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APPLICATION OF PROSPECT THEORY TO MICROINSURANCE BASED ON CONTINGENT VALUATION APPROACH FOR POOR POPULATION IN UKRAINE

This paper takes a behavioral economics approach and empirically tests if Prospect Theory can explain behavior of low-income people in Ukraine. The study uses the contingent valuation method due to direct inquiry of low-income people, in a survey, how much they would be willing to pay for insurance and to get back in case of an insurance event arising. This paper provides suggestive evidence that according to Prospect Theory poor individuals make decisions based on expectations of loss or gain from their current relative position and are more sensitive to losses compared to gains.

The work also answers the question concerning the microinsurance: can microinsurance be a business proposition and provide value for low-income people at the same time? The results lead to the power-law distribution of potential clients according to the price of a microinsurance service.

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The obtained correlations help to formulate strategies to tap the low-income market in the country.

Keywords: *microinsurance; prospect theory; contingent valuation; low-income people; subjective utility.*

1. INTRODUCTION

1.1. Problem Definition

Investing in something now that may never happen in the future can not be understood in the frame of the Utility Theory (Pindyck & Rubinfeld, 2009) and is rather related to human behaviour and the Prospect Theory (Kahneman & Tversky 1979). Prospect Theory is central in behavioral finance. It deals with the value function similar to a utility function, but having different shapes in gains and losses and shows that in terms of gains, people are risk sensitive, whereas in terms of loss, they are less risk sensitive.

One new and unsolved problem in behavioral economics is to discuss the microinsurance of low-income people because microinsurance itself can be regarded as a new risk for such individuals. Microinsurance is considered as insurance for low-income people, namely, defence of valuable interests of low-income persons in exchange for low insurance premiums (Dror & Jacquier, 1999; Churchill, 2007; Shirinyan & Shirinyan, 2019). It is worth noting that microinsurance is based on the analogic principles as conventional insurance and protects poor clients against main risks, such as accident, illness, death. As far as we know many important questions concerning microinsurance are open for discussing. Example of such issues are measure expectations of loss or gain of low-income people and their decision (willing to pay) concerning the insurance.

1.2. Analysis of publications and modern approaches

Our investigation is related to psychological effects in behavioral economics and properties of a value function in the Prospect Theory. According to the Prospect Theory one should separate prospects into positive and negative parts and consider of decision weights (or probability weighting functions) rather than probabilities (Thaler, 2008). There are several models for representing probabil-

ity weighting functions in behavioral economics: in the framework of Prospect Theory (Kahneman & Tversky, 1979) or Cumulative Prospect Theory (Tversky & Kahneman, 1992), from the viewpoint of Subjectively Weighted Utility Theory (Karmarkar, 1978) etc. The purpose of the present study is to find probability weights (also called as decision weights) of outcomes for low-income decision maker and compare with those in Cumulative Prospect Theory (further as the Prospect Theory).

As of today, due to usage of the Prospect Theory one can identify several new effects such as:

- “framing effect” (Beggan, 1994; Kahneman & Tversky, 1979 - gain and loss frames; Kahneman & Lovallo, 1993 - consumers evaluate a lottery in isolation, rather than mixing it with their pre-existing risks);
- “probability weighting” (Johnson, Hershey, Meszaros & Kunreuther, 1993 - reference point dependence and framing effects affect willingness to pay);
- “endowment effect” (Samuelson & Zeckhauser, 1988 - selling prices are higher than buying prices, contrary to economic theory);
- “status quo bias” (Samuelson & Zeckhauser, 1988 - disadvantages of leaving the current stage seem larger than advantages).

Framing effects take a central role in valuing insurance products against longevity risk (Brown, 2014; Barberis, Huang & Thaler, 2006). Laboratory experiments and other metrics show that:

- human behavior and willing to pay (WTP) may be different for low-probability and high-probability insurance events (Ganderton, Brookshire, McKee, Stewart & Thurston, 2000);
- average WTP and insurance demand decreases as the probability the insurance fails to pay for a shock increases (McIntosh, Sarris & Papadopoulos, 2013);
- individuals tend to underinsure against catastrophic events with a low-probability and high loss, relative to high-probability and low loss - significantly less insurance is purchased as the loss probability increases (Laury, McInnes & Swarthout, 2009);
- unconcerned individuals are not willing to pay even if premiums are subsidized, whereas highly risk averse individuals opt for premiums that are more than 10 times the expected loss (Schade, Howard & Koellinger, 2012).

Concerning the microinsurance our work answers the key question: can microinsurance be a business proposition and provide value for low-income people

at the same time? This is a very important question for low-income Ukraine and similar post-Soviet countries. According to the World Bank, 75% of Ukrainians were living below the poverty line, and about 7% of the country's population was in extreme poverty (The World Bank Group, 2018).

The impact of microinsurance is currently under the view of world organizations (United Nations; Roth, McCord & Liber, 2007; Biener & Eling, 2012). At the same time publications related to former Soviet Union countries include only a few articles in local journals (Matul, Durmanova & Tounitsky, 2006; Grebenshchikov, 2007; Shirinyan & Shirinyan, 2012) and unknown for wide academic audience.

The relevant empirical studies note that individuals:

- often view insurance as a “poor investment” (Kunreuther, Pauly & Mc-Morrow, 2013);
- may be less likely to uptake micro life insurance (Giesbert, Steiner & Bendig, 2011);
- may depress insurance demand because of conservative behavior towards potential losses (Hwang, 2016; Gottlieb & Mitchell, 2015).

To give the answer on the key question if this work one needs to know the WTP of low-income people for microinsurance. One of the most promising methods is the contingent valuation method due to direct inquiry of people, in a survey (Ligus, 2018). Hereby various survey methods are possible such as in-person interviews, telephone surveys, mail surveys and others (Carson, Flores, Martin & Wright, 1996). Typically the survey asks how much money people would be willing to pay for services (Venkatachalam, 2004). It is based on suggestion of hypothetical scenario (Diamond, Hausman, 1994). WTP for a service is defined as the amount of money that must be given by a person to keep his utility at the same level. An obstacle to the use of contingent valuation approach in low-income countries is the low level of literacy of respondents.

Regarding Ukraine it should be noticed that Ukraine belongs to a Eastern European country with a high level of the shadow economy. It is quite difficult to establish the real income of low-income citizens due to official statistics identifying categories of people for research in order to define patterns. That is why in our study we use face-to-face interviews conducted by authors. Recently the contingent valuation method helped to determine how suitable is the microinsurance for low-income people (Shirinyan & Shirinyan, 2019) whereas authors said nothing about: i) potential microinsurance provider and ii) comparison with the Prospect Theory approach. Here we eliminate such drawbacks and want to bridge the gap between researchers in insurance and colleagues in the insurance industry and other professionals.

1.3. Objectives for article

We aim to use the result of the contingent valuation method and test if Prospect Theory can explain behavior or measure expectations of loss or gain of low-income people in Ukraine.

We also estimate the possible market demand and potential income of commercial microinsurance provider if such microinsurance will likely to develop on a voluntary basis in Ukraine with poor clients having to pay a small premium.

1.4. Time distance, minimal Ukrainian salary and the Ukrainian insurance market

It is worth noting that in the following we use the minimum wage as a key parameter for comparison and use so-called “the minimal Ukrainian salary” (further MUS) as the reference value for wages. MUS is presented in many regulation laws of Ukraine and this amount is defined as monthly value per person (unlike standard practice in many other countries, where salary is calculated per calendar year). Thus, MUS is best suited value for estimating a poor person’s budget.

For international comparison purpose we also turn the Ukrainian unit currency “hryvnia” with code “uah” into US dollar, \$, due to official exchange rates (Wikipedia: Ukrainian Hryvnia; The National Bank of Ukraine): 8 uah= 1 \$ for 2011-2013. From this, MUS in 2011-2013 was equal to nearly 1000 uah per month (Law on the state budget of Ukraine, 2013) and 1000 uah was approximately equivalent to 125 \$ or 90 euro per one month at that time:

$$1 \text{ MUS} = 125 \$ \text{ per one month} = 90 \text{ euro per one month.}$$

It yields 4,2 \$ or 3 euro per day for 2011-2013. For example, average salary of experienced school teacher in 2011-2013 was in between 2 and 3 MUSs or nearly 300 \$ (220 euro) per month. So if we divide that sum by 30 days then we have 10 \$ or 7 euro per day.

Let us briefly discuss the relevance of data and trends over time. The survey has been conducting for 2011-2013, and the results are presented for publication in 2021. Obviously, living conditions of citizens may be expected to change. But figures show that the Ukrainian standard of living have not risen. For example, MUS in 2020 is equal to 3720 uah per month (Law on the state budget of Ukraine,

2020). Again, it yields nearly 145 \$ or 135 euro per one month, that is equivalent to 4.8 \$ or 4.5 euro per day. These values correspond to the value done by United Nations for the Sustainable Development Goals (Wikipedia: Sustainable Development Goals; United Nations). One can see that data from 2020 are comparable with ones for earlier mentioned years. Thus, despite of the time gap the information obtained in the survey (discussed further) still represents the actual situation..

For a complete picture of time distance, let us briefly examine the Ukrainian insurance market in last decade time distance (table 1). One can see decrease of total insurance premiums after 2008 with following oscillations and tiny-seen increase in 2018-2020, decrease and very small values of the insurance penetration (calculated as the ratio of gross insurance premiums to GDP in a given year). For economically developed countries the insurance penetration varies approximately from 5% to 23%. For comparison, the insurance penetration for Germany is 4 times larger than for Ukraine; closest neighbour, Poland has got the insurance penetration twice larger than in Ukraine (Shirinyan, 2020). Furthermore, decrease in the number of insurers occurs after 2008. There are 170 insurance undertakings in 2021, 17 of which are the life insurance companies and 153 - the non-life insurance companies. In 2010, the number of insurance companies was 456. Hence, sharp decrease to 286 insurance companies took place during the two decades.

Table 1.

INDICATORS OF THE UKRAINIAN INSURANCE MARKET AND GDP

Year	Number of "life" insurers	Number of "non-life" insurers	Gross Premiums, GP, billion \$	Nominal GDP, billion \$	Insurance Penetration (GP/GDP), %
2006	55	356	2.739	107.762	2.54
2008	73	396	3.201	180.001	1.78
2010	67	389	2.899	136.007	2.13
2012	60	355	2.689	175.785	1.53
2014	57	325	1.705	133.502	1.28
2016	39	271	1.331	93.357	1.43
2018	31	254	1.805	125.830	1.43
2020	19	196	1.589	142.622	1.13
2021	17	153	1.811	200.112	0.96

Source: Systematized by authors due to annual reports of (the National Commission for State Regulation of Financial Services Markets) and official exchange rates (The National Bank of Ukraine).

The data, time and country comparison give the picture of the permanent economic weakness. Most Ukrainians are unhappy because of the poor governance, low living standards, stagnation and the absence of economic growth. For example, on the fifth year of Ukraine's independence, the hryvnia to dollar ratio was 1.82; in 2011-2014 it changed to 8 and now, in 2021, it makes 26.4 (The National Bank of Ukraine, 2021). The population of Ukraine decreases every year: from 52 million people in 1991 to 44 million people in 2021. According to the first government strategy (Verkhovna Rada of Ukraine, 2001) for overcoming poverty, nearly 27% of Ukrainians were poor and about 15% lived below the poverty line. The second strategy (Verkhovna Rada of Ukraine, 2011) claimed that 27% Ukrainians lived below the poverty level in 2010. According to the third strategy (Verkhovna Rada of Ukraine, 2016, 2020), nearly 24% of Ukrainians were relatively poor in 2015. According to the State Statistics Service of Ukraine nearly 24% of population had about 1 MUS income in 2012 (State Statistics Service of Ukraine, 2013) and 53% of citizens had the month salary between 1 MUS and 2 MUSs (State Statistics Service of Ukraine, 2014). According to the United Nations Children's Fund, UNICEF, in 2020, the poverty rate in Ukraine increased to 43.6% (if not the pandemic, this figure could be 27.2%) and as a result of such effect, more than 6 million people found themselves below the poverty level (Analytical portal "Slovo i dilo", 2021). Hence, 30 years passed by but the level of poverty does not improve and the protection of low-income people is still ineffective. In other words, there exist negative tendencies and the domain of insurance in Ukraine has not changed, which causes criticism in the relation to regulatory authorities.

2. RESEARCH METHODOLOGY

2.1. Contingent valuation approach and sequential steps in realizing the survey

Due to direct asking people the contingent valuation method is one of the most widely used method for estimating non-use values: improvements in air quality (Ligus, 2018), public health programme in Ethiopia (Swallow and Woudyalew, 1994), preservation of national parks in Kenya (Navrud and Mungatana, 1994) etc. Most studies in developing countries have relied on face-to-face interviews because of low levels of literacy of respondents concerning the concept of probability. The main question in a survey is how much money people would be willing to pay for services (Venkatachalam, 2004; Bateman and Willis, 2001). The goal of such approach is to measure equivalent variation for the good in question and

to find willingness to pay for a service, which is defined as the amount of money that must be given to a person to keep his utility at the same level (Pindyck and Rubinfeld, 2009; Kunreuther, Pauly, McMorro, 2013). Hereby, different survey methods are possible: in-person interviews, telephone surveys, mail surveys, at shopping malls (Carson *et al.*, 1996). In our case the respondents are interviewed due to open-ended questions like: "What is the most you would be willing to pay for?". We also offered a number of different payment values on a form, and asked the interviewee to choose the amount that best represents his willingness to pay.

Contingent valuation approach is based on suggestion of hypothetical scenario and sequential steps. In our case the introduction of microinsurance for low-income people is considered as hypothetical scenario. Since microinsurance in Ukraine does not exist, other methods will be less effective (Dionne, 2000).

As the first step we should determine the relevant population as the target audience. We divided the whole population of Ukraine by three categories:

- i) poor with 1 MUS (or 90 euro per one month and per person) income at the most;
- ii) relatively poor, inwealthy - with more than 1 MUS and less than 2 MUSs (180 euro per one month and per person) income;
- iii) not poor (wealthy, rich and oligarchs) with more than 2 MUS income.

To our opinion, the poor population is most liable to microinsurance service with government support, whereas relatively poor are liable for voluntary microinsurance in the absence of government schemes.

Next we should develop inquiry form and determine services. For that purpose the proposed inquiry form and the survey consisted of 28 simple questions. Hereby, the set of questions (based on a quantifiable and a qualitative parameters) is designed to measure the importance of the insurance for poor people. Death, health, small-scale business, credit, goods, damage, property, harvest, unemployment, personal accidents, disability are considered as possible insurance services. Most suitable services are defined by question: "What do you like to be insured first of all?".

As the second step we used in-person interview among Ukrainian citizens about insurance and realized random sampling. Interviewers were authors and the replies were mainly verbal. We also offered each respondent to write symbol '+' in most suitable place of the form or say the answer or give own variant. The answers helped us to estimate WTP for microinsurance services.

We also defined the main risks due to maximally simply formulated questions for poor people. For answer options we offered 11 type of risks in the inquiry form.

Each interviewee had been invited to define his own risks to be insured. As the result respondents mentioned the following risks: i) health (40% of respondents), ii) death (21% of respondents), iii) property (16% of respondents), iv) accidents (12% of respondents), v) loan (6% of respondents), vi) harvest (4% of respondents). As one can see most respondents prefer microinsurance of health.

The last step in using the contingent valuation is to analyse the data and consider the corresponding poll results in details.

2.2. The poor population poll

The polling was held during the years 2011–2013 in the town Cherkasy (central Ukraine) and covered 3000 people in the age of 18 to 65 of different social status and different income: employees, toilers, pensioners, enterprisers, teachers, physicians, hirelings. The test site was mainly the different streets of the town Cherkasy. Such survey confirmed that nearly 70% of interviewees have no specific knowledge about insurance, 65% do not want to be insured at all, 68% do not trust to Ukrainian insurers, 52% would like to be insured in governmental insurance company, 36% are ready to choose the foreign insurer instead of Ukrainian company. The detailed discussion of whole survey will be done elsewhere. Some of the mentioned results explain the general situation about insurance in Ukraine and people preferences: the level of the insurance culture is very low, people ready to choose the foreign insurer and want to be insured by governmental undertaking (since 1993 there is no governmental insurer).

We examined the poor population poll and analyzed the results concerning insurance payment. The following questions were the key research ones contributing to the topic: i) «What sum of money wouldn't you grudge to pay for insurance annually?» and ii) «How much money would you like to get back according to your payment in case of insurance event arising?». The answers helped us to make empirical assessment of market demand on microinsurance services, discussed further.

As it is known, the sample size plays an important role in determining the statistical power of a test. In each experiment, there is a difference between groups that the researchers are testing. At the same time, hypothesis tests are not absolutely accurate because of errors related to drawing an incorrect conclusion (McShane, Greenland & Amrhein, 2019). Furthermore, random sampling comes with a higher risk of sampling error which can potentially lead to incorrect results. That is why during the survey we aimed to have statistically significant values. At

least we tried to conduct a survey for a large circle of people so that the number of poor and relatively poor in our survey were more than 500 people. However we understand that our study is not enough to get the whole picture of behaviour of poor population.

After the polling we used stratification (proportional random sampling or quota random sampling) based on members' shared key characteristics such as income and savings. (A representative sample seeks to choose components that match with key characteristics in the entire population being examined.) We selected 520 citizens from 3000 who don't have a possibility to save money, and also of those, who save not more than the third part of 1 MUS (up to 300 uah per month and per person). In our case 17.3% of respondents are poor and relatively poor people (520 out of 3000) without savings and with monthly income within 2 MUSs, 3.7% of respondents (110 out of 3000) are poor people without savings and with monthly income within 1 MUS. The official statistics yields 24% of population with 1 MUS income (State Statistics Service of Ukraine, 2013) and 53% of population with more than 1 MUS and less than 2 MUSs (State Statistics Service of Ukraine, 2014). Such comparison shows that most likely in our case we have a disproportionate stratification, when the sample size of each stratum is not proportionate to the population size of the stratum. Nevertheless, we believe that the results are noteworthy for understanding the behavior of poor people regarding insurance choices.

Table 2 represents the division of 520 low-income interviewees by intervals of their income.

Table 2.

DIVISION OF 520 INTERVIEWEES BY INTERVALS OF INCOME

Group numbers	monthly income of a person (uah)	monthly income in term of MUS (MUS)	monthly income of a person (US \$)	number of respondents
Group 1	800-1000	0.8 – 1.0	100-125	110
Group 2	1001-1200	1.0 – 1.2	125-150	93
Group 3	1201-1400	1.2 – 1.4	150-175	76
Group 4	1401-1600	1.4 – 1.6	175-200	99
Group 5	1601-1800	1.6 – 1.8	200-225	76
Group 6	1801-2000	1.8 – 2.0	225-250	66

Source: Developed by authors. Grouping based on the survey for 2011-2013 years. A weighted average exchange rate for turning the Ukrainian unit currency is chosen as 8 uah= 1 \$ (The National Bank of Ukraine).

Let us now answer who exactly is meant by the category of a poor person. Group 1 in table 2 defines the poor (who have an income not more than 1MUS). Groups 2-6 in table 2 define the relatively poor (who have an income of more than 1 MUS, but not more than 2 MUSs). Our investigation covers all mentioned six groups of poor people and focuses on group 1 as the main one in this study.

3. KEY FINDINGS AND DISCUSSION

3.1. *Microinsurance as a value for low-income people*

Let us zoom on key findings. Figure 1 represents the answer to the first question «What sum of money wouldn't you grudge to pay for insurance annually?». It shows the correlation between the percent of interviewees who agreed on annual insurance contract price and that contract price. The values on abscissa axis are negative explaining expenses or potential losses of respondents for insurance (uah). Hereby the results are presented for each group (table 2).

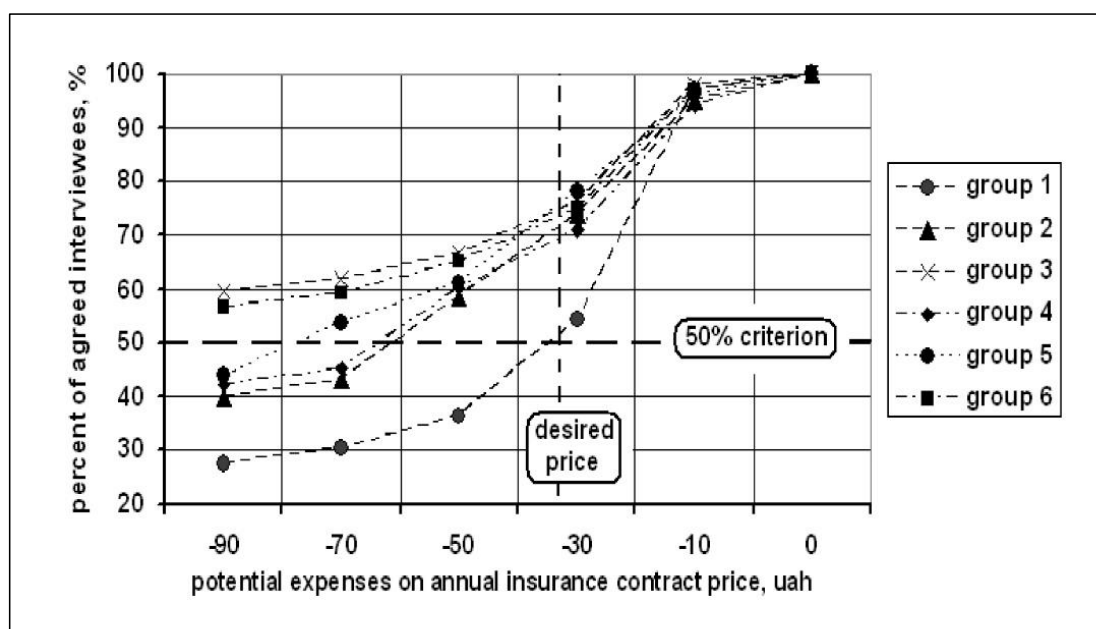
We see that insurance price 50 uah (or 6.25 US \$) satisfies the most part of the poor interviewees except group 1 (only 36.2% of such interviewees agree with that price), insurance policy price 10 uah (or 1.25 US \$) covers more than 90% of poor interviewees.

Similar results are found for India: about two-thirds of the sample agreed to pay 1%; about half the sample was willing to pay 1.35%; 30% was willing to pay about 2.0% of annual household income as health insurance premium (Dror, Radermacher & Koren, 2007).

Criterion. Let us choose as criterion of suitable for people price is that one which covers more than 50% of interviewees in each group. Then, the most suitable price for more than half of people fluctuates up to 30 uah (or 3.75 US \$). Such price may be considered as the “desired price”, “desired premium” or “contract price”, Pr , and can be reviewed in terms of MUSs as 3% of MUS.

Figure 1.

PERCENT OF INTERVIEWEES WHO AGREED ON ANNUAL INSURANCE CONTRACT PRICE VERSUS THAT CONTRACT PRICE (POTENTIAL LOSS, UAH). GEOMETRICAL SYMBOLS REPRESENT ACTUAL AMOUNTS FOR EACH GROUP (EXPLANATION IS IN THE RIGHT-HAND COLUMN). DASH-LINES ARE FOR VISUALIZATION. THE “DESIRED PRICE” FOR GROUP 1 CORRESPONDS TO 30 UAH (OR 3.75 US \$ OR 3% OF MUS).



Note: The set of the lowest circles corresponds to group 1.

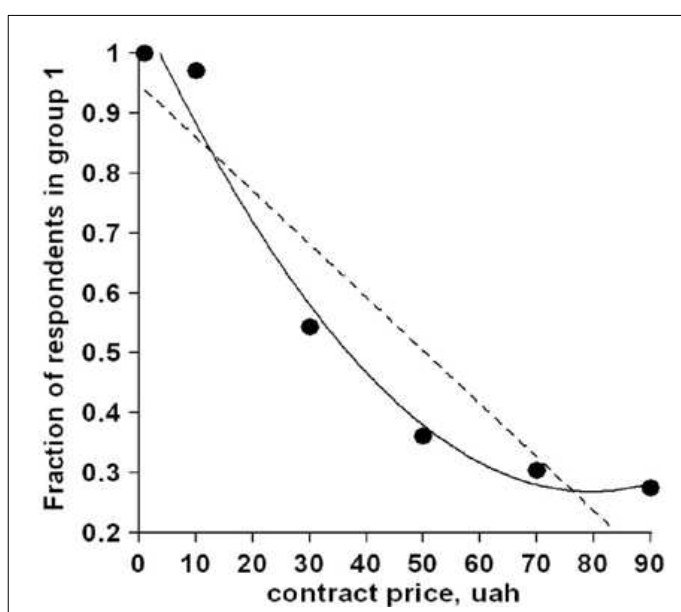
Source: Developed by authors.

Looking on figure 1 in more detail we see the demand relation: the bigger is the contract price the less is the fraction of people who agreed on that price. One can also draw a conclusion that the bigger is the income the larger is the fraction of people who agreed on same price. In other words, there exists the correlation between the percentage of respondents who agreed on the annual price of the insurance contract and the price. This conclusion is confirmed visually.

Let us select group 1 as a model example and give approximations with the value of the correlation coefficient for confirming its statistical significance (Figure 2 for group 1 only).

Figure 2.

FRACTION OF RESPONDENTS IN GROUP 1 (WHO AGREED ON ANNUAL INSURANCE CONTRACT PRICE) VERSUS THE CONTRACT PRICE (IN ABSOLUTE VALUE, UAH). CIRCLES REPRESENT ACTUAL AMOUNTS FOR GROUP 1. DASH-LINE IS THE LINEAR APPROXIMATION (THE PEARSON CORRELATION $R=0.93$). SOLID CONVEX CURVE IS THE SECOND DEGREE POLYNOMIAL FUNCTION (WITH THE DETERMINATION COEFFICIENT $R\text{-SQUARED} = 0.97296$).



Source: Developed by authors.

One can see the linear approximation with the Pearson correlation $r=0.93$. Such correlation coefficient represents a very strong relationship (determination coefficient $R\text{-squared} = 0.868$):

$$Y_1 = -0.00888x + 0.948. \quad (1)$$

Here, Y_1 – fraction of respondents in group 1 who agreed on annual insurance contract price, x – annual insurance contract price (positive values for figure 2, $1 < x < 90$ uah).

We consider also the parabolic equation approximation (solid convex curve in figure 2) which fits data even better:

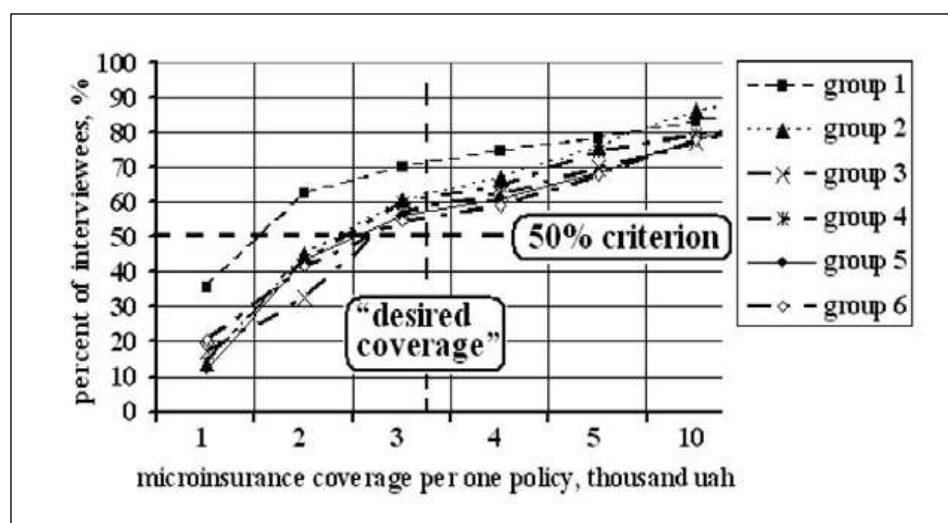
$$Y_1 = 0.000127x^2 - 0.0202x + 1.07195. \quad (2)$$

The corresponding determination coefficient is determined as R-squared = 0.973. Thus, additional analysis confirms the statistical significance and conclusion related to the contract price and WTP for low-income people.

Let us properly look on potential gains, that is the insurance coverage value which may be suitable for poor population in Ukraine. Figure 3 represents the answer to the question «How much money would you like to get back according to your payment in case of insurance event arising?». Again, we have a distribution of number of interviewers from wished coverage values and incomes.

Figure 3.

PERCENT OF INTERVIEWEES WHO AGREED ON INSURANCE COVERAGE VERSUS THAT COVERAGE (POTENTIAL BENEFITS, THOUSAND UAH). GEOMETRICAL SYMBOLS REPRESENT ACTUAL AMOUNTS FOR EACH GROUP (EXPLANATION IS IN THE RIGHT-HAND COLUMN). DASH-LINES ARE FOR VISUALIZATION. 62.6% OF GROUP 1 CAN AGREE WITH COVERAGE 2 THOUSAND UAH. THE “DESIRED COVERAGE” FOR ALL GROUPS CORRESPONDS TO 3000 UAH (OR 3 MUSS)



Source: Developed by authors.

We see that the microinsurance coverage 1000 uah (or 1 thousand uah in figure 3) is not suitable for poor citizens, coverage 2000 uah is suitable only for group 1 (62.6% of group 1 can agree with such coverage). The most suitable coverage for more than half of people fluctuates starting from 3000 uah which may be considered as the “desired coverage”. In the following we also use the notion “desired insurance compensation” and “insured sum”, S , under the assumption that this value may be the amount of money that a microinsurance company is obligated to cover in the case of insurance event arising. In terms of the MUSs $S=3000$ uah is equal to 3 MUSs.

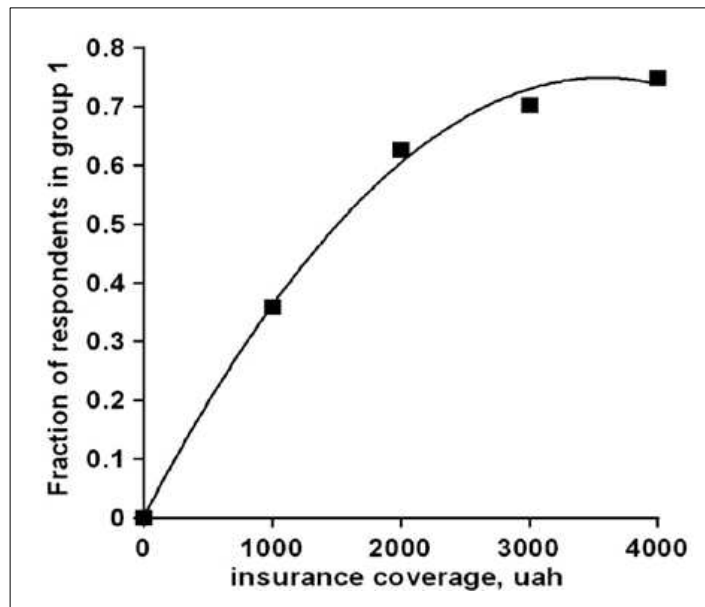
As the next step we single out group 1 and give the polynomial function as a most suitable approximation for the percent of interviewees who agreed on a given insurance coverage. If we restrict the range of values x within the $1 < x < 4000$ uah, that is within 4 MUSs, then the graphical smoothing allows to write a concave parabolic function fitting the data well in the following form:

$$Y_2 = -5.841607 \times 10^{-8} x^2 + 0.0004176 x + 0.002118. \quad (3)$$

Here, Y_2 – fraction of respondents in group 1 who agreed on insurance coverage, x – desired insurance compensation, insurance coverage or microinsurance coverage per one policy (positive values, $1 < x < 4000$ uah). Hereby the determination coefficient R-squared is equal to 0.9965 which is confirmed by visualization in figure 4.

Figure 4.

FRACTION OF RESPONDENTS IN GROUP 1 WHO AGREED ON INSURANCE COVERAGE VERSUS THAT COVERAGE (POTENTIAL BENEFITS, UAH). SQUARES REPRESENT ACTUAL AMOUNTS. SOLID CONCAVE CURVE IS THE SECOND DEGREE POLYNOMIAL FUNCTION (THE DETERMINATION COEFFICIENT R-SQUARED = 0.9965).

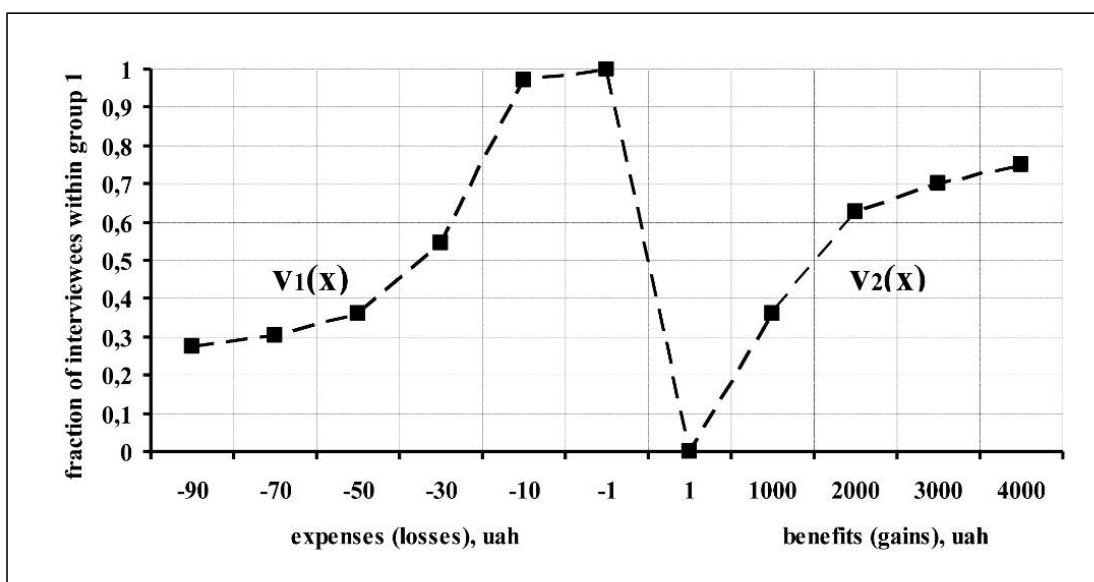


Source: Developed by authors.

Let us choose group 1 and compare potential gains (figure 4) and losses (figure 2) due to value function (figure 5). The value function in our case is the fraction of respondents in group 1 who according to our criterion agreed simultaneously on: i) annual insurance contract price and ii) annual insurance coverage. The value function $v(x)$ consists of two parts $v_1(x)$ and $v_2(x)$ and passes through the reference point ($x \approx 0$ or around $-1 < x < 1$ uah).

Figure 5

THE VALUE FUNCTION FOR GROUP 1 (FRACTION OF RESPONDENTS IN GROUP 1) THAT PASSES THROUGH THE REFERENCE POINT IS ASYMMETRICAL. SQUARES '■' REPRESENT ACTUAL AMOUNTS ACCORDING TO THE SURVEY, DASH-LINE IS SHOWN FOR VISUALIZATION.



Source: Developed by authors.

The left part of the value function $v_1(x)$ explains expenses or potential losses (figure 2) and may be described by equation for Y_1 . Due to approximation and graphical smoothing (for example, in Microsoft Excel or Grapher softwares) it is then given as a parabolic function of x :

$$v_1(x) = 0.000127 x^2 + 0.0202 x + 1.07195. \quad (4)$$

Here, x – expenses (negative values). The interval for x is defined as $-90 < x < -1$ uah. The determination coefficient R-squared is 0.973.

The right part of the value function $v_2(x)$ explains benefits or gains and due to similar analysis can be presented as nearly Y_2 function of x (x – gains, positive values):

$$v_2(x) = - 5.841607 \times 10^{-8} x^2 + 0.0004176 x + 0.002118. \quad (5)$$

Here x is the insurance coverage per one policy and ranges within the interval $1 < x < 4000$ uah. The determination coefficient R-squared is 0.9965.

As one can see in figure 5, the value function for group 1 is asymmetrical. Gains and losses are evaluated with reference to the neutral reference point. An individual's value function is concave downwards for gains but convex upwards for losses. In other words, people are more sensitive to losses compared to gains of similar magnitude.

3.2. Comparison with the Prospect Theory

Let us compare our results with those in the Prospect Theory: first and foremost - qualitatively, afterwards - quantitatively. One can see that presented value functions $v_1(x)$ and $v_2(x)$ convert money into value whereas probability weighting function in the Prospect Theory converts an objective probability into a subjective probability and into a decision weight. To analyze decision weights quantitatively we should convert value functions to decision weights or probability weights.

Originally, value functions $v_1(x)$ and $v_2(x)$ are nonlinear functions of money (4)-(5) similar to those in behavioural decision theory. Hence, our testing confirms that the Prospect Theory can explain behaviour of low-income people qualitatively.

Let us find probability weights of outcomes for low-income decision maker and compare with those in the Prospect Theory. As an example, we use experimental data for group 1 and the value function $v_2(x)$ for benefits. Kahneman and Tversky (1979, 1992) evaluated the form of the value function as coefficients of weighted probabilities. According to the Prospect Theory the two most essential properties of the value function for gains are the overweighting of small probabilities and the underweighting of large probabilities.

Probability weighting functions can be described in different way (Sheng et. al., 2021; Prelec, 1998). For example, in the framework of a one-parameter model of the Prospect Theory the probability weighting function, $w(p)$, explains the subjective probability, p , due to decision weights. Function $w(p)$ represents the value of probability and corresponds to the formula (Tversky & Kahneman, 1992):

$$w(p) = p^\gamma / [p^\gamma + (1-p)^\gamma]^{1/\gamma}. \quad (6)$$

Hereby, $0.28 < \gamma < 1$ with mean value $\gamma = 0.61$; $w(0) = 0$; $w(1) = 1$. The decision weight of an event $w(p)$ in formula (6) is not its probability and does not obey the probability axioms.

Furthermore, instead of Expected Utility one must say about subjectively weighted utility (SWU) with the functional form defined as:

$$SWU = \sum_{i=1}^n w(p_i) \cdot u(X_i). \quad (7)$$

Here $w(p_i)$ is the decision weight of the subjective probability p_i ; $u(X_i)$ is the utility of the outcome X_i and $i = 1, 2, \dots, n$; n is the total number of outcomes.

In our case outcome X_i is the desired insurance compensation, that is the insurance coverage or the microinsurance coverage per one policy and $u(X_i)$ is the subjective (expected) utility of outcome X_i for group 1.

It is worth noting that for low-income respondents the objective probabilities p_i of different outcomes X_i are not known (It may be estimated from the traditional insurance with the differentiation of risks). Instead due to direct inquiry of low-income people, in a survey, we deal with the subjective probability p_i as the percent of interviewees who agreed on insurance coverage. That is why in our case subjective probability p_i already represents the decision weight $w(p_i)$ and corresponds to the fraction of respondents in group 1: $w(p_i) = v(X_i)$. Hence, we can not compare $w(p_i)$ and $v(X_i)$ correctly without knowledge of probability p_i and should find an alternative approach. As an alternative, we discuss subjective utility $u(X_i)$.

One can say that in the case of survey for respondents in group 1 the subjective utility $u(X_i)$ may be determined due to the relation: $u(X_i) = v(X_i) \cdot X_i$. Then subjectively weighted utility for poor people (SWU_{poor}) may be defined in the following way:

$$SWU_{\text{poor}} = \sum_{i=1}^n v(X_i) \cdot X_i \quad \text{with} \quad u(X_i) = v(X_i) \cdot X_i. \quad (8)$$

On the other hand, in the case of using the Prospect Theory we can accept the subjective probability p_i as the percent of interviewees who agreed on insurance coverage: $p_i = v(X_i)$. Then the decision weight (6) may be rewritten as:

$$w(p_i) = w(v(X_i)) = v^\gamma(X_i) / [v^\gamma(X_i) + (1 - v(X_i))^\gamma]^{1/\gamma}. \quad (9)$$

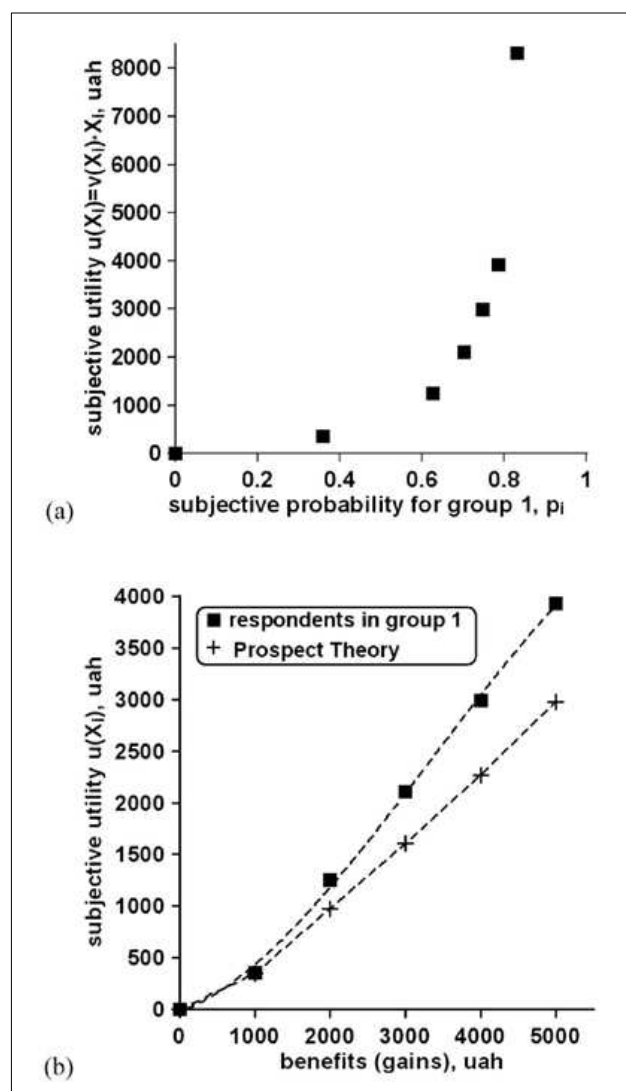
Similarly, subjectively weighted utility according to the Prospect Theory (SWU_{PT}) may be calculated as:

$$SWU_{PT} = \sum_{i=1}^n w(p_i) \cdot X_i \quad \text{with} \quad u(X_i) = w(v(X_i)) X_i. \quad (10)$$

Let us compare subjective utility of outcome X_i according to the Prospect Theory (10) with one (8) according to our results for potential gains (figure 4) due to value function $v(X)$. Such comparison is presented in figure 6b for actual data according to the survey and term (8) and for the case (10) by using interrelation (9) for the Prospect Theory with the choice $\gamma = 0.61$. Our testing discovers that the subjective utility $u(X_i)$ according to the Prospect Theory can not explain the behaviour and measure expectations of gains of low-income people quantitatively. Results show the underweighting of probabilities $w(p_i) < p_i$ and subjective utilities in the Prospect Theory as compared with the survey.

Figure 6

SUBJECTIVE UTILITY OF OUTCOME X_i : (A) – $u(X_i)$ AS FUNCTION OF THE SUBJECTIVE PROBABILITY p_i FOR RESPONDENTS IN GROUP 1 FOUND DUE TO EXPRESSION (8) AND ACTUAL DATA; (B) – COMPARISON OF $u(X_i)$ FOR THE PROSPECT THEORY AND FOR PRESENTED SURVEY. SQUARES '■' REPRESENT ACTUAL DATA ACCORDING TO SURVEY AND TERM (8), CROSSES '+' ARE SHOWN FOR THE CASE (10) BY USING INTERRELATION (9) WITH $\gamma=0.61$ ACCORDING TO THE PROSPECT THEORY. DASH LINES ARE PRESENTED FOR VISUALIZATION. RESULTS SHOW THE UNDERWEIGHTING OF PROBABILITIES AND SUBJECTIVE UTILITIES IN THE PROSPECT THEORY.



Source: Developed by authors.

3.3. Microinsurance as a business proposition

Let us give the answer on the key question concerning the microinsurance in terms of potential commercial microinsurance provider. For that purpose let us estimate the microinsurance tariff, T .

First of all we can find the “desired tariff” or “wished microinsurance tariff” suitable for more than a half of poor population (in statistical sense, according to above mentioned criterion), as the ratio of desired contract price Pr and desired coverage S . Our data yield 1% of the microinsurance coverage:

$$T = 100\% \times Pr / S = 100\% \times 30 \text{ uah} / 3000 \text{ uah} = 1\%. \quad (11)$$

Another way is to estimate the average wished tariff, T_{avg} (different from T). On the one hand each respondent gave desired for him contract price; on the other hand, he mentioned the desired for him coverage. Hence, we can find for each respondent ratio of desired contract price and desired compensation (relative tariff T_i). This ratio is relevant for only certain person. After the simple algebra, due to summing relative tariffs T_i of each respondent in mentioned groups 1-6 (table 2), we find average wished tariff $T_{avg} = 3.8\%$ (arithmetic mean value).

For proper look we must consider the tariff distribution and check up the hypothesis about the existence of correlation between the number of respondents, the size of desired insurance premium of a needy person and the size of desired insurance compensation. It is obvious that such computed solution (in the following called as “demand”) should reflect an intention of people to reduce risks from more or less frequent costs. From this, one should identify and record the function of market “demand” volume curve for the microinsurance service in the form of an equation: $Q = F(P)$. Here Q – the maximum number of items (say, insurance policies) which the poor people are ready to buy for a price, P – the price of insurance service, $F(P)$ – the function. We remember that each person responded to questions of a one contract, so the number of respondents is equivalent to the number of contracts. Graphical analysis has clearly showed the existence of functional relationship, which is well described by the formula:

$$Q(T_i) = N_0 \exp(-T_i / T_{avg}). \quad (12)$$

Here $Q(T_i)$ – the number of respondents who named the relative tariff T_i . $N_0 = 450$ – total number of respondents - poor people (who answered both key questions concerning the microinsurance and clearly indicated the “desired price” and “desired coverage”).

Expression (12) is recorded in discrete form and corresponds to the function of market demand for microinsurance service for the price. Interestingly, almost all tariffs the poor people preferred were in the range from 0 to 5 deviations from the mean T_{avg} , which corresponds to relative tariffs ranging from 0 to 19%.

We hope that the formula (12) is correct and have good chance to become unique empirical WTP law that describes the behavior of the needy population about the desire to be insured. Probable testing of these expressions for the whole population of any country with different income is also hopefully ahead. The importance of the result is not so much that there is a correlation between the desirable and premium refunds that obeys the law of demand, but the existence of an explicit dependence, which gives the possibility to identify changes of market demand for the new service.

Let us mark the ratio of desired relative tariff T_i to the average tariff by the relative price of insurance service: $P_i = T_i / T_{avg}$, where $P_i \in (0,5)$. Then the discrete function (12) can be rewritten as:

$$Q(P_i) = N_0 \exp(-P_i). \quad (13)$$

If we divide $Q(P_i)$ on N_0 then we obtain the probability $p(P_i) = Q(P_i)/N_0 = \exp(-P_i)$ of choosing at the market the relative tariff T_i (here and further the probability is indicated with a small letter p , and the relative price - with big one P). For large statistics one can move from discrete values $p(P_i)$ to continuous values of probability $p(P) = \exp(-P)$. An appropriate functional expression for the quantity $Q(P)$ willing to pay according to the relative price will be determined by multiplying the total number of respondents to the probability to accept a relative price:

$$Q(P) = N_0 p(P). \quad (14)$$

To give the answer on the main question concerning the microinsurance one should examine the potential income, which commercial microinsurance provider can receive.

Firstly, we turn to the calculation and check off the possible elasticity of the possible “market demand” curve (13)-(14) for the wished price. By definition of the coefficient of elasticity ε we have (Carlton and Perloff, 2000):

$$\varepsilon = (P/Q) (dQ/dP) = -(P/Q) N_0 \exp(-P) = -P. \quad (15)$$

Hence, the demand curve varies in elasticity in different points:

- the demand is completely elastic $\varepsilon = 0$ in the point $P=0$ for zero tariff;
- the demand is not elastic $-1 < \varepsilon < 0$ in the points $P \in (0,1)$ for $0 < T < T_{avg}$;
- the demand has unitary elasticity $\varepsilon = -1$ in the point $P = 1$ for tariff $T_{avg} = 3.8\%$;
- the demand is elastic within the interval $P \in (1,5)$ where $T_{avg} < T < 5T_{avg}$ and $\varepsilon < -1$.

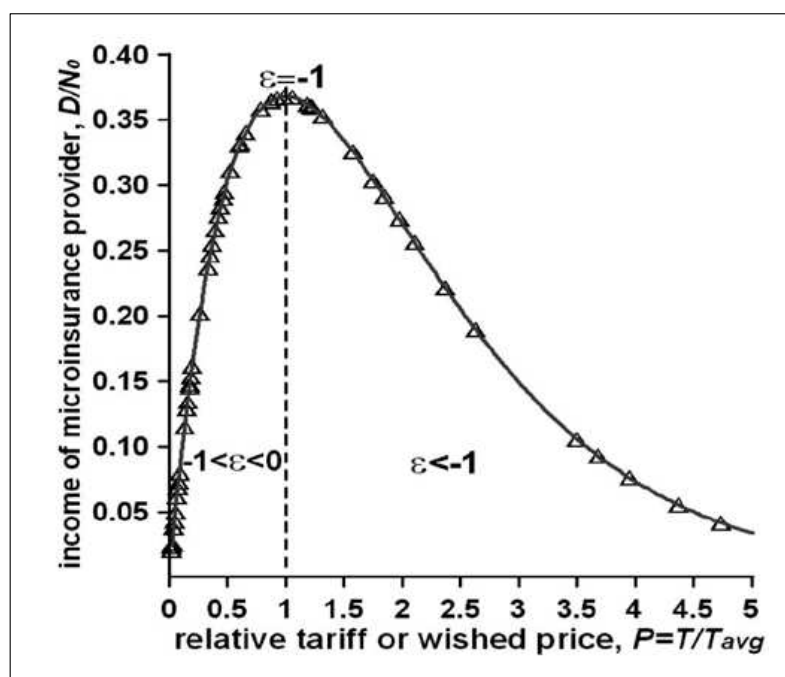
We can assume that for large relative tariffs $T_{avg} < T < 5T_{avg}$ a small change in price will drive to significant changes in the number of microinsurance contracts bought and for low relative tariffs $T < T_{avg}$ – vice versa. Taking into account that microinsurance should be for lowest prices, and therefore has low rates (less than an empirical average $T_{avg} = 3.8\%$), we can talk about the possible existence of inelastic market demand on microinsurance services and elastic market demand on the traditional insurance services for needy population.

Secondly, we examine potential income of commercial microinsurance provider. Let D be value of the potential income. Then, for discrete values of the market demand volume (13)-(14) we have value $D_i = P_i Q_i$, for continuous dependence it can be written as $D = PQ$. Corresponding statistics should be visualized by construction of the graph (figure 7).

Looking on figure 6 in more detail we see the growing dependence of D on P for inelastic market demand section so such insurer will try to increase income, thus increasing the price of goods and microinsurance services for the poor people. For elastic market demand (for traditional insurance), such insurers will be ready to reduce the price for insurance. The maximum income is reached at point $P=1$ when $T=T_{avg}=3.8\%$. Hence there will exist the conflict of interests between the commercial microinsurance providers and the potential clients, that is the tendency to have different tariffs.

Figure 7

EXPECTED INCOME OF MICROINSURANCE PROVIDER DEPENDING ON THE RELATIVE PRICE FOR INELASTIC AND ELASTIC DEMANDS: THE DISCRETE VALUES OF INCOME $D_i = P_i Q_i$ ARE SHOWN WITH TRIANGULAR SYMBOLS 'Δ' ACCORDING TO THE SURVEY OF THE POOR RESIDENTS, CONTINUOUS CURVE IS A MATHEMATIC APPROXIMATION DESCRIBED BY THE FORMULA $D = P N_0 \text{EXP}(-P)$.



Source: Developed by authors.

4. CONCLUSIONS AND DISCUSSION

Due to use of the contingent valuation method we have measured expectations of loss or gain and give the answer on the WTP of low-income people for microinsurance. The polling has been conducted during the years 2011–2013 and covered 3000 individuals. Such testing confirms that Prospect Theory can explain behavior of low-income people in the framework of a qualitative approach. In accordance with the Prospect Theory, the value function consists of two asymmetrical parts, passes through the reference point and may be presented in a cubic form. Poor individuals make decisions based on expectations of loss or gain from their current relative position and are much more sensitive to losses compared to gains. Poor people are more sensitive to losses compared to gains of similar magnitude.

Value functions for presented survey convert money into value whereas probability weighting function in the Prospect Theory converts the probability into a decision weight in such a way that there exists the overweighting of small probabilities and the underweighting of large probabilities. Testing shows that the subjective utility according to the Prospect Theory can not explain measure expectations of low-income people quantitatively. In the framework of a one-parameter model of the Prospect Theory the subjective utilities of outcome for poor people and the subjective probabilities appear to be underweighted.

Analysis confirms also the demand relation: the bigger is the contract price the less is the fraction of people who agreed on that price; the bigger is the income the larger is the fraction of people who agreed on same price.

For more than half of poor interviewees the most suitable price of annual microinsurance policy is equal to 3% of MUS whereas the most suitable coverage fluctuates starting from 3 MUSs. Most poor interviewees agree with the desired tariff equivalent to 1% of the microinsurance coverage whereas arithmetic mean value of wished tariff for all interviewees is about $T_{avg} = 3.8\%$.

A typical poor person intuitively makes decision concerning the insurance and statistically it leads to the certain power-law distribution of potential clients according to the relative price or relative tariff presented by function (12)-(13). That result represents the aggregated potential demand on microinsurance, not specified by kind. The power-law function proposed in the study fits the data well, and can thus be used for future studies.

Among the other new findings there are the existence of inelastic market demand on microinsurance services and a conflict of interests between the potential commercial microinsurance providers and the potential clients.

As far as we know, this is the first such study in Ukraine and post-Soviet countries. A proposed approach based on the Prospect Theory and results could be expanded to other countries with transition economics with similar economic problems taking into account regional influencing cultural and economic factors (Rieger, Wang & Hens 2017). However, the approach does not guarantee 100% reliability of the result, since in using the random sampling (and quota sampling) and hypotheses there exist I and II types errors related to drawing an incorrect conclusion. It all narrows assessments about behavior of entire populations.

Analysis shows that poor people are willing to invest nearly 3% of MUS or alternatively about 1% of the microinsurance coverage. Recommendation for future studies in this respect is related to the insurance companies and their willing to give an insurance services at that small price.

Another intriguing prolongation of the study is related to the age of low-income people. Prospect Theory describes how people's behavior affects their decisions associated with risks and uncertainty and say nothing about age-related questions of poor people. As a preliminary view, it is assumed that young poor people have a somewhat lower attitude to risk than, for example, poor people with lived experience. On the one hand, young people can have the help of their parents, and they cannot be classified as poor. On the other hand, official statistics says that the lowest poverty rate is usually recorded for 55-60 years old people. This means that the main potential customer of microinsurance services will be mostly poor people between the ages of 25 and 50 years.

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PRIMJENA TEORIJE IZGLEDNOSTI NA MIKROOSIGURANJE TEMELJENO NA PRISTUPU KONTINGENTNOG VREDNOVANJA ZA SIROMAŠNO STANOVNIŠTVO U UKRAJINI

Sažetak

Ovaj rad koristi pristup bihevioralne ekonomije i empirijski testira može li teorija izglednosti objasniti ponašanje osoba s niskim primanjima u Ukrajini. U radu se koristi metoda kontingentnog vrednovanja zbog izravnog ispitivanja osoba s niskim primanjima, kroz ankete, o tome koliko bi bili spremni platiti za osiguranje i dobiti natrag u slučaju nastanka osiguravajućeg slučaja. Ovaj rad pruža sugestivne dokaze da prema teoriji izglednosti siromašni pojedinci donose odluke na temelju očekivanja gubitka ili dobitka od svog trenutnog relativnog položaja i da su osjetljiviji na gubitke nego na dobitke.

Rad također odgovara na pitanje koje se tiče mikroosiguranja: može li mikroosiguranje biti poslovni prijedlog i istovremeno pružati vrijednost osobama s niskim primanjima? Rezultati dovedu do „power-law“ distribucije potencijalnih klijenata prema cijeni usluge mikroosiguranja. Dobi-vene korelacije pomažu u formuliranju strategija za iskorištavanje tržišta niskih prihoda u zemlji.

Ključne riječi: mikroosiguranja, teorija izglednosti, kontingentno vrednovanje, osobe s niskim primanjima, subjektivna korisnost.