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ON ONE EXPERIMENTAL TEST OF THE SAMARITAN'S DILEMMA

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Abstract

The Samaritan's dilemma problem is analyzed in the article. Based on the Buchanan's model, the strategies formulated according to the classical decision theory criterions were considered. Here, the impact of all the decision strategies combinations was evaluated from the point of social desirability. Empirical analysis based on the experimental data is also provided.

Keywords: Samaritan's dilemma, bimatrix game, decision criterion, equilibrium

JEL Classification: C91, C92, D7, D81

Introduction

Social behavior of the people and their hidden psychological motives has become inherent parts of the microeconomic research. Behavioral scientists observed and theoretically explained more real-life examples contradicting the classical microeconomic theory. Theoretical analysis of the charity providing was, firstly, performed by Buchanan (1972). In the introduction of his paper, Buchanan formulated two different bimatrix games without assigning any benefactor (Samaritan) or beneficiary (Parasite) roles to the particular players. After analyzing different strategies, he assigned the Samaritan and Parasite roles to the column and row players, respectively. Then, based on the model, he introduced some real-life examples containing the social unpleasant combination of strategies – the aid providing by Samaritan and misusing it by Parasite. The situation gives the inefficient solution of the game, which the Samaritan would like to avoid. Balancing between providing and non-providing aid is called "The Samaritan's dilemma".

Buchanan gives many examples of this dilemma. Coming from the family level examples (misbehaving child and spanking mother), up to the mezzo level in social work, university administration life, terrorists behaviour, etc. On the other hand, there are many other macro level examples confirming the micro conclusions. They are based mostly on the international aid and its consequences. Researching the poverty problems, Chen and Ravallion (2008) show that one quarter of the whole world population lives below the

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1.25$ a day threshold (2005 data). This fact increases the role of the foundations and programs providing the social aid. On the other hand, some studies results [see Rajan and Subramanian (2005), Burnside and Dollar (2000)] showed that international aid of the developed countries providing assistance to the developing countries does not necessary cause the economy growth in the recipient country. Knack (2000) and Bauer (1976) concluded that higher aid leads to the worsening of the governance (bureaucracy, corruption, etc.) and does not influence the economic growth and the long-term well being in the domestic country. Sometimes, this fact is explained by the moral hazard phenomenon or the consequence of the Samaritan's dilemma even on the macro-level.

Considerable attention is paid to the application of the Samaritan's dilemma approach in social work research. There is an empirical experience, that with receiving the social aid, the beneficiaries loose the motives to solve their own situation (e.g. decreasing responsibility, no motivation to start working). Hazlit (1971) took his example from the ancient Rome, Bovard (1983) analyzed the inefficient impact of the food stamp programs, Želinský (2010) discussed the problem within the microfinance programs provided to Roma people in the eastern Slovakia.

In the next section, the Buchanan's analysis of the Passive Samaritan's dilemma is presented. In the third section, we provide the alternative strategies formulation as well as the decision situation. The experiment based on the Buchan's passive Samaritan dilemma is described in the fourth section. Then, the experimental data analysis and results discussion is given in the last section.

1. Buchanan model as a coordination game

Buchanan formulated his Samaritan's dilemma using the game theory matrix formulation. He introduced two forms of the Samaritan's dilemma: the passive and the active forms. Both modifications differed by number of the Nash equilibrium strategies. The Active Samaritan modification contained one Nash equilibrium, while the Passive Samaritan modification contained two Nash equilibria. The active Samaritan strictly prefers providing the aid to non-providing independently on any action of the Parasite. On the other hand, in the case of the passive Samaritan, the aid providing is motivated by mutual strategies coordination of both players. In our further analysis, we follow the passive Samaritan's model.

Let $G = \{S, P\}$ be a set of Samaritan and Parasite players. The strategy space of the Samaritan is $\Sigma = \{c, n\}$ that describes the charity and non-charity strategies of the Samaritan. Then, $\Pi = \{w, r\}$ is the strategy space of the Parasite with work and refuse-work decision possibilities. The payoffs of both the Samaritan and the Parasite depend on their mutual decisions, which can be formulated by bimatrix

$$S/P = [s_{i,j}/p_{i,j}]_{i\in\Sigma, j\in\Pi} = \begin{bmatrix} s_{n,w}/p_{n,w} & s_{n,r}/p_{n,r} \\ s_{c,w}/p_{c,w} & s_{c,r}/p_{c,r} \end{bmatrix} = \begin{bmatrix} 4/2 & 1/1 \\ 2/3 & 3/4 \end{bmatrix}. \quad (1)$$

The players are fully rational and dispose with full information. The matrix element payoffs are the ordinal utility measures of each player. As the charity providing is a long-term process, we assume players playing iterative bimatrix game defined by the above given parameters.

Here, the strategies (n, w) and (c, r) represent two dominant Nash equilibria strategies in one-time game. Buchanan made a behavioral analysis of the exploitation of the Samaritan by the Parasite. He assumed that players start with (n, w) strategies. Then, the Parasite becomes cognizant of the Samaritan's payoffs (getting familiar with the Samaritan's intention to provide aid) and tries to misuse the situation. There are many real life examples of the people misusing the charity system by having excessive legal knowledge of the social program framework and their financial claims within this framework. Forcing Samaritan to contribute to charity, the Parasite changes his strategy to refuse-work. Thus the strategies pair (n, r) gives the worse payoff $(1, 1)$ for both players. The only Samaritan's response to this utility lose is to shift to the second row – providing charity. This is the way, by which the Parasite exploits the Samaritan's willingness to help.

Accepting the exploitation process given by Buchanan, we induce the backward process - how to cancel the exploitation and to force the Parasite to work. Keeping the equilibrium (c, r) stage, the Parasite is not motivated to change his strategy. The only possibility for the Samaritan is to shift to the non-charity strategy, which decreases the payoffs to $(1, 1)$. If the Samaritan strictly consists on this strategy, the only way for the Parasite is to start working; else, he suffers the low payoff. The process is given in figure no. 1.

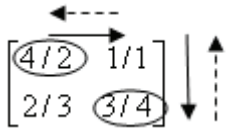

Figure no. 1: Exploitation of the Samaritan by the Parasite (Solid Arrow) and the Parasite forced to work by the Samaritan (Dashed Arrow)

However, we do not know real life examples of banning charity, although the history gives us some examples of persecuting beggars (early 20th century in Europe).

The Buchanan's explanation of the exploitation fully neglects the presence of the (c, w) strategies profile. Do the available theories really neglect them or is there any theoretical explanation for playing it? The answer is YES, the Coordination Game Theory considers this strategies pair to be focal, as playing it, both players minimize their potential loses.

2. Samaritan's dilemma as a decision strategy selection problem

Buchanan stated in his article that uncovering of all available information to both players is to be considered as the strategic problem. The strategies $i^* \in \Sigma$, $j^* \in \Pi$ are the Nash equilibrium strategies if for $\forall i \in \Sigma$ and $\forall j \in \Pi$ the following holds: $s_{i,j^*} \leq s_{i^*,j^*}$; $p_{i^*,j} \leq p_{i^*,j^*}$. If the game has two or more equilibria denoted (i', j') the equilibrium strategies pair (i^*, j^*) for which $s_{i^*,j^*} \geq s_{i',j'}$; $p_{i^*,j^*} \geq p_{i',j'}$ is satisfied, is called the dominant equilibrium strategies pair.

The first option for the players is to select the decision strategy using the Maximin criterion, maximizing the minimum guaranteed payoff. In this case, the Samaritan (row matrix player) will select the strategy

$$i^0 = \arg\left[\max_{i\in\Sigma}\left(\min_{j\in\Pi}\left(s_{i,j}\right)\right)\right] \quad (2)$$

and the Parasite (column matrix player) will select the strategy

$$j^0 = \arg\left[\max_{j\in\Pi}\left(\min_{i\in\Sigma}\left(p_{i,j}\right)\right)\right] \tag{3}$$

The second option for the players is to play according to the maximax criterion, where the players select the strategy which has the highest possible payoff, not taking into account the possibility of low or even negative payoff in the given strategy. If using this criterion, the Samaritan (row matrix player) will select the strategy

$$i^M = \arg\left[\max_{i\in\Sigma}\left(\max_{j\in\Pi}\left(s_{i,j}\right)\right)\right] \tag{4}$$

and the Parasite (column matrix player) will select the strategy

$$j^M = \arg\left[\max_{j\in\Pi}\left(\max_{i\in\Sigma}\left(p_{i,j}\right)\right)\right] \tag{5}$$

The third option for both players is to play according to the Laplace insufficient reason criterion, where players calculate their expected payoff of their strategy taking into account the equal likelihood of each outcome within the chosen strategy. According to this criterion, the Samaritan (row matrix player) will select the strategy

$$i^L = \arg\left[\max_{i\in\Sigma}\left(\frac{1}{2}\sum_{j\in\Pi} s_{i,j}\right)\right] \tag{6}$$

and the Parasite (column matrix player) will select the strategy

$$j^L = \arg\left[\max_{j\in\Pi}\left(\frac{1}{2}\sum_{i\in\Sigma} p_{i,j}\right)\right] \tag{7}$$

The fourth option is the "Tit for tat" criterion, where the player responds to the strategy of his opponent, rewarding kind strategies and punishing unkind strategies. The Samaritan (row matrix player) deems the strategy

$$j_k^T = \arg\left[\max_{j\in\Pi}\left(\frac{1}{2}\sum_{i\in\Sigma} s_{i,j}\right)\right] \tag{8}$$

of the Parasite kind and the strategy

$$j_u^T = \arg\left[\min_{j\in\Pi}\left(\frac{1}{2}\sum_{i\in\Sigma} s_{i,j}\right)\right] \tag{9}$$

unkind. The Parasite will consider the strategy of the Samaritan

$$i_k^T = \arg\left[\max_{i\in\Sigma}\left(\frac{1}{2}\sum_{j\in\Pi} p_{i,j}\right)\right] \tag{10}$$

as kind and the following strategy as unkind

$$i_u^T = \arg\left[\min_{i\in\Sigma}\left(\frac{1}{2}\sum_{j\in\Pi} p_{i,j}\right)\right] \tag{11}$$

If a player chooses to play according to this criterion, he will start the game with a strategy that will be considered by his opponent as kind, to signal good intentions. His opponent will take each consecutive strategy as a response to the previous move. If the opponent selected a strategy that is considered as kind, it will be rewarded by selecting a kind strategy, and unkind strategy selected by the opponent in the previous round will be punished by selecting unkind strategy as his following move.

Selecting a specific criterion to play by represents a „decision strategy" selection for the players. Selecting a specific „strategy" represents the selection either to contribute to charity, not to contribute to charity for the Samaritan, and to work, or not to work for the Parasite as the next move.

3. Applying of the decision strategies to the Samaritan's dilemma

If the players choose to play according to the Maximin criterion they will select the strategies(c, w), meaning the Samaritan will choose to contribute to charity, and the Parasite will choose the option to work. If the players choose to play according to the Maximax criterion, they will select the strategies(n, r), the Samaritan deciding not to contribute to charity, and the parasite deciding not to work. If the players choose to play according to the Laplace insufficient reason criterion, then they will be indifferent to individual strategies, since they will not be able to decide using this criterion. Therefore, we can assume their behavior random, with the probability of selecting each their available strategy equal to for the Samaritan, 0.5 and 0.5 for the Parasite. Finally, if the players choose to play according to the "Tit for tat" criterion, then the kind strategies for each player will be(c, w), and the unkind strategies will be(n, r), so if in the previous round the Parasite worked, the Samaritan will contribute in the next round, while, if the Parasite did not work, the Samaritan will not contribute. Likewise, the parasite will choose to work if the Samaritan has contributed to charity in the previous round, and not to work if he has not.

Of course, both players do not have to be playing according to the same criterion, but each of them can select their own. Therefore, we will get the following possible combinations of criterions. The payoffs shown table no. 1 represent an average payoff per round for each player in the case of an infinite game.

Table no. 1: Average payoff for players in an infinite game for criterion combinations

S/P	I. Maximin	II. Maximax	III. Laplace	IV. Tit for tat
I. Maximin	2/3	*3/4	2.5/3.5	2/3
II. Maximax	*4/2	1/1	2.5/1.5	1/1
III. Laplace	3/2.5	2/2.5	*2.5/2.5	*2.5/2.5
VI. Tit for tat	2/3	1/1	2.5/2.5	2/3

*Note: * denotes the Nash equilibrium*

As stated before, the Nash equilibria of the game are (n, w) and(c, r). However, the equilibira do not represent a particular criterion that can be selected by the players because of the lack of coordination between players. Thus, we can only identify criterion combinations leading to the Nash equilibria. Then the equilibria (n, w) and (c, r) are the

results of players selecting the criterion combinations $(Maximax, Maximin)$ and $(Maximin, Maximax)$ respectively.

Let us assume that the individual players will not select individual rows or columns as their strategies, but they will rather select the criterion they will play by as their decision strategy. In table no. 1, we can identify Nash equilibrium combinations of criterions selected by players. There are four Nash equilibria, the first being$(Maximin, Maximax)$, representing the situation when the Samaritan does contribute to charity and the Parasite does not work. The Samaritan will not stop contributing unless he can force the Parasite do start working, and the Parasite will not start working since he is getting contributions. This is what we call the socially unacceptable situation, the society would like to avoid. The second equilibrium is$(Maximax, Maximin)$, representing the situation when the Samaritan does not contribute to charity, and the Parasite does work. The Parasite will not stop working, since he would have no funds if he cannot be sure that the Samaritan will start to contribute, and the Samaritan is not motivated to contribute since the Parasite is already working. We could call this second equilibrium as socially optimal. The third equilibrium$(Laplace, Laplace)$, represents the situation when both players behave randomly, therefore it would not be beneficial for either of them to select a specific decision strategy without their opponent doing the same. The fourth equilibrium $(Laplace, Tit\ for\ tat)$ is similar to the third one in the way that a player responding to the previous move of a player behaving randomly will be in fact behaving randomly himself.

We said that we would consider the second Nash equilibrium as the social optimum. Let us consider this optimum unachievable in the real world, because if it were achievable, the problem of the Samaritan's dilemma would not exist. Figure no. 2 then shows all the possible combinations of strategies by the players, and shows the set of achievable combinations.

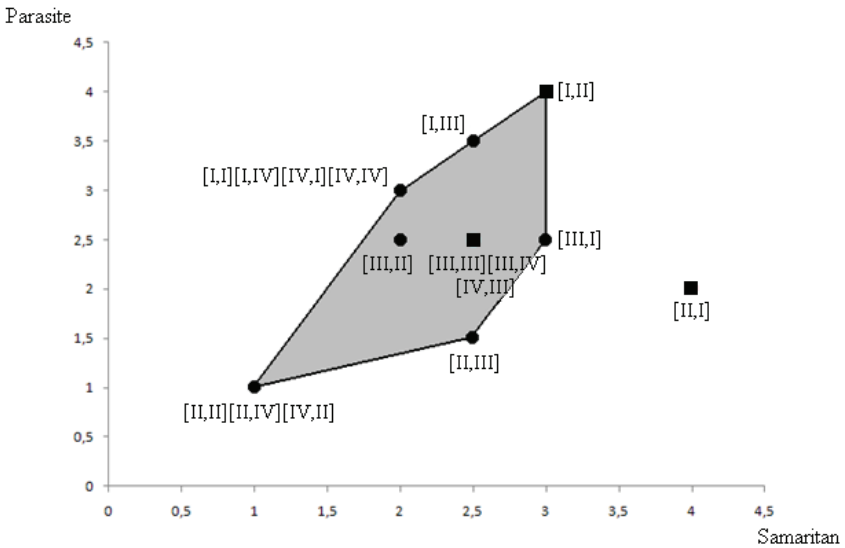

Figure no. 2: Graphic representation of average payoff in an infinite game for criterion combinations

Note: I. - Maximin, II. - Maximax, III. - Laplace, IV. - Tit for tat, ■ - Nash equilibria

As shown in figure no. 2, if the social optimum is not achievable, then the decision strategy profile closest to this optimum would be$(Laplace, Maximin)$, with the corresponding payoffs for the Samaritan and the Parasite of 3 and 2.5, respectively. This combination represents the situation when the Parasite is working, because he cannot be sure if the randomly behaving Samaritan will contribute or not, and he cannot afford not to work as a result. Practical implication of this is that a randomly behaving Samaritan does not create a fixed legal framework for his social program that guaranties systematic claims for the people misusing the system.

The gray area in figure no. 2 represents the set of all convex decision strategy profiles. These decision strategy profiles are the result of mixing all the atainable pure decision strategy profiles (excluding the unachievable, yet demanded social optimum).

4. Experimental setup

Experiment was conducted as a classroom experiment at the Faculty of Economics of the Technical University of Košice within the summer school in 2010. The experiment was run using ComLabGames software, which is designed to conduct experiments with players using the Internet. Session lasted approximately 60 minutes. Thirty-four secondary school students took part in the experiment. Among all players, twenty players were female and fourteen players were male. At the beginning of the session, the experiment participants were informed about the experiment details. Participants have been informed about the principles of matrix games in general, about the payoff system and technical details of the software used. No details of the Buchanan´s model were explained to preserve the emotional independence of players. After, the experiment commenced. The software randomly and anonymously matched players into couples and then they started playing the matrix games. During each round, the students wrote down their motivation for selecting a strategy and which criterion they intended to play by into paper forms they were provided. Their motivations and intentions were subjective perceptions of the four objective criterions defined in (2)-(11). This information was later used to identify the particular strategy played by individual players. After completing 10 rounds, the students were paid their final average payoff in Euro. Then, the experiment finished.

5. Results and discussion

Statistical data consisted of the history data provided by the ComLabGames software and the paper forms containing the motivations for the chosen strategies for each round by each participant. We obtained 340 valid records from the software and 336 valid records from the paper forms. Distribution of the strategies played is given in the table no. 2 and figure no. 3 shows the graphic representation of average payoffs for each pair of players for the entire game.

Table no. 2: Distribution of the strategies played

Samaritan \ Parasite	Work	Refuse work
Non-charity	73 (21 %)	74 (22 %)
Charity	70 (21 %)	123 (36 %)

Here, the Nash equilibrium (c, r) recorded the highest frequency of occurrences, which means the real exploitation of the Samaritan by the Parasite. On the other hand, the socially demanded Nash equilibrium (n, w) had approximately the same number of occurrences as the "enforcing" situation (n, r) and the risk avoiding strategy profile(c, w), respectively. It means, there was not any significant attitude to achieve the society demanded Nash equilibrium(n, w). If comparing the both equilibriums using the sign test, the statistically significant difference $(p = 0.046)$ was found.

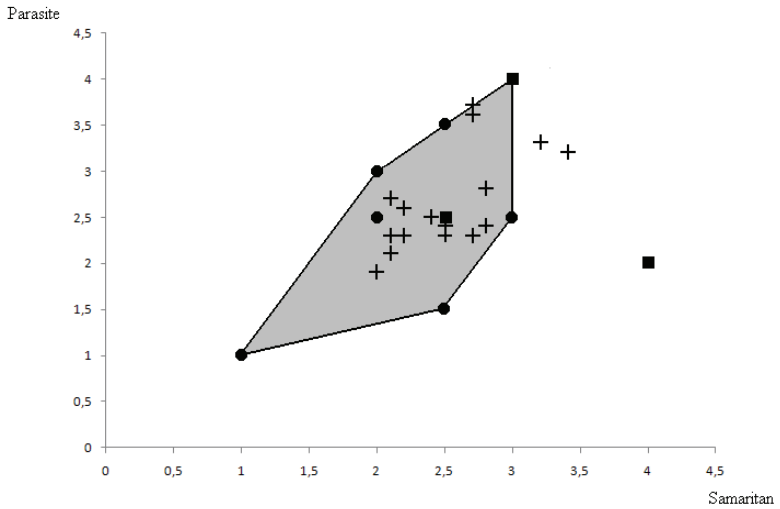

Figure no. 3: Graphic representation of avarage payoff for player pairs

Note: -■ Nash equilibria, + - Avarage payoff of a pair of players

In the following analysis, we excluded four invalidly filled out forms regarding the decision strategies by the participants. The frequency distribution of the decision strategy pairs is given in table no. 3. Here the $(Maximax, Maximin)$ and $(Maximin, Maximax)$ recorded only marginal frequence (3 and 4, respectively). The equilibriums $(Laplace, Laplace)$ and $(Laplace, Tit\ for\ tat)$ achieved rather high frequencies (31 and 21) with the payoffs (2.5, 2.5). The nearest approximation of the society demanding decision strategy profile $(Maximin, Laplace)$ achieved six occurences.

Table no. 3: Frequency distribution of decision strategy pairs

S/P	I. Maximin	II. Maximax	III. Laplace	IV. Tit for tat
I. Maximin	6	*4	6	2
II. Maximax	*3	8	10	7
III. Laplace	11	32	*31	*21
IV. Tit for tat	6	8	6	5

*Note: * denotes the Nash equilibrium*

The next research problem dealt with the question whether the decision strategies selected are somehow dependent on the strategy pair selected and the corresponding payoff in the

previous round. Here, we distinguish both the Samaritan and the Parasite roles. The contingency tables for both players are given in table no. 4. This table shows the frequency of selecting each decision strategy for both the Samaritan and the Parasite in relation to the result from the previous round. Based on the Chi–square tests we state in case of the Parasite that there is a statistically significant relation between the results in the previous round and the decision strategy used (p=0.017). In case of the Samaritan, this relation proved to be statistically non-signifficant (p=0.93). This means that the Parasite bases his decision strategy selecting on the result from the previous round, the Samaritan however does not. In this case, the Parasite cannot force the Samaritan to change his strategy, because the Samaritan will not react in any way. On the other hand, the Prasite will react to changes in strategies being selected by the Samaritan, and is therefore susceptible to manipulation. We consider this to be the experimental prove of the Samaritan's passivity, which has been described by Buchanan.

Table no. 4: Selected decision strategy based on strategy pair selected in previous round

Samaritan/Parasite	Maximin	Maximax	Laplace	Tit for tat
(n, w) 4/2	19/11	4/11	7/10	5/2
(n, r) 1/1	19/11	6/9	4/7	5/7
(c, w) 2/3	14/10	4/8	7/11	7/4
(c, r) 3/4	24/11	9/6	12/22	5/10

Conclusion

Growing differences between developed and a developing countries as well as the social stratification of the population within one economy increases the importance of social aid programs. Buchanan showed the support program risks based on the abuse of the social assistance. That leads to contrary results to the social goals the program was primarily aimed at. The dilemma of the benefactor to provide or not to provide the assistance is called the Samaritan's dilemma that was analyzed in the paper. The experimental research results were also provided, that indirectly support the passive Samaritan's dilemma.

Based on the experiment results, we empirically proved that the Samaritan does not base his strategy selection on the results from the previous round but the Parasite does, which confirms the passive Samaritan's dilemma formulated by Buchanan. We also formulated an approach based on the assumption that players do not select their individual strategies (columns and rows), but rather select their decision strategies that are formulated within the decision theory. In this case and under the assumption that the very socially demanded equilibrium is unachievable, we identified the next best option for the Samaritan is to behave according to the Laplace decision strategy. In practice, this behaviour would eliminate the presence of a systematic social program framework that is easily exploited by people misusing the social system by having excessive knowledge of their legal claims.

References

1. Bauer, P.T., 1976. *Dissent on Development*. Cambridge, Massachusetts: Harvard University Press.
2. Bovard, J., 1983. Feeding Everybody: How Federal Food programs Grew and Grew. *Policy Review*, 26 (Fall Issue), pp. 42-51.
3. Buchanan, J.M., 1972. The Samaritan's Dilemma. In: E. Phelps, ed. 1975. *Altruism, Morality and Economic Theory.* New York: Russell Sage, pp. 71-85.
4. Burnside, C. and Dollar, D., 2000. Aid, Policies, and Growth. *The American Economic Review*, 90(4), p. 847-868.
5. Chen, S. and Ravallion, M., 2008. The Developing World Is Poorer Than We Though, But No Less Successful in the Fight against Poverty. *Policy Research Working Paper 4703*, The World Bank Development Research Group, p. 52.
6. Hazlitt, H., 1971. Poor Relief in Ancient Rome. *The Freeman*, 21(4), p. 219.
7. Knack, S., 2000. Aid Dependence and the Quality of Governance: A Cross-Country Empirical Analysis. *38. World Bank Policy Research Working Paper 2396*. Washington, D.C., p. 44.
8. Rajan, R.G. and Subramanian, A., 2005. Aid and Growth: What Does the Cross-Country Evidence Really Show? *IMF Working Paper WP/05/17*, p. 48.
9. Želinský, T., 2010. Comparison of Alternative Approaches to Estimation of Individual Welfare of Poor Households. *Ekonomický časopis*, 58(3), pp. 251-270.