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RESPONSES TO RISK: A STUDY OF ESTONIANS, LATVIANS AND LITHUANIANS

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Abstract

People have to take decisions regarding accepting or avoiding risk all the time, even if often unconsciously. Risk is an important decision factor in various aspects of life. The purpose of our paper is to examine how people in Estonia, Latvia and Lithuania respond to risk. We run monetary lotteries to determine risk-related preferences. Our results show that there is no statistical difference between the valuation of self-protection and that of self-insurance. Furthermore, we find that individuals value private risk reduction opportunities higher than collective ones. In addition, we rejected the hypothesis that there are no statistical differences between Estonians, Latvians and Lithuanians. Finally, we find the value of statistical life in the Baltic region to be about 1.45 million LVL.

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Introduction

People encounter risk in their daily lives at every step. We have to take decisions regarding accepting or avoiding risk all the time, even if often unconsciously. Risk is important decision factor in traffic, sports, construction and numerous other everyday activities and, therefore, an important field for research.

Risk is defined by two elements: probability and severity (Ehrlich & Becker, 1972). Risk can be lowered by reducing either one of them and there is some evidence individuals' response to risk may depend on how risk is mitigated. Decreased probability is referred to as self-protection, reduced severity as self-insurance. People can often choose either way to minimise risk, the choice is dependent on their preferences. People can also choose between private and collective ways to reduce risk, i.e. whether to take individual action to increase their safety or contribute towards a unified action that will protect more than one individual at the same time in the same way. People's preferences in that case should influence the policy outcome.

The purpose of our paper is to examine how people in Estonia, Latvia and Lithuania respond to risk. That includes responses to opportunities to engage in self-protection and self-insurance, both collectively and individually; it also enables us to measure how people of the Baltic States value risk. We will also test for differences between the attitudes of the three Baltic nations.

The reaction to risk is highly relevant and important issue and we see a lack in research of that field in the Baltics. There are many economic decisions that people and communities have to make where risk and individual attitudes towards it need to be taken into account. A very simple example, as described also in Shogren (1990), is purification of water: people can choose whether to clean their own drinking water or pay for a collective cleaning system. Similarly, answers to questions about apartment buildings security and maintenance should depend on the preferences of the people living in them. Valuation of risk and preferences over different ways of reducing it have important implications not only to the individuals themselves but to municipalities and governments, as efficient allocation of resources must depend on the preferences of individuals.

The attitude towards risk and its reduction mechanism depends on the psychology of people but as the decisions are most often also based on financial reasoning then economists have a large field to study. With no significant previous research of this kind in the Baltics we build our experiment on papers written elsewhere in the world. In particular, Shogren (1990),

Cherry et al. (2003), Shogren and Stamland (2005) and Blomquist and O'Conor (2002) provided the basis for our research.

There are two closely linked questions that our experiment enables us to study: whether there are differences in valuation of self-protection and self-insurance; and whether there are differences in valuation of private and collective risk reduction methods. Additionally, we will compare the results over three nationalities. Table 1 summarises these ideas.

Table 1. Research Questions

#	Idea	Measurement	Hypothesis
1	Differences between reduction of probability and severity	Valuation of changes in expected outcome	Individuals do not value possibilities to mitigate risk via reduction of probability and severity differently
2	Differences between individual and collective risk reduction	Willingness to pay for similar changes	Individuals value private risk reduction opportunities higher than collective ones
Comp	Differences among Estonians, Latvians and Lithuanians	Statistical tests of differences	There are no statistical differences among the three nations

Differences between self-insurance and self-protection can be observed if participants will pay different sums of money for the same changes in expected outcomes. Previous work on the field gives different evidence as to which method could be preferred (Boyer & Dionne, 1983; Chang & Ehrlich, 1985).

If individuals are willing to sacrifice different sums for the same reduction in risk in cases of private and collective methods, we will be able to conclude that they value one higher than the other. Previous research points out that individuals should prefer private risk reduction methods (Boyer & Dionne, 1983; Shogren, 1990).

Finally, we will compare our results over three nations. Our own experience suggests that the results should not be significantly different although the three nationalities differ in some aspects of mentality.

In addition, we incorporate questions about value of statistical life (VSL) in our research. That means adding questions about risk in an environment where human lives are the measure of severity, not monetary payoffs. The concept of risk is the same in both cases: people risk losing something while having an upside to gain. Although it is possible to separate the owner's being from the financial risk and not the physical risk, we believe that the underlying principle of risk is what determines people's decisions: they hate to lose something if there is not a decent chance of gaining something else. We acknowledge that monetary experiments as ours create "rationality spillovers" (Cherry et al., 2003) and these would allow us to introduce this closely connected to valuation of risk issue to Baltic environment.

The value of statistical life is usually referred to as the marginal cost of death prevention. As the name says, it is a statistical term and measures the cost of reducing the number of deaths by one. VSL is quite an important issue in a wide range of disciplines such as health care, political economy, insurance, environmental studies and of course economics. VSL can be observed in everyday decisions about wearing safety equipment, purchasing vehicles and selecting homes for living. For example, when the government is deciding on the level of healthcare expenditure it has to estimate the dollar value of life.

The value of life is most commonly determined by looking at a person's willingness to pay for certain drug or their willingness to accept certain sums of money for giving something away. For example, an individual is asked how much he or she is willing to pay extra for an even more effective drug. Or another example is how much people are willing to pay more for a safer location when buying a home. These kinds of willingness to pay for small changes in probability of survival give economists and other researchers an insight to the theoretical implied value of life.

According to Viscusi (2004), the value of life is $4.7 million. This value takes into account the risk of influence of clustering of the job risk variable and compensating differentials for both workers' compensation and nonfatal job risks. Just as there are no such things as risk-free investments, there are no such things as risk-free jobs. Murphy and Topel (2006) value improvements in health and find that potential gains from the future health improvements are quite large. In fact, a 1 percent reduction in cancer mortality would be worth $500 billion.

VSL has received much criticism because how one could put a price tag on human life, since every life is "priceless". But as stated previously, it is mainly a statistical term, not a way to compare the value of one person's life relative to another person's.

The paper will proceed as follows: the next section will give an overview of the theoretical framework; the third section will describe the methodology used; the forth section will summarize the results, which will be followed by analysis; and before making the conclusions, we will describe the implications and give suggestions for further research.

Literature Review – Theoretical Framework

Risk has been subject to studies for over four decades. Behavioural finance and behavioural economics have to deal with uncertainty daily and that is the reason why with the development of research in those fields, risk has become more and more popular topic.

As early as in 1972 Ehrlich and Becker in their article “Market Insurance, Self-Insurance, and Self-Protection” develop a theory of demand for insurance that emphasizes the interaction between market insurance, "self-insurance," and "self-protection", defining the latter terms. The effects of changes in "prices", income, and other variables on the demand for these alternative forms of insurance are analyzed using the "state preference" approach to behaviour under uncertainty. Market insurance and self-insurance are shown to be substitutes, but market insurance and self-protection can be complements. The analysis challenges the notion that "moral hazard" is an inevitable consequence of market insurance, by showing that under certain conditions the latter may lead to a reduction in the probabilities of hazardous events.

In their famous paper about prospect theory in 1979, Kahneman and Tversky present a critique of expected utility theory as a descriptive model of decision making under risk, and develop an alternative model. Choices among risky prospects exhibit several pervasive effects that are inconsistent with the basic tenets of utility theory. In particular, people underweight outcomes that are merely probable in comparison with outcomes that are obtained with certainty. This tendency, called the certainty effect, contributes to risk-aversion in choices involving sure gains and to risk-seeking in choices involving sure losses. That means that people do not always behave rationally when dealing with risk or that the disutility per unit of risk is dependent on the level of risk (probability, not severity). In addition, people generally discard components that are shared by all prospects under consideration. Thus, they develop an alternative theory of choice in which value is assigned to gains and losses rather than to final assets and in which probabilities are replaced by decision weights. The value function is normally concave for gains, commonly convex for losses, and is generally steeper for losses than for gains. Decision weights are generally lower than the corresponding probabilities, except in the range of low probabilities. Overweighting

of low probabilities may contribute to the attractiveness of both insurance and gambling and must be taken into account when exploring who people deal with risk in their everyday (economic) activities as these risks are rather often of very low probability.

Boyer and Dionne (1983) analyse the changes of risk associated with self-insurance and self-protection. They show that risk-averse individuals always favour an increase in self-insurance to an equivalent increase in self-protection and always prefer an increase in private self-insurance to an equivalent increase in collective self-insurance when the probability of loss is a function of the individual's actions and is observable without cost. Overall, that implies that people are happier to see a decrease in the severity rather than the probability of the risk.

Chang and Ehrlich (1985) extend Ehrlich and Becker's (1972) analysis of the demand for insurance by deriving several new propositions concerning the demand for self-insurance, self-protection and market insurance under alternative market conditions. A key behavioural prediction is that if the price of market insurance were responsive to self-protection, then the latter would induce a substitution away from self-insurance and towards market insurance, regardless of the fairness of insurance terms, as long as the utility function exhibits constant or decreasing absolute risk aversion. In addition, they compare their results to the results by Boyer and Dionne (1983), and claim that Boyer and Dionne's results were derived without accounting for the relevant optimality conditions governing insurance and protection decisions. In a later paper, Boyer and Dionne (1988) show that the two articles, Chang and Erlich (1985) and Boyer and Dionne (1983), are complementary rather than conflicting: Chang and Erlich (1985) analysed the individual choice between self-insurance, self-protection and market insurance, while Boyer and Dionne (1983) were interested in proposing a methodology to isolate the risk factor involved in that choice. The difference between the results is due to the fact that different problems were analysed. So, there is various evidence as to whether people prefer self-protection or self-insurance and how are they related to people's overreaction to low and underreaction to high probabilities of loss.

Shogren (1990) comes back to the two elements which define risk: probability and severity. Since risk can be reduced by decreasing either element, Shogren develops experimental markets to observe how people respond to risk: self-insurance and self-protection in both collective and private auctions. Shogren finds that upper and lower bounds on value are obtained by the private self-protection and the collective self-insurance markets. Furthermore, he finds evidence that individuals overestimate the impact of low probability events, and as the individuals get more and more exposure to the market, their perception and

valuation of reduced risk stabilizes. Namely, respondents were initially very risk averse, overestimating the 1% probability of a loss in the initial inexperienced hypothetical bid; with repeated market exposure, though, the overestimation declined. He provides a solid framework for extending his study to other environments by construction of experiments based on auctions and designed to reveal individuals' willingness to pay for changes in the probability of loss, thus revealing preferences and valuation involved in risky decisions.

Mauro and Maffioletti (1996) build two experimental markets to examine individual valuations of risk reductions with two risk-management tools: self-insurance and self-protection. They find no positive evidence that the risk-reducing mechanisms constitute a "frame." Ambiguity in the probability on average affects valuation only weakly, and changes in the representation of ambiguity do not alter valuation. So, according to them people do not value chances to reduce probability and severity differently. Unfortunately, no conclusions are drawn about whether private and collective methods of risk reduction produce significantly different results.

Cherry et al. (2003) design an experiment to test whether the rationality that is induced by market-like discipline spills over to non-market valuation settings— in other words, rationality spillover. Their results confirm that this kind of new phenomenon exists. The rationality stimulated by market-like discipline extends to the non-market setting, and these spillover effects are robust even when the non-market setting involves hypothetical choices and environmental lotteries. They observe that people stop reversing their preferences for lotteries by revising downward their stated values to buy and sell high-risk lotteries; they do not change their preference ordering. That enables us to use the rationality of participants gained during market environment based tests to determine their preferences in settings which are not directly market based without introducing the regular biases of „yes-saying" and showing higher willingness to pay than in reality.

Self-protection has also been used to help define lower bounds on the value of statistical life (VSL). Shogren and Stamland (2005) show circumstances exist in which, the lower bounds are so low as to be more misleading than informative; and the bound is an upper bound on the population's average VSL. They derive that the relationship between the bound and VSL depends on the fraction of the population buying self protection, and the price and market setting for self-protection. VSL is a particularly interesting subject and its close relations with self-protection and risk valuation enable us to use rationality spillovers to determine VSL in the Baltics.

VSL has been tried to be estimated in various studies. A study by O'Conor and Blomquist (1997) introduces a hybrid, two-stage, contingent valuation method applied to asthma treatment. In the first stage, respondents are offered a choice between hypothetical medications, implying a trade-off between safety and efficacy. In the second stage, the authors elicit willingness to pay (WTP) for an improvement along a single risk dimension. Estimates of the value of asthma control based on the initial risk trade-off stage range from approximately $1400 to $2100 per year, assuming a $6 million value of life. Analysis of the second-stage WTP responses, however, yield estimates for the value of a statistical life of approximately $9 million and for asthma control of approximately $2200 per year.

In 2002, Blomquist and O'Conor expanded the previous study and tested whether the hybrid contingent valuation method that worked for asthmatics is also useful for the general population. Results indicate that general population values can be estimated for situations in which people have some familiarity even if they do not have direct experience. The value of statistical life for the full sample in their study was $4.94 million.

Blumenschein et al. (2008) find evidence of hypothetical bias for unadulterated contingent valuation. Their concern is that hypothetical willingness to pay questions overestimate real willingness to pay. In a field experiment, they compare two methods of removing hypothetical bias, a cheap talk approach and a certainty approach, with real purchases. They conclude that contingent valuation with certainty statements removes the hypothetical bias, but the cheap talk approach has no significant impact. The findings suggest that willingness to pay can be accurately estimated by adding a simple follow-up question about the certainty of responses and that cheap talk is not a generally effective approach.

Although the rest of the world is rich in research about attitudes towards risk and valuation of risk and VSL, to our best knowledge, nothing significant has been written in the Baltics on this topic area. As decisions about everyday life and risks must be similar, then models that apply in other parts of the world will be useful here as well.

Methodology

Experimental Economics

Experimental economics is very common to behavioural economics since both of them try to look how and why people make certain decisions. Just as behavioural economics, experimental economics itself has a very close link with psychology, and Earl's (1990)

suggestion to mainstream economists, that there are gains to be had from seeking help from psychology in many areas of economic research, has become very evident. Both groups of economics can trace their origins to psychology – psychological theory in one case and experimentation in the other (Loewenstein, 1999). Thus, it can be argued that these kinds of experiments such as ours can be viewed as both experimental and behavioural economics.

Experimental economics uses experimental methods to evaluate theoretical predictions of economic behaviour. As stated earlier, since the attitude towards risk and its reduction mechanism depends on the psychology of people, then running laboratory and controlled experiments provides a good way to compare different situations and to analyze the outcomes.

Economists started to use experimental economics more widely due to the fact that traditional economics relies mostly on decisions in natural environment, whereas, in contrast, experimental economics seeks to control various variables in order to provide more exact conclusions to certain types of problems.

According to Smith (1989), our experiments can be categorized into two types: learning experiments and market experiments. Learning experiments in the sense that as the individuals make decisions repeatedly then after getting exposed to the market and receiving new information from the market then they adjust their next decisions accordingly. Secondly, as already mentioned the subjects get information from the market which forces them to take into account how the market would react to their next decisions.

Our Experiment

In order to gather the necessary data for our analysis we conducted experiments in all three Baltic countries to see how people value risk. As stated earlier, we build our experiments on previous similar researches, in particular on Shogren's (1990) work.

The experiment consists of four parts: making bids for private self-protection, private self-insurance, collective self-protection, and collective self-insurance. All the subjects are told that they are participating in a study about risk and uncertainty. They have to take part in a number of lotteries and they are given a chance to purchase insurance against losses that may or may not occur. The purchasing system of insurance is the following: all participants have to write the sum that they are willing to pay for ensuring a win in the lottery on a piece of paper and not reveal it to any other participant. Communication between the participants is

strictly forbidden, and any attempt to do so results in a monetary loss of 0.5 Latvian lats (LVL, or local currency equivalent).

In the beginning of each round of lottery participants are given 1 LVL (or local currency equivalent, see Appendix 1). The lotteries are with a win of 0.1 LVL and loss of 0.4 LVL, and the probability of loss is 10%. In the case of self-insurance, everybody has to write down their maximum willingness to pay to reduce the probability of loss to 0. In every round, the person whose bid is the highest will get to buy insurance for the price of the second highest bid (sealed-bid second-price auction). Although it may seem at the first glance that participants are motivated to bid artificially high, they learned and game theory proves that it is still optimal to bid one's marginal willingness to pay. If two (or more) highest bids are equal, those participants will be required to bid again. Each round starts with a hypothetical bid that will not be followed by actual lottery. Then we would have 3 rounds of actual lottery where the decisions have actual financial implications for the participants. Finally, the last round is again a hypothetical one.

An actual lottery looks as follows. Everyone posts their bids and the highest bid buys the insurance. Then an outcome is drawn for everyone and everyone either loses or wins. The losses, wins and purchases of insurance do not carry over to the next lottery. In the end everyone receives the sum of all gains, losses and purchases of insurance.

In the second part of the experiment everything is the same, except that instead of the chance to reduce probability to zero, subjects are able to pay for the reduction of loss to zero. But again only the highest bidder gets insurance.

Next, in the case of collective self-protection the same probabilities are used and participants are bidding to reduce the probability of loss to zero. If the sum of all bids exceeds the expected consumer surplus, the participants are told the average bid (price) and they all have to accept and pay this price in order to reduce the probability of loss to zero (modified sealed-bid Smith auction as described in Shogren (1990)). If at least one participant does not agree to pay this price, everyone would be subject to a random draw. If the sum of all bids is not high enough, everyone would be subject to a random draw.

The last part of the experiment is exactly like the third except that the participants are bidding to reduce the loss to 0. The same rules for determining the usage of insurance apply.

All the participants are gathered in a classroom and seated separately. They are given paper and pen for making bids. The experiment starts by all of them making a hypothetical bid for the first case, private self-protection. The subjects have a chance to compete for risk reduction in three rounds of bidding where the winner gets insurance (in cases of private risk

reduction methods) or everyone gets insurance if the total sum offered is high enough (in cases of collective risk reduction methods). In the end of each method they have to post another hypothetical bid.

After every round of bidding we collect their bid to determine the winner, or in case of collective method, to see whether the threshold for collective risk reduction is met. In case of need we draw lottery results for participants using a laptop. All the bids and cash flows for individual participants are recorded in an Excel spreadsheet.

Experimental Design

The experimental design incorporates one main issue in the theory of choice under risk: how individuals value risk given alternative reduction mechanisms. Psychologists have discovered that choice and values are systematically influenced by alternative means of representing or framing an identical problem (Tversky & Kahneman, 1981). This gives further reason to believe that different risk reduction mechanisms should influence individuals' choice. Our experimental market is constructed in order to test whether alternative mechanisms matter. The experimental market is framed so that all subjects value reduced risk through one of four mechanisms: private self-protection, private self-insurance, collective self-protection, and collective self-insurance (Shogren, 1990).

Existing economic theory gives an unclear answer whether self-protection or self-insurance is preferred. Some argue that risk-averse consumers will always prefer private self-insurance to self-protection (Boyer & Dionne, 1983), while according to others self-insurance will not be preferred to self-protection since both must be equally desirable in terms of marginal contribution to expected utility (Chang & Ehrlich, 1985). In our experimental design, a monetary gain is guaranteed to the purchaser of self-protection, while the gain is not guaranteed to the purchaser of self-insurance. Self-insurance reduces the severity of the possible loss to zero, leaving the probability of the win at 10%. On the other hand, self-protection reduces the probability of a loss to zero, which gives the participants a 100% chance of gaining. As a result, risk-averse individual should value self-protection more than self-insurance (Shogren, 1990).

According to Shogren and Cocker (1989) if an individual can always produce a given reduction at less cost privately than collectively, then he or she will do so. In many cases an individuals' preference between private and collective reduction will depend on the perceived

productivity of their payment. In other words, collective reduction may prove more efficient due to economies of scale or because some private reductions might be too expensive.

Sample

All the participants in the study were university students. Given the time and resource constraints and the fact that students have been shown to give similar results for results to the whole population (Bennet, 1987), we believe that this was the best approach. To motivate the subjects to participate and validate the results, all of them were paid according to experiment results. Altogether, we had six sessions, two in each country, with ten participants in every session, which gave as a sample size of sixty. The rather small size of our sample is mainly due to the fact that experimental economics is quite expensive, and funding for these kinds of researches is not that easily available.

The sample consists of 32 male and 28 female students, which represent 53% and 47% of the sample, respectively. Country-wise, there are 13 males from Estonia, 6 males from Latvia, and 13 males from Lithuania; and 7, 14 and 7 females from Estonia, Latvia and Lithuania, respectively. The average age of the participants is 20 years. The participants represent 12 different universities across the Baltics, and 19 different majors, starting with economics and finishing with graphic design.

Methodology for Determination of VSL

Value of statistical life is the implicit value that individuals place on reducing the number of deaths resulting from a certain cause. When people get to choose between different alternatives in terms of riskiness and price it is possible to observe their preferences: how much they are willing to pay for reducing the probability of dying within, for example, a year. The decisions people have to make are very similar (as both include valuation of changes in risk, it is just that in one case monetary loss forms severity, in the other case these are human lives) to the ones in valuation of financial risks in the first part of our study, therefore we can rely on rationality spillovers described by Cherry et al. (2003).

We research individuals' willingness to pay for the reduction in the number of deaths (i.e. risk) by having our participants filling in a survey about asthma (Blomquist and O'Conor, 2002) and, of our particular interest, hypothetical asthma drugs where they have to decide about prices they are willing to pay and risks they are willing to accept for these prices.

Appendix 3 contains this questionnaire. Respondents had to start by answering questions that would make them think about characteristics and threats of asthma. Then they were guided to think about monetary issues and risk and presented two drugs with different effectiveness and risk. Having decided about this they were given additional choice of "even better" medicine and offered a monetary dilemma – to determine, in the end, how much they are willing to pay for decreased probability of death (or increased efficacy of the drug). Question 18 enables the respondents to express the strength of their decision about the third, "even better" drug. As this part of our experiment is completely hypothetical, the results may suffer from a bias related to that. To remove hypothetical bias, we will use only "Definitely Yes" answers in the derivation of results as proposed by Blumenschein et al. (2008).

The aim of our work is to determine the mean willingness to pay (WTP) for the given change in the probability of death (10/100000). We will use the non-parametric method described in Kriström (1990) and used by Blumenschein et al. (2008) and estimate the demand curve for our hypothetical asthma drug. We will be able to use the respondents who choose the dangerous drug at the first place (Drug B) and then later on will switch to the safer option. To calculate the mean willingness to pay for safety we will construct a graph where the vertical axis will display the amount of money and the horizontal one the fraction of all respondents who say yes. Then the area under the curve gives us the mean willingness to pay (Blumenschein et al., 2008). From the mean willingness we will calculate the value of statistical life according to the following formula

$$VSL = \frac{WTP * \#\ of\ months\ in\ a\ year}{change\ in\ probability} = \frac{WTP * 12}{10/100000} \qquad [1]$$

As our questionnaire has expense per month but death rate per year, then we need to annualise by multiplying with 12 before finding the willingness to pay for a whole statistical life (value of statistical life).

Results of Empirical Study

Data Description

To begin with, we look at the data gathered from the experiments. We try to spot whether there are any outliers or very strange observations. After running some mean comparison tests, we decided to remove 11 observations from the experienced hypothetical bids. Statistics of the experiments for risk reduction is summarized in Appendix 2 in table 8. Table 9 lists statistics without excluding the 11 observations. The observations that were removed were

clearly irrational: bids where participants posted sums that were either the full amount they had (1 LVL) or very close to that. We look at the mean, median and the variance of the inexperienced hypothetical bid (IEHB), the average nonhypothetical bid (ANB), and the experienced hypothetical bid (EHB). Furthermore, we list all the statistics separately for every country as well.

For private self-protection, we can observe that the mean for IEHB is larger than that of ANB and EHB, which implies that after the first exposure to the market the participants adjusted their bids accordingly. This is strictly true for Estonians, but not for Latvians. In fact, the mean bid increased for Latvians after being exposed to the market.

Bids for private self-insurance are a bit lower than the bids for private self-protection in general makes sense since insurance does not guarantee a gain. One can also notice that the mean for EHB for Lithuanians is considerably lower than that of Estonians or Latvians, 0.12 LVL versus 0.18 LVL and 0.21 LVL, respectively.

One can observe right away that participants were risk averse. The expected value of the lottery is

$$E(Outcome) = 0.9 \cdot 1.1 + 0.1 \cdot 0.6 = 1.05, \qquad [2]$$

so that bids lower than 0.05 imply risk loving, higher than 0.05 risk averseness and 0.05, obviously, risk neutrality. All the means for all risk reduction mechanisms and all nationalities are higher than 0.05 so in all risk reduction markets our participants behaved, on average, as risk averse players.

Data Description for VSL

Data for estimating VSL was gathered from the same sample as the experiment was ran on. This implies that there were 60 people who filled in the questionnaire – 20 Estonians, 20 Latvians and 20 Lithuanians. First of all, we can observe how many people chose the less effective and less riskier drug A, and how large proportion of people chose the more effective and riskier drug B in the beginning. Out of 60 participants, 25 indicated that they would prefer the less effective and less riskier drug A, 28 people marked down they would choose the more effective and riskier drug B, and 7 people said they would not have chosen either of the drugs. If we looked at each of the nationality separately then it would look as follows: out of 20 Estonians 7 would prefer drug A, 12 would prefer drug B, and 1 would not choose any; out of 20 Latvians 9 would prefer drug A, 7 would prefer drug B, and 4 would not choose any; and out of 20 Lithuanians 9 would prefer drug A, 9 would prefer drug B, and 2 would not choose any. All this is summarized in Table 2.

Table 2. Summary of the asthma medication choices. Composed by the authors.

	Drug A	Drug B	Neither
Estonians	7	12	1
Latvians	9	7	4
Lithuanians	9	9	2
Full sample	25	28	7

From the previous comparison between nationalities, we could hypothesise about Estonians being more risk-taking as a larger proportion of them chose drug B, or that Latvians are more risk averse as quite a few would not have chosen either of the drugs.

When the respondents were given a chance to switch to a more expensive drug C – a mixture of drug A and drug B, having the riskiness of the less riskier drug A and the effectiveness of the more effective drug B – then out of those 25 people who initially chose drug A, 20 would have switched to drug C and 5 people would have not. This means that those 20 people found it reasonable to pay a little more extra for the increased effectiveness. More interestingly, out of the 28 people who initially chose drug B, 18 would have switched to drug C and 10 people would have not. This, on the other hand, means that those 18 people considered it feasible to pay a little extra money for the reduced risk of fatality.

But as Blumenschein et al. (2008) argue that there exists a hypothetical bias in contingent valuation, and they conclude that contingent valuation with certainty statements removes the hypothetical bias, then for our analysis we shall only use those participants who would definitely switch to drug C. The results of the follow-up question about the certainty of responses are summarized in Table 3.

Table 3. Results of the follow-up question about the certainty of switching to drug C. Composed by the authors.

	Initial choice	
	Drug A	Drug B
Definitely Yes	8	6
Probably Yes	12	12
Probably No	4	8
Definitely No	1	2

From the results of the follow-up question about the certainty of switching to drug C, we can conclude that for estimating VSL we can only use those 6 observations which initially

chose drug B and then switched over to drug C with certainty since then we can observe how much people would be willing to pay for the reduction in the risk of fatality, and therefore, estimate VSL.

Results

We start the exploration of our experiment results by looking at them on aggregate level, i.e. we do not separate between different nationalities. We do that to find general trends in responses, at first, under the reasonable assumption that there are no big differences between the three Baltic nations. To determine the differences in valuation of different risk reduction methods we use Wilcoxon rank sum test for the comparison of distributions and t-test for the comparison of means. The results of these tests are given in columns 1 of tables 4 and 5.

Table 4. Results of Wilcoxon rank sum test for EHB. Composed by the authors.

Wilcoxon rank sum test	1	2	3	4
Parental distribution[1]	Total	Estonians	Latvians	Lithuanians
Self-protection Private vs. Collective	-3.369**[2]	-1.262	-3.649**	0.028
Self-insurance Private vs. Collective	-3.800**	-2.723**	-3.233**	-0.156
Private Self-protection vs. Self-insurance	0.630	0.182	0.509	0.710
Collective Self-protection vs. Self-insurance	1.168	0.921	0.248	0.849
[1]z-values, [2] **indicates significance at 95% level, positive values indicate lower valuation of private risk reduction mechanism or self-insurance respectively				

Table 5. Results of t-test for means of EHB. Composed by the authors.

t-test	1	2	3	4
Difference of means[1]	Total	Estonians	Latvians	Lithuanians
Self-protection Private vs. Collective	-2.8764**[2]	-0.9823	-4.3519**	-0.1555
Self-insurance Private vs. Collective	-2.2082**	-2.5324**	-3.4565**	1.1644
Private Self-protection vs. Self-insurance	0.8520	-0.0118	0.7301	1.4436
Collective Self-protection vs. Self-insurance	0.1991	0.9740	-0.2902	-0.5362
[1]t-values, [2] **indicates significance at 95% level, positive values indicate lower valuation of private risk reduction mechanism or self-insurance respectively				

Private and Collective Risk Reduction Methods

We begin by comparing private and collective risk reduction mechanisms. As seen from tables 4 and 5, both for the case of self-insurance and self-protection the participants were willing to pay more for private risk reduction opportunities. The result is particularly strong in both the mean comparison test, and in the Wilcoxon rank sum test that bids are not derived from the same parental distribution. Shogren (1990) and Boyer and Dionne (1983) reached the same result. In general it seems rational to pay more for private risk reduction as there one is not dependent on anyone else and there are no free-riding opportunities – a person either mitigates risk or does not. Collective risk reduction is, in contrast, open to free-riders, one can pay less and as long as there are others paying more, that person will get the same benefit for lower cost.

Self-Protection and Self-Insurance

Secondly, we explore whether people value reductions in probability (self-protection) and severity (self-insurance) the same. Apparently, both tables 4 and 5 show the same result: there is no statistical difference between the valuation of self-protection and that of self-insurance. There is previous evidence for both sides: Boyer and Dionne (1983) showed that self-insurance is valued higher than self-protection but Shogren (1990) got the opposite results. Our data does not support either side, we cannot reject the hypothesis that there is no difference between the distributions or means of bids for self-insurance and self-protection and that applies both to private and collective risk reduction.

Robustness across Baltic Nations

Next, we relax the assumption that the Baltic nationalities are very similar and go through all three nationalities and check whether the results described above for the whole sample hold also in smaller samples of Estonians, Latvians and Lithuanians.

The results for Estonians are given in columns 2 of tables 4 and 5. We do not see very strong and clear trends. The distributions are only significantly different in one case: we have enough statistical power to reject the null hypothesis that Estonians value private and collective self-insurance the same. However, we do not have enough statistical power to

reject the hypotheses that self-protection and self-insurance and private and collective self-protection mechanisms are valued the same. So, Estonians value private self-insurance higher than collective self-insurance.

The results for Latvians are given in columns 3 of tables 4 and 5. Latvians are the most homogenous and most strong-trended in their willingness to pay more for private risk reduction. They follow the characteristics of the total group very well, and are probably the strongest trend setters for the total sample. For them, as for everyone else, there is no statistically significant difference between self-protection and self-insurance.

The results for Lithuanians are given in columns 4 of tables 4 and 5. We see no significant differences in their valuations of self-protection and self-insurance as well as in bids for private and collective risk reduction opportunities.

Table 6. Comparison of EHB for Estonians, Latvians and Lithuanians. Composed by the authors.

	1	2	3	4
Comparison by nationalities	Private self-protection	Private self-insurance	Collective self-protection	Collective self-insurance
Parental distribution[1]				
Estonians	-0.402	-1.336	0.809	1.554
Latvians	-1.459	-1.656*	1.333	0.209
Lithuanians	1.845*[4]	2.973**	-2.147**	-1.743*
Difference of means[2]				
Estonians	-0.7019	-1.7183*	-1.1747	0.6653
Latvians	-1.5783	-1.2168	1.6869*	1.0471
Lithuanians	2.3192**[3]	3.0931**	-0.5225	-1.7355*

[1]z-values for distribution test, [2]t-values for mean difference test, [3] **indicates significance at 95% level, [4] * indicates significance at 90% level, positive values indicate relatively lower valuation of particular risk reduction mechanism by respective nationality

Comparison of Estonians, Latvians and Lithuanians

We have described the results for the whole sample as well as for each and every nationality separately for comparing the willingness to pay for different risk reduction mechanisms. Next, we will compare every nation against the two others to see if there are any significant traits in how they value the four risk reduction mechanisms. Once again we use Wilcoxon rank sum test to test whether the bids of participants of different nationalities are derived from the same parental distribution and t-test to see if the means of the bids are different. The results of these tests are given in table 6; in particular, the results for private self-protection

are in column 1, private self-insurance in column 2, collective self-protection in column 3 and collective self-insurance in column 4.

As for private self-protection, one can see that Lithuanians value that considerably lower than the other two nations. Although barely insignificant, Latvians seems to value private self-protection lower than Estonians and Lithuanians. So, we see that there are considerable differences also between nationalities when it comes to valuing the reduction of probability of loss.

For private self-insurance, the same trends are even more strongly visible. Lithuanians value this risk reduction method once again lower than the two others, and the Latvians' and Estonians' value of private self-insurance is higher than that of the other respective two nations together. Apparently, Lithuanians are much more strongly different in their preferences from the average of the three nationalities than the other two. (Table 6)

There are not very many significant test results for collective self-protection. However, Wilcoxon rank sum test reveals that Lithuanians value collective self protection higher than the two other nationalities and from the mean difference test we can say that at 90% significance level Latvians value this risk reduction method lower than the others.

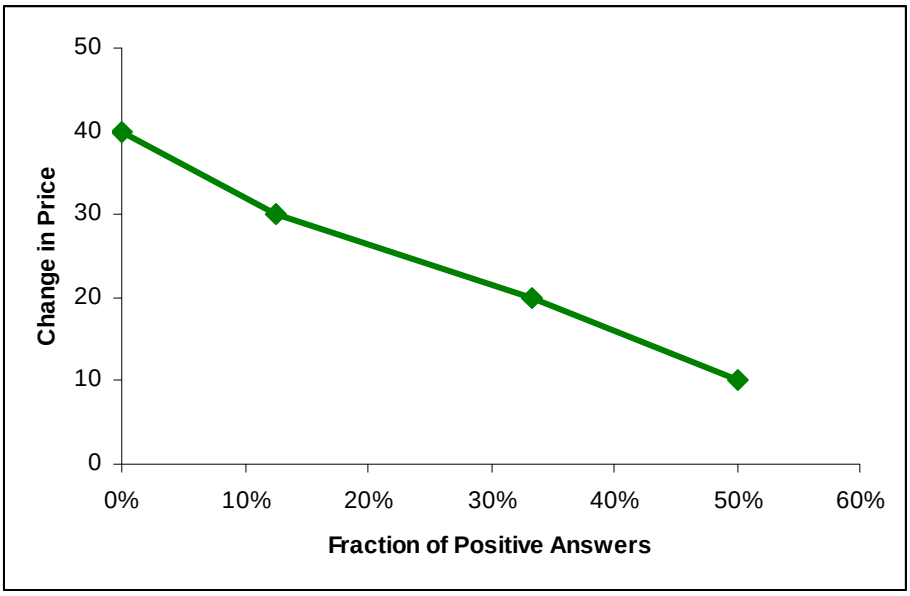
Collective self-insurance is valued relatively high by Lithuanians. In terms of means, Estonians and Latvians seem to be the counterweights to Lithuanians equally, so there is no great difference between them.

Altogether, Latvians value strongly higher private risk reduction mechanisms in comparison to the other two Baltic nations, and, supporting the results from tables 4 and 5, they value collective self-protection lower than the others. Lithuanians value private risk-reduction mechanisms relatively lower, and prefer, in particular, collective self-insurance (significant result for collective self-protection comes only from distribution test). Estonians seem to be modestly somewhere between the two others, the only difference comes out in the case of private self-insurance, and Estonians value that higher than Latvians and Lithuanians and higher than collective self-insurance.

Value of Statistical Life

Having taken a look at a rather theoretical perspective of people's willingness to pay for reducing risk, we will next move on to a very practical application of valuation of risk. We had 28 people who chose drug B at the first place and of them we had the following definitely positive response rate for different prices: 50% for 10 LVL, 33% for 20 LVL, 13% for 30

LVL and 0% for 40 LVL. Graph 1 displays these results. The horizontal axis measures the fraction of respondents who replied definitely yes, the vertical axis measures the increases in the price they had to face.



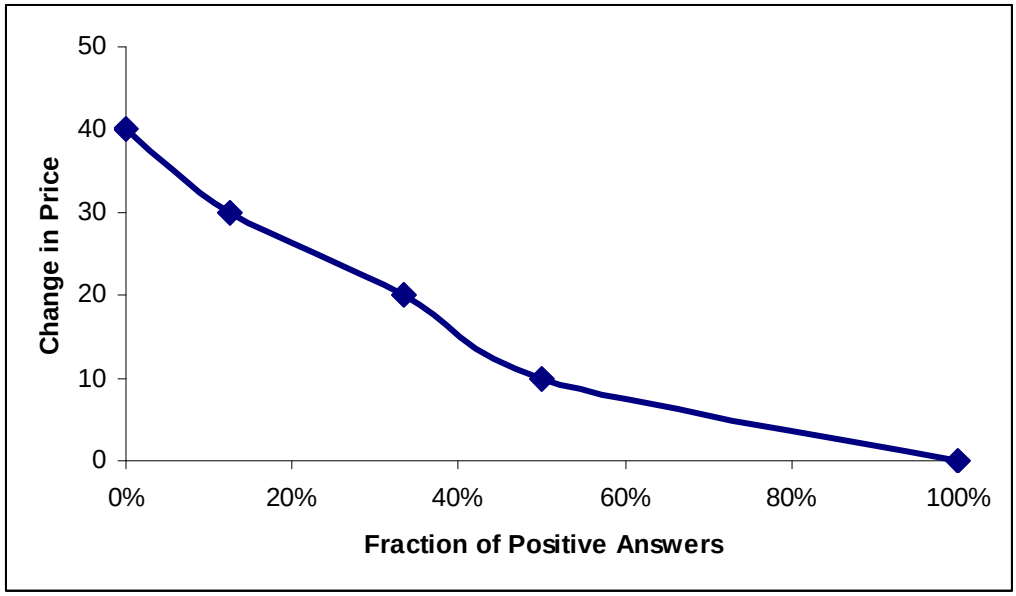
Graph 1. Demand for the safer drug. Composed by the authors.

The area under the curve is 12.1 LVL (see Appendix 4 for calculation). According to the formula proposed in the methodology part, the implied value of statistical life is

$$VSL = \frac{12.1*12}{10/100000} = 1450000\,LVL \qquad [3]$$

As noted by Blumenschein et al. (2008), such derivation method assumes that the maximum willingness to pay is not higher than our maximum price offered to participants (the results of 0% yes-rate confirm that) and "that the proportion of subjects with zero willingness to pay was equal to the proportion of effectively "No"[1] responses at the lowest price used in the study" (10 LVL increase). We acknowledge that there may be people who are willing to pay lower sums for the proposed drug and that our scale does not cover all possible amounts. However, assuming a demand curve with constant slope (given that generally demand curves are convex, we must be on the safe side), the error is not more than 2.5 LVL in willingness to pay or 300000 LVL in VSL. Most probably, the error is smaller, though. Graph 2 displays the demand curve with maximum error.

[1] As we use only "Definitely Yes" responses to eliminate hypothetical bias, "Definitely No", "Probably No" and "Probably Yes" all effectively count as negative responses.



Graph 2. Demand for safer drug with the maximum estimated error. Composed by the authors.

Analysis

We have explored the results of our empirical study. The detailed results presented in the previous section can be concluded into four large blocks. Firstly, on the aggregate level we conclude that people are willing to pay more for private risk reduction opportunities while in every case they remain risk averse. At the same time, there is no significant difference between self-insurance and self-protection. Secondly, Latvians are very strongly valuing private risk reduction methods higher than collective ones, even to the extent that they can be differentiated from the other two nations by the fact that they pay relatively more for private and relatively less for collective risk reduction mechanisms. Thirdly, Estonians show some preference towards private risk reduction. Fourthly, Lithuanians do not have clear preferences for any kind of risk reduction mechanism (so they are willing to pay more for collective risk reduction in comparison to private) but they have posted higher bids for collective self-insurance. This is probably a result of lower bids of other nations for collective self-insurance.

The first observation is that participants were risk averse and even to a very great extent. The participants did not only bid more for risk avoiding than the difference between expected outcome in case without risk and the case with risk (see equation 1 above and equations 2 and 3 below). So the negative value participants attain to risk is considerable: they believe they get larger utility from certain, but quite small outcome than from a situation where they have

chances to win more and even the expected outcome is higher than the outcome with certainty. For example, the mean of 0.2 in case of private self-protection implies that people are willing to sacrifice

$$E(Outcome\ \ with\ \ risk) - E(Outcome\ \ with\ \ certa\,\text{int}\ y) = 1.05 - (1.1 - 0.2) = 0.15 \qquad [4]$$

in expected outcome in order to ensure that they have this outcome with certainty and that they will definitely not lose the largest possible amount – 0.4.

The general trend for preferring private risk reduction to collective is intuitive and makes economic sense. In the cases of private risk reduction individuals are able to control risk to the fullest, they are not exposed to risks that may arise from the behaviour or actions of other players. As it is rational to consider risk having negative value then people are willing to pay more to reduce dependence on variables (people) they are unable to control. In addition, collective risk reduction mechanisms are open to free riders and that gives two reasons for lower valuation of these mechanisms. Firstly, people do not like to be free rode on and, taking that into account, they are expected to pay less for such opportunities. Secondly, the results of our experiments (as any other valuation of collective risk reduction must) take also into account the bids of free riders. And that, obviously, decreases the average bid for collective risk reduction mechanisms.

The fact that there appeared to be no difference between risk reduction via self-protection and self-insurance shows that the two risk reduction mechanisms – reducing either probability or severity – are valued as equal. Given that the expected value in the case of self-protection is

$$E(Outcome) = 1 \cdot 1.1 - payment = 1.1 - payment \qquad [5]$$

and the expected value in the case of self-insurance is

$$E(Outcome) = 0.9 \cdot 1.1 + 0.1 \cdot 1 - payment = 1.09 - payment \qquad [6]$$

As these two payments have the same value then there must be something that compensates for the fact that the expected outcome is 0.01 LVL higher in the case of self-protection. At first glance it looks like people are behaving irrationally and that they essentially pay for the fun of gambling (risk). Actually, this difference of 0.01 LVL is so small that even if we corrected for that in the results they would still remain statistically the same, i.e. variances of the bids are high enough to create confidence intervals wide enough. We must conclude that there is no difference for people how they ensure themselves more or less certain outcomes.

Latvians proved to be the strongest followers of overall trends. They value private risk reduction much higher than collective. Consequently, the upper bound for their value of risk

is determined by private risk reduction methods. So, private persons are more efficient risk reducers than collective systems. Which, in turn, means that whenever there are opportunities to mitigate risk via private risk reduction mechanisms, they should be preferred to collective ones (given that the cost of risk reduction is the same for both private and collective options). Furthermore, the (negative) value of risk cannot be determined from collective risk reduction opportunities as this would yield too low valuations of risk.

In comparison with the other two nations, Latvians are valuing collective risk reduction particularly low. So, we should expect less collectively organised risk reduction arrangements in Latvia. At least, the benefit they get from collective risk reduction system is lower. The importance of valuation of different risk reduction mechanisms should be expressed in public policy, taken into account when developing policies designed to direct people's choices about everyday risks.

As Estonians also demonstrated their preference of private risk reduction methods over collective ones, similarly to Latvians, for them private risk reduction opportunities provide more utility than collective self-protection and self-insurance. So, in designing risk reduction opportunities for Estonians, one should take into account that private mechanisms are valued the highest.

Estonians also showed that they value private self-insurance higher than the other two nationalities. While international comparisons are probably of smaller effective importance to real life decisions, there are enough cross-border decisions that might benefit from risk valuation information. As Estonians benefit comparatively more from private self-insurance than others, then in the case of need to use private self-insurance one should get the highest results in Estonia. Given the recent increase in international business, improved connections between the three Baltic countries and further expectations of co-operation on the background of globalisation such decisions will have more and more importance.

Lithuanians did not show traits of preferring any type of risk reduction. So, for them, all risk reduction methods yield statistically equal utility. Which in turn means that when making decisions about risk reduction method for using in some case, one should look at other factors possibly influencing the decision: costs, ease of implementation, possible side-effects and no value should be put on the actual type of risk reduction methods itself. But this applies, as in the case of the two other nations, to domestic/internal decision making.

On the level of international decision making, i.e. comparing nations against each other, one can see that Lithuanians are relatively fond of collective self-insurance. So, analogically

to the case with Estonians and private self-insurance, when one needs to use collective self-insurance then Lithuanians are the ones that will put the highest value on such an opportunity.

The next question that arises is why the experiment shows exactly the results it does. The fact that people in the Baltics value private risk reduction mechanisms higher than collective ones is proven also in other parts of the world, e.g. in Shogren (1990) and seems to be just a natural trait in human psychology. However, there appeared to be differences also between the three nationalities – Latvians favour very strongly private risk reduction, Estonians do it more mildly while valuing private self-insurance higher than others and Lithuanians do not prefer any risk reduction mechanism in particular while they are willing to pay more than others for collective self-insurance. Our experiment does not explore the reasons for the decisions participants made but the results probably root from differences in the mentalities of people. This is and interesting idea for further research but belongs rather to the fields of psychology and history than economics.

Discussion of VSL

We calculated the value of statistical life to be 1450000 LVL. This is to our knowledge the first attempt to estimate the value of statistical life in the Baltic States although the field is well explored in other countries. The value we got is lower than in other studies (e.g. Viscusi (1994) found VSL to be $4.7 million, Blomquist and O'Conor (2002) in the USA $4.94 million), but one has to take into account differences in purchasing power. So, we consider our result to be feasible.

Our sample was rather small, mainly because of the reason that experimental economics is an expensive field and due to the time and resource constraints. There may be biases related to small sample size in our results, but at least observations of data have shown no outliers that may influence the outcome. As indicated above, the result is a bit lower than we expected and therefore the very lowest part of demand curve is not reflected in the calculation. The maximum error from that is 300000 LVL.

Implications

The results of our paper are useful in many spheres. The preferences of different risk reduction methods are useful when designing policies for state and municipal governments, companies, organizations of civil society and other groups of individuals.

The fact that all participants in our experiment together, Latvians in particular, and Estonians to a lesser extent prefer private risk reduction methods over collective ones means that when possible the law makers and trend setters should strive for solutions that allow individuals to mitigate risks and not force them to do that collectively. The results can be lower overall costs of risk reduction (keeping the amount of risk – variance – reduced constant), more risk reduced (keeping costs constant) or greater utility from risk reduction (keeping both costs and the amount of risk reduced constant). The implicit assumption behind these statements – that risk carries negative value – is generally accepted and proven earlier (Kahneman & Tversky, 1979; Shogren, 1990) as well as proven in our study.

There was no difference in valuation of self-protection and self-insurance, so both of these risk reduction methods are equally perceived in the society, at least in terms of price/cost/utility.

Differences between nationalities create opportunities for international decision makers, multinational companies in particular. Providers of services that depend on risk reduction mechanisms (e.g. insurance companies) firstly can diversify their portfolios by taking different approaches in different countries and secondly maximise income by suiting their customers better.

The value of statistical life must be an important decision factor when dealing with risk mitigation or safety decisions. It gives an actual opportunity for authorities to weigh costs and benefits in decisions where human lives are involved and act in line with values of the society, therefore using the resources more efficiently.

The value of statistical life is also important in valuation of various phenomena. For example, one needs to know the value of human life to find values of control of diseases or other similar things. The exact consumer value of statistical human life leads to better estimations of values of control of diseases and, therefore, enables more efficient allocation of resources (based on the values of people).

Implications to other fields

These kinds of experiments about risk reduction can also increase the validity and accuracy of other type of valuation mechanisms such as the contingent valuation method. This is true because our experiments are designed to examine people's choice and actions under risk and uncertainty. As Shogren (1990) states, results to these experiments have implications for two

important issues in nonmarket valuation: determining a complete measure of ex ante value and the continuing use of contingent valuation.

Firstly, with contingent claims individuals are never fully insured, making ex post and ex ante valuation quite relevant. And since complete contingency markets rarely exist, ex ante measures are especially important for nonmarket risk (Helms, 1985). Ex ante measure stands for the smallest payment an individual is willing to pay to stay at the same utility curve given the change in the outcome.

And secondly, our results also give proof to Shogren's (1990) suggestion that the accuracy of the field contingent valuation of nonmarket assets can be increased with the addition of a second-chance bid. This is true as the subjects were able to change their bid after getting information from the market about the highest and the second-highest bid (Table 8). This reflects the learning which individuals go though after obtaining information from the market. And if participants have a second chance to bid for the same situation after the inexperienced hypothetical bid, in the end the result would be more realistic and closer to the actual market response.

Suggestions for Further Research

We consider our research to be the first steps in the field in the Baltics. In addition to determining different values of private and collective self-protection and self-insurance, we see that the experiments could be expanded to explore participants' behaviour over different probabilities and see if the results are robust over various probability periods.

Secondly, although it is very costly we would like to see if the behaviour of participants changes in case of higher stakes – i.e. would the results and risk averseness remain the same if the sums were, say, ten times larger.

Our research focused on ethnic Estonians, Latvians and Lithuanians only. Given that all three countries have considerable minorities in population (Russians in Estonia and Latvia, Poles and Russians in Lithuania), it would be interesting to see if they react to risk reduction methods similarly to majorities and if there are any significant differences among the Russian minorities in different countries.

As stated above, we did not explore the reasons behind the differences among the three Baltic nationalities. The reasons may lie in slight differences in mentality, history or something similar and we find it exciting to determine the causes for such, at the first glance, unexpected results.

The study of the value of statistical life could benefit from increase in sample size and different approaches could be used for that (e.g. mailing used by Blomquist and O'Conor, (2002)). Increased sample size would increase the significance of results and allow for comparisons between different nationalities, ethnic groups and to control for variables that may segment the society (age, education, wealth, income etc).

Finally, we would suggest varying also the risk of fatality in questionnaires about asthma as in Blomquist and O'Conor (2002) to be able to use parametric method for the determination of VSL. Increased sample size would make the use of regressions feasible. Different approaches supporting each other would increase the significance of the results.

Conclusion

The purpose of our paper was to examine how people in Estonia, Latvia and Lithuania respond to risk. That includes responses to opportunities to engage in self-protection and self-insurance, both collectively and individually; it also enabled us to measure how people of the Baltic States value risk.

We posed 3 hypotheses. One of the hypotheses was that individuals do not value possibilities to mitigate risk via reduction of probability and severity differently. Previous work on the field gives different evidence as to which method could be preferred. Boyer and Dionne (1983) argued that risk-averse consumers will always prefer private self-insurance to self-protection, whereas according to Chang and Ehrlich (1985) self-insurance will not be preferred to self-protection since both must be equally desirable in terms of marginal contribution to expected utility. We found support to Chang and Ehrlich (1985) as our results show that there is no statistical difference between the valuation of self-protection and that of self-insurance. The fact that there appeared to be no difference between risk reduction via self-protection and self-insurance shows that the two risk reduction mechanisms – reducing either probability or severity – are valued as equal. We cannot reject the hypothesis that there is no difference between the distributions or means of bids for self-insurance and self-protection and that applies both to private and collective risk reduction. So, when choosing between the two risk reduction methods, then for consumers both result in equal utility and decision of which one to use should be based on other factors than just the risk reduction method.

The second hypothesis was that individuals value private risk reduction opportunities higher than collective ones. In this case, previous research points out that individuals should

prefer private risk reduction methods (Boyer & Dionne, 1983; Shogren, 1990). We reached the same result, as both for the case of self-insurance and self-protection the participants were willing to pay more for private risk reduction opportunities. All in all, the general trend for preferring private risk reduction to collective is intuitive and makes economic sense. Thus, we cannot reject the hypotheses that private risk reduction opportunities are being valued higher than collective ones. Consequently, whenever choosing between private and collective risk reduction methods, one should take into account that private ones result in higher utility for consumers, more risk reduced or lower costs of risk reduction.

Our third hypothesis was that there are no statistical differences between the three nations. When we looked at the three nations separately, we found that Estonians value private self-insurance higher than collective self-insurance, and Latvians are the most homogenous and most strong-trended in their willingness to pay more for private risk reduction. Diversity means that companies can optimise their production and diversify their portfolios of risk between the three Baltic countries.

Regarding statistical differences, our data showed that Lithuanians value private self-protection and self-insurance considerably lower than the other two nations. Apparently, Lithuanians are much more strongly different in their preferences from the average of the three nationalities than the other two. Altogether, Latvians value strongly higher private risk reduction mechanisms in comparison to the other two Baltic nations and they value collective self-protection lower than the others. Estonians seem to be modestly somewhere between the two others, the only difference comes out in the case of private self-insurance, and Estonians value that higher than Latvians and Lithuanians and higher than collective self-insurance.

As the last part of our thesis, we estimated the value of statistical life. Our estimation of VSL is 1.45 million LVL. This result may suffer from small sample bias, however the error does not surpass 300000 LVL and is most probably even smaller. Although the value os statistical life has been derived to be larger in other parts of the world (e.g. USA), we believe that this discrepancy exists due to lower purchasing power in Estonia, Latvia and Lithuania. Value of statistical life enables more efficient decisions on government but also at business level and creates basis and opportunities for further research in related fields.

In total, experiments with the three Baltic nations gave similar results to earlier works in the same field. At the same time, there are also significant differences among the three nationalities themselves, but this diversity is positive and creates opportunities for gains in efficiency.

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Appendix 1

Table 7. Monetary values in experiments in Estonia, Latvia and Lithuania

Value	Estonia	Latvia	Lithuania
Initial amount	22.4 EEK	1 LVL	5 LTL
Size of win	2.2 EEK	0.1 LVL	0.5 LTL
Size of loss	9 EEK	0.4 LVL	2 LTL
Fine for communication	11.5 EEK	0.5 LVL	2.5 LTL

Appendix 2

Table 8. Summary statistic of experiments for risk reduction. Composed by the authors.

Asset Market	Inexperienced Hypothetical Bid (IEHB)			Average Nonhypothetical Bid (ANB)			Experienced Hypothetical Bid (EHB)		
	Mean	Median	Variance	Mean	Median	Variance	Mean	Median	Variance
Private Self-Protection	0.22	0.10	0.05	0.20	0.20	0.02	0.20	0.18	0.03
Estonia	0.29	0.22	0.06	0.22	0.19	0.04	0.22	0.25	0.04
Latvia	0.21	0.10	0.07	0.22	0.22	0.01	0.25	0.20	0.03
Lithuania	0.16	0.09	0.03	0.15	0.11	0.01	0.14	0.10	0.01
Private Self-Insurance	0.20	0.20	0.03	0.17	0.17	0.01	0.18	0.14	0.02
Estonia	0.21	0.18	0.04	0.19	0.19	0.03	0.23	0.21	0.04
Latvia	0.22	0.20	0.05	0.21	0.22	0.01	0.21	0.20	0.02
Lithuania	0.16	0.14	0.01	0.12	0.13	0.00	0.10	0.10	0.00
Collective Self-Protection	0.14	0.10	0.01	0.13	0.10	0.01	0.12	0.08	0.02
Estonia	0.13	0.12	0.01	0.15	0.10	0.03	0.15	0.05	0.06
Latvia	0.14	0.10	0.02	0.09	0.10	0.00	0.07	0.05	0.00
Lithuania	0.13	0.10	0.02	0.14	0.10	0.01	0.13	0.10	0.01
Collective Self-Insurance	0.13	0.10	0.02	0.11	0.07	0.02	0.11	0.05	0.03
Estonia	0.12	0.07	0.02	0.10	0.05	0.02	0.09	0.03	0.02
Latvia	0.12	0.10	0.02	0.07	0.06	0.00	0.08	0.05	0.01
Lithuania	0.14	0.10	0.02	0.14	0.10	0.03	0.16	0.10	0.06

Table 9. Summary statistic of experiments for risk reduction with all observations (before removing 11 observations). Composed by the authors.

Asset Market	Inexperienced Hypothetical Bid (IEHB)			Average Nonhypothetical Bid (ANB)			Experienced Hypothetical Bid (EHB)		
	Mean	Median	Variance	Mean	Median	Variance	Mean	Median	Variance
Private Self-Protection	0.22	0.10	0.05	0.20	0.20	0.02	0.24	0.2	0.05
Estonia	0.29	0.22	0.06	0.22	0.19	0.04	0.33	0.29	0.09
Latvia	0.21	0.10	0.07	0.22	0.22	0.01	0.25	0.20	0.03
Lithuania	0.16	0.09	0.03	0.15	0.11	0.01	0.14	0.10	0.01
Private Self-Insurance	0.20	0.20	0.03	0.17	0.17	0.01	0.22	0.16	0.05
Estonia	0.21	0.18	0.04	0.19	0.19	0.03	0.28	0.22	0.06
Latvia	0.22	0.20	0.05	0.21	0.22	0.01	0.25	0.21	0.05
Lithuania	0.16	0.14	0.01	0.12	0.13	0.00	0.14	0.10	0.04
Collective Self-Protection	0.14	0.10	0.01	0.13	0.10	0.01	0.16	0.09	0.06
Estonia	0.13	0.12	0.01	0.15	0.10	0.03	0.23	0.06	0.11
Latvia	0.14	0.10	0.02	0.09	0.10	0.00	0.07	0.05	0.00
Lithuania	0.13	0.10	0.02	0.14	0.10	0.01	0.17	0.10	0.05
Collective Self-Insurance	0.13	0.10	0.02	0.11	0.07	0.02	0.13	0.05	0.04
Estonia	0.12	0.07	0.02	0.10	0.05	0.02	0.13	0.04	0.06
Latvia	0.12	0.10	0.02	0.07	0.06	0.00	0.08	0.05	0.01
Lithuania	0.14	0.10	0.02	0.14	0.10	0.03	0.16	0.10	0.06

Appendix 3

Asthma Questionnaire (Blomquist and O'Conor, 2002)

Health and Personal Budget Choices

1. Have you ever been told by a doctor that you have asthma? *(circle one number)*

Yes 1
No 2

2. Do you have a close friend or relative who has asthma? *(circle one number)*

Yes 1
No 2

What Causes Asthma?

Table 1: Asthma Triggers

	None at all	Some	A Fair Amount	Quite a bit	Very Much
3. Allergic reactions (e.g. pollen, feathers, molds, pets, dust)	**0**	**1**	**2**	**3**	**4**
4. Household products (e.g. paints, sprays, cleaners)	**0**	**1**	**2**	**3**	**4**
5. Vigorous exercise	**0**	**1**	**2**	**3**	**4**
6. Infections (e.g. common cold, flu)	**0**	**1**	**2**	**3**	**4**
7. Cold air	**0**	**1**	**2**	**3**	**4**
8. Cigarette smoke	**0**	**1**	**2**	**3**	**4**
9. Occupational dusts and vapors (e.g. plastics, grains, metals, woods)	**0**	**1**	**2**	**3**	**4**
10. Air pollution	**0**	**1**	**2**	**3**	**4**

Chronic Moderate Asthma

Table 2: Chronic Moderate Asthma

	Symptoms Without Treatment
How often attacks occur:	• Mild attacks occur more than 1-2 times per week. • Could have history of severe attacks, but not frequent. • Urgent care treatment in hospital emergency department or doctor's office up to 3 times per year.
Chronic symptoms:	Cough and low-grade wheezing often present between attacks.
Ability to exercise:	Wheezing may begin after exertion, especially in cold weather.
Ability to sleep:	Night-time asthma 2-3 times per week.
School or work attendance:	School or work attendance may be affected.

Table 3: Asthma Symptoms

	Not at all	Slightly	Moderately	Quite a bit	Extremely
11. Frequent mild attacks	0	1	2	3	4
12. Occasional severe attacks	0	1	2	3	4
13. Cough and wheezing daily ...	0	1	2	3	4
14. Wheezing when exercising ..	0	1	2	3	4
15. Difficulty sleeping	0	1	2	3	4
16. Difficulty at work or school .	0	1	2	3	4

Medication for Asthma

Again, suppose that you suffer from **chronic moderate asthma,** and your regular physician tells you the following:

> I'd like to prescribe some new medicine for you. If the medicine works, it will help with the symptoms like wheezing and chest tightness, and it will also help you maintain a normal life, including being able to exercise and sleep through the night.

There are two of these medicines available that I can prescribe for you. They are a little bit different from each other and I wanted to ask you about which drug you think might be best for you. I've prescribed these two medicines to about one hundred patients each. Of those one hundred patients who tried **Drug A** about 80 (80/100) have experienced excellent control of their asthma symptoms. About 95 of the one hundred patients (95/100) who are taking **Drug B** have experienced excellent control of their asthma.

I want you to understand that, although these drugs are very effective in controlling asthma, there are risks associated with using them. Sometimes, rather than helping asthma symptoms, these drugs can cause sudden and severe reactions, even death. I don't want you to be alarmed, the risk of dying from taking these drugs is still very small, less than from driving a car; but I do want you to consider the risk of such a fatal reaction when considering which drug would be best for you. About 5 people out of 100,000 who use **Drug A** die from such a reaction each year. The risk for **Drug B** is higher, about 15 people out of 100,000 die each year from reactions caused by Drug B.

Which of These Asthma Medicines Would Be Best For You?

Table 4: Summary of Drug Characteristics

Characteristic	Drug A	Drug B
Likelihood of Effectiveness	**80 %**	**95 %**
Annual Risk of Fatality	**5 / 100,000**	**15 / 100,000**
Length of Effect	**12 hours**	**12 hours**
Minor Side Effects	**same**	**same**
Other (taste, smell, feel)	**same**	**same**
Out-of-Pocket Expense	**5 LVL per month**	**5 LVL per month**

17. Which asthma medication would you choose? *(circle one number)*

Drug A..... 1
Drug B 2
I would not choose either drug 3

Note: If you would not choose either Drug A or Drug B in Question 17 please answer the following questions. If you chose either Drug A or Drug B, skip these questions and proceed to the next page.

a) If you answered "I would not choose either drug" please indicate a reason for your answer. *(circle one number)*

Don't know	0
Too expensive	1
Don't think they would be effective	2
Don't think they are safe	3
Other reason	4

If other reason, please list: _____.

Although you have stated that you would not choose either of these medications to treat **your asthma**, some people with more severe asthma symptoms might benefit from these potent drugs.

Suppose that you were to develop **severe chronic asthma**. Consider Figure 1, which lists some of the characteristics of this form of the disease.

Figure 1: Severe Chronic Asthma

- Virtually daily wheezing.
- Frequent attacks, often sudden and severe.
- Urgent visits to hospital emergency department or doctor's office more than 3 times per year.
- Hospitalization more than twice per year.
- Continuous low-grade cough and wheezing almost always present.
- Very poor exercise tolerance with activity limited.
- Considerable, almost nightly sleep interruption. Chest tight early in morning.
- Irregular school or work attendance.

b) If you suffered from **severe chronic asthma** (as described in Figure 1) and the physician who treats your asthma were to suggest that you try one of these new drugs, which asthma medication would you choose? *(circle one number)*

Drug A.....	1
Drug B	2
I still would not choose either drug ...	3

Please continue and complete remaining sections.

What If There Was An Even Better Medicine?

Table 5: Drug Characteristic and Cost Comparisons

Characteristic	Drug A	Drug B	Drug C
Likelihood of Effectiveness	**80 %**	**95 %**	**95 %**
Annual Risk of Fatality	**5 / 100,000**	**15 / 100,000**	**5 / 100,000**
Out-of-Pocket Expense	5 LVL per month	5 LVL per month	15 LVL per[2] month
Increase in Expense	-----	------	**10 LVL per month**

18. If you were offered a choice between Drug C and the medication which you chose in Question 17 (either Drug A or Drug B), would you be willing to pay *$20.00 per month* more out of your own pocket for Drug C? *(circle one number)*

Definitely Yes 1
Probably Yes 2
Probably No 3
Definitely No 4

19 - A. If you answered "Definitely Yes or Probably Yes" to question 19, please indicate the reasons for your answer. *(circle all that apply)*

Drug C is safer 1
Drug C is more effective 2
Drug C is worth the extra cost 3
I don't care about cost 4
Other reason 5

If other reason, please list: _____.

19 - B. If you answered "Definitely No or Probably No" to question 19, please indicate the reasons for your answer. *(circle all that apply)*

Too expensive 1
Don't think C would be more effective 2
Don't think C would be safer 3
Drugs A or B were safe enough 4
Drugs A or B were effective enough.... 5
Other reason 6

If other reason, please list: _____.

[2] Varied among participants, in their national currency

Appendix 4

Calculation of marginal willingness to pay for 10/100000 change in the probability of survival (the area under the demand curve):

$$WTP = \frac{1}{8}\cdot 30 + \frac{1}{8}\cdot\frac{10}{2} + \left(\frac{1}{3}-\frac{1}{8}\right)\cdot\left(20+\frac{10}{2}\right) + \left(\frac{1}{2}-\frac{1}{3}\right)\cdot\left(10+\frac{10}{2}\right) = \frac{30}{8} + \frac{10}{16} + \frac{10}{48}\cdot 25 + \frac{15}{6} =$$

$$= \frac{180+30+250+120}{48} = \frac{580}{48} = \frac{145}{12} \approx 12.1$$