle in relation with eating habits.

Procrastination is an effect based on the constant postponement of (unpleasant) duties, or normal things. This way, people affected by overweight or obesity enjoy the short term pleasure of their favourite high calorie meal, while at the same time, they keep postponing the adoption of a regime to reduce their body weight, which is lead by a long term goal (Ariely, 2009). Or postpone healthy physical activities and replace them with other, more pleasant ones (meeting friends).

The effect of excessive self-confidence is another case of irrationality. A significant majority of the people, especially at a younger age, overrate the quality of their health. They underestimate healthy lifestyles and NCD risk factors and live in a health illusion based of the principal-agent effect (Stieglitz, 1987). Excessive self-confidence has a trigger effect in the formation of the responsibility over one's health that leads to the choice of the Consumer role, described as behavioural type B.

Framing effect. For many people, following the principles of a healthy lifestyle is very uncomfortable and complicated matter. That is the reason why they transfer the responsibility over their health to a doctor (principal-agent problem, Stieglitz, 1987). This way, they generate the illusion of health, a pleasantly misleading feeling of having solved the problem of the responsibility over their own health by having transferred that responsibility to a more competent person.

Status quo bias. This effect is characterised by people's strong preference to remain in a predetermined position without changing their established behaviour, as long as the motivations for change are not convincing enough, particularly in cases where the disadvantages of leaving the current position present a greater difficulty or threat than the advantages resulting from a change (Kahneman, etc., 1991). A heavy smoker will not be able to change their life's status quo as long as they do not have a sufficiently convincing reason why to do it.

Aversion to loss. It acts on the behaviour in such way, which for the individual a given increase in gains will have lower value than the same increase in losses (Kahneman, et al, 1982). The substitute of harmful assets (cigarettes, alcohol, drugs) will have to bring (much) greater benefits (satisfaction) than the original assets for the individual to consider the substitution as favourable and to realise it. This economic approach to behaviour allows to understand a completely new approach to people's risky behaviours in terms of prevention of NCD's. It shows that the addictive risky behaviour, for instance, smoking, is not a primarily
dangerous habit for the smoker, but a benefit from the asset. Understanding the cases of anomalies of rationality helps to implement new approaches and arguments in, for example, anti-smoking programs of health promotion. To replace the negative medical arguments and warnings with a more positive approach in the shape of the substitution of smoking with other, more valuable assets with higher preference (beauty, physical condition).

Conclusion
The economic approach to health promotion is based on the methods and approaches of the economic analyses of human behaviour. It combines the approaches of mainstream and behavioural economy that arise from the interpretation of behaviours of bounded rationality. By using an economic approach based on analyses of human behaviour, as well as the tools of behavioural economy, health promotion can offer a solution to the impending macroeconomic problems of sustainability of the social and health care of the population in the EU in the coming years. On the basis of the theory of health demand, we are able to define two different basic types of human behaviour in terms of healthy lifestyles. The active, effective and rational behaviour of the Investor type, consisting on the prevention of disease by strengthening their own health, or the passive, ineffective behaviour of a person with reduced rationality (Consumer), consisting on the use of all possible treatments for disease offered by modern medicine within the healthcare system. In relation with the factual incurableness of most NCD's, a healthy lifestyle, represented by the behavioural type Investor, plays a key role in one's health.

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