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THE VALUE OF HUMAN LIFE

Development of an exceptional economic issue in Hungary

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PH.D. DISSERTATION

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'The world is dangerous, the possibility of an accident lurks in every situation of life, this danger and possibility equivalent to human life. Yes, perhaps this danger gives deeper aim and tension for people.

Just think of a human life or the world without the danger of accidents. What an arrogantly self-confident, shamelessly proud and bumptious life it would be! No, the danger of an accident lurks in every moment of you, the objects, the situations, the people, the chemical materials, the static and physical figures are all against you.'

/Sándor Márai: Füves Könyv/

I. INTRODUCTION

The seminar of *Professor David Grrenberg* was the first opportunity for me to meet the approach that put a money value to the value of human life. On that course this trial did not surprise us (the students), because so far we had attained the way of looking at things of cost-benefit analysis (CBA).

Later on, when I decided to choose this topic for my PhD thesis, I realised from the reaction of other people, that this way of looking at things is by no means comes natural to most of them. The monetizing of the value of human life is something that encounters opposition. I think that is right. Human life is not an interchangeable good and its value is not an economic category. The discipline of economics is not the only science that investigates the value of life (other social sciences, some branches of natural science and philosophy also make some efforts), and it must be very cautious in this field.

After a few years, when I began to work on problems of the economic aspects of budget-making and allocation of public funds in the Ministry of Finance, I noticed that the way of thinking of CBA is quite rare even among experts.

One very important goal of my thesis is to contribute to the procedure, in which these kind of researches and approaches become *known* and *accepted* (at least among economists), and its *results* become *applied* in the process of searching for the most effective way of allocating public funds.

I.1. The initial problem

> *'To persons who are not murderers, concentration camp administrators, or dreamers of sadistic fantasies, the inviolability of human life seems to be self-evident that it might appear pointless to inquire into it. To inquire into it is embarrassing as well because, once raised, the question seems to commit us to beliefs we do not wish to espouse and to confront us with contradictions which seem to deny what is self-evident.'*
>
> */Edward Shils: The Sanctity of Life/*[1]

The writer of these rows can identify himself with the above citation as well as other statements of *J. Glover* [1977]. Glover – as we can read it in the Preface – wrote a philosophical book about human life, its sanctity, its value and rights, about saving and extinguishing it. He investigates the problems that dominate the social debates nowadays, like the problem of abortion, euthanasia, capital punishment, suicide and war. However, the presented dissertation does not deal with similar problems. Let us see, what the discipline of economics can put to the problem in question.

In the seventies, with the trend of *institutional economics*, economics began to penetrate into spheres of life that – according to many – do not and cannot belong to this discipline's sphere. 'According to the representatives of the new trend, a human being is able to enforce his or her efforts in a rational and intelligent way not only by individually facing economic decision situations but also through family relations and political activities, even if in donating some money to the poor or handicapped people, picking up a literature fad or trying to act out his or her emotions.' (*Bara-Szabó* [1997], p. 45).

Still, I would not include my present research[2], method of approach or analysis technique in this interesting and challenging trend, even if the subject of the

[1] Citation: *Glover* [1977], p. 39.

examination (*homo sapiens*, the human being itself) would make it possible or even indicate it. Therefore, it is recommended to accurately describe the problem and solution that we will be dealing with in the following sections.[3]

A heterogeneous society presents a very wide range of requirements to the state. Through certain, more or less efficient mechanisms, these requirements aggregate to concrete programs and projects. There is only one economic criterion for realising these programs: their net social benefit (i.e. the difference of the social benefit and the social cost) must be positive and larger than in case of alternative programs.

Among methods that indicate possible relative advantages and disadvantages, the *cost-benefit analysis* has proved to be the most viable.[4] An important characteristic of this method is that it requires indicating the benefits and costs with a *monetary value* when a given economic system is evaluated. This seems to be impossible in many cases. *That is, among other reasons, why we have to specify the value of human life with a monetary value in order to be able to compare it to the values of other items*, i.e. to be able to compare it to benefits of different kinds and to contrast it with the costs necessary for reaching these benefits. It must be seen that in the decisions of various state bodies there is an *implicit* trade-off between human life and other values, such as the values of education or culture. Otherwise, no more libraries would be built until we have erected barriers next to every road, built dams for every river and used all possible means to protect human life. However, because they are scientifically unfounded, the decisions of policy are accidental and subject to the

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[2] The research on which the present study is based on was partially funded by the SSCD (Social Sciences Curriculum Development Program for Selected Central European Universities) program, which is financed by the United States Information Agency. Of course, these organisations take no responsibility for the ideas described here.

[3] I would like to thank to those who helped me select and access to the adequate literature. I would like to especially thank to *David H. Greenberg*, *Sherwin Rosen*, *Pauline M. Ippoliton*, *Shelby Gerking* and *Ann Fisher,* who provided such studies to me that would not have been accessible without their help.

[4] *Boardman-Greenberg-Vining-Weimer* [1996] provides an excellent review on the cost-benefit analysis and the other possible methods. In Chapter II we also summarize the unique characteristics of CBA and its role in Hungary.

politicians' own preferences, which rarely map accurately the preference system of the electors.[5]

What is it all about? We want to specify how the members of society (or a given population) evaluate their own life. It is a widely accepted viewpoint that the state should make decisions concerning spending public money based on the opinion of the society – which 'created' the state in the first place – that is, the preference system of the society should be used as a starting point.

W. K. Viscusi [1983], who is a leading theoretical and practical expert on the subject and filled high positions in the *Ford* and *Carter* administrations, summarised his experience in a book that uses very few mathematical-statistical approaches; therefore, it can be understood by those who are not experts in this field. Nevertheless, the book accurately deals with the most recent developments.

The goal of the book is to introduce the role of the regulating authorities for each program where the risks of losing human life must be taken into account, in some form. The author considers that there are *two crucial roles* for these institutions. One is to *create* (by, for example, providing adequate information) *conditions and circumstances* in which people are able to establish and articulate their real preferences. The other is to *look at and aggregate these preferences* (this is where a cost-benefit analysis can help) and make them appear in the decisions.

There is a consensus in economic society (*Viscusi* [1986], p. 207) that in this context, human life must only mean *statistical human life* and its value should be based on the current *willingness-to-pay (WTP)* of the people. Namely, we have to summarise how much money individuals in the population under review are willing to sacrifice in order to decrease the risk of death by a certain level, or – as another solution – how

[5] Cf. with the well-known theory of *Downs* [1990] and the following professional literature. The cost-benefit analysis, of course, cannot replace the political decision-making, it should rather be considered as an *input factor* in the process. Without the methods to tap the preferences of the society (whose methods must be more than the only procedure of political voting); however, it is impossible even theoretically having an effective or close to effective way of allocating public funds.

much money they are willing to accept as a compensation in exchange for the increased risks (the latter can be called *willingness-to-accept compensation (WTA)*).

The definition and operationalization of the concepts can be found in Chapter V. The following is an example from Hungary to illustrate the relevance of the study topic in public policy decision making.

Ameliorating vehicle traffic in Budapest, the capital of Hungary and its unquestionable traffic centre, has been a request (rightfully) from both experts and residents for a long time. The M0 ring road, which was completed in the mid-1990s, was supposed to concentrically connect the incoming highways and other main roads in order to bypass Budapest.

The accident and death statistics were exceptionally high on a section of highway, some few tens of kilometres. The reason for this is probably an unfortunate combination of several disadvantageous circumstances (construction faults, traffic miscalculations or irregularities of the drivers, etc.).

The real reasons are not important from our point of view. What is important is the fact that spending a certain amount of money, the number of expected deaths – i.e. the statistical death cases – could be definitely decreased, in other words, statistical human lives could be saved. The costs would be different depending on the solution: reconstruction expenses, regulation costs or cost of loss of time due to slower driving, etc.

The question here is whether it is worth it to save *x* statistical lives (i.e. to decrease the chances of the occurrence of death) at *y* expense, whose amount can be determined. This question must be answered by the decision makers. ***The result of our calculations can help decision makers to be able to compare – based on social preferences – the calculated costs with the benefits of saving statistical human lives.*** Such a comparison can only be done (or more accurately, is only worth doing) if the units of measure are the same in both categories. In the present case, this unit is the *value of money*, i.e. the Hungarian forint.

It is important to note that decision makers only *receive certain facts to make their decision.* There can be several reasons for differing from the judgement provided by the numbers: decision makers put different subjective weights on certain cost or benefit items; political factors or the media can influence the decision; and the pressure or indifference of public opinion can also interfere, etc. These factors, however, are outside of the borders of this study. Once we have specified the value of a statistical human life (VSL), we are 'not interested' in the future course of the problem. *Our calculations are only one, albeit important, link in the whole chain; however, without this link, we believe the chain becomes unusable and decision-making becomes incidental.*

I.2. The structure of the dissertation

I set the following triple goal in front of my dissertation, the structure of it is subordinated to reach these goals.

a) I want to present the cost-benefit analysis 'in motion' by reviewing the literature and methodology of this topic. It would contribute to make this method and mental approach known among economists.

b) By examining theoretical questions and testing hypothesis I would like to enrich the scope of knowledge in this field.

c) By the result of my empirical research I would like to help the practical decison making.

In Chapter II I present the *most important characteristics of cost-benefit analysis* and the potential of the Hungarian usage. The *theoretical questions* and the review of the foreign literature take place in the next chapter. In this I show the most important milestones of the road to establishing the concept of *statistical human life*.

Chapter IV occupies an *intermadiate position* between *theory* and *practice*. In this part I present the colourful methodology of valuing human life, its development and the arising theoretical and practical problems. Out of the three main branches of this methodology I go into details in case of two: the *hedonic price method* and the *contingent valuation (CV) approach*. The third one, the so called *consumer or other market approach* is also presented through the most important studies using and developing this method.

In Chapter V and VI empiry gains the main role. First I set my research hypotheses and operationalize the most important concepts. Then I reveal the procedures of my empirical researches based on the methods showed in Chapter IV. One of these researches was conducted four years ago, I have the opportunity to present the results of it. In case of the other research, the dissertation presents the ground-work of the examination using large sample. Three pilot tests, the experiences and the changes induced by them are reviewed. The large sample research itself has not yet been conducted due to technical and financial reasons, it will be one important direction of further steps.

In Chapter VII I carry out a theoretical model about the cost-benefit analysis of a potential regulation for bomb alerts. According to my knowledge there were no efforts took for going thoroughly into this question inside or outside Hungary. My goal by writing this chapter was to show how to use the sophisticated methods and its results in public policy.

The dissertation closes with a short evaluation of the most important statements and results, and the broad outline of the possible research direction in the future.[6]

[6] During the creation of the above structure and the final version of my dissertation I tried to fully satisfy the recommendations that has been drawn up when I defended the plan of my thesis. These recommendations were the following:

1. Erasing the prologue.
2. Making the structure more unambiguous.
3. Making the methodological part more robust.
4. Emphasizing the main statements and conclusions.
5. Giving the practical usability prominence.

I accepted the first three – mainly structural – recommendations and made the required changes. I also made efforts to fulfil the rather substantial and also accepted the 4th and 5th requirements. The whole idea and analysis of Chapter VI is to illustrate how to utilize the considerations of the thesis.

Finally I took into consideration the detailed comments of *Professor László Hunyadi* and *Professor David H. Greenberg* that they wrote to my studies in this topic (*Adorján* [2000] and *Adorján* [2001]). Hereby I would say thank you for the valuable recommendations.

II. COST-BENEFIT ANALYSIS

Cost-benefit analysis is a *method*, but in my opinion it is worth to consider it as a *way of looking at things* or an *approach*. To be able to use this method in solving public policy problems, one has to accept certain philosophical considerations, premisses, and take a stand on other important questions. Questions like 'do we have the right to put money value to human life, the life of an animal or the beauty of a landscape'? The person who gives negative answer to these questions, refuses the justification of the use of CBA.

The main characteristic of CBA – considering it as a direction or channel of thought – is the ability to use its technical tools in almost every sphere of life. This ability does not come from the insensibility of CBA (or the person uses it), rather from the fact, that the involvement of all these aspects of a program results a better decision. Of course, CBA uses its own tools to achieve this goal.

Thus, when an expert monetizes things during the cost-benefit analysis that is unacceptable for some people, he does not do it because he sees the same world with different eyes, quite the contrary, he thinks that the use of all these factors make the analysis more accurate and complete.

In this chapter first we present the key ideas of cost-benefit analysis[7], then the role of CBA in today's functioning of the public sector in Hungary will be shown. During this a short historical outlook will also be presented.

[7] There is no reason to analyse the steps or the method of CBA in details, its literature could fill a library. The following books are accesible in Hungary: *Boardman-Greenberg-Vining-Weimer* [1996], *Layard* [1972], *Lesourne* [1975], *Mishan* [1971a], *Mishan* [1973], *Sassone-Schaffer* [1978] and *Sugden-Williams* [1978].

II.1. The key points of cost-benefit analysis

II.1.1. The most important characteristics of the method

CBA could be characterized by three main features, which are on one hand really the most important ones, and on the other hand, in this combination make it different from any other method or economic procedure.

1) First – because of the use of it in peblic sector programs –, all effects (costs and benefits) should be counted that accrue to a given population or – taking a global perspective – the *whole mankind*. There is no priority to a single person, a public or a private company, or the state itself in contradiction to methods in private sector where the effects on the company itself gain dominance.[8] That is why this method is often called *social cost-benefit analysis*.

2) Second, CBA catalogues *all identifiable impacts* where a cause-and-effect relationship exists between the physical outcome of the project and human being with standing. In case of private sector programs, only the impacts with financial effects count, the process of net present value calculation, which is very similar to CBA as a technique, *concentrates only on cash flows*. For instance, in case of building a dam, CBA involves the caused changes in the biocenosis or the modification in the landscape.

3) Third, CBA *values every impact* (either having any effect on cash flow or not) *in monetary terms*, opposite to other common methods, like cost-effectiveness analysis. This is inevitable if we want to measure all impacts in a common way in order to find out whether the present value of social benefits exceeds the present value of social costs, i.e. the net social benefit is positive or not. In the former case the given project is worth realizing, in the latter not.

[8] Of course, it is impossible to take every effect into consideration in practice. First, some effects or preferences are excluded because they are harmful for the society. (For instance, though people who consume drugs have positive feelings and they are willing to pay for this, we have to thwart the expression of such preferences when analysing the cost and benefits of a program against drugs.) Second, in some cases it is necessary to tighten the perspective to practical reasons.

The *net social benefit rule* directly comes from the *potential Pareto criterion*. Any changes in the allocation of goods is *Pareto efficient* if it makes at least one person better off without making anyone else worse off. The *potential Pareto criterion* (often called *Kaldor-Hicks test*) expect less: any changes in the allocation of goods is *potential Pareto efficient* if the person (or people) who are better off *can compensate* the person (or people) who are worse off. (The point is the *possibility* to find a set of transfers that makes at least one person better off without making anyone else worse off.) That is why potential Pareto criterion is equivalent with the criterion which requires the net social benefit to be positive as a result of the change.

According to all this the following definition can be drawn up:

Cost-benefit analysis is a frame for evaluating the programs, projects, governmental activities in public sector. It is an economic method that values the utility of a project not only from the viewpoint of the participants based on the pure cash flows, but investigates the effect on the whole economy, the welfare of the given society or population. The method tries to attach money value to all social benefits and social costs in order to compare them.

There is one final important feature of CBA yet. It values all impacts in terms of *willingness-to-pay* (or *willingness-to-accept compensation*) and all required inputs in terms of opportunity costs. It means that all benefits are equal to the sum of money the winners are willing to pay and all costs are equal to the sum of money the losers are willing to accept as a compensation, or to the value of the input in its best alternative use.

II.1.2. Philosophical issues and other critiques

„Most of the differences between economists and economic models are the results of the fundamental cultural values and the political differences coming from philosophical considerations."

/Michael Barratt Brown: The models of political economics/[9]

Valuing a human life gained importance among experts and perhaps the whole humankind for practical reasons, however, it would be carelessness to neglect the philosophical problems of the field. ***It is also true that the ethical considerations in connection with the valuing of a human life actually pervade the entire CBA. The reason for this is the way in which economics treats the problem, i.e. the introduction of the concept of statistical human life.*** According to this, the decreasing of the risk of death and so the saving of a human life is a benefit, that must be counted in the same way as other, really different type of benefits, e.g. the joy from the beauty of a landscape or the value of the produced jackets.[10] Therefore, it is worth it to take a look at the philosophical problem, which manifests in two dimensions.[11]

The first problem comes from the name of this method. 'Cost-benefit analysis' fully builds on the principle of *utilitarianism*. According to this mode, all activities have to be valued by the following test: it must be determined whether the pleasure exceeds the pain, happiness exceeds unhappiness, utility exceeds inutility, benefits exceed costs. *Bentham*'s principle of 'the most pleasure to the most people' reincarnates in the criterion of net social benefit maximisation. It is far from the truth if we believed that utilitarian thoughts are widely accepted and expressed among philosophers. The problem is not only how to define *utility, happiness or pleasure,* and how to define

[9] Citation: *Adorján-Hoppál-Mikó-Süveges* [2000], p. 16.

[10] However, producing jackets is quite rare as a benefit of a public program.

[11] *Gillroy-Wade* [1992] presents the widest range of ethical problems and considerations arising in public policy.

their level, but it is also a matter of doubt, whether it is admissible or possible to measure the '*goodness*' of an activity based on such principles and considerations.[12]

The other theoretical issue is also connecting to the basic postulate of welfare economics. According to this, any effects of a program are to be evaluated for the society by reference to what each member of the community is *willing to pay* or to receive for the estimated impact (*Mishan* [1971b]). Thus, this procedure makes the estimated money benefit of a program dependent on the income and wealth distribution among the members of the society or the given population. In other words, people with greater income and wealth have bigger weight in the decision about these programs, their 'vote' is more valuable in saying how the 'cake is divided'.[13] This procedure can be refused 'either because it is felt that the income distribution is inequitable and hence not a just basis of public program evaluation; or it is felt that whether or not the income distribution is equitable it is simply not an appropriate basis for determining the production and distribution of certain goods' (*Acton* [1976], p. 61).

Considering the above ideas *Steven Kelman*'s conclusions are not unexpected. His conclusions are that (1) in certain cases a decision might be right even though its benefits do not outweight its costs, and (2) there are good reasons to oppose efforts to put money values on non-marketed benefits and costs (*Kelman* [1981], p. 33). Further on, with respect towards these considerations we accept the foundations of cost-benefit analysis and built on them in our investigation.

[12] See, for example*: MacIntyre* [1992] and *Sen-Williams (ed.)* [1982] for this subject in detail.

[13] There are techniqes in cost-benefit analysis to defend this problem. One of them is putting weights to certain social groups' or individuals' benefits and costs based on ethical or any other decision makers' consideration.

II.2. The history of CBA and its use in Hungary

II.2.1. From the beginning till the Executive Order of President Reagan

The method of cost-benefit analysis basicly originates in the United States of America. The roots go back to the beginning of the 19th century, when in 1808 the systematic comparison of the costs and benefits was recommended by the U.S. Treasury. The *Food Control Act* in 1936 could be considered as the next important step, which required the U.S. Army Corps of Engineers to evaluate the benefits and costs of all water resource projects, 'to whomsoever they accrue'.

A practical guide to CBA was produced in 1950, nicknamed the *Green Book*. Finally, in the history of the application of CBA the most significant event was the issue of the *Presidential Executive Order* 12291 of 1981 by *President Ronald Reagan*. This requires that a regulatory impact analysis (RIA) accompany every regulatory initiative over $100.000 in cost from government agencies. RIA is a special kind of CBA that identifies distributional and fairness considerations.

Outside the United States, the development of the method has been relatively slow, but recently speeded up. Under the European Community Directive on Environmental Assessment, certain types of projects must undergo a cost-benefit analysis. However, the world outside North America uses CBA only in case of cross-border and other very large projects (dam and highway systems, building airports etc.). Using this method in case of building a zoo or starting a training program is symptomatic only in the U.S.

II.2.2. The role of CBA in Hungary today

There is probably no area in economics whose research, interpretation and application have not changed fundamentally in our region due to the political changes at the end of 1980s and the beginning of 1990s. This is especially true for those parts of economics that were almost nonexistent in the socialist system, such as

several issues of *public policy analysis*, among them, *cost-benefit analysis* and our current subject, the examination of the *value of human life*.

In the socialist system[14], the state had an extensive role in the direction and control of social and economic life. However, due to the logic and the operation mechanism of the system, this required means that were fundamentally different from the North American and Western European practice, which is built on traditional economics and subsequent theories. A theory or a method which is built on scanning the preferences of society is totally incompatible with the planned economy, the bureaucratic coordination, the autocratic ruling and paternalism of the state party.

It is unsurprising that a bit more than one decade was insufficient to integrate this way of thinking into the region's administrative systems and that exercising public policy becomes natural and its methodology is widespread. However, the development of the political system must point in a direction where the state would like to act on the behalf of its 'subjects' (i.e. the citizens) much more than before. The reason for this is that the primary goal of the state is to achieve as high a level of satisfaction as possible for its citizens, because then the chances of re-election for those currently in power is highest.

According to this, the first steps towards the probably long process of widespreading of CBA was made in Hungary at the end of the previous decade. The Government Decree[15] on the governmental task plan in connection with the development of public administration for 1999-2000 prescribed that 'the cost-benefit analysis of decisions and the performance evaluation of work must be ensured in all ministries and central administrative bodies that operate in a ministerial form'. The task plan for 2001-2002 – according to the recommendation of the Ministry of Finance that should play an important role in the process of modernisation – is much more concrete, sets achievable goals, put greater emphasis on the appearence of CBA in different spheres of public administration. It prescribes that

[14] See the classic work of *Kornai* [1992] for its examination in more detail.

[15] Government Decree No. 1052/1999. (V. 21.), Point I/4.a.

a) *methodological assistance* must be given for developing CBA and for the extensive use of it,

b) the *legal background* of the duty of the *application of CBA* must be created (which institutions, under which conditions and circumstances would be obliged to make a CBA),

c) the present *possibilities for applying CBA* and its *obstacles* under the present informatical, human resource conditions, and also the accessibility to databases must be investigated,

d) *the informatical* and *data-safety conditions* must be investigated in order to create *wide and accesssible databases* that could constitute the basis of the use of CBA in public sector and the *first steps* must be made in this direction,

e) the maintainance of the ministerial background institutions must be reinforced by the use of cost-benefit analysis,

f) the use of the money coming on the basis of the *Act about the Subsidy for Developing of Vocational Training* must be scrutinized by the application of CBA.[16]

Out of the six prescriptions four are *indirect*, aiming to create the legal and economic conditions for spreading of CBA. These are very important points of the Decree, however, the real value of them depends on the implementation and the consequent creation of the further steps needed. We can say that at the time of writing this part of the dissertation (October of 2003), only the germ of the implementation can be seen. ***At the moment, the public policy and public funds allocation decisions are mainly characterized by the dominance of the political dimension and the enforcement of particular interests, the lack of the coordination between the professional and the financial aspects and the eventuality.***

[16] The II/12. (first three points), II/15. e), I/1. b) and II/14. Points of Government Decree No. 1057/2001. (V. 21.), respectively.

The last two points contain prescribtions about the *direct* use of cost-benefit analysis. Beside this, that kind of direct indication to the usage of this method can be found in the following parts of the whole Hungarian law system.

a) A Parliamentary Decree from Year 2000 prescribes that CBA must be applied in solving the problems of placement of the scrap item.[17]

b) An Act from the Year 2000 prescribes that choice between the less risky dangerous materials used up for different activities must be based on a cost-benefit analysis.[18]

c) A modification of a Governmental Regulation from the Year 2002 prescribes, that in case of establishing or obtaining a share in a company, a foundation or a public foundation, a cost-benefit analysis must be conducted in order to justify the reason for the existence.[19]

d) A Directive of the PSZÁF[20] mentions cost-benefit analysis as an element of the preparation process of the cost-managing procedure of the voluntary pension-, health-, mutual and private pension funds.[21]

e) A few ministerial and governmental regulations from 2003 on the appropriation of special estimates of the budget prescribes that in case of workplace creation or maintainance programs the competitiveness of the subsidised activities must be justified by a cost-benefit analysis for a certain period of time.[22]

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[17] Parlament Decree No. 38/2000. (V. 5.), Point 5. c).

[18] Act XXV of 2000, Paragraph 20, Section (1).

[19] Governmant Regulation No. 2171998. (XII. 30.), Appendix No. 18, Point 4.

[20] State Supervision of Financial Institutions.

[21] PSZÁF Directive No. 1/2002. (MK 88.), Point 3.2.b4).

[22] Governmen Regulation No. 26/2003. (III. 4.), Paragraph 6, Section (1), Point c); Government Regulation No. 27/2003. (III. 4.), Paragraph 6, Section (1), Point c); MeHVM Regulation No. 4/2003. (V. 8.) Paragraph 6, Section (1), Point c); MeHVM Regulation No. 5/2003. (V. 20.), Paragraph 6, Section (1), Point c).

f) Finally, a lot of ministerial regulations prescribe the compulsary knowledge of the cost-benefit analysis method for various professions and qualifications.

As we can see, the prescriptions for the use of CBA can be found in a *stochastic way*. However, it is unquestionably the road for the public sector towards modernisation. ***A solid economic basis for spending public money is important, and is especially relevant for this region. It is important for EU accession and to ensure that in the future, decision-making will be based on principles and methods that harmonise. Furthermore, it enforces the spirit of democratic thinking and directs the decision-making process of public policy actors into a rational channel as they debate important issues that affect the society.***

III. THE HISTORY OF THE ECONOMIC APPROACH TOWARDS VALUING A HUMAN LIFE

In this chapter I try to follow in the wake of the road, on which economics went through in concerning the concept of the value of a human life. During this I also refer to the relevant philosophical problems.

III.1. The road to establishing the concept of statistical human life

L. I. Dublin and A. J. Lotka [1934] first attempted to specify the 'economic value' of human life. According to them, the adequate method is to specify the discounted present value of the given individual's net future earnings (which is the difference of his anticipated future earnings and his anticipated future consumption expenditures).[23] Although they were also aware that certain 'intangible' ('sentimental' or 'esthetic', etc.) factors also have a role in the value of human life, only *D. J. Reynolds* [1956] attempted to explicitly display these factors years later.

In his study, he examined what kind of costs the society should take into account for traffic accidents, which can be fatal in extreme cases.[24] He specified two, well-definable categories:

a) pain, fear and suffering imposed by the accident (or the risk of occurence!);
b) concrete and ascertainable costs: (1) the loss of future output of goods and services because of the death or injury; and (2) the expenditure of resources spent on repairing the consequences of the accident: e. g. medical expenses, material damages in the vehicle and other properties and administrative expenses.

[23] This is equivalent to the present value calculation process well known in finance. Its difficulty is – in addition to assessing the incomes – to specify the probability of incomes and select the applied discount rate.

[24] In Hungary, the Institution of Traffic Science has made calculations about the social costs of road accidents for decades. According to the results of the year 1998, a light injury costs 0.5, a heavy injury costs 4, and a fatal accident costs 42 million forints for the society. It is important mentioning, that the institution uses the so called *human capital approach* at their calculations. (For details see *Holló* [2001].)

According to *Reynolds*, examination of the first category is beyond the competence of economists. *R. F. F. Dawson* [1967] had a similar opinion, although he made a not too significant difference – he considered the potential victim's future earnings rather than his future output as the adequate basis of the present value calculation.

C. Abraham and J. Thedié [1960] separate the costs and distinguish 'economic elements' and 'subjective elements'. They follow the categories of *Reynolds* in connection with the economic elements; however, they classify the subjective elements and define them numerically. They specified the following five categories:

(1) suffering of relatives;
(2) subjective costs to society;
(3) suffering of non-fatal accident victims;
(4) diminution of the capacity of non-fatal accident victims to enjoy life;
(5) anxiety of individuals concerning the possibility of their own future involvement in accidents.

They chose a surprising method to evaluate these elements: they consider the *court awards* as an adequate basis. Of course, the second and the fifth categories are not considered by the courts: the authors specify the value of the former in a completely subjective way (this way, this category is always subject to the personal judgement of those who carry out the research), while they specify the value of the latter category as the sum of the values of the first two categories. *Dawson* criticized this method in the abovementioned study. He believes that the courts only deal with cases that are more serious than average; thus, the received values are not typical. He also rules out separation of payment made for subjective costs incurred.

The abovementioned four studies belong to a class of professional literature whose common aspect is concentrating mainly (or solely) on the loss of net income produced by the victims or the actual material damages: these we can call, using *M. W. Jones-Lee*'s [1976, p. 47] expressions 'losses of net output' and 'real resource costs'. They also mention what they call 'subjective costs'. Their attempts to

measure them are interesting intellectually; nevertheless, *they were not able to provide a real solution to the correct handling of these subjective elements*.

As a matter of curiosity, it is interesting to take a look at the numerical results the researchers got in terms of the value of human life. *Dublin and Lotka* calculated 9,802 and *Reynolds* 2,000 dollars (of that period), *Abraham and Thedié* 110,000 French francs and *Dawson* 3,430 English pounds.[25]

In a more recent paper of *Dawson* [1971], he came up with a new consideration. He argues that theoretically it is more reasonable to move from a *net* to a *gross* loss of output, where the potential future consumption of the victim also takes part of the costs. The basis of his argument is that the consumption of the victim is also a part of the social wealth, because we have to make the calculations about the social loss as a result of an accident comparing with the situation without the accident. Without the accident that needs to be costed the victim would have stayed alive, thus he or she would have consumed in the future. If we calculate with *net* output, we will see the loss of the society from a *viewpoint after the accident*, thus we ignore the loss of the victim. *Jones-Lee* considers this way of thinking acceptable only if the goal of all programs and projects is to contribute to the maximisation of GNP, which is – on the other hand – not compatible with the potential Pareto criterion used by CBA.[26]

Dréze [1962] was the first who approached the issue from a completely different angle. By doing this, he laid the theoretical foundation of a methodology that is now widely accepted. His analysis has two steps: first he examined the value of increasing safety at the level of the individual. Then he put this evaluation problem into a collective decision-making context. His reasoning was that if decisions that individuals make in situations when uncertainties are present satisfy the requirement of regularity and consistency, then economic tools are perfectly adequate for specifying how much individuals are willing to spend to affect certain improvements

[25] Of course, these data can only be comparable to today's monetary values after some calculations. We can still say that their values were quite low.

[26] This problem will be analysed in details in the next subchapter in connection with *Mishan*'s contributions.

in their safety. Furthermore, he believed that if certain conditions are met, these individual cardinal utilities can be summed up in terms of society in such a way that we weigh each individual's utility function based on how much the community appreciates the opinion of the given individual, then the weighted individual utilities are added up. Thus, we can get the collective utility of each program that is responsible for increasing safety.

T. C. Schelling [1968] also did not concentrate on human life as such, but rather on the *prevention of death*. According to his reasoning, since it is not known exactly whose life would be saved by a given safety equipment, therefore the right question is how much a decrease in the *probability* (i.e. *risk*) of death is worth for the members of the given population. In this sense, this is *statistical death*, i.e. we can only measure the value of the *statistical life*.

His opinion is that when a person dies there are negative effects on the GNP. (These 'damages' are mentioned in the writings of earlier researchers, such as *Reynolds*.) *Schelling*'s fundamental contribution to the economic literature was the concept of evaluating death by individuals, as *customers*. When an individual, as a customer, evaluates the increase of safety, then he evaluates his own life and not the loss of income or GNP of the society, and not even the damages caused to the financial situation of the family of the victim. These factors, of course, contribute to the evaluation of a life; nevertheless, they are not equivalent to it.

In one of the most important studies in this field, *E. J. Mishan* [1971b] makes an attempt to give a short theoretical summary then a crushing critique of all of the methods that come up when the value of human life (or a limb, which is of a similar nature) is specified. Thereafter, he describes his own viewpoint of the problem. He examines four basic methods.

1) We can specify the value of human life as the sum of the discounted value of the future earnings of the given person. This value is modified by such factors as 'premature burial', because the earlier it happens, the higher the present value of the cost (*Mishan* [1971b], p. 688). This method can be rationalized only if the

value of every economic reorganisation is specified based on their contribution to GNP.[27]

2) By slightly modifying the first method, which can be called the '*gross output*' method, we get the second method. In this, we *deduct* from the earnings of the given person the part that he consumes and only the difference is discounted. This way we receive results calculated on the basis of '*net output*'.[28] This method assumes that the only 'interesting' thing for society is what *they* get from the earnings of the person. This term might seem logical at first glance, but it has great risks. What about, for example, those people who do not produce earnings, but still consume? In the case of a simple calculation, the values of these people's life are negative for society. Therefore, their death would be desirable in order to decrease the negative value and gain a net benefit. This idea sounds quite absurd and dangerous.

3) The third method is built on faith in the *effectiveness of political methods*.[29] According to this method, the society does in fact take decisions on investments that are supposed to save human life. Thus, the society evaluates them in an *implicit* way. This logic is entirely contrary to the train of thought of our present research, because we believe that we need to specify the value of human life (deriving quantitive values from an independent economic criterion) in order to help the – more or less political – decision-making about the investments. We do not and cannot assume that society's real evaluation '*automatically'* appears in these decisions.

4) Finally, the *insurance principle* also offers a possible method: we know how much premium a person is willing to pay concerning certain risks that endanger his life with a specifiable probability. From this, the evaluation of his own life

[27] Several researchers came to the conclusion during their empiric researches that the value of statistic life specified according to WTP exceeds the present value of future incomes. (*Low-McPheters* [1983], p. 278).

[28] Cf. *Dawson* [1971].

[29] Cf. Ghosh-Lees-Seal [1975].

can be calculated.[30] There are a number of problems with this method, the most serious one is a logical error: *we do not decrease the risk of our death by life insurance,* we only decrease the financial problems of our loved ones and relatives after we have died. Therefore, when we sign the insurance (and specify the amount), *we don't try to evaluate our life, rather we try to influence the financial situation of others after our death*. A bachelor who lives alone does not have any reason to sign life insurance, even if he may consider himself as 'valuable' as any other member of the society.

There is a single, very serious charge against these four methods: none of them are consistent with the basic rationale of the economic calculus used in cost-benefit analysis. The reason for this, in short, is that this requires the use of the *potential Pareto criterion* as a decision rule for each allocation decision.[31]

With the help of any of the above four methods, we can specify the value of *each* human life, at least in theory. Therefore, we can say that if an investment is expected to require the death of 100 people[32], the value of this 100 people will be part of the costs of the investment. If the benefits will still exceed the costs, then it is worth it to start the investment. However, the *potential Pareto criterion* does not allow this. No amount can compensate people who will die as the result of the investment; therefore, there is no way that this investment can complete the *Kaldor-Hicks test*.

What if we cannot tell which 100 people will die during the investment (this will be the situation in the majority of cases)? In these cases we can only specify the value of each person *ex post*, as costs. Therefore, we can only calculate the net benefit of the investment *ex post*. It is obvious that this is not what we need in general: we need an *ex ante* decision criterion.

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[30] By using a very simplified example, if we sign up for a one million forints life insurance for a single 2% risk (this is an enormous risk!), then we evaluated our life at (1 million × 1 / 0.02 =) 50 million forints.

[31] See Chapter II.

[32] Here I am talking about an investment which costs human life instead of saving it. We have to see that the entire train of thought is valid for both cases, with, of course, opposite signs, since what is cost in one case is benefit in the other.

Before the investment, we can only make statements about probabilities and risks. We do not have the knowledge about the future events. We can only say in advance – using the previous example – that as a result of the investment, if we consider – for the sake of simplicity – a ten thousandth probability of death to everyone, a hundred people from one million people is *expected* to die. We have to calculate the deaths of these currently unknown people as costs. We can say that we would like to know the value of 100 *statistical human lives* in a population of one million people.

In such conditions, we can talk about *potential Pareto-improvement*, since here everybody can actually be *compensated in exchange for the risk undertaken*. The compensation of future victims is also possible, since they do not yet know that they will become victims; therefore, it is the risk of death rather than death itself that appears for them as cost that can be compensated. Therefore, compensation is possible even if later on some of them unfortunately will come to grief – the risk of this is exactly what we compensate.

We have to cover one thing in connection with *Mishan* in more detail. There is agreement among most of economists[33] on accepting the principle that people themselves are most aware of their own interests. Therefore, if a person claims that he is indifferent whether he will not be put in a certain risk or he will be put in this risk for x compensation, then economists must consider the cost of the risk to that particular person to be x.

It is possible that the given person's risk detection is imperfect (more or less everybody's risk detection is imperfect) or he doesn't consider important factors when x is specified or his evaluation mechanism is 'faulty'. However, all these factors also exist at consuming and valuing other goods such as shoes, and we are

[33] There are exceptions. For example, the recently Nobel prize winner *Amartya Sen* [1990] believes that despite the fact that in Indian society women who live in an inferior, disadvantageous situation do not envy the better position of men (this fact can be proven), their specific situation still cannot be accepted. He believes that freedom cannot be evaluated by utilitarian calculations; therefore, we have to reject it. 'The protectors of status quo may be able to find peace and justification in some versions of the utilitarian calculus; nevertheless, this justification is indefensible if we really consider personal freedom a social obligation.' (*Sen* [1990], p. 35)

still ready to accept the price of shoes as their value without questioning. We have to accept the same mechanism in connection with risks and, through them, human life.

III.2. The most important critique of the concensual method

The society of economists use the concensual method in evaluating human lives worked out by *Schelling*, *Mishan* and their advocates. *J. Broome* [1978b] passes judgement on these methods, which gained solid ground.[34] With his article, he stirred a wild debate at the end of 1970s and the beginning of 1980s in well-known American and Western European journals.[35]

John Broome resolutely refuses the conclusions of *Mishan*, who claims that we only *ex ante* know how many victims a project is expected to have, but we do not exactly know the number and the identity of victims; therefore, the project's cost is the *increase of risk of death* (and people must be compensated for this) and *not the death itself*. We are, however, able to measure the level of this increase. According to *Broome,* from the point of view of decision-making, the time when it becomes known who will die is irrelevant. Whether we know or not who will die, the point is that how many will die. He cited the following absurd examples to illustrate his argument.

a) A computer in a locked box stores the names of those who will die during a project. If we open the box, we have to cancel the project immediately according to *Mishan*, because the name of the victims will become *known*. However; the project can be approved as long as it is not opened. (An even more extreme case for this example: the government knows the name of the victims but does not disclose it.) *Broome* considers it *prima facie* absurd.

[34] Cost-benefit analysis is actually often the target of various, nevertheless generally well-founded, critiques. We believe that this fits well in that general process where principles and mentalities of economics expand and penetrate into previously untouched spheres of life, which creates considerable debate.

[35] See *Buchanan-Faith* [1979], *Jones-Lee* [1979], *Mishan* [1981] and *Williams* [1979] among others.

b) People cannot assess very small probabilities, or they assess them as zero. For example, if in a country whose population is 100 million people, the risk of a program is one twenty millionth for each person, then the government can consider the related cost zero, because nobody would individually require compensation for this extremely small increase of risk. In reality, five people are expected to be killed!

c) Imagine that we have to compare two alternative projects. One of them will surely cause the death of a single person, and we know who it will be. The other will cause the death of a thousand people, but we do not know which thousand. According to *Mishan*'s method only the latter project can be accepted if the benefits are high enough.

'These examples help us to see how *Mishan* has gone wrong.' (*Broome* [1978b], p. 93) The theoretical basis of *Mishan*'s argumentation is that we have to accept that each person knows his own interest best. Since we do not know the future – argues *Broome* –, we necessarily do not know our own interest accurately. It doesn't matter whether we do know or do not know the victims, the fact is that there will be some people who will die as a result of the project. Their interest is to refuse every compensation, but they do not know this, thus they are not able to make this decision. They can only make a right decision *ex post*, but *ex post* we cannot measure the costs, because the willingness to pay of the victims is senseless.

According to *Broome,* we should specify the value of life by evaluating the *anonymous human life*[36] (because this indicates that loss of life is sure). However, this is theoretically incorrect; as the society cannot evaluate as an axiom the state of the world that will result after the death of an *ex ante* known, but anonymous human life (similarly, the loss of value because of death, i.e. the value of life) differently from the *ex ante* evaluation of the *ex post* state (and therefore not anonymous) of that

[36] We will give an exact definition to this concept in Chapter V.

same death.[37] However, the latter evaluation is – as we have already seen – theoretically impossible.

III.3. An attempt to synthesize

A. Ulph [1982] tried to make a synthesis in this controversial topic. The author thinks that at the heart of the debate between *Broome* and his critics is the issue whether it is adequate to use *ex ante* or *ex post* welfare judgements when we decide about programs that may kill or save human lives. The conclusion of *Ulph* seems surprising: 'neither criterion is likely to be appropriate; rather, welfare judgements should be based on a mixture of ex ante and ex post considerations' (*Ulph* [1982], p. 266).

Let us suppose that society is faced with a choice amongst D possible decisions ($d = 1, ..., D$). There are S possible states of the world ($s = 1, ..., S$), and since *Ulph* wants to ignore problems of imperfect perceptions of risks in his analysis, he assumes that the probabilities of each state occuring, $\pi_s > 0$, $\Sigma^S_{s=1}\ \pi_s = 1$, are agreed by everyone. Finally, there are I individuals in the society ($i = 1, ..., I$), and if decision d is taken it will yield utility U_{isd} to individual i in state s. Individual behaviour is supposed to be consistent with expected utility maximisation, so let

$$V_{id} = \Sigma_s \pi_s U_{isd}$$

denote expected utility for individual i if decision d is taken. Suppose that there exists a $W(.)$ social welfare function that represents a well-behaved social preference ordering over the decisions $d = 1, ..., D,$ where

$$W(d) = W(U_{11d}, ..., U_{ISd}, \pi_1, ..., \pi_S). \qquad (1)$$

[37] This, of course, depends on what axioms we accept concerning the social evaluation or the social welfare formula. For the detailed analysis of the issue, see the study of *Ulph* [1982] in the next subchapter.

What properties should this function satisfy? *Harsányi* [1955] proposes two restrictions which are relavant in the value of life debate. The first is that W should be written as an increasing function of individual expected utilities. This is the *ex ante restriction* that requires W being able to be written as

$$W(d) = W_1(V_{1d}, ..., V_{Id}). \qquad (2)$$

Thus, the social welfare function should reflect private tastes and preferences as these exist at the time of the social decision. As we have seen before, the advocates of this characteristic of W are those who prefer *ex ante* decisions.

The second restriction is that social welfare should be based on the axioms for expected utility maximisation, which *Ulph* calls the *ex post rectriction*, since it requires the existence of an *ex post* welfare function W_2 such that

$$W(d) = \Sigma^S_{s=1} \pi_s W_2(U_{1sd}, ..., U_{Isd}). \qquad (3)$$

The most important assumption we require for social welfare to be consistent with the axioms of expected utility maximisation is the 'sure-thing' principle, or the independence of irrelevant alternatives assumption. This means the following. Suppose decision d yields the same utilities in all state of the world as decision d', except in state t. Then if society *ex post* is indefferent between the distribution of utilities in state t as a result of decision d and decision d', it should be indifferent between d and d'. It is exactly the principle that Broome is appealing to when he argues that a project which involves the certain death of one person of a number of identical individuals, where the only uncertainty concerns the name of the individual who is to die, should be treated as equivalent to an identical project where the name of the individual who is to die is known *a priori*. Thus *we must evaluate the statistical death equivalent to the certain death.*

The *ex ante* and *ex post* restrictions need not be in conflict, but it is now well known that the only welfare function which satisfies both restrictions is the *utilitarian* function

$$W(d) = \Sigma_i \alpha_i V_{id} = \Sigma_i \alpha_i \Sigma_s \pi_s U_{isd} = \Sigma_s \alpha_s \Sigma_i \pi_i U_{isd}, \qquad (4)$$

where α_i is the weight of individual i in the calculations ($\Sigma_i \alpha_i = 1$) (*Harsányi* [1955], p. 314). Both of the restrictions can be applied under certain circumstances, but not always together. The welfare function (1) should embody a mix of *ex ante* and *ex post* considerations. After this, *Ulph* illustrates his viewpoint in the debate with the help of an example with real numbers. Now we present only the summary of his conclusion (*Ulph* [1982], pp. 269-270).

a) If social welfare can be represented by the *utilitarian* function (so we consider this type of function adequate), it would be appropriate to use the cost-benefit approach of evaluating compensation for the risk of death. Since in this case society treats statistical and known death equivalently, the same method should be used, i. e. one treats known deaths *as if* they were statistical deaths.

b) If social welfare satisfies only the *ex ante* criterion then the conventional cost-benefit approach will be appropriate only in case of statistical death. In this case one would need to incorporate society's distributional judgements to evaluate how much of an increase in the incomes of those who live is required to compensate for the loss of life.

c) If social welfare satisfies only the ex post criterion then society wants to treat known and statistical deaths equivalently. In this case, however, the conventional cost-benefit approach will not be relevant.

d) Finally, if both restrictions are unsatisfied by the social welfare, then the conventional cost-benefit approach will not, in general, be appropriate, and the society doesn't wish to treat known and statistical deaths equivalently.

Thus if social choice will be reflected 'only' in the general social welfare function as in (1), rather than the restricted form of (2), (3), or (4), then it will be inappropriate both to judge decisions involving death solely on whether *ex ante* welfare will

increase and to treat statistical and known deaths equivalently, although both of these considerations form part of society's judgement.

III.4. Summary of Jones-Lee in the problem of value of human life

In the following sections I present some ideas of the well-known book of one of the leading experts in this field, the Englishman *M. W. Jones-Lee*. The goal of *Jones-Lee* [1976] was to summarize all the knowledge of this field for the readers who want to see this problem with an economist's eyes. The author pays attention to the mathematical and statistical basement of the problem and to other branches of science that deal with it (mainly to psychology, sociology and decision theory). I dont't have the intention to write about all of these aspects, but in my opinion it is worth mentioning one thing in connection with the above considerations: the synthesis of *Jones-Lee* about the question of what benefits (or costs) should be incorporated in the calculations in case of saving (or losing) a human life.

According to *Jones-Lee* when an investment improves the safety of human lives, the social benefits per life saved (V) of this improvement can be divided into at least three components (*Jones-Lee* [1976], p. 118.):

a) the (average) value of avoided real resource costs per life saved (V_1),
b) the (average) value of avoided loss of net output per life saved (V_2),
c) the (average) value of human life *per se* (V_3).

V_1 and V_2 reflect the economic losses occasioned by death, whereas V_3 component is due to society's aversion to the event of death *per se*. The total benefit (B) in case of saving *s* human lives is the following:

$$B = s \times V = s \times (V_1 + V_2 + V_3).$$

The researcher puts the question how the essentially non-marginal concept, V_3, is related to the marginal value of change risk. (Earlier on we declared that only the

evaluation of the marginal change in the risk of death is consistent with the potential Pareto criterion.) *Jones-Lee* proves that V_3 and the marginal value of a change in risk can be very simply related. Leaving now the mathematical details, the key point is that if all members of a group of N people evaluates the improvement in safety

$$(s/\mathrm{N})\times(\text{marginal value of safety})$$

(supposing that on one hand the subjective decrease in risk is equal to the objective level and on the other hand s is very small in relation to N), then the value of the improvement in safety is

$$(s/\mathrm{N})\times\Sigma(\text{marginal value of safety})$$

for the given group of people, thus – according to our approach – it is eual to the value of s human lives, and so the value of one human life is:

$$V_3 = (s/\mathrm{N})\times\Sigma(\text{marginal value of safety})/s = \Sigma(\text{marginal value of safety})/\mathrm{N}.$$

In this way the disparities of the concepts of a ’value per life saved’ and the ’marginal value of a decrease in risk’ are eliminated.

Instead of mentioning all the topics that the book deals with, let me write about the limitations of the researches and the results. The most apparent restriction is that we consider the individuals displaying sufficient order and consistency in choice situations to make expected utility maximisation a legitime hypothesis for our purposes. The reality of this hypothesis has been questioned many times by many experts. Hereby we only mention the most important efforts.

H. M. Markowitz supposes in his classic *portfolio theory* that investors are not neutral to risk (that would come from the expected utility theory), rather, most of them are risk averse (*Markowitz* [1952], *Neumann-Morgenstern* [1944]). Thus, in the process of drawing up an effective prortfolio the expected yield is not the only factor to involve, the risk of the portfolio also counts.

Kahneman and Tversky presented a powerful critique of expected utility theory as a descriptive model of decision making under risk, proving that the axioms on which the theory of *János Neumann* and *Oscar Morgenstern* is built are not valid. They developed an alternative model, called *prospect theory*, in which value is assigned to gains and losses rather than final assets and in which probabilities are replaced by decision weights (*Kahneman-Tversky* [1979]).

Some of the theories did not reject the theoretical basis of expected utility theory, but made a few modifications on them in order to elimininate the paradoxes it resulted. One of the most promising attempts is undoubtedly the *regret theory* of *G. Loomes and R. Sugden* (*Loomes-Sugden* [1982]).[38]

According to *Jones-Lee* ([1976], p. 152.), the expected utility maximisation hypothesis scores well in any sensible overal weighting of the desirable performance criterion of such a theory (e. g. explanatory power, generality, predictive capacity), thus it is the most popular theoretical foundation for the analysis in choice under uncertainty. There are, however, important limitations that should be considered. We cannot investigate the connections between subjective and objective probabilities. The expected utility theory deals with subjective interpretation of probability. At least two difficulties arise. When we quantify the probabilities we assume that subjective probabilities could be identified with relative frequences (*s*/N). According to *Jones-Lee*, there is no reason to suppose that over a large sample of individuals, there will be a systematic divergence between the two when information concerning the frequencies is available. The more alarming assumption is that each member of the relevant population will adjust his degree of belief in the event of his own death to an extent which can be precisely described as a reduction of *s*/N in the subjective probability of the event. It seems rather unlikely.

An other problem appears from the fact that individuals can feel having the opportunity to influence their own safety by e.g. expenditure on marketed safety

[38] Unfortunately the description of the intellectually really interesting theory is beyond the frame of the thesis.

instruments. The existence of such opportunities may mean that an individual will react to risk reduction showing less willingness to pay, because by spending money on private safety improvement he can reduce the risk cheaper for himself. This effect causes a downward bias in our calculations.[39]

Finally, the researher mentions two phenomena that will be described in details in the next chapter. One of them is perhaps the most serious limitation of the *contingent valuation* method, namely, the estimates concerning the willingness to pay for risk reduction are derived from responses to *hypothetical* situations. Its relation to the real world is at least not unambiguous. The other problem comes from the treatment of the death. Throughout the discussion, at the theoretical as well as the empirical analysis, death is treated as a *unique* event. However, beside the *fact* of a death, the *way* of it is also important. Most people presumably prefer to die quickly and painlessly, and thus evaluate the risk of this death less.[40]

[39] We do not have to calculate with this effect in the other direction. If the use of a private equipment to reduce the risk is more expensive then the individual will not change his willingness to pay to a given risk reduction.

[40] *Jones-Lee* probably did not know the famous Hungarian poet, *Sándor Petőfi*, who in his famous poem (‘Egy gondolat bánt engemet...’) undoubtedly assured the reader that people can evaluate the different way of death quite differently.

IV. THE COLOURFUL METHODOLOGY

In the previous chapters I analysed all the theoretical considerations and questions that assure adequate basis to the empirical work. The next chapters are devoted to empiry. During the previous decades, three main branches of the evaluation of statistical human life gained ground. The first is the so called *consumer or other market approach*, the second is the *labor market approach*[41] and the final one is the *contingent valuation method.*

The first subchapter describes the method, in which researchers investigate market behaviour, thus real, revealed preferences, but these markets are not the labour market (that is why it is often called *other* market approach). The labour market approach is an independent direction of researches, the second subchapter deals with it. Finally, the experts of this field can lean on the result of researches which try to map the preferences with the help of building up hypothetical situations (markets). The third subchapter is about this method. The latter two methods (i.e. the hedonic price and the contingent valuation method) are applied in my researches, as I know, for the first time in Hungary. The review of these researches can be found in Chapter V and VI.

IV.1. The consumer market approach

The common feature of the *other market* or *revealed preferences studies* is that they specify the risk-money *trade-off* by examining *real* market decisions. The main problem is that risks are not directly traded in the markets; thus – as an alternative – the market of such products can be examined that are closely related to risk or life-threatening danger. However, customer decisions are fairly complex in these cases as well, and it is hard to isolate the effect of one single factor (usually the intention to increase safety). Additionally, there are few products whose risk (or ability to reduce

[41] Also called compensating wage differential studies, wage-risk studies or hedonic price method. We can consider these concepts as synonyms.

risk) is relatively accurate known by the general public, and this is a basic requirement for such a study.

Another solution is to examine market decisions – in connection with some kind of activity or service, rather than a product – where considerations of security are important (e.g. use of pavement or safety belt, the selection of adequate vehicle or speed limits). The problems with research projects in this category include the – previously mentioned – isolation problem, the lack of accurate knowledge concerning risks and the fact that it is generally hard to assign money values for factors that play a part in decision-making or reduce risk. For example, the benefit of the decision in connection with the use of safety belts is reduced risk. In exchange, they require a certain amount of time and they are a little inconvenient. However, how much is the loss of time and the inconvenience worth to people? We can try to specify this; nevertheless, we should handle the results carefully.

Because of all these reasons, research projects such as these generally provide less reliable results for the value of risk to people. They should rather be considered as interesting – but valuable – intellectual exercises. For this reason, I do not apply this method at my empirical researches and also strive after concision in describing the most important studies in the following subchapter.

IV.1.1. Investigating the optimal motorway speed

The authors of this pioneer study, *D. Ghosh, D. Lees* and *W. Seal* [1975] built their research on the assumption that there exists a socially optimal speed on motorways, at which the marginal social benefit from increased speed (coming from the saving of time) is equal to the marginal social cost (coming from the increased fuel consumption and the increased risk of accident).

The trio dertermined the relationship between speed and time-saving, speed and fuel-consumption and speed and casualty (the first is based on a simple function, the latter two are based on statistics). Then they expressed the optimal average motorway speed as a function of (among others)

a) the total traffic volume in miles per month,
b) the value of time,
c) the price of fuel,
d) the average cost of accidents.

If we put a numerical value to *n*-1 variables in the equation that can be created, the value of variable *n* can be calculated. The authors employed 0,35 pounds per gallon as the price of fuel, 2.445 pounds as the social cost of accident derived from the work of *Dawson* [1971]. Using these data they obtain the following optimal average speeds corresponding to various alternative values of time:

at 1,00 pound/hour[42]:	67,45 mph,
at 0,50 pound/hour:	47,69 mph,
at 0,25 pound/hour:	33,72 mph.

From our viewpoint that part of the study is much more interesting when the researchers assume that the *actual* average motorway speed was in fact *optimal* as well. The value of time of 1,00 pound/hour and the price of petrol of 0,35 pound/gallon are then shown to imply a value of life (the cost of a death caused by a motorway accident) of 94.000 pounds. It must be mentioned that this value is very sensitive to the price of petrol and also to the (shadow) price of time. For instance, if we decrease the value of time *ceteris paribus* to 0,63 pound/hour, the calculations will result zero value for a human life.

IV.1.2. Investigating the market of smoke detectors

The basic assumption of the study of *R. Dardis* [1980] is that individuals know the probability of domestic fires and also the reduction of the possibility of injuries or

[42] In that time it was the level of wages approximately. The whole interval of saving time is not so valuable, that is why it is necessary to make the calculations with lower figures as well.

deaths resulted by using a smoke detector.[43] With the help of the probabilities and the price of smoke detector, the value of a stitistical life can be calculated. Those people who purchased the equipment in the given interval (it was 13 percent of the whole population in 1976) evaluated the human life more, because they would probably pay more money for the smoke detector (because market price is equal to the *marginal* willingness-to-pay of people who purchase). Among them, we are able to give only the lower bound of their evaluation. Those who did hot purchase the equipment evaluate the human life less, because the market price is probably not the lowest price that they wouldn't give for the detector. Among them, the market price is an upper, and zero is a lower bound of their willingness-to-pay.

As always, a few difficulties arise. The benefit of the smoke detector is not only the saving of lives but also the reducing of the probability of injuries. As we are only interested in the former one, we have to know the ratio of the two. There does not exist any procedure to gain the information about the relative importance of the two effects, thus the researcher applied three different weighting schemes. She put 50 percent, 10 percent and 0 percent respectively to injury.[44] The level of the applied discount rate for evaluating the cost of the replacable batteries was also questionable. *Dardis* used both 5 and 10 percents. Finally, the price of the equipment showed a considerable fall during the time priod 1974-1979, thus the calculations were made for every year then an average value was determined. Table 1 shows the results.

Table 1. Implicit value of human life (time period 1974-79, in dollar).

Discount rate	*Weight of injury*		
	0,5	0,1	0
5%	189.049	239.239	256.652
10%	217.273	274.956	294.968

Source: *Dardis* [1980], p. 1081.

[43] *Dardis* chose the market of smoke detectors for his researches, because the cost of the usage is almost entirely the price of the equipment with the needed batteries, the benefit is – beside the saving of material things – the reduced risk of death and injury.

[44] According to the author, perhaps surprisingly the 0 percent scheme seems to be the most realistic, since campaigns have focused on the life-saving role of smoke detectors.

As it was mentioned above, the results provide an overestimate of the value of a life to the total population, since at the majority of people the estimations were upper bounds, and only at a minority of them are proved to be lower bound.

IV.1.3. Hedonic models outside labour market

Two important studies deal with the risk element of the price of certain market products. *P. R. Portney* [1981] attemted to measure the risk premium in the housing prices coming from the level of air pollution in the area. *S. E. Atkinson* and *R. Halvorsen* [1990] investigated the market of automobiles with different characteristics such as safety in order to determine the implicit price of risk.

Both researches use similar methodology: they build up a regression model with the dependent variable of the price of the given thing (i. e. the house or the automobile) and the independent variables (such as the risk variable, the personal characteristics of the consumer and the special characteristics of the given purchased thing – e. g. the fuel efficiency, the acceleration, the comfort by cars and the infrastructural circumstances, the neighbourhood by houses).[45]

The research and results of *Portney* needs more caution. In his summary he also mentions the limitations of his method. The most important one is the unreality of the assumption that people are aware of the approximate level of air pollution and – as a second step – aware of the health risk of that. The existence of the knowledge about the level of air pollution is doubtful, but the same assumption about the effect of it on the human body is rather totally unrealistic.[46] And even if the purchaser knew all this information, it would be still questionable whether he would enforce this knowledge in the mechanism of price determination, or, in case of enforcing it, we still don't know whether he paid attention only to the level of mortality risk or other harmful characteristics of air pollution. *Portney* received 142.000 dollars as the implicit VSL.

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[45] See the detailed description of the method in the following subchapter.

[46] An earlier research showed that people systematically underestimate the harmfulness of air pollution to a considerable extent (*Jones-Lee* [1989], p. 73).

The study of *Atkinson* and *Halvorsen* 'provides the most comprehensive analysis of risk-dollar trade-offs outside labor market' (*Viscusi* [1993], p. 1937). They investigated the data for 112 models of new 1978 automobiles. Unit sales by model varied from a minimum of 5.857 to a maximum of 401.392 dollars that shows the wide range of the sample and therefore the wealth situation of purchasers. The result they received is similar to that of other methods': the weighted average estimate of the VSL for the sample as a whole was about 3,4 million dollars; it was 6,6 million for the lowest risk quartile and 0,8 million for the highest risk quartile.

IV.1.4. The effect of a new information

P. M. Ippolito and *R. A. Ippolito* [1984] realized that the conventional researches based on revealed preferences have serious restrictions which were mentioned earlier on. In their analysis they attempted to defend these sources of errors.

It is worth mentioning that – in contrary to other experts of this field – the authors are not academic people, rather they work as officials for the U. S. Government. Their basic premise was that the receipt of information concerning the health effects of smoking would have a result in two ways: (a) the entire demand for cigarettes would decrease and (b) the consumption would switch from cigarettes of higher nicotine content to those of lower one. Both of these two effects are the result of the higher *perceived* risk of cigarettes, however, the compensation for a *real risk reduction* was able to be studied.

They operationalized the risk of smoking as a change in life expectancy per unit cigarette consumption to obtain what they called *annualized value of life-saving*. The estimates for this figure was found to vary widely accross the population and to be highly high-skewed, with a mean of between 5.142 dollars and 16.008 dollars per annum in 1980 prices. The average was 8.622 dollars. In order to compare these estimates with the results of other empirical studies, we have to summarize for an entire life. This operation has lots of theoretical difficulties, e. g. choosing the adequate discount rate. The most serious one is that we have to assume that the marginal rate of substitution of wealth for life expectancy is uncorrelated with life

expectancy itself, thus multiplying the mean of one by the mean of the other will produce an unbiased estimate of the mean of their product. Simply saying we have to assume that this rate of substitution is independent from age.[47] Bearing in mind these caveats, the best estimate of the authors of the VSL falls in the range 300.000 – 600.000 1980 dollars, which is considerably lower than the previous results.

IV.2. Labour market approach

IV.2.1. Description of the method[48]

The Scottish father of modern economics, *Adam Smith*, in his famous book *Wealth of Nations* first described the thought that specific circumstances 'make up for a small pecuniary gain in some employments, and counterbalance a great one in others: First, the agreeableness or disagreeableness of the employments themselves. … The wages of labour vary with the ease or hardship … of the employment.' (*Smith* [1776], in: *Smith* [1992], p. 109). This phenomenon is the basis of calculations that are based on the *compensating wage differential for risk.*

According to the basic economic theory of the labour market, the prevailing level of wages is such that the aggregated market demand (i.e. the demand of the employers) is in balance with the market supply (i.e. the supply of employees). It is also obvious that the job held for a given wage is nothing else but a set of features or characteristics. Depending on these features, the employer is willing to part with a certain amount of money for the person who holds the job. The employee also forms his opinion concerning compensation based on these same features. Security is one of the basic features of all jobs; i.e. how much risk the work carries to human life. In those jobs, where the risk is higher than in *ceteris paribus* jobs, i.e. jobs whose other

[47] This assumption is not realistic. Theoretical and empirical evidence both suggest that this rate of substitution declines with age (*Jones-Lee* [1989], p. 74).

[48] The *wage-risk* and *hedonic price method* expressions are also used for the method of *compensating wage differential studies* that built on the *labour market approach*. In the followings we will treat them as synonyms.

circumstances are similar, the payment must also be higher: i.e. the wage must contain a risk premium. The reason for that is primarily the following:

a) employees are only willing to hold a job with higher risks for higher wages;
b) to avoid higher risk means higher expenses for the employer; therefore, they are only willing to pay less wages for more security.

Jobs with higher risks, therefore, result in *ceteris paribus* higher compensation. It is known that in real life *ceteris paribus* comparisons are seldom possible, because behind every wage, there is an employee with specific features and a workplace with individual peculiarities.

Our task is to specify how certain factors affect the wage rate: i.e. the dependent variable (w_i). These factors include the personality features (x_{im}, $m = 1, \ldots, M$); various other factors, including some in connection with the given job, but not including risk, (z_{ik}, $k = 1, \ldots, K$); separately, the fatality risk of the given job (p_i). The following formula is the basis of the regression calculation to be used in this case:

$$w_i = \alpha + \Sigma^{M}_{m=1}\psi_m x_{im} + \Sigma^{K}_{k=1}\xi_k z_{ik} + \gamma p_i + u_i,$$

where is a constant term, u_i the random error term reflecting unmeasured factors that influence the wage rate, and ψ_m, ξ_k and γ are the coefficients of the given variables. Of the coefficients, only the last one is interesting from our point of view. It indicates how much in terms of additional wages the *increase* and the *decrease* of a risk is 'worth' in the labour market. In the previous case, the worker accepts the additional risk for this amount of wage increase, while in the latter case the worker is ready to give up this amount of money from his wages in order to decrease the risk of his job by a certain level.

Those who support this approach argue that the value of a statistical human life can be calculated by *real* data that have been tested by the market.

The model is logical and illustrative, but for its validity, we need some assumptions that only in some cases or never meet reality. We will discuss some of them in details later on in connection with a described study in this field, however, it is worth mentioning here the most important ones.

a) We assume that we manage to find all the relevant independent variables.

b) We assume that workers perceive their job risks well.

c) We assume that workers are mobile so that they can move from one job to another, thus they are able to enforce their prferences towards risk in their wages.

Other limitations of the method should also be mentioned:

a) The risk variable is measured by the fatality risk, because it is equal to the risk in loss of life. However, the risk that is reflected in the wage rate arises in injury risk in many cases (e. g. in case of workers at assembly line).

b) The independent variable is the wage rate, however, it is only one part (though the most important) of the compensation packet.

c) It is questionable, whether net or gross wage rates are appropriate. The net values seem to be more reasonable, but in this case the change in tax system causes hardly solvable problems.

d) Even if the model works perfectly, it is only able to measure the willingness-to-pay values for the worker's own risk. In reality, all people are altruists to a certain extent, so willing to pay for other people's safety. These evaluations should also take part of the value of a statistical life.[49]

e) Finally, a very important limitation of the use of the method is that it is only capable to work with one type of risk – namely the risk of work –, thus cannot involve the *kind* of the risk as a factor.

[49] *Viscusi-Magat-Forrest* [1988] investigates this problem in details.

In the following subchapters studies using the labour market approach or developing the method itself will be described.

IV.2.2. The earliest important researches

It is worth beginning the review of the most important studies with the work of *R. Thaler* and *S. Rosen* [1976]. On one hand, it was chronologically the first considerable attempt, on the other hand, due to its advantages and also disadvantages, it is the most widely quoted compensating wage differential study.

The risk data employed concerned probability of death for individuals in 37 hazardous occupations and were obtained from the *US Society of Actuaries*. The researhers used up these data and built them to an earlier database of a sample of 907 individuals in the various risky occupations, which database contained data concerning variables such as geographical location, family size, nature of industry, unionization, nature of occupation, age, education and weekly wage.

After this, they ran different (linear and semilogarithmic) regressions modifying the set of explanatory variables, and investigated the coefficient of the risk variable. The results were mixed. Out of the eight regressions only one had a risk coefficient significant at the 5% level and two at 10%. The VSL implied by these estimated risk coefficients also took place in a large interval, ranging from 5.000 to 260.000 1967 US dollars. The lower estimates generally came from equations with interaction terms (e. g. age×risk, married×risk). It implies that the risk data reflected other factors than the riskiness of the occupation itself, e. g. the specific demographic and lifestyle characteristics of the people who worked in the given occupation.[50] This phenomenon makes it possible that according to the results a bartender must face higher risks than a fireworker. It is obvious that this kind of risk comes from the lifestyle of individuals attracted to the given occupations and not the occupation itself. As a conclusion, *Thaler* and *Rosen* put the VSL near 200.000 1967 dollars.

[50] It can be generally stated that the early wage-risk studies used an inappropriate measure for the risk variable, thus they obtained estimates mainly in the low range, but sometimes in the high range (*Fisher et al* [1989], p. 91).

A couple of years later *A. Marin* and *G. Psacharopoulos* [1982] investigated a wide range of data concerning risk, individual and job characteristics for a large number of different occupations ranging from managerial and professional to manual workers in their study conducted in the United Kingdom. The novelty of their approach was the use of two different measures for risk. The first one (referred to by the authors as GENRISK) reflected the excess risk of death for members of each occupational group over and above the risk faced by members of the *general* population of the same age and social class. The way of calculation: the actual death rate of the members of the occupation *minus* the death rate that could have been expected given the age and social class structure of workers in the occupational group. This measure is similar to that employed by *Thaler* and *Rosen*.[51] This approach was subject to the criticism that the excess risk may include elements that are totally independent from the occupation or the job. It obviously distorts the results.

To eliminate this, the authors defined a second risk measure, ACCRISK, which was based upon the *excess risk of a fatal accident at work* in each occupation, over and above the *average* risk of such an accident for workers as a whole, taking account of the age pattern of the group.

The researchers ran a regression analysis on the entire sample and also on subsamples of managers and professionals, non-manual workers and manual workers. The estimated coefficients were positive in all cases, significance tended to increase moving from the *managerial* to the *manual* end of the spectrum. (According to *Marin* and *Psacharopoulos* the relative lack of significance in case of managerial workers is not surprising, because for most managers and professionals there is a zero or negative excess risk of accidental death at work.) Using the preferred ACCRISK variable, the duo gained 650.000 1975 English pounds for the VSL. This value is a bit lower among manual workers, but considerably higher, about 2,2 million pounds among managers and professionals.[52] When they made the same

[51] As I mentioned above, it is common in the literature of this field to compare all wage-risk studies to that of *Thaler* and *Rosen*. I don't want to disregard this tradition.

[52] This fact seems to underpin the argument accepted widely that *safety is a superior good*.

calculations by the traditional GENRISK variable, results became lower, as it was expected.

Finally, two subsidiary regressions were also run. At the first, the risk variable was put in the model in a quadratic form. In this case, the risk coefficient was not significant. The second regression was run for a subsample comprising the top third of the jobs in terms of risk. The risk coefficient in this case was not markedly different from that for the whole sample. These results therefore did not support the hypothesis that the wage-risk function in equilibrium is concave, so that workers having the most risky jobs are less risk-averse than others.

The study of *V. K. Smith* [1983] had a lot of novel considerations. First – according to *Smith* – among the independent variables not only the demographical and occupational or work-related features should be represented, but also the characteristics of the neighbourhood where the workplace (and often the living place) settles down such as crime rate, air pollution, cultural and infrastructural facilities, unemployment rate and weather. The approach is based on the hypothesis that household's choice of residential location will also be reflected in wage rates. (This hypothesis is much more realistic in the United States than in Hungary.) Cost of living which varies with regions is also an important factor in the researcher's model. That kind of factors like the industry index of exposure to carcinogenic materials must also be compensated in the wage rate.

The common feature in the regression models of Smith is that the dependent variable is the natural logarithmic form of the ratio of the nominal wage rate and the cost of living index. The results showed the risk coefficient significantly positive in all cases and broadly the same order of magnitude. However, inference of a value of statistical life from these estimates is complicated by the fact that the risk variable included fatal and non-fatal accidents as well. In a situation like this we must make an assumption about the proportion of wage premium that applies to fatal as opposed to non-fatal accidents. We can hardly determine a 'good' proportion, the best estimates are between 30% and 50% for the fatal part (*Jones-Lee* [1989], p. 65). According to

the calculations on the sample of approximately 16.000 individuals the VSL is put in the interval of 400.000 and 700.000 1978 dollars.

If we assume that, because of the existence of insurance or workers' compensation, there are no compensating wage differentials for non-fatal injuries so that the entire wage premium applies to fatalities. In this case the estimates yield 1.400.000 dollars for the VSL.

R. J. Arnould and *L. M. Nichols* [1983] also attempt to take the effect of insurance into account. They think that previous researches made a mistake when they used only the level of wage rate as the dependent variable in the model. There are other parts of compensation for the work such as the different kind of insurances, mainly the accident, health and life insurances paid by the employer. The failure to take account of such compensation will tend to bias estimated wage premia for risk in a downward direction.

The authors wanted to reproduce the regressional calculations of *Thaler* and *Rosen*, so they used the same database and the same form of regression model. The difference was that they presented the annual value of insurances for the workers, but not as dependent, rather independent variable. Thus, the negative coefficient concerning the insurance variable shows the decrease in wage rate as a result of the increase in the value of insurance by one unit. As a result, the VSL was 200.000 dollars in 1970 prices where no workers' compensation insurance exists. However, taking into account wages an individual is observed to be willing to forgo for insurance coverage of wages lost due to work-related injuries, 23.000 dollars, the VSL grows up to 223.000 dollars.

IV.2.3. Are workers Bayesian decision makers?

W. K. Viscusi and *C. J. O'Connor* [1984] investigate the question whether workers are *Bayesian decision makers* or not, in their study. In other words, the question is whether we have the right to assume that a worker goes through the following procedure in choosing a job that involves risk. When workers accept jobs whose

risks are not fully understood, learn about these risks based on their on-the-job experiences, and then quit if these experiences are sufficiently unfavorable given the wage for the job. Thus, the worker gives an *adaptive response*.

The researchers investigate a simplier assumption. Can we state that workers do a minimal effort to revise their reservation wage rates according to the changed perceived risk on the job? It is important to emphasize that it is a basic question concerning the validity of the compensating wage differential researches.

The results of the survey research among workers in chemical industry service a reason for optimism for researchers using this method. The assumption was confirmed that after a period of imperfect risk perception most of the workers revise their past decisions and – according to the adaptive model – try to enforce the new perceived risk in their wage rate if needed and in case of failure quit the company.

IV.2.4. Calculations by perceived risk

D. Gegax, S. Gerking and *W. Schulze* [1991] broke the 'tradition' when they obtained the risk data from a postal survey instead of an existing database. Though these surveys also have their own restrictions and disadvantages, it is unquestionable that this method is more adequate to scan the perceived risks than purely displacing them by the objective measures from data of the occupation or industry.[53]

The other novelty of the research is that they ran the regression analysis for different categories of workers and gained surprising results. The two dimensions in selection of the categories was the white collar – blue collar axis and the labour union membership. They found the coefficient of the risk variable significant in the group of blue collar workers (with a value of 1,18 million dollars for the statistical life) and in the group of union members (the VSL was 1,58 million dollars among them), but not in the two supplemental categories. When they applied the two dimensions at the

[53] Of course the result of the research of *Viscusi* and *O'Connor* [1984] was known by the authors, however, in this latter research only the risks of illnesses and injuries were tested, but in the study of *Gegax et al*. the risk measure is the perceived probability of fatal accidents. The authors don't feel the optimistic statements of *Viscusi* and *O'Connor* automatically generalisable.

same time, only among the union member blue collar workers showed the risk coefficient significancy, resulting a 2,1 million dollars value for a statistical life.

These results highlight – as a possible explanation – the role of unions in securing a compensating wage differential for fatal accident risks common in the empirical literature (see e. g. *Marin-Psacharopoulos* [1982]). However, the causality is not proved. The trio claimed for instance that the mean level of risk in the subsample of the union members was considerably higher than among non-union members. That can also cause differences in the results.

The fact that certain risk coefficients did not differ from zero significantly (and thus resulting a zero or very low VSL) probably comes from the deficiency of the method rather than the fact that these groups of workers really do not enforce the level of risk in their wage rate, or what is even more absurd, do not evalute their life 'so much'. (This statement seems to be valid despite the fact that among white collar workers – and the non-union members are tipically from this group – the received risk measure was almost zero.)

IV.2.5. Wage-risk inequilibrium

The basic theory of compensating wage differentials suggests that the *WTP* of the individuals for risk reduction is equal to the marginal cost of risk reduction at the equilibrium level of risk. *H. W. Herzog* and *A. M. Schlottmann* [1990] showed that this is not the case within the manufacturing sector where the willingness-to-pay values exceed the marginal cost of risk reduction. The reasons for that are *imperfect information, ineffective bargaining, and transactions costs.*

The results of the research indicate that additional investment within manufacturing to reduce workplace hazards would likely increase social welfare, because workers are willing to forgo a part of their wages with higher present value in exchange for a risk reduction than the cost of the achievement for the firm would be.

In addition, the authors state that the VLS estimates derived from hedonic equations assuming the above equilibrium are likely to be downward biased by perhaps more than 50 per cent.

IV.2.6. The value of life expectancy

Studies at the end of the 1980s investigated the value of human life from a 'more economic' viewpoint than before. Namely, they considered human life as an existence in a certain time interval (or in an interval of certain number of years) instead of a unit entity. As a result, the risk of death cannot be described as a variable with two discrete outcomes, instead, it is a factor in the discount rate of the decreasing value of life years of a life which considered as a variable of life expectancy.

The previous studies used a single-period model when searched for the compensation for the work-related risk in the wage rate. *S. Rosen, W. K. Viscusi*, *M. J. Moore* (*Rosen* [1988], *Viscusi-Moore* [1989], *Moore-Viscusi* [1990]) and others thought, that it was more reasonable to take into account the loss in the duration of life, thus to *consider risk as a continuously existing danger*. Individuals in these models face a multi-periodical problem. The sooner the unexpected deaths happens, the larger the loss for himself and his family and relatives is.

The researchers used different models to analyse the problem. One of the most simpliest is when the standard hedonic wage equation of

$$\text{Wage} = \alpha + \beta' X + \gamma \times (\text{Death Risk}) + \varepsilon$$

is replaced by the following formula:

$$\text{Wage} = \alpha + \beta' X + \gamma \times (\text{Discounted Expected Life Years Lost}) + \varepsilon,$$

where α is a constant, γ is the investigated coefficient, β' is a coefficient vector, X is a variable vector of job and worker attributes and ε is a random error term.

There were also attempts to analyze how the value of a change in the survival probability varies with the age of the individual. For instance, *Per-Olov Johansson* [1996] pointed out that when people determine the 'utility' of their remaining years in terms of discounted value of their consumption and health ('health capital'), the marginal rate of time preference is the dominant factor in the applied discount rate for young people, while the conditional death probability is the central factor for old people.

A common feature of the models is the assumption that the value of a young person's life is *ceteris paribus* larger than that of an old person. While the calculations are built on this assumption, the results become valid and applicable in public policy decisions only if we accept this assumption. This is not easy from moral point of view. The question is whether public decision makers declare the *'more years – more value*' principle when they apply the results coming from this assumption or not. Another question is whether they have the 'right' to do this or not. Also a consequence of this principle is that in case of evaluating public programs, the expected saved lifetime and its distribution can be considered as benefit, i. e. not the expected number of saved lives. From this point the value of a program that saves mainly young people (e. g. building safety equipment along motorways) will differ from the one that saves the same number of old people (e. g. a health care program). Clarifying all these questions cannot be the task of economists alone.

IV.3. The contingent valuation method

IV.3.1. Description of the method

There is a huge disadvantage with *labour market approach* – despite the mathematical clearness of the regression model, it is not sure whether it can adequately describe reality. The cause and effect relationships are also questionable.

The method that we will discuss in the following subchapter is able to solve these problems. However, at the same time it brings up new difficulties.

Contingent valuation is a kind of survey approach, at least technically a questionnaire is used. The basis of the 'real' survey method is that interviewers do not give information to the interviewees, they only want to know how the interviewees react to the questions based on information available at the time of questioning. On the other hand, the *contingent valuation* method combines this with features characteristic to the method of trying to make decisions mainly by information flow in both directions (*Csontos-Kornai-Tóth* [1996], p. 9).

The point is that the interviewers set up certain *hypothetic* market or other decision situations for the interviewees, who have to decide: how much they would be willing to pay (or how much compensation they would be willing to accept) for a (generally very small level of) decrease (or increase) of physical risk. For example, how much money they would be willing to pay to travel to Greece by a bus that is provably safer. In theory, the *value of statistical human life* can be easily specified from the answers.

However, in practice, we have to consider all the problems related to the survey method on one hand, and the characteristics of the specific subject on the other hand. It would take long even to list them; however, two limits are most often mentioned.

One of them is the result of the *hypothetic nature* of the situation: there is simply no guarantee that the interviewees' answers reflect reality. This is true even if the respondents are helpful and try to be honest – we simply do not know whether they would really behave that way in real situations (*Fisher-Chestnut-Violette* [1989], p. 94). We are not interested in what they say but rather in how they would act. However, we can only measure the former with this method.

The other main problem originates from the fact that most people are simply unable to adequately understand and comprehend the concept of probability. As a result they are unable to adequately calculate the – mainly small – probability values in their

decisions (*Viscusi* [1993], p. 1942).[54] That is why it is so hard to prepare such questionnaires and carry out such surveys.

This method is described through the most important studies, too.

IV.3.2. The techniques of questioning

There are three main techniques in CV, these are the followings:

a) *Direct method*. In this case the respondents face a question that directly asks, for instance, how much money they would require to accept a given risk increase. A variant of this is to proceed in iterative fashion. Rather than seeking a response to an open-ended question, the *willingness-to-pay* value may be adjusted until the respondent indicates indifference.

b) *Pairwise comparison*. Respondents are asked to compare two two-dimensional (wage, risk) situation. (E. g. to compare *Job A* characterised by 50.000 forints net wage and 5/100.000 fatal risk with *Job B* characterised by 55.000 forints net wage and 10/100.000 fatal risk.) Subjects could indicate their preferences between these two situations, and the packages could be manipulated until indifference is achieved.

c) *Method of lotteries*. In this case we try to ascertain the equilibrium probability, p, that establishes indifference between a given positive thing and a *lottery* on life and death, where the probability of death is p, and thus the probability of life is $(1-p)$. If we consider the utility of death zero than the utility (i. e. the value) of life is equal to the utility of the given negative thing multiplied by $1/p$.

There is no priority among the three techniques, none of them is preferred in theory. However, the most often applied technique is the pairwise comparison or a similar iterative method.

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[54] Human mentality cannot, for example, include the difference between 0.006% and 0.01% into the decision system.

IV.3.3. Limitations of the CV method

M. Hammerton, M. W. Jones-Lee and *V. Abbott* [1982] attempt to conduct a feasibility study to establish many features of the CV method.[55] The present dissertation doesn't give an opportunity to describe the interesting study in details, the most important statements are as follows.

1) People would generally be both *willing* and *able* to answer the kinds of questions that it would be necessary to ask.
2) People would not systematically mispresent their 'true' preferences in answering questions concerning their attitudes to death or injury.
3) 90 per cent of the respondents showed conformity with the standard axioms of choice under uncertainty that form the basis for the expected utility theory.[56]
4) Answers by the respondents seemed surprisingly stable.[57]
5) The aswers for different kind of questions did not always show consistency. However, according to the researchers, the level of this inconsistency did not service reason for giving up the method.
6) People seem to be rather bad at perceiving relatively unfamiliar activities in terms of risk, they are much better on everyday activities such as transport. Another conclusion is that there is a wide dispersion in assessments of ratios of riskiness, but the average subjective assessments are of a broadly similar order of magnitude to the objective ratio.

IV.3.4. Early contingent valuation researches

It was the mid-70s when CV method was first applied for determining the VSL.[58] It is quite difficult to access these studies, however, we don't have too many reasons to

[55] It was only a secondary goal to give an estimate to the VSL.

[56] It is often referred to as *coherence*.

[57] It is often referred to as *reliability*.

deal with them in details, because due to the beginning status of the method, they suffer in teething troubles.

According to the critique of *A. Fisher, L. G. Chestnut* and *D. M. Violette*, the samples tended to be nonrandom or too small for providing estimates applicable in public policy questions (*Fisher-Chestnut-Violette* [1989], p. 94). For instance, *J. P. Acton* [1973] used samples of 36 and 21 individuals, *S. J. Melinek et al* [1973] had a sample of 836, but appears to be self-selected and non-random. Other limitations were that the scenarios and payment mechanisms were not well defined, the change in risk being valued was not presented clearly, and there was little checking for 'problem' bids or inconsistency across bids. Researchers generally did not emloy interviewers.

Despite the methodological weaknesses it is worth mentioning what results these investigations gained. In the questions of *Acton* two different expected reductions in mortality were considered, namely the expected saving of 10 and 20 leves respectively in a community of 10.000 people. *Acton* varied the situation accross questions. The different questions resulted different implicit VSL, but generally at a lower level than in case of revealed preferences studies. The minimal result was 7.400 dollars, the maximum was 47.000 dollars in 1970 prices. *Melinek et al* measured the *WTP* values for a smoke detector that reduces the risk of death to a known, and informed extent and for a hypothetical 'safe' kind of cigarette. Responds for the first question implied a VSL of 55.000 English pounds and for the second question 17.200 pounds in 1972 prices.

IV.3.5. The most important CV research

In 1982 perhaps the most sophisticated and comprehensive research was conducted in the United Kingdom. The three-stage stratified random sample was drawn from 93 parliamentary constituencies in England, Scotland and Wales and produced 1103 full and 47 partial interviews. The study of *M. W. Jones-Lee* and his colleagues was

[58] For a good summary, see *Jones-Lee* [1989], pp. 74-88.

commissioned by the UK Department of Transport.[59] The study was designed to shed light on a range of issues concerning individul perception and valuatuion of transport safety and thus to determine the value of a statistical human life and also the value of health.

The 60-page questionnaire, which took on average 45 minutes to complete with the help of professional interviewers, contained 37 questions that fall into three broad categories:

a) *Valuation questions*. They intended to provide estimates of relevant marginal rates of risk-money substitution and the relative valuation of fatal and non-fatal accidents among others. Respondents had to evaluate not only the risk concerning themselves but also risks concerning other people (e. g. relatives and friends). Questions were made about private and public goods, too.

b) *Perception/consistency questions*. They intended to test the quality of individual perceptions of transport risks, the ability to handle probability concepts, the veracity and stability of valuation responses, and finally the conformity with the standard axioms of rational choice under uncertainty.

c) *Factual and other questions*. They intended to ask important facts and demographic parameters for the research, such as vehicle ownership, annual mileage and age, income etc.

In order to test the temporal stability of responses, a follow-up survey with a selection of the original questions was also conducted about a month after the main survey on a subsample of 210 respondents.

From our viewpoint the most important questions and answers are those that measured the *WTP* values for (1) a safety equipment which reduces the risk of death by a certain amount and (2) the increase of the safety of a bus with which a foreign

[59] See the summary about the research in: *Jones-Lee et al.* [1985] and *Jones-Lee* [1989], Chapter 4.

trip is made. The level of risk was always measured by the number of saved lives out of 100.000 people due to the construction.[60]

The main findings of the research are as folllows.

a) A substantial majority of respondents were willing and able to provide answers to the various questions.

b) While a part of the respondents gave apparently inconsistent answers to a few questions, and had difficulties with the concepts involved, it was the researchers' opinion that the quality of perception of transport risks, the ability to process probability information and the veracity of responses were sufficient to justify the inference of at least broad orders of magnitude of the VSL for transport risks.

c) Leaving out the 'suspicious' responses, the VSL by *mean* responses – which is supported by the theory – ranged from 1,2 to 2,2 million 1982 English pounds, while values based on *median* responses ranged from 0,5 to 1,2 million pounds.

d) The regression analysis showed that the valuation of safety is significantly affected by income and age. In the regression equation with the dependent variable of marginal rate of substition of wealth for risk of death the coefficient of the linear income variable implied an income elasticity of about 0,3, that can be considered quite high.

e) The value of avoiding a serious injury was at least one-hundredth of the VSL.

Finally, *Jones-Lee, Hammerton* and *Philips* compared their results to that of *Marin* and *Psacharopoulos* [1982], which was conducted also in the UK, but applied the labour market approach. They consider the highly similar estimates very powerful evidence in favor of the credibility of these estimates, and that the majority of people would tend to be more or less equally averse to the prospect of dying in a transport accident or in an accident at work.

[60] In order to help the respondents in perceiving the level of risk, all probability statements were supplemented by a pictoral representation in which the appropriate number of squares had been blacked out on a piece of graph paper containing 100.000 squares.

IV.3.6. A comparison of the hedonic price and the contingent valuation method

D. S. Brookshire, M. A. Thayer, W. D. Schulze and R. C. d'Arge [1982] attempts to compare the most common methods of evaluating public goods, the *hedonic price method* and the *contingent valuation*. According to the authors the results of the latter method apears to be internally consistent, but the external validity is still questionable. They thought that this external validity was 'receivable' by conducting two parallel researches for the same problem applying the two approaches and gaining consistent results with the theoretical considerations.

The authors investigated the behaviour of hundreds of households in Los Angeles in two ways. On one hand, they searched for the rent differential paid by households for cleaner air at their homes (hedonic approach). On the other hand, households were asked to provide their willingness to pay for an improvement in air quality at their current location (CV approach).

The quartette proves in the study that the results coming from the hedonic method have to be greater than that of CV method.[61] For the empirical research they build up two hypotheses:

1) Results of hedonic approach exceed the similar results of survey approach.
2) Results coming from the survey method are also greater than zero.

The empirical results *did not allow the rejection of either of the two hypotheses*, thereby providing evidence towards the validity of survey methods as a means of determining the value of public goods,[62] so it is recommended to use this method in

[61] On the basis of the researches described in the study, the results of the contingent valuation method might be biased downward by 55 to 67 percent (*Brookshire-Thayer-Schulze-d'Arge* [1982], p. 175).

[62] Perhaps it is not necessary to add that one has to be cautious in generalization of this statement. The speciality of the research, the understandability and perceptibility of the air pollution problem and other factors all put us on guard in the question of extensibility.

every case where no well-developed hedonic market exists, thus hedonic price method cannot work.

IV.4. Empirical results of the most important researches

After this short overview on how the literature of economics deals with the value of human life, let us take a look at the empiric results of the more significant researches (see *Appendix 1*). It can be seen that these were conducted mainly in the United States and the United Kingdom during the last few decades. ***The variation in the numerical results is quite extensive, however, leading economists agree that the best estimates for the value of a statistical life are between two and four million dollars.***

V. HYPOTHESES, CONCEPTUALIZATION, OPERACIONALIZATION

V.1. Hypotheses of the research

In our case, building up classic research hypotheses is not the most important task, since the research, due to its nature, aims at examining quantity relations rather than the existence of these relations and the truthfulness of certain statements.

Basic question

What is the value of a statistical human life in Hungary?

I attempt to answer this question with the help of both methodological approaches I use. ***It is the most important goal of my research to calculate a numerical value.*** Since Hungarian incomes and wealth circumstances are significantly different from American and British (and presumably there are significant differences between the preference-map of the people as well), it is not worthwhile to make preliminary guesses in connection with the value of Hungarian human life. Thus, I do not intend to build up a hypothesis concerning this.

The basic hypothesis of the *labour market approach* can be formulated in the following section.

Hypothesis 1

The riskiness of work performed by the employees influences the level of the wage. The direction of this connection is positive: more risk means ceteris paribus higher wages.

We have to examine this hypothesis if we want to know whether in Hungary it is possible to measure the value of statistical human life through analysing wages and whether the necessary mechanisms are operational. If we have to discard the hypothesis, then this method cannot be used in Hungary. If we find the hypothesis

true, then the method can be used. In that case, however, it still has to be examined to see whether the numerical figures really indicate what we expect them to indicate.

Therefore, in connection with the regression model that will be build up later on, we have to subject the facts to a statistical test. This will determine whether the coefficient that belongs to the explanatory variable, which includes risk, significantly differs from zero and whether its sign is positive.

Nevertheless, proving the basic hypothesis is not the most important, although it would be reassuring from the point of view of the usability of the method.

The other direction of the empirical work, the *contingent valuation* approach, gives us wider possibilities for hypothesis testing and opportunity to clarify (or at least to make statements based upon empirical data) those questions that arise in the international theoretical debates.[63]

Hypothesis 2
The value of a statistical life exceeds the value of an anonymous life.

If the empirical results justify this hypothesis, then this will weaken the considerations of *Broome* we described in Chapter III. Because it is possible that we make a failure in determining the VSL in a way that some branches (with *Broome* on the first place) of theory refuse. However, in connection with principles reaching entire consensus is almost impossible in this 'swampy' field of economics. If we show that the VLS is larger than the value of an anonymous life, from this point, *Broome* and his followers should have the opinion that valuing the statistical human life results *too* large estimates. It would be obviously against their purposes.

[63] Because of the above mentioned fact that I did have opportunity only to make researches on small and not representative samples, thus the test of the following hypotheses are only prepared here, the large sample survey will give opportunity for the real and valid investigation.

On the other hand, discarding the hypothesis would leave the dilemma open, in which the arguments of *Broome* would grow stronger, and the arguments of *Mishan* would become weaker.

Hypothesis 3

People are indifferent about the same level of workplace and transport risks that threaten their life.

With testing this hypothesis, in fact the validity of the methodology in which the value of life comes from the evaluation of the change in risk is tested in some way. If we have to reject the hypothesis, it means that the *kind* of risk affects the evaluation of the *ceteris paribus* change in the level of it. If it's true then the *WTP* for change in risk measures (and thus the VSL measures) will depend on the kind of the risk. However, the value of life should obviously be independent from the method we use to determine it. Thus, rejecting the hypothesis means rejecting the method, too.

If we find the hypothesis true, we will have the possibility to choose from different type of risks in our researches.[64]

Hypothesis 4

The level of WTP for risk depends on the absolute level of risk.

With this hypothesis we test the statement of *Jones-Lee* [1976], that the marginal rate of WTP is not a constant, rather a growing function of risk. If the statistical tests with the empirical data support the acception of the hypothesis as true, then the validity of the concept of statistical human life will suffer damage, because in this case there isn't a robust value for a statistical life in the preferences of the people, rather, this value depends on the chosen level of risk in the research.

[64] Of course the 'methodological indefference' between the different kinds of risk can only be stated in case of that particular kinds that we use in the test.

If the rejection of the hypothesis is possible, then we will have the right to say that the level of risk in the research does not have an effect on the received value of statistical human life.

V.2. Conceptualization and operationalization of the key concepts

In this subchapter the conceptualization and – if needed – the operationalization of the key concepts of the field comes.

Risk

We define any risks that endanger human life as a mathematical probability of losing life (i.e. the occurrence of death).

Identifiable human life

The *identifiable* human being is a person, who exists or existed and can *be well-identified in the present*, such as the writer of the present study. We *do not aim* to specify the value of such human life, the philosophical considerations and economic logic that we follow do not allow it either. Therefore, it is clearly out of the question to deal with the value of an identifiable human life in any way.

Statistical human life

A *statistical* human being is a *fictive* human being who does not exist, never existed nor will exist (as opposed to the *anonymous* human beings!). It is only a *sum of probabilities*. A statistical human life can only be interpreted in a given *population,* or group of human beings. Its concept is closely tied to the concept of death: when the sum of the possibilities of death that endanger each member of the population independently (within a given time interval) is equal to one, then it is equal to one statistical human life.

This is easier to understand through an example. If in a given year a piece of safety equipment decreases the probability of death for every member of a population of 1,000 individuals from two per thousand to one per thousand (i.e. by one

thousandth), then we can say that the safety equipment saved one statistical human life during the year under review (since 1000×(1/1000)=1). In other words: the expected number of the saved lives is equal to one.

Value of a statistical human life

We never deal with statistical human lives by themselves. The *value* of statistical human life is much more important for us. This value is equal to the amount of money that all the members exposed to life-threatening risks are willing to pay to decrease the possibilities of death that endanger all members individually, by a little for each member and altogether by one (*WTP* approach). From the other viewpoint: the value of statistical human life is equal to the amount of compensation that all the members exposed to life-threatening risks are willing to accept to increase the possibilities of death that endanger all members individually, by a little for each member and altogether by one (*WTA* approach).

By using the previous example: if, for the sake of simplicity, all the 1,000 people are willing to pay 10,000 Hungarian forints towards the safety equipment (i.e. to decrease the risk by one thousandth), then the value of the statistical human life is 1,000□10,000=10,000,000 forints in this population.

Anonymous human life

As opposed to the statistical human life, the *anonymous* human life is *not a fictive* life, but an existing or existed person who – only because of the time factor – *cannot be identified;* however, in the future he *can be identified*. Basically, it is a probability variable in a mathematical sense which, due to its nature, *a priori* does not receive a concrete value, but only *a posteriori*.

In our example, the safety equipment saves an anonymous human life if without the equipment exactly one person, whose identity we do not know yet, would die in the given year.

Value of an anonymous human life

The value of an anonymous human life is similar to the value of a statistical human life, with the exception that now the members of the population must evaluate the life of exactly one person (whose identity is not known yet). In other words, its value is equal to the aggregation of the money that the members of a population are willing to pay to avoid the one occurrence of death that endangers everybody at an equally low level, nevertheless, that would surely happen. From the other viewpoint: the value of anonymous human life is equal to the amount of compensation that all the members exposed to life-threatening risks are willing to accept to bring about the one occurrence of death that endangers everybody at an equally low level, nevertheless, that will surely happen (*WTA* approach).

It is important to emphasise again that the present study only examines the value of statistical human life. It is still important to emphasise that, although it follows from the concept's definition, the only things considered are the risk of losing life and the subsequent evaluation. The life to be evaluated, therefore, is an '*exist/not exist' two-value variable*. The parameters concerning *quality* of life are not included in our calculations (such as health, general condition and happiness or a useful or useless role in the society). The reason for this is not because they are unimportant.[65] The concept of the *value of a statistical human life*, which has been developed in economic theory and is based on consensus, cannot and does not want to include these types of parameters into its system of thought and calculation.

However, we cannot claim that this consensus is incontestable. On the contrary: exactly because of the sensitivity of the issue, it is easy to contest it upon good grounds, and this is often done. We discussed some of these contests and critiques above.

In my thesis I do not intend to take sides in these debates. Or to be more accurate, I take sides only by accepting the methodology recommended by the developed consensus, and I will make our calculations accordingly. ***I believe that even***

[65] A number of economic schools study calculations where the evaluation of the quality of life is at their focus.

calculations that use methods based on unsure and assailable principles provide valuable and usable results for decision makers who want to spend public fund efficiently.[66]

[66] Let us just imagine where the economic would have developed by now along with the micro and macro economies that are based on it if this discipline had only been built on 'incontestable' principles and methods during its hundred-year history.

VI. EMPIRICAL RESEARCHES CONDUCTED IN HUNGARY

VI.1. The research based on hedonic price approach[67]

The following research was conducted in 1999, using the labour market approach in this issue for the first time in Hungary to my knowledge.

VI.1.1. Databases used in the research

Most of the data used for the regression calculation originates from the 1998 TÁRKI Household Monitor survey.[68] After adequate selections[69] I received a sample of 1,287 elements, which was weighed according to Mikrocenzus '96. This represented the full-time employed adult population in March 1998.

There are two reasons why I chose this sample for my examination. First, this sphere of society is made up of taxpayers, and the majority of state income originates from their work. That is why it is recommended to judge the use of public money based on their preferences.[70] Second, our method requires information on the sectors where the individuals in the sample worked (in order to specify the risk level that can be assigned to the jobs), and also their wages. These two pieces of information were available exactly in this sample.

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[67] See the following publications about the research: *Adorján* [2001] and *Adorján* [2002].

[68] Source: TÁRKI Adatbank. 1999. 'TÁRKI Háztartás Monitor 1998 adatbázis.' (1.0A. CD-ROM version) Budapest: Társadalomkutatási Informatikai Egyesülés.

[69] I carried out the selection in four steps. First, I separated those who answered the personal questionnaires (3,827 records remained), then I separated those who were working on May 31, 1998 (1,504). Eventually, I left those people in the sample who worked full-time in March 1998 (1,303), and those whose sector could be clearly specified (1,287). The latter selection was necessary for practical reason. I believe that its distortion effect on my examination is negligible.

[70] This statement is contestable. The issue of *standing*, i. e. whose and which preferences count in an analysis is one of the most important theoretical problems in CBA. Here I do not want to go into details.

Almost all variables included in the model come from the Monitor research: I obtained them by modifying their variables to a greater or lesser degree. The only exception is the variable of workplace risk, which has a key importance in our analysis: I specified it from other sources with the help of data collected and recorded by the Central Statistical Office (KSH), the Hungarian Labour Inspectorate (OMMF) and the Hungarian Mining Office (MBH).[71]

VI.1.2. The independent variables

As I have mentioned, a number of researchers in Anglo-Saxon countries have carried out calculations similar to ours during the last few decades. *Table 2* shows the most common explanatory variables.

[71] Data like the number of employees and the number of accidents are needed for specifying the risk indicator (see later in detail). The source of the former is KSH. (For years 1994-1996: Foglalkoztatottság és kereseti arányok 1996-1997 (Munkaügyi adattár), KSH, Budapest, 1998, p. 20; for years 1997-1998: Időszaki Tájékoztató: Főbb Munkaügyi Folyamatok 1998. I-IV. negyedév, KSH, 1999. március, p. 18) The sources of the latter are such statistics and reports of OMMF and MBH that are not available in publications. I hereby would like to thank *Károlyné Tokaji* and *István Harcsa* (KSH), *Sándor Galló* (OMMF) and *György Lukuca* (MBH), who provided great help in data collecting.

Table 2. Explanatory variables that were included in most cases. [72]

Explanatory variable	*Number of cases*
Education	16
Union membership	15
Race	12
Job category	11
Age	10
Gender	10
Time spent working	10
Marital status	10
Region	9
Health problem, existence of handicap	8
Time spent in the particular workplace	6
Number of staff in the workplace	5
Number of children	4
Participation in work training/course	4
Education□education	4
City - country	4

Source: The compilation is based on the following researches: *Arnould-Nichols* [1983], *Brown* [1980], *Dillingham* [1985], *Garen* [1988], *Gegax-Gerking-Schulze* [1991], *Herzog-Schlottmann* [1990], *Leigh* [1987], *Marin-Psacharopoulos* [1982], *Moore-Viscusi* [1988a], *Moore-Viscusi* [1988b], *Moore-Viscusi* [1990], *Olson* [1981], *Sandy-Elliott* [1996], *Smith* [1983], *Thaler-Rosen* [1976], *Viscusi* [1979].

It can be seen that some of the variables are demographic parameters, others are connected to the job, workplace or economic sector. Union membership as an explanatory variable is almost always included in surveys. Currently in Hungary this is pointless. In fact, according to *Sandy-Elliott* [1996], it is pointless in other researches as well, because unions usually lobby for decreasing risks and not *ex ante* compensation for increased risk.

In addition to the variables listed, there are about fifty other variables in the studies. Some of these variables in the explanation of the income level are unusual (e.g. the desirability level of the profession in *Marin-Psacharopoulos* [1982]). It is also common to include, as a new variable, the multiplication (e.g. education×age or

[72] *Table 2* contains only those variables that can be found in at least 4 out of the 16 researches in a similar way. The risk variable is part of every model, of course.

gender×marital status) of certain variables or their square (e.g. education^2, staff number^2, age^2).

In addition to traditions, the limitations on possible explanatory variables were, of course, the bundle of data of the Monitor study. The widest model contains the following independent variables:[73]

HALKOCK = Risk of mortal work accident in the given sector, in (1/million)/month (see later in more detail).

BALKOCK = Risk of work accident in the given sector, in (1/million)/month (see later in more detail).

VAROS = Is your residence in a city, dual value (1=yes, 0=no).

BUDAPEST = Is your residence in Budapest, dual value (1=yes, 0=no).

DUNANTUL = Is your residence in Transdanubia, dual value (1=yes, 0=no).

HAZAS = Are you married, dual value (1=yes, 0=no).

NEM = Gender, dual value (1=man, 0=woman).

KOR = Age in years.

ISKOLA = Education expressed by the number of years up to the highest education level.

GYERMEK = Number of household members under 18 years of age.

IDNYELV = Do you speak any foreign languages, dual value (1=yes, 0=no).

BETEGSEG = Do you regularly take pills because of an illness, dual value (1=yes, 0=no).

MELLEK = Do you have a supplementary job, dual value (1=yes, 0=no).

MEZOGAZD = Does your workplace belong to the agricultural sector, dual value (1=yes, 0=no).

IPAR = Does your workplace belong to the industrial sector, dual value (1=yes, 0=no).

ONALLO = Are you independent or an entrepreneur, dual value (1=yes, 0=no).

VEZSZELL = Are you a white collar worker, dual value (1=yes, 0=no).

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[73] *Appendix 2.* contains the descriptive statistics of the variables. The variables were operationalized based on the answer options to be given to the questions of the original study. Since they were mainly closed questions; thus, the operationalization was unambiguous every case.

CEGMERET = How many people work in your company, dual value (1=10 or more, 0=less).

ALLAMTUL = Is your company state or municipality-owned, dual value (1=yes, partially or fully, 0=no).

MAGYTUL = Is your company fully Hungarian, dual value (1=yes, 0=no, partially or fully foreign).

KIEGJUT = Did you received at least one of the following from your company during the last 12 months: life insurance, retirement insurance, official car, car maintenance refund, gas money, shopping or transport discount, workplace healthcare or discount holiday possibility (1=yes, 0=no).

MAGYAR = Which ethnic group do you consider yourself part of, dual value (1=Hungarian, 0=other).

CIGANY = Which ethnic group do you consider yourself part of, dual value (1=gypsy, 0=other).

UJSAGOLV = Do you regularly read newspapers, dual value (1=yes, 0=no).

KONYVOLV = Do you regularly read books, dual value (1=yes, 0=no).

SZINHAZ = Did you go to the theatre during the last twelve months, dual value (1=yes, 0=no).

HANGVERS = Did you attend a concert during the last twelve months, dual value (1=yes, 0=no).

MUZEUM = Did you visit a museum during the last twelve months, dual value (1=yes, 0=no).

SPORT = Do you play a sport, dual value (1=yes, 0=no).

BARATOK = Number of good friends.

SZELSPOL = Do you consider yourself politically extreme, dual value (1=yes, 0=no).

Only the last eight variables may require a short explanation. *Brown* [1980], among others, criticized the research in this field for leaving out – in the lack of adequate data – a large number of potentially important personal parameters. These are factors that are characteristic to the individuals, do not change in time but cannot be included in the conventional variables. *Low and McPheters* [1983] chose a different method to achieve the same thing: they examined only city policemen. Because this social

group can be considered homogenous in several aspects, they reduced the distortion resulting from differences of risk recognition, education and several other characteristics.

By including the last eight variables in the list, my goal was to decrease the distortions due to personal differences and also to control this in some way in the regression formula. The assumptions behind it include that, for example, the reading habit of a person is a good indication for an internal characteristic that can help the explanation of income although it is not covered by the other variables. Of course cause-effect relations are not unambiguous, but I still consider it better to 'try' the variables in the first round.

VI.1.3. Risk variables

The risk in connection with a concrete job (which can be described from our point of view by the workplace and the work to be carried out there) appears in two dimensions.[74] It endangers the worker's life and his health. From the point of view of evaluating statistical human life, only the first type of risk is relevant; however, the second type of risk can also influence the amount of income, which is why it is recommended to also include among the explanatory variables.

We described life-threatening risk with the *HALKOCK* variable. We created its value as follows: every year, OMMF sums up the number of deadly work accidents broken down by sector, based on the current publication of the head of KSH.[75] The ratio of this value and the average annual number of the employees in the given sector (this data is published by KSH) can define the level of a certain kind of *ex post* life-threatening risk for the given year. This, of course, changes every year; it is therefore recommended to use an average value. Because the Monitor study was conducted in 1998, I used the average value of the data of the previous five years (1993-1997). I calculated the monthly risk for one million people, because we would like to know

[74] Risks such as the danger of losing a job are not applicable here, even if it is obvious that the possible knowledge of data like this would improve our regression model considerably.

[75] The only exception is mining: the accident statistics are from MBH.

the effect of risk on monthly income. Therefore, the *HALKOCK* variable indicates the average monthly number of people who died due to work accidents during the five years, out of one million people. I consider this risk level to be the basis of financial compensation in the regression calculation.

I defined the *BALKOCK* variable very similarly for the risk of work injuries. The only difference is that the numerator of the ratio is not the number of *deadly* accidents, but the number of *all* work accidents. Here I would like to note that measuring risk is, without doubt, the most critical point of the method. We will describe this in detail in the section that deals with the sources of the problems.[76]

VI.1.4. The dependent variable

The aim of our research is to specify the marginal money-risk exchange; therefore, the dependent variable must be some kind of income data that is logically in a cause–effect relationship value with the level of workplace risk. That is why I did not deem it advisable to use the monthly net total incomes from the Monitor survey. Income from full-time jobs seemed to be more appropriate for our goal. However, it is questionable whether things like bonuses, remunerations, 13th month wages, profit sharing, profit from enterprises, dividend and shares should be included in this value. On one hand, these elements are unsure, i.e. they cannot be considered steady income. On the other hand, in most cases they can be well estimated and are 'quasi-sure' part of the compensation for the job based on preliminary agreements.

Accordingly, I carried out the calculations in two ways, including the more specific income data in the *JOVED1* variable, and the wider range of compensation in the *JOVED2* variable. By following established methodological practices, I ran our model using the natural logarithm of the income variable (*LNJOVED1* and *LNJOVED2*) as the result variable.[77]

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[76] Assigning the adequate *HALKOCK* and *BALKOCK* values to each element of the sample was not without problems. Although there was a variable which contained a sector classification for respondents' workplaces, some of the categories used were not adequately specific.

[77] According to *Marin-Psacharopoulos* ([1982], p. 833), the use of logarithmic form is theoretically more justified.

The question might be raised whether *net* or *gross* income data should be used. I was lucky in this, because literature recommends the use of net data, which was the type that was available for us (*Moore-Viscusi* [1988b], p. 379).

VI.1.5. The results of regression analysis

In the first round I ran the regression model in four forms. *Table 3* contains the most important results.

Table 3. Models of the first round.

	Model 1.1.	*Model 1.2.*	*Model 1.3.*	*Model 1.4.*
Dependent variable	*JOVED1*	*JOVED2*	*LNJOVED1*	*LNJOVED2*
Number of explanatory variables	31	31	31	31
Number of explanatory variables that are significant on 5%	8	8	12	14
Corrected R^2	0.196	0.229	0.345	0.374
Global F-value	11.107	13.268	22.793	25.723
BALKOCK coefficient	0.426	-0.339	1.871E-05	1.184E-05
BALKOCK coefficient's standard error	0.640	0.703	0.000	0.000
BALKOCK coefficient's significance level	0.506	0.630	0.059	0.051
Pearson-correlation of *BALKOCK* with dependent variable	0.030	0.025	0.058	0.050
Partial correlation of *BALKOCK* with dependent variable	0.019	-0.014	0.053	0.033
HALKOCK coefficient	138.033	346.492	2.077E-03	3.723E-03
HALKOCK coefficient's standard error	121.934	133.963	0.002	0.002
HALKOCK coefficient's significance level	0.258	0.010	0.271	0.238
Pearson-correlation of *HALKOCK* with dependent variable	0.069	0.092	0.078	0.084
Partial correlation of *HALKOCK* with dependent variable	0.032	0.073	0.031	0.055
VSL (million HUF)	*138.033*	*346.492*	*77.99*	*146.124*

We can make the following statements:

a) Based on the data from the F-function, we can establish that 'from a global viewpoint' all four regression functions explain the result variable to a level which is significantly different from zero ($F_{0,95}(31.1253) \approx 1.46$).

b) The explanative force of the model that was built with the wider type of income variable was stronger (the determining coefficient corrected by the degree of freedom was higher). However, in the case of both income variables, the logarithmic form is more explanatory.

c) From the relatively large number of variables, only a few seemed to be significant; therefore, it is definitely recommended to further specify our models.

d) At traditional levels, none of the coefficients that belong to either *HALKOCK* or *BALKOCK* appeared to be significant.

e) Since risk is an *inferior good* (i.e. by increasing the income, the demand for it decreases (*Jones-Lee* [1976], *Thaler-Rosen* [1976])), it is expected that the value of the *Pearson-type* correlation coefficient between the income and risk is negative. The situation with the partial correlation coefficient, where we filter out the effect of other factors, is different. In almost all cases it is positive, but quite a low level of correlation can be indicated in our models. This is perhaps the most surprising result.

f) The value of a statistical human life is in the range of 78 million to 346 million forints in the models.

In the second round, I tried to filter out the non-significant variables with the help of *backward* procedure (using a 5% threshold). This is the next step towards the optimal model. *Table 4* shows the results.

Table 4. Models of the second round.

	Model 2.1.	*Model 2.2.*	*Model 2.3.*	*Model 2.4.*
Dependent variable	*JOVED1*	*JOVED2*	*LNJOVED1*	*LNJOVED2*
Number of explanatory variables	11	12	13	14
Number of explanatory variables that are significant on 5%	11	12	13	14
Corrected R^2	0.197	0.227	0.343	0.372
Global F-value	29.577	32.437	52.650	55.402
BALKOCK coefficient	-	-	2.938E-05	-
BALKOCK coefficient's standard error	-	-	0.000	-
BALKOCK coefficient's significance level	-	-	0.000	-
HALKOCK coefficient	236.075	369.320	-	5.978E-03
HALKOCK coefficient's standard error	89.827	98.898	-	0.001
HALKOCK coefficient's significance level	0.009	0.000	-	0.000
VSL (million HUF)	*236.075*	*369.320*	-	*234.896*

Furthermore, I calculated the *Pearson-type* correlation coefficient between *HALKOCK* and *BALKOCK* variables. The result was 0.664; i.e. the two variables explain each other's variance to the extent of 44.1%. (By running regression calculations for each, I established that *BALKOCK* variable, together with the rest of the variables, explains *HALKOCK* variable to the extent of 53.4%, while this value is 47.4% to the opposite direction.)

Based on the above, the following seems to be true:

a) The considerable correlation of the *HALKOCK* and *BALKOCK* variables introduces significant multi-collinearity in the model. Therefore, it is recommended to use the *HALKOCK* variable only.[78] The results also support this:

[78] I must note here that according to the comments of *Professor David Greenberg* on my English language study (*Adorján* [2002]), he did not think the multi-collinearity between the two variables all that high that would give serious cause for dropping *BALKOCK* variable; although he understood the reason for that.

only one of the two variables was significant in all four models at the same time. The value of that variable, however, was much lower than in our original models, once the other variable was removed from the model. The reason for this phenomenon is that in reality the two variables measure almost the same thing, because in each sector the relative fatal and non-fatal risks were very similar. For our needs, the *HALKOCK* variable is much more useful. Nevertheless, we must realise that if we leave out the *BALKOCK* variable, then the compensation gained from the coefficient of *HALKOCK* variable, also includes compensation for non-fatal risks. This is true even if the level of compensation for non-fatal risk is much less (by about two orders of magnitude) than the compensation for fatal risk.

b) The corrected multiple determination coefficients barely decreased, compared to the previous models. We can draw the conclusion from this that the explanatory force of our models did not decrease when a large number of variables were not included.

c) The value of statistical human life is in the range of 235 to 369 million forints in the different models.

d) This time, the fourth type model, which works with the *LNJOVED2* explanatory variable, seemed to be optimal; therefore, further on we will only deal with this model.

Table 5 indicates the coefficients that relate to the explanatory variables of *Model 2.4.*, including standard errors and significance levels. Actually, only the coefficient that belongs to the *HALKOCK* variable interests us; the rest of the variables are only interesting from the point of view of specifying the best model.

Table 5. The explanatory variables of Model 2.4.

Variable	*Coefficient*	*Standard error*	*Level of significance*
(Constant)	9.058	0.082	0.000
ISKOLA	4.825E-02	0.006	0.000
NEM	0.192	0.025	0.000
VEZSZELL	0.182	0.032	0.000
BUDAPEST	0.221	0.033	0.000
KIEGJUT	0.132	0.024	0.000
KOR	6.180E-03	0.001	0.000
CEGMERET	0.199	0.034	0.000
ONALLO	0.264	0.053	0.000
UJSAGOLV	0.108	0.025	0.000
HALKOCK	5.978E-03	0.001	0.000
MAGYTUL	-8.930E-02	0.025	0.000
GYERMEK	3.102E-02	0.012	0.011
VAROS	6.132E-02	0.026	0.019
MUZEUM	5.744E-02	0.028	0.042

As was expected, income was significantly influenced in a positive direction by education level, gender, whether white collar worker or not, residence (in Budapest or countryside towns) and age. The positive direction of the size of the company, independence, and number of children and the negative effect of the company being Hungarian were not so obvious. Finally, it is important to see that in the case of a positive connection, supplementary allowances and size of income are not in a cause-and-effect relationship. The reason for this is that we cannot say that wages are systematically increased *because* of the existence of possible additional allowances. (In the case of negative connections, we could establish a causal relationship.) Therefore, I removed this variable from the model. Some important characteristics of *Model 3.1.* can be found in *Table 6*.

I tried two other specifications. First I adopted *ISKOLA*×*ISKOLA* and *KOR*×*KOR* variables into the explanatory variables of *Model 3.1.* (see *Model 3.2., Table 6*). Earlier I referred to the use of such interactions in certain researches. In the regression model run by the *forward* procedure, both variables were significant; however, *ISKOLA* and *GYERMEK* variables 'lost' their significance. Finally, I adopted the cross-product of all variables of *Model 3.1.* – except for the *HALKOCK*

variable – with every variable. These results became the new variables in a model that was also run, using *forward* procedure (see *Model 3.3.*, *Table 6*). This meant 69 ((12*12)/2-3=69) new variables, because the product of the two-value variables by themselves results in the original variable. It is important to draw attention to the fact that this should be considered a ’game’ or an ’interesting effort’ rather than a serious, methodologically supported initiative. Out of the 82 variables, 24 appeared to be significant. Although the multiple corrected determination coefficient indicated the highest value in this model, the results should be handled with great care because of the ‘uncleanness’ of the model.

Table 6. Models of the third round.

	Model 3.1.	*Model 3.2.*	*Model 3.3.*
Dependent variable	*LNJOVED2*	*LNJOVED2*	*LNJOVED2*
Number of explanatory variables	13	13	24
Number of explanatory variables that are significant on 5%	13	13	24
Corrected R^2	0.358	0.368	0.404
Global F-value	56.087	58.477	37.326
HALKOCK coefficient	6.145E-03	6.399E-03	9.980E-03
HALKOCK coefficient’s standard error	0.001	0.001	0.005
HALKOCK coefficient’s significance level	0.000	0.000	0.034
VSL (million HUF)	*241.478*	*251.492*	*392.935*

Based on our calculations, we can establish the following: *in 1998 the value of a statistical human life in Hungary was, to all probability, between 79 million and 393 million Hungarian forints. The most reliable values are around 250 million forints.*

VI.1.6. Limitations of the method, possible sources of errors

I do not intend to cover here those sources of error that are common in regression calculations because of the method's mathematical and statistical characteristics. I consider it more important to analyse whether the theoretical model is able to describe reality adequately. In this section I will examine the most important problems. Of course I do not mention those considerations that I described in Chapter IV.

The most common critique is that, in these days, labour market conditions are not formed by competition factors; therefore, it cannot be expected that factors like risk should appear in wages. If we look at the riskiest jobs (e.g. workers who work in high altitudes or miners), we will see that these are not well paid. The highest wages are for jobs almost without any risk (e.g. in banks or consulting companies). This critique is easy to fend off, since the aim of regression calculation is to filter out the effect of other factors that influence the amount of income (these factors are responsible for the differences in the income of, for example, a banker and a miner). The level of risk is used for explaining only the remaining differences (*Marin-Psacharopoulos* [1982]).

One of the important statements *Thaler and Rosen* [1976] made in their well-known study is that jobs with higher risk are usually pursued by people who are willing to take more risks. Therefore, the willingness-to-pay value is lower in their case, which results in a lower value for human life than in areas with less risk. *C. Olson* [1981] also supported this empirically. This means that the applied sample must be representative in terms of job and workplace risk; otherwise the result will be distorted. (*Thaler and Rosen* examined particularly high-risk jobs.)

The problem of which kind of risk data to use first appeared in their study. There are two basic possibilities: *job* or *industrial sector* data. Moreover, their *job-related data* was prepared in such a way that first the number of statistically *expected* deaths among those who had the given job was calculated. Then this value was deducted from the *actual* death values. The result was the extra number of death that can be

attributed to a given job. This method was often criticized (e. g. *Viscusi* [1979], *Lipsey* [1976]), because the extra risks specified this way are closely related not only to the riskiness of a job, but also to the specific characteristics, lifestyle and income situations of those who pursue the job.[79]

A. Dillingham [1985] devoted himself to finding out how the risk variable influences the specification of the value of human life. His experience was that the reason for the significant differences in VSL found by other researchers can be largely attributed to risk definition. Estimations that are based on *industrial sector* data are significantly higher than those based on *job-related* data. Furthermore, calculations based on the *additional death proportion* specified by insurance mathematics are significantly lower than those based on *work accident statistics*. Since we performed our calculations with the help of work accident statistics broken down by industrial sector, we expected a distortion towards higher than real values. *Leigh's* [1987] empiric results also supported the exceptional importance of selecting the risk variable.

Unfortunately, our work accident data are incomplete, even from a statistical point of view. They underestimate the risk levels; thus, they distort the value of human life in a positive direction. One reason for this is the fact that these data only deal with accidents that happen during working hours, but we can assume that there are a large number of work-related accidents outside this time, as well. Another factor is that accidents, illnesses and deaths can originate from a previous workplace or profession (e.g. in the chemical industry). These obviously do not appear in the statistics concerning a given area. Another reason, confirmed by the employees at OMMF, is that companies have a strong inclination not to record accidents – often mortal – but settle privately with the victims or their families. In several cases, the official procedure was only followed when private talks failed.[80]

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[79] That is why the waiters' jobs are three times more risky than firemen, according to the data (*Thaler-Rosen* [1976], p. 288).

[80] According to the statement of the National Alliance of Hungarian Trade Unions (Magyar Szakszervezetek Országos Szövetsége - MSZOSZ) from 2001, about one quarter of all workplace accidents are not declared by the employers. (Tízmilliós munkavédelmi bírság [2001].)

VI.1.7. Brief evaluation of the results

The basic hypothesis of our research was that the risk level of work carried out by employees influences the wage received for that work in a positive direction. ***We assume this hypothesis to be true based on the empiric test, since in the 'optimal' regression model the coefficient of the risk variable that explains the amount of income was positive and different from zero at every conventional significance level.*** Therefore, using the hedonic price method to specify the value of specifically defined statistical human life in Hungary is not unfounded.

Based on our research we received an answer to the basic question, namely what the value of a statistical human life in Hungary is. ***The ten models that yielded some results specified this value to be between 78 million and 393 million forints. We should consider the figure from 1998 of 250 million forints to be the most reliable.***[81] Accurately interpreting our results and drawing appropriate conclusions – taking into account the distortion effect described above – requires care and, at the same time, bravery. More details on this question can be found at the and of the dissertation.

VI.2. Establishment of the research based on the contingent valuation method

Having indicated before, the further improvement of my research lies in the realization of a large sampled, representative data survey among the entire Hungarian population based on the *contingent valuation* method. I consider two scenarios in connection with this. The optimistic version is to carry out the query of a bulkier

[81] It is questionable, that if we intend to specify the VSL for future years, what index is adequate to use for multiplying the 1998 year value. Using the normal inflation rate is not the best solution, because on one hand it measures the increase of consumer prices, and on the other hand it is an average value. However, this important theoretical question is out of the scope of my study. We do not make big mistake if we calculate by the inflation rate in a few years interval, but in long term the preferences and willingness-to-pay values about human life can change considerably, so that valid results can only be gained out of a new research.

questionnaire on a sample of a few thousand people. The relatively more pessimistic scenario is to perform the research with a shorter questionnaire on a monthly basis on a smaller, but also representative sample consisting of adults living in a non-institutional household in Hungary (similar to the Omnibus-research of TÁRKI).[82]

Prepared to take both versions I carried out three pilot tests. The first survey took one hour per person to finish and needed an active interviewer role which I carried out on ten of my close acquaintances. The second and the third test was carried out in two different times on students of the Budapest University of Economic Sciences and Public Administration. These shorter tests took only 5-10 minutes per person to finish and consisted of a set of questions to be filled in independently.

VI.2.1. Subjects of the first pilot test

I carried out the first pilot test based on ten close relatives and friends in Budapest, Kecskemét and Kiskunfélegyháza in July, 1999. The most important aim of the survey was to test the 17-page questionnaire with 36 questions which I compiled making use of almost all of the possibilities lying in the *contingent valuation* method.[83]

The "sample" of the ten persons is not similar in any of the parameters to the Hungarian population except for the 50-50% ratio of the sexes.[84] This would only be of importance by a sample of this size to be able to measure the problems arising by the survey and the evaluations concerning the questions from a point of view of a

[82] For more detailed information on the Omnibus-survey visit the following website: www.tarki.hu. To be able to decide which survey and the research based on that I would finally manage to carry out depends on many factors, but primarily it is a matter of finance.

[83] For the final version of the questionnaire modified based on the experiences see *Appendix 3*.

[84] Only one of the ten persons was old, two were middle-aged and seven were between 24 and 26. All but one had university or college degree. Eight had university degree, five of whom had this degree in economic sciences. Their permanent residence was Kecskemét for five of them, Sátoraljaújhely for two and Budapest, Nyíregyháza and Kiskunfélegyháza for the others, although seven of them lived in the capital at the time of the survey. There was no inquiry into their financial circumstances but eight of the ten persons were most probably in the upper third region of the society. It can also be stated with a high probability that the sample over-represented the adult Hungarian population with respect to the mental capacities.

possibly broader social group. The acquired quantitave-type data can by no means be observed as a decent guide with respect to the average, deviation or the range of the results.

However, the sample over-represents the population in many respects, therefore I could experience a certain “upper limit” of my investigations – upper limit referring to numerical data (naturally not in a pure mathematical sense), comprehensibility, attention, hepfulness, willingness, etc.

VI.2.2. Role of the interviewer and the subsidiary materials used

The questions, their wording and order, the order of magnitude of the numerical data used in them, the type of the examples, etc. applied in the survey have all been a deliberate result of the utilization of an immense knowledge of the related field assembled together through the past decades. Therefore I do not enter into details concerning the problems of every single question in this thesis, but I do have the opportunity to characterise the circumstances of the interviews, the subsidiary materials used and the role of the interviewer in a few sentences.

During the interviews I always tried to keep a contact based on an interactive dialogue with the respondents. I preferred the advantage acquired by occasional repetitions, short explanations to make sure every interviewee understands the task to the advantage of the interviewer’s objectivity and the equalised surroundings by merely reading the questions without any repetitions or explanations. The road leading to this is dependent upon situation and individual therefore it can not be standardised. Due to these reasons the interviewer is in a difficult situation, as well, because he has to consider the optimal level of giving help.

When I asked the interviewees to tell me about their evaluations, experiences, feelings or any other remarks on the questions after the survey it was a recurring factor to have paid less attention to a small detail, or some words, which were of high importance during answering. This happenned frequently, despite the fact that having gained experience from the first interviews I always emphasized that every word

does or can have a high importance and I also stressed, made pauses, repetitions, etc. to help to understand the most important information. As some expressions were of utmost importance by the answers and the verbal aids described above did not prove to be sufficient in every case I had to modify the wording of some questions.

In order to make it easier for the respondents I used different subsidiary materials during the interviews. One of these was the so-called *subsidiary table* in the form of small sheets of paper to serve two goals. Some of them had the role to show the decision situation in a tabular account that was perhaps too much "mathematized" and thus difficult in the wording of the question. The subsidiary table for *Question 10* looked like the one shown below:

Figure 1. Subsidiary table for Question 10.

	1st risk	2nd risk	
base	2	20	
(1)	2 → **1**	**20**	
(2)	**2**	20 → **15**	*out of 100.000*

The other part of the subsidiary tables would have played a part if the interviewees had not been able to answer a question without help. None of the first ten interviewees needed this so these tables remained untested. A table like this is shown in *Figure 2*.

Figure 2. Subsidiary table for Question 13.

"I will read numbers in increasing order. Please stop me when I say the number compared to what the the value in question is less!" READ THE VALUES QUICKLY AND UNHESITANTLY! **0, 1, 2, 3, 5, 7, 10, 15, 20, 30, 40, 50, 70, 100, 150, 200, 250, 300, 400, 500, 700, 1.000, 1.500, 2.000, 3.000, 5.000, 10.000, 20.000** WHEN THE RESPONDENT STOPS YOU ASK HIM/HER: "You stopped me at the number .... Can you tell me now what the value in question may be?" WHEN (S)HE BEGINS WITH "Less than ...", THEN TRY TO MAKE HIM/HER SAY A DENOMINATE NUMBER!

I constructed another subsidiary material from a *millimetre-scaled squared paper* with the aim of illustrating and making the measure of the probabilities – given in the form of x/100.000 as almost always suggested in the scientific literature – even more understandable. It is a known fact (being reflected in the interviews, as well) that people can handle low probabilities mentally with great difficulty. In order to help this problem I constructed sheets of size 25cm×40cm from the millimetre-scaled squared paper. These sheets therefore consisted of exactly 250×400=100.000 pieces of squares with the length of one millimetre of the sides. Having shaded x number of pieces from these squares, the ratio of the black squares compared to the total number of squares (being also equal to the ratio of the territories) perfectly illustrated the intended size of the risk. This subsidiary material was used in every case. According to the experiences told by the interviewees the use of these millimetre-scaled squared papers significantly helped the answers in most of the cases.

VI.2.3. Experiences of the survey

After having had the questionnaires filled in I had a second, more informal conversation with the interviewees asking them about the mental processes initialized in them by certain questions, the difficulty of answering, the factors

playing a role in the decisions, hearing and understanding the questions for the first time and later on, etc. All utilizable opinions were built into the questionnaire. I mention the most important experiences here, as well.

I made the situation in *Question 10* more transparent by using the subsidiary table described above. The alternative (2) is clearly more favourable than alternative (1) because it brings a five times higher reduction of risk. Despite of this only four chose alternative (2) correctly, and only three of these four chose it based on the correct reason. Most of the others chose alternative (1) because of the halved probability or because of an incorrect calculation (for example wrongly multiplying the probabilities), while others termed the 1/100.000 risk in alternative (1) as "being shrunk into insignificance".

The decision situation *in Question 11* (which I used in the second and third pilot tests, as well) can easily be modelled mathematically: choosing between a distribution resulting in any number of deaths from 0 to 100 with an expected value of 1 ("statistical death") – with a constantly decreasing but precisely definable probability beginning from 1 and a surely resulting 1 death ("anonymous death"). Nobody perceived the problem this way. Only some of the respondents had taken into consideration that the expected number of deaths is 1 by both alternatives. They rather used intuition or some kind of a principle (like "I don't want to choose certain death") by their decisions.

Question 14 was also used in both the second and the third test. It was clearly evident after the interviews during the first test that almost all respondents – although the text had not referred to it by any means – gave their answers *with respect to the ticket price of 20.000 forints* to the maximum willingness-to-pay values for risk reduction or the minimal willingness-to-accept compensation values for risk increase. Theoretically the measure of risk-taking should be the *exclusive* factor during decision, the ticket price should not play a part – *Hypothesis 3* referred exactly to this. *This phenomenon seems to contradict this hypothesis*. The fact that the answers given to another evaluative *question (No. 20)* resulted in a totally different value of human life (see *Table 9*) strengthened the belief further that *one can not evaluate*

risk, as a good in itself, only together with its characteristics where these characteristics would also be elements of the evaluation just like risk, the basic good.

Question 14 justified another phenomenon, as well, which was dealt with among the philosophical considerations in connection with cost-benefit analysis. Most of the respondents gave voice to their problems about having to think of affording a safety device taking their *current* financial situation into consideration. As most of the respondents were students before their graduation their financial situation did not afford them to pay as much for a safety device as they would be willing to 'after their hearts under normal conditions'. Therefore the amount they are willing to pay at the time of the survey is not in conformity with their actual preferences only with a preference system presenting a basis for an evaluation of possibilities of a seriously limited set due to the conditions.[85]

Question 15 of the actual questionnaire became the third and last question during the second and third pilot test. Making a pleasant surprise all ten interviewees realised that having had their choice in the *a)* part of the question about *snow versus rain* they insisted on remaining *consistent* with themselves and had the same decision in the *b)* and *c)* part of the question, as well.

Question 22 was another pleasant surprise where all of the ten respondents chose the dominant alternative *A*, although only seven of them realised the dominance whereas the other three chose this possibility because of other reasons.[86]

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[85] At the occurrence of this problem I gave the answer to everybody that they should think of an amount they would really be willing to pay and they can afford given their current situation (just as the original question asked them). The representativity of the survey on a great sample will make sure that these 'true only on the short run'-type answers would shape the big picture to an extent with respect to their true rate in the society. This procedure is also underlined by the fact that it would be a logical fault resulting in serious distortions if the respondents – already placed in a *fictitious* situation – were to give an evalutaion based on another *fictitious* financial situation from which we would be trying to draw conclusions with 'scientific methods' about *reality*.

[86] The following phenomenon was frequent: the answerers initially switched the two values of cost automatically not having realised they had already been in a reverse order compared to being logically right. After a short period of time they noticed the dominance and that time they thought the question had been wrongly worded and told this to the interviewer. Then I told them without explanation to 'decide, the wording was all right'. Given this instruction all of them chose the 'right' alternative.

According to my experiences *Question 24* seemed to be the most successful; I felt the *validity* of the answers given to this question was the most powerful during the interview. The role of other factors besides risk usually attached to the valuation were probably the smallest here. Most of the respondents found this question to be not too difficult, interesting and set them thinking – these characteristics all coincided with our intentions.

Two tables should be examined if we were to sum up numerically the experiences of the pilot test. *Table 7* is to illustrate whether we were successful in reaching our aims with the methods applied, namely whether we were getting answers to show the value of implicit human life to our evaluative questions. The validity would be strengthened by the fact that the relative order of the respondents with respect to their valuations of risk is not modified considerably based on their answers given to questions differing in wording, subject, logic and even far from each other physically within the questionnaire itself. The table shows a surprising harmony with respect to this. The ten respondents can be placed into four distinctive groups. Respondents No. 1, 2 and 10 had the highest results (sum of their rank orders being 7,5, 8 and 8,5 respectively), the second group consisted of respondents No. 5 and 3 (with sum of rank orders 11 and 13), respondents No. 9, 8 and 4 formed the third group (with sums of 18, 20,5 and 21,5 respectively) and finally risk had the lowest values with respondents No. 7 and 6 (sum of their rank orders 27 and 30 respectively).

Our confidence invested in our method and questions can further be strengthened by examining the correlation between columns of the rank orders of each question. The correlation value is *0,808* between *Questions 14* and *20*, the value is *0,827* between *Questions 14* and *28* and it is *0,683* between *Questions 20* and *28.* These correlation values count as very high showing a strong relation. However I do not intend to show the appearance of having a belief to be able to draw any similar conclusions from a small sample like this.

Table 7. Risk evaluation rank order of the respondents.[87]

Question / *Respondent*	*14*	*20*	*28*	*Sum*
1	2	2,5	3	7,5
2	1	4	3	8
3	4,5	2,5	6	13
4	7	6,5	8	21,5
5	3	5	3	11
6	9	9	9	27
7	10	10	10	30
8	7	6,5	7	20,5
9	7	8	3	18
10	4,5	1	3	8,5

Finally, *Table 8* shows the value of human life concluded from the given questions in our group of ten people. The average in the last row is based on a weighing of subjective judgment of the usefulness and validity of the questions.

Table 8. The value of human life in our sample of 10 people.

Data in million HUF

Question	*VHL*	*weight*
14/a	468	1/6
14/b	366	1/6
20/a	1.914	1/6
20/b	2.743	1/6
28	567	1/3
Mean	***1.104***	

[87] The rank order shows the decreasing evaluation of human life of the respondents given to the questions together with their subquestions. In case of equal evaluations the average of the ranks is shown in the table.

VI.2.4. The second pilot test

I compiled a questionnaire with only three detailed questions that can be filled in in 5-10 minutes based on the first pilot test with the intention of getting the most results as possible within the given limits.[88] These results are suitable for two things. On the one hand they help to formulate conjectures and hypotheses, on the other hand they serve a basis for the survey on a large sample.

The questionnaire was filled in for the first time in 2001 by 55 students in the second year (so most of them were around 20 years of age) in the Budapest University of Economic Sciences and Public Administration. The one and only demographic question was about the sex of the respondent, so we know that there were 26 females (girls) and 29 males (boys) in the sample.

The respondents were not given any instructions and information before or during their answering. The reason for this was that I tried to formulate the questions in a way that they would have no need to call for the interviewer's help.

VI.2.5. Lessons of the pilot test

Question *1)*[89] tried to reveal the difference between the *evaluation of anonymous and statistical human life*. Choosing alternative (1) in both cases – *a)* and *b)* – the respondent values *anonymous* life higher (by choosing "statistical death") while choosing alternative (2) gives a higher value for *statistical* life (by choosing "anonymous death"). While the respondent is not personally involved in the case described in *a)*, the case under *b)* has the respondent and his/her close acquaintances exposed to the danger. *Table 9* shows the results to this question based on the total sample and the subsample of boys and girls separately.

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[88] See *Appendix 4* for the questionnaire.

[89] The question – with slight differences – was also part of the survey conducted by *Hammerton-Jones-Lee-Abbott* [1982].

Table 9. Distribution of answers given to Question 1 in the pilot questionnaire based on the total sample and the subsample of boys and girls in 2001.

total sample

		1/a		
		1	2	*sum*
1/b	1	**14**	**10**	*24*
	2	**8**	**23**	*31*
sum		*22*	*33*	*55*

boys

		1/a		
		1	2	*sum*
1/b	1	**10**	**4**	*14*
	2	**4**	**11**	*15*
sum		*14*	*15*	*29*

girls

		1/a		
		1	2	*sum*
1/b	1	**4**	**6**	*10*
	2	**4**	**12**	*16*
sum		*8*	*18*	*26*

Based on the tables the following conclusions can be drawn:

a) There is *no definite decision* about whether the anonymous or the statistical life should be valued higher. Nevertheless the majority of both sexes feel statistical life more valuable.

b) The difference between the answers of the boys and girls are perceptible. The ratio of the two alternatives – (1) and (2) – was practically equalized in both – *a)* and *b)* – cases by the boys, while the girls definitely feel statistical life more valuable, especially in the case where the respondent and her close acquaintances were not exposed to danger in the hypothetical situation (outsider judges).

c) *Being personally involved* has a significance, especially among girls. This is shown by having 28% for the ratio of "cross-votes" (when a respondent chose a different alternative in cases *a)* and *b)*) for boys, while 38% for girls (the average is 33%).

Let's change the order and discuss the third question briefly. With this playful, *coherence-examining* question we can test the extent of conformity with the standard axioms of rational choice shown by the respondents in simple decision situations

under uncertainty.[90] To meet the requirements of *coherence* anyone choosing possibility *A* in case *a)* then (s)he has to make a preference for possibility *B* in case *b)*. This is *mutatis mutandis* true for possibility *B*, as well.

The sample consisting of students of economics proved to be of very "coherent thinking". Only 4 of the 55 did not pass this test, all of them girls.[91]

Finally the second question was the *evaluation* question based on which we can attach money value to the statistical human life. The question consisted of four subquestions calling for answers to evaluate risks of different size. The first two subquestions measured *willingness to pay (WTP)* for risk reduction, while the other two measured *willingness to accept compensation (WTA)* for risk increase.

The answers of 0 forint given for questions *c)* and *d)* need special consideration and handling. This can happen becaues of two reasons.

i) The respondent is not willing to accept a compensation of even 20.000 forints for risk increase.

ii) The risk increase has not any negative utility, meaning no costs attached for the respondent therefore (s)he need not be compensated with any amount.

There weren't any questions in the questionnaire to be able to decide which one of these reasons was the actual one for each respondent (we can make attempts to find it out in the large sample research), however, we can most probably decide it based on the answers given to questions *a)* and *b)*. In every case where the answers to questions *a)* or *b)* were differing from 0 it can be *presumed*, that the reason is i), while having 0 answer for both *a)* and *b)*, the reason is *presumably* ii).

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[90] I have already discussed some aspects of this issue, for more detailed examination see: *Savage* [1954]. This concrete type of question was used in the following surveys: *Hammerton-Jones-Lee-Abbott* [1982], and *Jones-Lee-Hammerton-Philips* [1985].

[91] Due to the extremely small sample number we should not draw any kind of conclusions whether there is a difference between males and females in this respect.

In accordance with this I modified the 0 evaluation to the maximal 20.000 forints where I presumed reason i), in order to avoid further distortion of these data. We have to see that 20.000 forints in these cases is a *lower limit*. The number of the questionnaires where I had to modify accordingly was relatively high; 14 out of the 55 questionnaires.

Table 10 shows the results of the value of human life after the modifications. I make three remarks to the table:

a) The values are shown with respect to six samples. On one hand there is the total sample and the subsamples of boys and girls. On the other hand there is a *truncated* version of each original sample (marked with the letter "t"). I left out those respondents who gave a 0 answer to subquestions *a)* and *b)*. Their answers would mean that they were unwilling to pay any amount to decrease the risk therefore resulting in a 0 value of statistical human life among them. Another question would be needed to find out whether their willingness to pay was really 0 in this situation or they just did not understand the question properly. The significance of the problem is shown by having had the sample of 55 persons truncated by 20 persons.

b) The last row of the table shows the averages of the answers given to the four subquestions with respect to all six kinds of samples. These are not simple arithmetical averages because I tried to give weights to the results based on their reliability. The values calculated for the four subquestions from *a)* to *d)* received the weights 35-35-20-10 per cent respectively. According to those written before we have to calculate with a lower limit in the case of *WTA*-type evaluations (in *c)* and especially *d)*), while there is no limit like this in the case of *WTP*-type evaluations (in *a)* and *b)*).

c) A *coherence-test* is involved in this question, as well. Those respondents who either gave a lower value to subquestion *b)* than *a)*, or gave a lower value to subquestion *d)* than *c)* did not pass this test. Only one respondent of the truncated sample of 35 persons failed to pass this test.

Table 10. Results given for the value of statistical human life for each sample based on the answers given to the second question in 2001.

data in million HUF

	total sample *55 prs*	total t. sample *35 prs*	boy sample *29 prs*	boy t. sample *19 prs*	girl sample *26 prs*	girl t. sample *16 prs*
2/a	156	245	109	166	209	339
2/b	131	206	102	155	163	266
2/c	129	151	133	151	124	150
2/d	54	67	53	62	56	73
***mean*[92]**	***132***	***195***	***106***	***149***	***161***	***249***

Based on the results the following remarks can be made:[93]

a) *WTP* values were higher than *WTA* values in all of the subsamples. This harmonises to the experiences of the earlier surveys. It is an interesting fact that the *WTP* values were significantly higher among girls than boys, however, the differences between the *WTA* values of these subsamples were not so striking.

b) The linearity of the function *WTP (risk)* or *WTA (risk)* (that is where the value given in question *2/b)* is to be 7/4 times the value given in question *2/a)* or the value given in question *2/d)* is to be three times the value given in question *2/c)*) can not be detected in any of the respondents giving answers other than 0. This means that none of the respondents possess such a robust 'internal value of life' that they would be able to consequently evaluate a change of risk threatening their life proportionately to that of its level.

c) The smaller the change of risk that had to be evaluated in the questions the bigger the value of statistical human life became.

[92] For the weighing scheme and the reasons see text above.

[93] It is important to draw attention to the fact again that *we should not feel entitled to draw any kind of valid consequences* from the sample due to its small number of participants from a well circumscribed social group. However, we have the possibility to fix some *conjectures* in connection with special trends, values in our memory.

d) The value of statistical human life is most probably between 132 million and 195 million 2001 forints in the case of this small sample.

VI.2.6. Repeating the test

I repeated the test two years later in 2003. I had the same questionnaire filled in with the same age group in the same university. Repeating the test had a double purpose. On one hand it can be examined whether we would be able to draw similar consequences as for the first time.[94] On the other hand I asked the respondents in a group interview after the test whether they had any – and if yes what kind of – problems during answering. Its aim was to further develop the quality of the questionnaire by rephrasing the questions in order to enhance the probability of the success of the large sampled survey with utilisable results.[95]

This time the test was filled in by 68 students with exactly 50% of the representatives of each sex. As I have mentioned before and it also turns out from the questionnaire we know no other demographical characteristics of the sample. Nobody received any kind of help before or during answering – just like in the test previous time.

The answers given to question 1) investigating the *difference of evaluation between anonymous and statistical human life* are the following:

[94] Of course the question is again not about statistically testing the constancy in time of the results, becaues this test is not suitable for that due to the reasons mentioned before.

[95] See *Appendix 5* for the modified questionnaire. A remark has to be made here that it would be important to carry out a last test survey before the finalisation of the questionnaire to be used for the large sampled survey (the size and list of questions of which is mostly dependent upon the possibilities avaliable). The subjects of this test would consist of the less qualified strata of the society which is of crucial importance during the final wording and understandability of the questions.

Table 11. Distribution of answers given to question 1) in the test questionnaire based on the total sample and the subsample of boys and girls in 2003.

total sample

		1/a		
		1	2	*sum*
1/b	1	**32**	**15**	*47*
	2	**6**	**15**	*21*
sum		*38*	*30*	*68*

boys

		1/a		
		1	2	*sum*
1/b	1	**16**	**9**	*25*
	2	**4**	**5**	*9*
sum		*20*	*14*	*34*

girls

		1/a		
		1	2	*sum*
1/b	1	**16**	**6**	*22*
	2	**2**	**10**	*12*
sum		*18*	*16*	*34*

The following statements can be made by comparing the results of this table with that of the one filled out in 2001.

a) There is *no definite decision just like before* about whether the anonymous or the statistical life is to be valued higher. This time anonymous life proved to be more valuable in both – *a)* and *b)* – cases, which is just the opposite finding compared to the experience gained two years before.

b) The difference of the answers between boys and girls in 2003 is not so striking as it was in 2001. This time not only the majority of boys but most of the girls chose alternative (1) in both cases, resulting in a bigger ratio among girls (76%) than boys (62%) having answered the same way to both questions – that means consequently valuing either anonymous or statistical human life higher. This was just the opposite two years ago (62% of the girls and 72% of the boys).

c) The ratio of the "cross-votes" is 31% based on the total sample, slightly lower than in 2001 when it was 33%. This shows that *being personally involved* had significance among the respondents of the second test, as well. However the ratio of those valuing anonymous human life higher was bigger when being personally involved this time.

Summarising the experiences gained from the answers to question *1)* it can be stated that they show a slightly opposite finding compared to the results two years ago. ***Therefore we can deduce the consequence that we can not foretell with a great probability the results of a survey based on a representative sample with respect to the evaluation of the anonymous and the statistical human life. The probability of not being able to show a statistically significant difference between the two evaluations is not low, based on the two tests.*** We can not even make conjectures about the differences in the evaluations between males and females.

I carried out some modifications to become more precise in the wording of the questions based on the experiences of the interviews following the answering. It was not clear whether the epidemic infects only this week or later on as well, which does have a significant role in answering. I also had to make more clear in the wording that there were *exclusively* those two possibilities described to solve the problem. The wording of question *1/a)* also needed a slight change to be more precise.

It became evident during the conversation that it is very hard to reach the *feeling of being personally involved* by drawing up a hypothetical situation (see also disadvantages of CV method), only a few respondent was capable of fully feeling into it. It also became clear that even the group certainly over-representating the society with respect to cognitive capacities could not have a good grip on the situation during the short time available for answering what kind of alternatives they had to compare in a mathematical-statistical meaning. As a consequence the time limit available for answering has to be enlarged, but not even this time should we expect the relatively precise realisation of the probability-distributions of the two alternatives. My opinion is that further specification of the wording makes understanding not easier, but more difficult.

The question occurred to me to give an independent possibility to choose “I don’t know” or “I don’t understand” or both. The reason I finally rejected this idea was that I think this would have ensured such an easy “avenue of escape” during questions that do need a little mental activity that answeres would choose these

options in a greater amount than their real ratio therefore causing reduction in the validity of the consequences.

I could gain favourable experiences by the *third question testing coherent thinking* by the repeated test, as well. Only seven of the 68 respondents did not pass the test. This time three of them were males so the rejection of building up a hypothesis about females being more probable to fail this test than males became confirmed. It became clear during the interview following the answering that this question was easy to understand for this social group, most of them realised the "trick" lying in it. Another favourable experience is that students tried to understand and answer properly to this question as well despite of the short time available and they were not in a haste to "get it over".

Finally let us discuss the second, evaulative question. I carried out the same modifications after the answers as I had done with the results of the previous test. The results can be seen in *Table 12,* which is parallel to *Table 10.*

Table 12. Results given for the value of statistical human life for each sample based on the answers given to the second question in 2003.

data in million HUF

	total sample *68 prs*	total t. sample *50 prs*	boy sample *34 prs*	boy t. sample *25 prs*	girl sample *34 prs*	girl t. sample *25 prs*
2/a	117	159	87	119	146	199
2/b	157	214	104	142	210	286
2/c	144	183	141	173	147	192
2/d	56	68	57	68	54	69
***mean*[96]**	***130***	***174***	***101***	***133***	***159***	***215***

The following remarks can be made by comparing this table to the results of the analogous table based on the survey in 2001.

[96] For the weighing of the average and the reasons see text in connection with the survey in 2001.

a) The necessary truncation of the total sample was smaller in 2003 (26%) than in 2001 (36%). This partly gives the reason for the value of life coming from the answers of the truncated and subsamples being somewhat closer to the values of the untruncated and subsamples than two years before.

b) Unlike the survey in 2001 this time the highest value of statistical life came from question *2/b)* instead of *2/a)*. The reason for this is mostly because of the decrease of the value of life based on the answers to question *2/a)*, only a smaller part is due to the increase of the value of life based on the answers to question *2/b)*.

c) The value of life based on the answers given to *2/c)* increased compared to that of in 2001 (with 12% in the total sample and 21% in the truncated total sample) with the measure of the increase roughly equalling to the depreciation of money (around 15% in the given time interval). The difference is insignificant in question *2/d)* based on the total and truncated total sample, the values coming from the subsamples of girls and boys approached each other.

d) *WTP*-questions resulted in a higher value of life than *WTA*-questions again, although the value of life is less in question *2/a)* than in question *2/c)* for both the untruncated and the truncated total sample due to the male respondents.

e) The value of statistical human life in the sample of 2003 is surprisingly close the value of the sample of 2001: it is most probably between 130 and 174 million 2003 Hungarian forints.

The conversation following the answering in order to further clarify this question proved to be useful again. On one hand I thought it inevitable to change the 20.000 forints in the question to 50.000 forints which is a more realistic amount in our present (and future) price relations and it also serves a two and a half time larger possibility to financially evaluate the increase of risk in the *WTA*-question.

WTP-subquestions were generally easy to understand for the students. I still made it even more clear here that the amount to be written in is to be paid as an *extra* above the 50.000 forints.

Having experienced more difficulty and misunderstanding in the *WTA*-subquestions I rephrased them. A new answering possibility had to be shown in an explicit way for cases when the respondent felt that not even the total amount of 50.000 forints would be enough for him/her to compensate for the risk increase. Up until now the respondent was right in writing 0 forint in this case, however this could also mean that the respondent did not need any amount of money for compensation for the risk increase. Answering 0 forint in the new questionnaire can mean only this latter case.

Finally it was confirmed that it had been very hard to perceive the measure of risk expressed by numerical values. The perception of the measure of risk is made easier in cases when referring to a measure of risk of a real and frequently occurring everyday phenomenon. However, we encounter here the distorting effect coming from subjective perception, meaning that the same objective risk (for example the danger of an air flight) can be percepted as being of different measures, so the measure of risk brought into comparison with it would naturally also be dispersed among the respondents. The illustration of the measure of risk and promoting its mental reception can be helped by a visual tool (like the the millimetre-scaled squared paper I used in the first test) shown by the interviewer that would serve as a proper solution.

VII. REGULATION IN CASE OF A BOMB ALARM – A THEORETICAL MODEL

Bomb alarm is one of the incidents suitable for hindering the satisfactory functioning of social order. Its massive appearance causes significant financial loss not only directly but due to its facelessness, incalculableness and insidiousness it can have a disturbing, alarming effect decresing, can reduce safety to a much wider group than those directly involved; even to a society. Although several examples can be cited from the last years in Hungary, fortunately we still can not talk about it as becoming a massive, general phenomenon.[97]

According to the statement of the Central Statistical Office there is no official statistics written about bomb alarms so their frequency and the significance of the problem can merely be demonstrated in a rather indirect way. The following table shows the number of results found for the special expressions in the most widespread Hungarian Internet browsers. These expressions are all (with the exception of 'cost-benefit analysis' listed only as a point of interest) in connection with phenomena bearing negative judgment; sin, deviant behaviour and society-wide catastrophes.

Table 13. Results for certain expressions in the Internet.

Expression	*Origo-vizsla*	*Google*	*Heuréka*	*Mean*
Bomb alarm	3 791	8 130	355	*4 092*
Kidnapping	2 327	2 830	386	*1 848*
Domiciliary visit	5 651	8 030	1 858	*5 180*
Suicide	13 737	5 930	4 567	*8 078*
Earthquake	13 462	14 100	3 420	*10 327*
Drug	43 527	21 300	7 288	*24 038*
Cost-benefit analysis	1 091	715	12	*606*

Date of query: 3 October 2003.

The numbers clearly give an idea of a phenomenon that is bound to be examined, however, the intention of drawing up an adequate, nationwide solution on the long run to remedy the problem is still not in the top of today's political agenda. Its reason should not be searched for in rationality (namely the proper priorisation of efforts to

[97] For a short summary of some Hungarian bomb alarms in the past few years see *Appendix 6*.

minimalise social costs) but in the priorisation of issues calling for immediate treatment, issues of scandalous nature or receiving public attention by the media or perhaps influencing the popularity of the parties or the government in any way.

Bomb alerts – as we could see through the examples of the Hungarian cases – show difference from and similarity to each other at the same time. They are different primarily in the *character of the target* and the *motivation of the alarming*. They are similar in special definitive characteristics, like:

a) their *aim* is *harmful* and *destructive* for society;
b) the alarm has no results: the bomb is *in fact not placed* in the indicated place;
c) the perpetrator of the crime *does not fall into the hands of the police*.

There are exceptions to the second and especially the third characteristic, but definitely not to the first one.

From economic viewpoint bomb alarm is a tool for a citizen intending to cause trouble with which (s)he can cause a *significant social damage* with a very small, practically *negligible individual cost* (for the perpetrator: *investment*). The social damage is in the decisive majority of the cases much too larger than the individual benefit of the perpetrator – for example postponing a written examination! Therefore the phenomenon of a bomb alarm would result in a net cost in the viewpoint of society even if we accepted the individual benefit of the perpetrator, of course we do know that this factor must not be internalised. The net social cost of bomb scare is equal to its gross social cost in social cost-benefit analysis because the benefits connected to it is not acknowledged.[98]

This characteristic just mentioned serve a reason for the reconsideration of the regulation in connection with bomb alarms in order to draft an alternative solution different from the actual one – at least as an intellectual *theoretical model*.

[98] See also *Boardman-Greenberg-Vining-Weimer* [1996], p. 44-45.

VII.1. Current regulation and law surroundings[99]

The current provisions of law *do not give a straightforward, direct guide* in Hungary about the actions to follow in case of a telephone call or other information coming from an unidentified source threatening with a bomb. The behaviour expected by the legislator can be deduced only indirectly.

In a certain way *educational institutions* form an exception based on the MKM Regulation No. 11/1994. (VI. 8.) on the Operation of Educational Institutions in Paragraph 4, Section 1, Point o) stating that the organisational and functional regulation of these institutions has to involve the 'necessary actions to be taken in case of an extraordinary event, bomb alarm, etc.'. Even in this case the regulation orders to *define* the necessary actions instead of defining the *necessary actions themselves*.

The bomb alarm is not named in the compulsory elements of the organisational and functional regulations of any other institutions or in the Government Regulation No. 217/1998. (XII. 30.) on the Rules of Operation of the General Government giving general rules for public agencies and bodies.

In the lack of direct guide we have to examine how the problem is handled by the Hungarian legal system, namely the criminal code[100] as it is about a crime. A person threarening with a bomb commits the crime of *threatening with public danger* executing the statement of facts in Paragraph 270/A in the criminal code.[101] Section (1) of this paragraph says that 'the one who states an untrue fact to others about an event bound to come and threatening with public danger that is suitable for

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[99] I expended a great care on the proper use of the legal technical terms (*terminus technicus*) in this subchapter. Despite all my efforts it can happen that I do not use the terms properly in some places. I apologize for this in advance especially from Readers of the legal profession.

[100] Act IV of 1978 on the Criminal Code.

[101] The reason given by the minister for framing this law in 1997 – as a special case of the *spreading of disquieting rumours* in Paragraph 270 of the criminal code – is that cases about unidentified persons threatening different public institutions with having placed bombs there became very numerous.

disturbing public order commits crime...'[102]. If the threatening is about radioactive substance or it has seriously disturbed public order it is handled as an aggravating circumstance when judging the action. The *untruthfulness of the stated fact* is an important criterion in the viewpoint of realising the statement of facts, meaning that the occurence of the event with public danger should not threaten in reality; the stated 'fact' should be a forgery known by the perpetrator. In case of a bomb alarm this is equivalent to the factor motivating the accomplishment of the total theoretical model, namely that *the aim of the threatener is just to disturb public order and not to actually blow up a bomb*.

If the unidentified person actually places a bomb then (s)he violates the law (and commits a crime against the society) naturally not by his/her telephone call but by his/her action to blow up the bomb realising the statement of facts of *causing public danger* or perhaps *act of terrorism*. The former statement of facts is included in Section (1) of Paragraph 259 of the criminal code: 'if a person causes public danger by causing flood, by executing the destroying effects of explosive, radiating or any other material, energy or fire or hinders averting of public danger or alleviating its consequences commits a crime ...'. It is an aggravating circumstance when judging the action if the crime is committed in a criminal gang or causing extraordinarily big pecuniary loss or causing the death of one or more people. Warning about the public danger may be a mitigating circumstance especially when the public danger is not carried into effect, so the bomb explosion is successfully kept back. According to Section (6) 'the punishment may be mitigated without restraint if the public danger is voluntarily terminated before the harmful consequences had taken place'. (The statement of facts of the act of terrorism is dealt with in Paragraph 261 of the criminal code, we do not discuss this in details.)[103]

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[102] The perpetrator of the crime is to be sentenced to imprisonment not exceeding two years, to carry out work of public interest or to be punished with a fine. Based on Section (2) the sentence is three years in prison if the crime desribed in Section (1) is committed by threatening with radioactive materials. If the public order is seriously disturbed the punishment based on Section (3) is imprisonment not exceeding three years in case of Section (1) and imprisonment not exceeding five years in case of Section (2).

[103] The crime of *causing public danger* is to be punished with an imprisonment ranging from two to eight years. The punishment is an imprisonment ranging from five to ten years if the crime is committed in a criminal gang or causing an extraordinarily big pecuniary loss; and it is an

In our viewpoint the judgement of the behaviour of the person receiving the telephone call threatening with public danger or is notified by the receiver of the call and is *competent to take orders in connection with it* is more interesting. If an internal regulation describes the necessary actions to be taken in case of a bomb alert then the judgment of the behaviour of this person can take place based on that, it can be clearly decided whether his/her actions were right or wrong. The legal consequences in connection with it can also be unambigiously determined. (We presume of course that this internal regulation is in conformity with the provisions of law.)

If there is no internal regulation that would serve a direction about the necessary steps to be taken then the competent person in connection with it has a deliberation possibility. If (s)he notifies the authorities then (s)he brings about the usual course of action resulting in material and/or non-material costs for the authorities taking action and for the given institution as well. If (s)he does not notify the authorities then (s)he takes a risk. If the threatening was only a false alarm then nobody suffers damages, the case will not become an issue of the police, no crime or offence except for threatening with public danger is realised. However if the bomb was really placed in the premises and it actually explodes then the person failing to notify the authorities realises the statement of facts of the crime of *causing public danger* (see above) because (s)he hindered averting of public danger or alleviating its consequences. (If

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imprisonment ranging from five to fifteen years or for life if the causing of public danger causes the death of one or more people.

If the causing of public danger is committed through negligence, (s)he is to be sentenced to an imprisonment not exceeding three years in case of an offence, not exceeding five years in case of an extraordinariliy big pecuniary loss, not less than two and not exceeding eight years in case of causing the death of one or more people. The one who makes preparations for causing public danger is to be sentenced to an imprisonment not exceeding three years.

The statement of acts of the crime of *act of terrorism* is realised if one commits a violent crime against a person or in connection with weapons, or causes public danger in order to

a) force state organ, other state, international organisation to do, not to do or tolerate something,
b) intimidate inhabitants,
c) change or disturb the constitutional, social or economic order of another state or disturb the functioning of an international organisation.

The perpetrator of the act of terrorism is to be sentenced to an imprisonment not less than ten and not exceeding fifteen years or for life. Section (8) of Paragraph 261 is important and therefore needs to be emphasised for our viewpoint: 'the one who obtains trustworthy knowledge of an act of terrorism about to be committed and does not notify the authorities as soon as possible commits a crime and is to be sentenced to an imprisonment not exceeding three years'.

the bomb actually does not explode then we can not talk about public danger, so the statement of facts of causing public danger is not realised.) It is a significant mitigating circumstance if the jury qualifies the action negligent, in this case there is only an offence (of course the amounts of punishments are also significantly milder).

It can be seen that the judgment of the behaviour of the person receiving the telephone call or message threatening with a bomb is fundamentally dependent upon whether there is a bomb or not behind the threatening. Failing to notify the authorities in the former case can result in a serious punishment. As the receiver of the call can not know whether the threatening is a false alarm or not, the *rational action to take is clearly to notify the authorities*, except for the case when – based on his/her deliberation – the expected measure of the damage caused is more significant to him/her than without the notification. This can happen when the receiver judges the probability of having a bomb that can explode negligible while notifying the authorities would cause a highly significant damage for him/her. These two conditions exist together only in a very small number of the cases so we may state that – *given the current law surroundings – the rational action to take after receiving a threatening with a bomb is to notify the authorities who are bound to probe into the matter following the way prescribed to them without deliberation.* [104]

VII.2. An alternative regulation model

The new regulation would be briefly the following: the procedure to be taken in case of receiving an unidentified telephone call threatening with an explosive device would be to notify the person – referring to the proper place of the regulation – that as an effect of the threatening *no other action has to* and therefore *will not* happen based on and abiding by the provisions of law, except for notifying the police who will start to trace down the person making the telephone call.

[104] The ambigous social judgment of the current procedure applied in case of a bomb alarm is well demonstrated by an event in Hatvan in 1997, when the owner of a disco denounced the police taking action after a bomb alarm for having vacated the premises.

VII.2.1. Bomb alarm versus act of terrorism with explosion

We draw up a model in the following section to confront all social costs of the above regulation with all of its social benefits. As a matter of fact we will execute a social cost-benefit analysis of the regulation, substituting the lack of precise data for variables of the cost- and benefit-items and the formula describing them. This is the point where the subject of the section meets the subject of the thesis: 'sacrificing' statistical human life, that is the increase of the risk of death due to the explosion is one of the most important costs of the regulation.

The most striking characteristic of the bomb alarm is that it is *not about the bomb*, but rather *about the alarm* itself. The aim of the person telephoning is not the explosion of the building or any other institution and therefore the extinction of the lives of innocent people, because if it was so then it would not be rational to notify anyone in advance, risking that the bomb would be found and the explosion would be undone. It is important to note, however, that unfortunately this does not always happen in the way described, we may not always take the rationality of the person threatening with a bomb alarm for granted. It has already happenned even in Hungary (although in a negligible quantity) that the bomb disposal squad did find a bomb in the building. Therefore this possibility has to be represented in our model.

Our fundamental assumption however still remains the following: the person intending to explode a bomb and therefore cause the greatest possible damage to the society should conceal his/her activity and carry out the explosion in the most suitable time without leaving any kind of trace behind him/her. The perpetrator can maximalise the damage caused and at the same time decrease the danger of getting caught by the police to a minimal level by not giving another possible clue to the police by identifying the telephone call. It is natural to assume that getting caught has a negative benefit for the perpetrators so it is desirable for them to avoid it.

On the other hand the real aim of the person threatening with a bomb is not to blow up the bomb but to cause panic (with the aim of avoiding a written test, calling public attention to anything, causing damage to a competing company, etc.).

Consequently we can not avoid the intentional bomb explosion (perhaps to be handled as an act of terrorism) causing significant social damage with the help of an investigation after the bomb alarm. On the contrary, we give rise to a social cost of an activity with a criminologically different weight and category having a completely different motivation but also harmful to society. And this is exactly the wish we satisfy for the person threatening with a bomb but not intending to blow that up. If we accept that the *bomb alarm and the act (of terrorism) of a bomb explosion are two phenomena of completely different characteristics* having a common section only in very small number of cases then we have to examine the following statement: the minimalisation of the social damage happens with a greater probability if society does not react to the telephone call threatening with having supposedly placed a bomb – besides attempting to identify the person making the call –, therefore avoiding all kinds of material, non-material damages, costs arising due to the alarm and the vacation.

VII.2.2. Calculation of the costs of the regulation

The alternative regulation has the following cost elements compared to the *status guo*:

1) marketing cost of introducing the new regulation,
2) the social damage caused by certain (to be exactly defined later) explosions that could be avoided by the investigations after the telephone calls.

We can divide the first cost element into two parts. Let K be the cost item to mark the one-time cost in the present to make the regulation modification well known to everybody including the potential threateners. This cost item would be significantly decreased by the fact that it would probably gain a huge attention for itself through the media even without the introducing campaign, thus generating a wide publicity to the regulation with the help of news coverage. We have to take into consideration a smaller marketing cost (k) to be paid as an annuity every year in order to keep this knowledge fresh in the public. The sum of the net present values of the two cost

elements is $K + k/(r_k-g_k)$, where r_k is the nominal social discount rate to be applied and g_k is the assumed constant annual rate of increase of the value of k.[105]

The marketing work in connection with making the new regulation widely known is an important element of the model, because that would generate the increased realisation of the absence of the intended consequences – the confusion and vacating to be caused – in the minds of the potential threateners. It is highly essential for the communication to be creditable and the proceedings of the new regulation to be strictly insisted on by the authorities.

The other target group of the marketing campaign is every potential receiver of the telephone calls and every manager competent in giving out the necessary orders who should also be fully aware of the new regulation.

The *key element of the theoretical model* is the *hundred percent commitment* to the behaviour required by the new regulation and *its realisation* in the minds of the potential threateners. If this happens then – assuming rational behaviour – the aim of the threatener who actually places a bomb in the designated place is not the generation of the damage caused by the threatening itself (he already knows that it will not take place!), but the explosion! If the aim is the explosion then the perpetrator can do that under the old regulation as well, without notification, naturally. Thus we have to calculate only those damages caused by explosions as social cost caused by the new regulation where the aim of the perpetrator is

a) not the explosion but causing disorder (in this case this was an irrational activity, but we can not preclude this possibility),
b) the action against the new regulation (perhaps guided by the intention to replace the original regulation) to prove its harmful nature to society.

Case a) describes the activity of people who intended to cause the effect of *threatening with a bomb* (perhaps ignorant of the fact that it was bound to become a

[105] The information on writing the formula is to be discussed later.

failure due to the new regulation), but they did actually place the bomb hoping that it would have been found anyway. This is by no means a rational behaviour, especially if the threatener is told by the receiver of the call that the authorities will not take the actions desired by the threatener. The threatener with this latter information who still not defuses the bomb wanted either to actually explode the bomb (in this case the damages caused should not be included in the costs of the new regulation based on the reasons desribed before) or (s)he does not believe it or perhaps does not understand it. The damages caused in the latter two cases are to be included in the costs of the new regulation. The case is similar when the receiver of the call has no time to or – out of any reason – can not tell the threatener the sentence about the 'failure' based on the new regulation. It is important to lay an emphasis again on the fact that every subcase described in case a) is *supposed to be irrational behaviour* (the threatener places a bomb without the intention of exploding it).

The problem described in case b) is more complex. In this case the threatener does know about the new regulation, but wants to prove its harmful nature and this is the very reason of placing a bomb, making the telephone call and exploding the bomb afterwards. The question goes: who might have such a powerful motivation to do this? We know that in case b) it is not about an irrational behaviour, so we should suppose that the perpetrator has such a strong desire to return to the old regulation that (s)he is actually ready to explode the bomb together with significantly increasing the risk of his/her arrest due to the telephone call. This assumption is not too life-like for anyone thinking rationally, especially if the commitment of the society and the politics to the new regulation is unquestionable and the measures taken by the authorities are also consistent every time. Of course this social and political commitment may decrease and even cease to exist (by this way realising the intention of the threatener-exploder) after a series of 'successful' explosions (preceded by a notification). It is important to stress, however, that the threatener exactly knows that the bomb is to be exploded so this perpetrator is someone who will not be diverted from his/her original purpose by the consequences of the bomb explosion. It can be supposed with reason that this kind of perpetrator would explode the bomb under the old regulation as well – of course finding another reason for it.

Taking the above described into consideration we have to include another social damage – caused by the explosions that could have been avoided under the old regulation – in the second social cost element of the new regulation. This damage can be *divided into three parts*: (1) material damage, (2) damages arising from human injuries and (3) damages arising from losses in human life. Let the annual measure of the first element be denoted by $n_a \times a$, where n_a is the number of explosions and a is the measure of an average material damage caused by an explosion. Let the formula $n_s \times s$ be the annual measure of the second element, where n_s is the expected number of injuries in a year and s is the measure of the average social damage connected to one injury. Finally let the formula $n_l \times l$ be the measure of the social damage arising from losses of human life, where n_l is the expected number of losses in human life in a year and l is the measure of the social damage connected to one loss in human life which is *exactly equivalent to the value of statistical human life*. If we continue to work with the assumption of the constant annual increase of the values of a, s and l and the constancy of the expected numbers of explosions, injuries and losses in human life then the value of the total social cost connected to the new regulation (C_{reg}) can be calculated as shown below:

$$C_{reg} = K + k/(r_k - g_k) + (n_a \times a)/(r_a - g_a) + (n_s \times s)/(r_s - g_s) + (n_l \times l)/(r_l - g_l),$$

where r_a, r_s and r_l are the nominal social discount rates of the cost elements a, s and l respectively; g_a, g_s and g_l are the supposed rates of annual increase of the nominal values of a, s and l.

For the sake of simplicity we had the assumption of the constant increase of the nominal measures of the cost element units and the constancy of the expected numbers of explosions, injuries and losses in human life (that is the annuity-type presence of the cost elements) when creating the formula. The former assumption is realistic, but not the latter one, if we consider that in case of the obviousness of the commitment to the new regulation the number of the explosions arising from the second (and designated by b) reason is expected to decrease by time. Therefore the

formula may be changed to be more sophisticated but this is of slight importance in view of the theoretical model.

VII.2.3. Calculation of the benefits and the net benefit of the regulation

A very significant benefit element of the new regulation compared to the old one is the absence of all those social damages that are accompanied with bomb alarms presently. These are the costs of actions taken by the authorities (let *h* denote its average measure), the costs emerging at the injured party of the bomb alarm and at any others directly involved (moral cost, costs emerging from interruption of business function: material, loss of time, etc., let *d* denote its average measure) and the moral damage hardly to be operationalised and defined numerically emerging not at those directly involved but rather connected to the feeling of exposure to bomb alarm threatenings. We have to calculate with a society-wide moral damage under the new regulation – out of other reasons – as well, but not having had taken that into consideration at the calculation of the cost-formula we do not have to include it here either. Therefore the value of the total benefit of the new regulation (B_{reg}) can be calculated as shown below:

$$B_{reg} = (n_r \times h)/(r_h - g_h) + (n_r \times d)/(r_d - g_d),$$

where n_r is the number of bomb alarms under the old regulation, r_h and r_d are the nominal social discount rates connected to benefit items *h* and *d* respectively; g_h and g_d are the supposed rates of annual increase of the nominal values of *h* and *d*. (When creating this formula we used similar asumptions as in the case of the cost elements.)

Now we can create the net social benefit – in other words, the net present value (NPV_{reg}) – of the new regulation described in the theoretical model as shown below:

$$NPV_{reg} = B_{reg} - C_{reg} = (n_r \times h)/(r_h - g_h) + (n_r \times d)/(r_d - g_d) - [K + k/(r_k - g_k) + (n_a \times a)/(r_a - g_a) + (n_s \times s)/(r_s - g_s) + (n_l \times l)/(r_l - g_l)] =$$

$$= (n_r \times h)/(r_h - g_h) + (n_r \times d)/(r_d - g_d) - K - k/(r_k - g_k) - (n_a \times a)/(r_a - g_a) - (n_s \times s)/(r_s - g_s) - (n_l \times l)/(r_l - g_l).$$

Now we can displace by the expected values (being produced based on calculations, statistical estimations and other examinations) of the variables – among others the value of statistical human life as one of the important elements of the model – into the formula then we receive the net social benefit of the new regulation. *If this value is positive then it is worth introducing it, otherwise not.*

VIII. CLOSING REMARKS

I will briefly discuss four subjects as closing remarks. I present the method of the so-called *meta-analysis* (namely the 'analysis of the analyses') and the results of the most up-to-date examination. I put it into words again why the examination of the value of human life should be handled as a question of cardinal importance for economic sciences. I summarise the results of the investigations of the research questions and hypotheses built up described in my essay. Finally I indicate the possible and – based on the most recent scientific literature – actual directions of the pursuance of my research.

Meta-analyses form a special type of the researches handling with the examination of the value of human life. Being a kind of secondary research they wish to produce new results (and not only descriptive summarisation) with the help and elaboration of the analyses as inputs of the scientific literature thus contributing to the further development of the field. The studies of *W. K. Viscusi* [1993] and the research of the writer trio of *A. Fisher, L. G. Chestnut and D. M. Violette* [1989] from the past years and most recently the work of *J. R. Mrozek and L. O. Taylor* [2003] are examples of using this method.

Elaborating about fifty of the most significant researches based on labour market approach the writer duo came to the conclusion that the researches using and setting the surroundings of the so-called *best practice* – being the closest to reality – assumptions out of the results fluctuating in very wide ranges (from 100 thousand dollars to 25 million dollars) produce the value of 1,5 – 2,5 million (year 1998) dollars as the value of statistical human life.

Why is this knowledge important in view of practical decision making? ***I laid emphasis several times in my essay on the fact that defining the value of human life is important not because of theoretical reasons but because its assistance given to making public policy and regulation decisions.*** For example, according to the estimations of traffic experts, 11 thousand human lives may be saved in the member

states of the European Union annually if the average speed decreased by 5 km/hours[106]. Putting a value of 1 million euros for the statistical human life based on the calculations of the EU, the social benefit (more precisely one of its important parts) of the actions resulting in the appropriate decrease in speed is to be easily calculated and could be compared to the social costs.

As *James K. Hammit* remarks it in one of his short writing, in the majority of the public programs aiming to keep and save health and life, it is the social benefit arising from saving human lives that constitutes the considerable part of all of the benefits in connection with the program (*Hammit* [2003], p. 271). He quotes the Clean Air Act by way of example; the 90% of the benefits of this new regulation would be generated by the decrease of the death rate by the year 2010.[107] ***The dominant and desirable role in the consideration of the costs and – primarily – benefits not directly connected to actual cash flow and the effective use of public funds of the attachment of the appropriate money value is unquestionable among the experts nowadays and it is recognised and accepted more and more by the decision makers as well.***

I had the pleasant surprise during my own empirical researches that I managed to get a similar numerical result[108] with respect to the value of statistical human life – based on primarily the research with the wage-risk method and secondarily the pilot tests with the CV method – as the most respectful Anglo-Saxon researches. ***My investigation produced the range 78-393 million forints (in year 1998) for the most probable interval of the value of human life, with 250 million forints being the most probable value. Based on this the most probable value of statistical human life in the beginning of year 2004 in Hungary is between 350 and 400 million forints. This gives the answer to my basic research question at the same time as well.*** The results – determined merely for curiosity – of the pilot tests helping the

[106] The verbal and numerical facts in this section originate from the study of *Holló* [2001].

[107] The writer remarks that this high rate is probably due to the fact that the experiments to monetise all of the other – hardly expressible in money – benefits (for example the effect of decreasing air pollution to the ecosystem) are still in their infancy compared to the evaluation of human life.

[108] It is pleasant because of two reasons. On one hand it increases the confidence in the methods used, on the other hand it is satisfying that we are not behind the developed world in this respect either.

large sampled CV research are 1.104 million forints (1999) in the first test, a range between 132 and 195 million forints (2001) in the second test and a range between 130 and 174 million forints (2003) in the repetition of the second test.

The proper interpretation of the results is of high importance. We still not know whether a program that can save a human life at a cost of 110 or 350 million forints surely meets with the social acceptance. Our results do not entitle us to such an accuracy. However, we can be sure that if this value is, for example, 35 million forints, then the answer of the society is surely 'yes', while if it is 3,5 billion forints then, it is surely 'no'.

As mentioned above, the confidence in the results can be further increased by the fact that they harmonise with the numerical data gained from the most important Anglo-Saxon researches. Although the value equalling to about one and a half million dollars is slightly lower (about half) than the most reliable American and English values, however this fact should by no means be explained as Hungarian statistical human life being less valuable than for example that of the American, although the naive comparison of the numbers might suggest it that way. ***The statistical human life can only be interpreted in a given population so it is not suitable for direct comparison.*** It is normal for any communities having a nominally lower income and wealth at their disposal to evaluate their own lives at a lower level (to be more precise: at a smaller amount of money), too. ***Yet this value is characteristic to the given community, and the 'statistical individual' as a member of this community. By no means is it characteristic to the individual in relation to individuals from other communities.***

I tested *Hypothesis 1* with the method of regression analysis with the help of wage as the dependent variable. It was ascertained during the examination that the hypothesis can be accepted as being true because the coefficient related to the risk explanatory variable definitely proved to be different – being significantly in the positive region – from zero in the models considered to be the best, at the usual levels of significancy. ***This means that the application of this method should not be rejected in the***

examination of statistical human life bacause the employees receive premium in their wages (of course implicitly) in return for occupational risk.

The test of the *Hypotheses 2 and 3* can be carried out with the help of the large sampled CV research. I performed three pilot tests as a preparation to it. The results of the tests can be summarised as the followings in view of the hypotheses. ***The tests (second pilot test and its repetition) in connection with Hypothesis 2 did not support our conjecture about the measures of the values of anonymous and statistical human life compared to each other. This means that we can leave this hypothesis in its original form but its acceptance as being true – based on our new knowledge from the results of test – has a lower chance than before the tests.***

The first test in connection with the Hypothesis 3 was carried out on such a small, statistically negligible sample that it would be totally 'unscientific' to draw up any kind of conjectures so we can leave that in its original form. The first test was of excellent help to us in placing an appropriate methodology for testing our hypothesis at our disposal.

I find it worthwhile to briefly touch upon the possible research directions at the end of my study. As I have mentioned it more than once – given the necessary conditions – ***the large sampled data survey using the CV method could be carried out using the results of the tests, based on which we can obtain a new, valid numerical data for the value of human life together with statistically testing the Hypotheses 2 and 3.*** The approach of *Moore and Viscusi* ([1988b] and [1990]) evaluating *human life-years* and not *human life* can also be made the subject of an empirical investigation. The evaluation of the risks of *non-deadly* accidents can also be investigated more thoroughly.[109] Although this would rather give a direction to evaluate health and 'human capital' instead of evaluating human life but the strict separation of the two things does not seem a lucky choice either.[110] Furthermore, the regression

[109] The research of *Olson* [1981] may give a direction in connection with it.

[110] The available statistics of the working place accidents were not appropriate for calculations of the similar type out of two reasons. On one hand the total aggregation concealed the qualitative differences lying in the consequences of the accidents, on the other hand the two variables could not

calculations should also be carried out with risk variables *broken down by occupations* and *based on additional mortality data*. This would not require modification in the methodology.

Finally – to satisfy my own increased interests shown in the investigation of theoretical questions – a theoretical problem, the examination of the value of human life in case of projects stretching over the national borders could be tightly connected to the subject of my present essay. We can *prima facie* feel the practical significance of this problem (we should think on the evaluation of the environmental protection investments in connection with the cyanide pollution in the river Tisza some years ago), its theoretical curiosity is provided by the need to combine the many different preference systems (and the dissimilar income-wealth, cultural and political-social differences providing their basis) of many populations and to integrate them into one final decision.

Working out all of these possibilities would go beyond the ranges already wide even without them of my present Ph.D. thesis in volume and in contents.

It can supply an excuse for me for the bulkier than usual representation of scientific literature that the aim of my essay in addition to the empirical researches was primarily to provide an insider view into the attitude of raising a problem and thinking that characterise the economists or at least part of them nowadays. ***By the evaluation of human life and thus the promotion of the effective use of public funds and public property, the economics fulfils its utmost goal: helping in the solution of social problems.***

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be handled together in the regression model because of the high correlation with the data of the deadly accidents.

APPENDIX 1

Summary of the most important research results

Study	*Best estimate for the VSL (thousand dollar, 1990)*
Labour market approach	
Thaler and Rosen [1976] - USA	1.000
Brown [1980] - USA	1.500
Marin and Psacharopoulos [1982] - UK	2.800
Smith [1983] - USA	1.300
Arnould and Nichols [1983] - USA	900
Low and McPheters [1983] - USA	1.200
Moore and Viscusi [1988a] - USA	7.300
Gegax, Gerking and Schulze [1991] - USA	1.600
Revealed preferences approach	
Ghosh, Lees and Seal [1975] - UK	700
Dardis [1980] - USA	600
Portney [1981] - USA	800
Ippolito and Ippolito [1984] - USA	700
Atkinson and Halvorsen [1990] - USA	4.000
Contingent valuation approach	
Acton [1973] - USA	100
Melinek, Woolley and Baldwin [1973] – UK	170
Jones-Lee [1976] – UK	15.600
Jones-Lee, Hammerton and Philips [1985] - UK	3.700
Viscusi, Magat and Huber [1991] - USA	9.700

Source: *Fisher-Chestnut-Violette* ([1989], Table 1, p. 90), *Jones-Lee* ([1989], Table 2.2-2.3, pp. 91-93), *Viscusi* ([1993], Table 2, 5, 6, pp. 1926-1927, 1936, 1940)[111]

[111] The table contains the best estimates according to the researchers for the value of statistical life in December 1990 prices. However, the data can only be found in this form in the study of *Viscusi* [1993], the data from the two other studies are converted in the best possible way.

APPENDIX 2

Mean and standard deviation of the variables.

Variable	*Mean*	*Standard deviation*
Dependent variables		
JOVED1	37.511,688	29.620,518
JOVED2	39.176,085	33.218,324
LNJOVED1	10,389	0,508
LNJOVED2	10.419	0,526
Independent variables		
HALKOCK	6,875	8,899
BALKOCK	1.189,898	1.595,225
VAROS	0,659	0,483
BUDAPEST	0,180	0,391
DUNANTUL	0,352	0,487
HAZAS	0,644	0,488
NEM	0,514	0,509
KOR	38,288	11,007
ISKOLA	11,357	2,563
GYERMEK	0,829	0,966
IDNYELV	0,186	0,397
BETEGSEG	0,202	0,409
MELLEK	0,070	0,261
MEZOGAZD	0,067	0,254
IPAR	0,372	0,493
ONALLO	0,075	0,268
VEZSZELL	0,345	0,486
CEGMERET	0,805	0,404
ALLAMTUL	0,352	0,486
MAGYTUL	0,677	0,476
KIEGJUT	0,446	0,506
MAGYAR	0,974	0,164
CIGANY	0,011	0,108
UJSAGOLV	0,651	0,486
KONYVOLV	0,297	0,465
SZINHAZ	0,231	0,429
HANGVERS	0,112	0,322
MUZEUM	0,331	0,479
SPORT	0,298	0,469
BARATOK	2,235	3,770
SZELSPOL	0,085	0,284

APPENDIX 3

*The **QUESTIONNAIRE** applied in the first test.*

□□□ Budapest University of Economic Sciences
No. Department of Public Services

The value of human life in Hungary

Questionnaire

1 9 9 9

Answering is voluntary!

Place of survey: ..... county, ... (settlement)
Type of settlement: (1) - farm
(2) - village
(3) - town
(4) - county seat
(5) - Budapest, district: .....

Date of survey: 1999. ..... month ..... day

No. of interviewer: □□

I declare, that I handle the personal data handled and surveyed by me confidentially and will hand it over only to the person competent in the survey.

Signature of the interviewer: .....

1. Sex of the respondent: (1) - male
(2) - female
(X) -

2. When were you born?

..... year

(Y) - DOESN'T KNOW
(X) -

3. What is your family status?

(1) - single
(2) - married
(3) - widow
(4) - divorced

(Y) - DOESN'T KNOW
(X) -

4. What is your place of residence?

..... county, ... (settlement)

(Y) - DOESN'T KNOW
(X) -

5. What type of settlement is this?

ASK ONLY IF IT HASN'T TURNED OUT YET!

(1) - farm
(2) - village
(3) - town
(4) - county seat
(5) - Budapest

(Y) - DOESN'T KNOW
(X) -

6. What is your highest finished educational degree?

(1) - did not attend school
(2) - 4 or 6 primary, or less than 8 grades
(3) - 8 primary, 4 civil or 4 years of secondary school in old school system
(4) - industrial / vocational / stenographic school, certificate of mastership, journeyman's certificate, school of professional training
(5) - specialised secondary school, engineering school
(6) - secondary grammar school, other secondary school
(7) - college, higher level of engineering school
(8) - university

(Y) - DOESN'T KNOW
(X) -

7. Do you work?

YES → (1) - works as a subordinate
(2) - works in an individual or joint venture
(3) - works casually or as a helping family member
(4) - is on maternity leave (has a working place)

NO → (5) - unemployed
(6) - pensioner
(7) - other non-worker (student, dependent, etc.)

(Y) - DOESN'T KNOW
(X) -

CALL HIS/HER ATTENTION:

Please don't answer the following two questions if you feel yourself uncomfortable!

8. How much is your monthly (net) income?

HUF.....

(Y) - DOESN'T KNOW
(X) -

9. How much is your household's monthly (net) income per person, including your income, as well?

HUF.....

(Y) - DOESN'T KNOW
(X) -

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10. *Imagine*, that you have to face two types of deadly risks *at the same time,* for example deadly risks of two independent food poisonings:

a) the measure of the deadly risk is 2 out of 100.000 in the first case
b) the measure of the deadly risk is 20 out of 100.000 in the second case

You can not avoid any of the risks, so the two risks will be present in a certain extent, but you have the possibility to decrease the risk of one of them. Which one would you choose?

(1) - The first risk should be 1 out of 100.000 instead of 2 out of 100.000.
(2) - The second risk should be 15 out of 100.000 instead of 20 out of 100.000.

(Y) - DOESN'T KNOW
(X) -

11. There are 100 inhabitants in an island. They set off on a journey to visit the mainland once every week. There is an epidemic raging in the mainland *currently* and we know it for certain that *exactly one* of the islanders returned back infected from the usual weekly journey. This infection is not necessarily deadly, anyone can recover from that without any problems. Unfortunately, nobody knows (not even the infected person) who that one infected man is. There are two possibilities: (1) If nobody does anything then every islanders will be infected and will have a risk of dying because of the infection with a probability of 1/100 independent from each other. This means that it is possible that nobody dies, but it is also possible that one or – if they are less lucky – even two, three or in an extreme case all hundred of them die. The chance of dying is 1% for everybody, therefore the most probable case will be that 1 islander would die. (2) However, if a doctor gives a vaccination to everybody then nobody will get infected, but the man already infected will certainly die on the next day due to the vaccination.

11/a. Which solution would you prefer as an outsider?

(1) - They do nothing.
(2) - They give everybody the vaccination.

(Y) - DOESN'T KNOW
(X) -

11/b. Which solution would you prefer if you were one of the islanders and your family and friends were islanders, as well?

(1) - Nobody should do anything.
(2) - The doctor should give the vaccination to everybody.

(Y) - DOESN'T KNOW
(X) -

12. Has any of your close relatives or acquaintances suffered a serious traffic accident in the past year?

(1) - YES □ JUMP TO QUESTION NO. 15!

(2) - NO □ JUMP TO QUESTION NO. 13!

(Y) - DOESN'T KNOW
(X) -

13/a. What do you think, how many people suffer traffic accidents from 100.000 people (from about 1% of the population) in Hungary annually?

..... NEEDED HELP: □

(Y) - DOESN'T KNOW
(X) -

13/b. What do you think, how many people die of traffic accidents from 100.000 people (from about 1% of the population) in Hungary annually?

..... NEEDED HELP: □

(Y) - DOESN'T KNOW
(X) -

14. Imagine you have to go to a longer journey by bus. You receive 20.000 forints to cover your travelling expenses and you are given the name of the travelling company that will take you to your desired destination place for exactly 20.000 forints. The probability of you dying in an accident suffered during this trip is exactly 8 out of 100.000 people.

SHOW THE PROBABILITY!

However you have the possibility to travel by the bus of another company that is more safe but of course more expensive, as well and you have to pay the extra amount for yourself.

14/a. How much money would you be willing to pay (if you would be willing any) to decrease the risk of a fatal accident to the half of the original, so to 4 out of 100.000 people?

SHOW THE PROBABILITY!

HUF ..... NEEDED HELP: □

(Y) - DOESN'T KNOW
(X) -

14/b. How much money would you be willing to pay (if you would be willing any) to decrease the risk of a fatal accident to the one eighth of the original, so to 1 out of 100.000 people?

SHOW THE PROBABILITY!

HUF ..... NEEDED HELP: □

(Y) - DOESN'T KNOW
(X) -

You can also decide to choose another, less safe, so riskier bus instead of the one originally presented and therefore rather keep part of the 20.000 forints.

14/c. What is the minimum amount to be kept (if there is any) from the 20.000 forints together with the fact of having to travel by a bus by which the risk of a fatal accident is the double of the original, so 16 out of 100.000 people?

SHOW THE PROBABILITY!

HUF ..... NEEDED HELP: □

(Y) - DOESN'T KNOW
(X) -

14/d. What is the minimum amount to be kept (if there is any) from the 20.000 forints together with the fact of having to travel by a bus by which the risk of a fatal accident is four times the original, so 32 out of 100.000 people?

SHOW THE PROBABILITY!

HUF ..... NEEDED HELP: □

(Y) - DOESN'T KNOW
(X) -

15. You have the luck to be offered to take part in a very favourable game without any cheating. You may choose from two alternatives (*A* and *B*) – both of them rewarding for you, the exact amount of your prize only dependent upon the weather on December 24th, so on Christmas Eve this year. There are three possibilities: rainy, snowy or dry weather. If you choose alternative *A* you win 10.000 forints but only if the weather is rainy on that day. If you choose alternative *B* you win the same amount; 10.000 forints but only if the weather is snowy on that day.

15/a. Which alternative do you choose?

(A) - HUF 10.000 if it rains
- HUF 0 if it snows
- HUF 0 if it is dry

(B) - HUF 0 if it rains
- HUF 10.000 if it snows
- HUF 0 if it is dry

(Y) - DOESN'T KNOW
(X) -

15/b. Which one would you choose if the alternatives were the following?

PUT THE TWO ALTERNATIVES INTO WORDS SIMILAR TO THE EXAMPLE DESCRIBED BEFORE!

(A) - HUF 0 if it rains
- HUF 10.000 if it snows
- HUF 50.000 if it is dry

(B) - HUF 10.000 if it rains
- HUF 0 if it snows
- HUF 50.000 if it is dry

(Y) - DOESN'T KNOW
(X) -

15/c. Which one would you choose if the alternatives were the following?

PUT THE TWO ALTERNATIVES INTO WORDS SIMILAR TO THE EXAMPLE DESCRIBED BEFORE!

(A) - HUF 5.000 if it rains
- HUF 4.500 if it snows
- HUF 0 if it is dry

(B) - HUF 4.500 if it rains
- HUF 5.000 if it snows
- HUF 0 if it is dry

(Y) - DOESN'T KNOW
(X) -

IF YOU JUMPED HERE FROM QUESTION NO. 12 THEN JUMP TO QUESTION NO. 22!

16. Does your family has a car and do you regularly (weekly) drive?

(1) - There is a car, I regularly drive. → JUMP TO QUESTION NO. 20!

(2) - There is a car, I do not drive regularly. → JUMP TO QUESTION NO. 17!

(3) - There is no car, but I regularly drive. → JUMP TO QUESTION NO. 19!

(4) - There is no car, I do not drive regularly. → JUMP TO QUESTION NO. 18!

(Y) - DOESN'T KNOW
(X) -

17. Can you drive?

(1) - Yes
(2) - No

(Y) - DOESN'T KNOW
(X) -

JUMP TO QUESTION NO. 20!

18. Can you drive?

(1) - Yes
(2) - No

(Y) - DOESN'T KNOW
(X) -

JUMP TO QUESTION NO. 19!

19. Have you or anyone else in your family ever had a car?

(1) - Yes
(2) - No

(Y) - DOESN'T KNOW
(X) -

JUMP TO QUESTION NO. 20!

20. Imagine, you have just won a certain type of car on a lottery. You have the possibility to have a new type of safety device installed in your car for extra costs. So you don't have to pay for the car, but you have to pay for the safety device. The next questions will all refer to how much you would be willing to pay for different types of safety devices. You would always have to pay an annuity (annually), not a lump sum payment. Please always take your current financial situation into consideration.

20/a. 8 out of 100.000 people die in a fatal traffic accident as a car *driver* in Hungary annualy. The safety device you may choose to be installed would decrease this risk for you, that is, exclusively for the driver to the half, meaning 4 out of 100.000 people. This means only every second accident would be fatal for you whereas you would lose your life without the safety device. Taking your current financial situation into consideration what is the maximum amount of annuity that you would be willing to pay annually for this safety device defending the driver?

SHOW THE PROBABILITY!

HUF ..... NEEDED HELP: □

(Y) - DOESN'T KNOW
(X) -

20/b. Another safety device would decrease this risk for you, that is, exclusively for the driver with 25%, meaning 6 out of 100.000 people. This means you would survive one accident out of four with the safety device, whereas all four would be fatal without the safety device. Taking your current financial situation into consideration what is the maximum amount of annuity that you would be willing to pay annually for this safety device defending the driver?

SHOW THE PROBABILITY!

HUF ..... NEEDED HELP: □

(Y) - DOESN'T KNOW
(X) -

20/c. The next question refers to a safety device that decreases not only the risk of the *driver* but of the *passengers*, as well. Take it into consideration that usually there is one passenger, too sitting in the car, whose risk to a fatal accident is about the same as the driver's. Imagine, that you may choose a safety device to be installed that would decrease this risk for the driver and the passengers, as well to the half, meaning 4 instead of 8 out of 100.000 people. This means that only every second accident would be fatal for you and your passengers whereas you and your passengers would lose their life without the safety device. Taking your current financial situation into consideration what is the maximum amount of annuity that you would be willing to pay annually for this safety device defending the driver and the passengers, as well?

SHOW THE PROBABILITY!

HUF ..... NEEDED HELP: □

(Y) - DOESN'T KNOW
(X) -

21. The question before dealt with the risk of death during the accidents. However the accidents have other consequences some of which are listed below. Although we didn't ask you before, please tell us whether you took the following elements into consideration during answering?

	Yes	No
Working hours falling out	□	□
Future income falling out	□	□
Pain caused to relatives, friends	□	□
Expenses for repairs, material damage caused	□	□
Legal expenses	□	□

22. Imagine that you have to spend three months on a foreign place because of business or some other reasons. You can choose between two similar accommodation possibilities – *A* and *B* – being different only in the deadly risk arising from air pollution and the measure of the cost of living specific to each region which latter cost has to be financed by you. Let's suppose further on that if you don't die of the disease caused by air pollution during the three months then you won't have to fear any other negative effects later on in your life, so the deadly risk alone remains the only negative effect.

Let the deadly risk arising from air pollution during the three months be 10 out of 100.000 people in region *A* and 20 out of 100.000 people in region *B*. The sum of the cost of living for the three months is 80.000 forints for region *A* and 100.000 forints for region *B*.

SHOW THE PROBABILITY!

Which one do you choose?

(1) - *A* (10; 80.000) → JUMP TO QUESTION NO. 23!

(2) - *B* (20; 100.000) → EXPLAIN, WHY IT IS A WRONG CHOICE THEN JUMP TO QUESTION NO. 24!

23. Please tell me why you chose alternative *A*!

IT'S NOT THE EXACT, WORD BY WORD ANSWER THAT IS IMPORTANT, BUT THE FACT WHETHER (S)HE REALISED THE DOMINANCE OF ALTERNATIVE "*A*" IN BOTH FACTORS!

(1) - Alternative *A* is dominant in both factors → JUMP TO QUESTION NO. 24!

(2) – Any other reason → EXPLAIN WHY ALTERNATIVE "*A"* IS DOMINANT THEN JUMP TO QUESTION NO. 24!

24. The situation is the same as before: imagine that you have to spend three months on a foreign place because of business or some other reasons. You can choose between two similar accommodation possibilities – *A* and *B* –

being different only in the deadly risk arising from air pollution and the measure of the cost of living specific to each region which latter cost has to be financed by you. Let's suppose further on that if you don't die of the disease caused by air pollution during the three months then you won't have to fear any other negative effects later on in your life.

Which alternative would you choose?

24/a. (1) - *A* (10; 80.000) or (2) - *B* (20; 10.000)	(3) - indifferent
24/b. (1) - *A* (10; 80.000) or (2) - *B* (20; 20.000)	(3) - indifferent
24/c. (1) - *A* (10; 80.000) or (2) - *B* (20; 30.000)	(3) - indifferent
24/d. (1) - *A* (10; 80.000) or (2) - *B* (20; 40.000)	(3) - indifferent
24/e. (1) - *A* (10; 80.000) or (2) - *B* (20; 50.000)	(3) - indifferent
24/f. (1) - *A* (10; 80.000) or (2) - *B* (20; 60.000)	(3) - indifferent
24/g. (1) - *A* (10; 80.000) or (2) - *B* (20; 70.000)	(3) - indifferent
24/h. (1) - *A* (10; 80.000) or (2) - *B* (20; 80.000)	(3) - indifferent
24/i. (1) - *A* (10; 80.000) or (2) - *B* (20; 90.000)	(3) - indifferent

25. Were there any problems?

MORE ANSWERS ARE POSSIBLE!

(1) - No.	→	JUMP TO QUESTION NO. 28!
(2) - Yes, *(s)he didn't switch to A*.	→	JUMP TO QUESTION NO. 26!
(3) – Yes, *(s)he switched from A or indifferent to B or indifferent*.	→	JUMP TO QUESTION NO. 26!
(4) – Yes, *(s)he didn't choose A at h or i*.	→	JUMP TO QUESTION NO. 26!
(5) – Yes, *(s)he was indifferent more than once*.	→	JUMP TO QUESTION NO. 26!

26. Now which alternative would you choose?

EXPLAIN HIM/HER IN ADVANCE THE PROBLEMS WITH HIS/HER ANSWERS BEFORE!

26/a. (1) - *A* (10; 80.000) or (2) - *B* (20; 10.000)	(3) - indifferent
26/b. (1) - *A* (10; 80.000) or (2) - *B* (20; 20.000)	(3) - indifferent

26/c. (1) - *A* (10; 80.000) or (2) - *B* (20; 30.000)	(3) - indifferent
26/d. (1) - *A* (10; 80.000) or (2) - *B* (20; 40.000)	(3) - indifferent
26/e. (1) - *A* (10; 80.000) or (2) - *B* (20; 50.000)	(3) - indifferent
26/f. (1) - *A* (10; 80.000) or (2) - *B* (20; 60.000)	(3) - indifferent
26/g. (1) - *A* (10; 80.000) or (2) - *B* (20; 70.000)	(3) - indifferent
26/h. (1) - *A* (10; 80.000) or (2) - *B* (20; 80.000)	(3) - indifferent
26/i. (1) - *A* (10; 80.000) or (2) - *B* (20; 90.000)	(3) - indifferent

27. Were there any problems?

MORE ANSWERS ARE POSSIBLE!

(1) - No. → JUMP TO QUESTION NO. 28!

(2) - Yes, *(s)he didn't switch to A*. → JUMP TO QUESTION NO. 29!

(3) - Yes, *(s)he switched from A or indifferent to B or indifferent*. → JUMP TO QUESTION NO. 29!

(4) - Yes, *(s)he didn't choose A at h or i*. → JUMP TO QUESTION NO. 29!

(5) - Yes, *(s)he was indifferent more than once*.→ JUMP TO QUESTION NO. 29!

28. PERFORM THE PROCEDURE OF HALFING THE INTERVAL! THE RESULT:

HUF ..... (*B* cost of living)

THE NEXT QUESTIONS ARE IN CONNECTION WITH THE RESPONDENT BUT THEY ARE ADDRESSED TO YOU!

29. Based on your opinion do any of these criteria – making the answers excluded from the survey – be applied to the respondent? (More answers are possible!)

(1) - (S)he didn't answer fully to practically any of the *evaluative* questions.
(2) - (S)he did't take the task seriously.
(3) - (S)he was seemingly unable to interpret the questions and his/her task.

(4) - None of the above excluding criteria can be applied.

30. Was the respondent interested in the subject of the questionnaire?

(1) - Rather yes
(2) - Rather no

(Y) - You can not decide
(X) -

31. Did any of the questions arouse his/her interest?

(1) - Yes → **Which No.?** .....
(2) - No

(Y) - You can not decide
(X) -

32. Mark from 1 to 5 deciding how tired the respondent became during the survey. Give mark 5 if (s)he became very tired and mark 1 if (s)he didn't become tired at all!

5	4	3	2	1
became very tired				no tiredness at all

(Y) - You can not decide
(X) -

33. Has it happenned that the respondent's mind was wandering, couldn't pay attention to the question (e.g. he became tired) and answered only at random?

(1) - It has happenned frequently
(2) - It has happenned sometimes
(3) - It hasn't happenned

(Y) - You can not decide
(X) -

34. Were there any questions that proved to be particularly difficult for the respondent to answer?

(1) - Yes → **Which No.?** .....
(2) - No

(Y) - You can not decide
(X) -

35. Were there any questions to which (s)he was particularly unwilling to answer?

(1) - Yes → **Which No.?** .....
(2) - No

(Y) - You can not decide
(X) -

36. Have you got any other comments, remarks?

(1) - No
(2) - Yes, more specifically:

THANK YOU FOR YOUR WORK!

APPENDIX 4

*The **QUESTIONNAIRE** applied in the second pilot test.*

Sex of the respondent: (1) female (2) male

1) There are 100 inhabitants in an island. They set off on a journey to visit the mainland once every week. There is an epidemic raging in the mainland *currently* and we know it for certain that *exactly one* of the islanders returned back infected from the usual weekly journey. This infection is not necessarily deadly (the probability of death is exactly 1%), anyone can recover from that without any problems. Unfortunately, nobody knows (not even the infected person) who that one infected man is. There are two possibilities: (1) If nobody does anything then every islanders will be infected and will have a risk of dying because of the infection with a probability of 1/100 independent from each other. (This means that it is possible that nobody dies, but it is also possible that one or – if they are less lucky – even two, three or in an extreme case all hundred of them die.) The chance of dying is 1% for everybody, therefore the most probable case will be that 1 islander would die. (2) However, if a doctor gives a vaccination to everybody then nobody will get infected, but the man already infected will *certainly* die on the next day due to the vaccination.

1/a) Which solution would you prefer as an *outsider* judge?

(1) - They should do nothing.
(2) - They should give the vaccination to everybody.

1/b) Which solution would you prefer if you were one of the islanders and your family and friends were islanders, as well?

(1) - Nobody should do anything.
(2) - The doctor should give the vaccination to everybody.

2) Imagine you have to go to a longer journey by bus. You receive 20.000 forints to cover your travelling expenses and you are given the name of the travelling company that will take you to your desired destination place for exactly 20.000 forints. The probability of you dying in an accident suffered during this trip is exactly 8 out of 100.000 people.

However, you have the possibility to travel by the bus of another company that is more safe, but of course more expensive, as well and you have to pay the extra amount for yourself.

2/a) How much money would you be willing to pay (if you would be willing any) to decrease the risk of a fatal accident to the half of the original, so to 4 out of 100.000 people?

HUF .....

2/b) How much money would you be willing to pay (if you would be willing any) to decrease the risk of a fatal accident to the one eighth of the original, so to 1 out of 100.000 people?

HUF .....

You can also decide to choose another, less safe, so riskier bus instead of the one originally presented and therefore rather keep part of the 20.000 forints.

2/c) What is the minimum amount that you would be willing to keep (if there is any) from the 20.000 forints together with the fact of having to travel by a bus by which the risk of a fatal accident is the double of the original, so 16 out of 100.000 people?

HUF .....

2/d) What is the minimum amount that you would be willing to keep (if there is any) from the 20.000 forints together with the fact of having to travel by a bus by which the risk of a fatal accident is four times the original, so 32 out of 100.000 people?

HUF .....

3) You have the luck to be offered to take part in a very favourable game without any cheating. You may choose from two alternatives (*A* and *B*) – both of them rewarding for you, the exact amount of your prize only dependent upon the weather on December 24th, so on Christmas Eve this year. There are three possibilities: rainy, snowy or dry weather. If you choose alternative *A* you win 10.000 forints but only if the weather is rainy on that day. If you choose alternative *B* you win the same amount; 10.000 forints but only if the weather is snowy on that day.

3/a) Which alternative do you choose?

(A) - HUF 10.000 if it rains
- HUF 0 if it snows
- HUF 0 if it is dry

(B) - HUF 0 if it rains
- HUF 10.000 if it snows
- HUF 0 if it is dry

3/b) Which one would you choose if the alternatives were the following?

(A) - HUF 0 if it rains
- HUF 10.000 if it snows
- HUF 50.000 if it is dry

(B) - HUF 10.000 if it rains
- HUF 0 if it snows
- HUF 50.000 if it is dry

THANK YOU VERY MUCH FOR YOUR ANSWERS!

APPENDIX 5

*The **QUESTIONNAIRE** modified based on the second pilot test.*

Sex of the respondent: (1) female (2) male

1) There are 100 inhabitants in an island. They set off on a journey to visit the mainland once every week. There is an epidemic raging in the mainland *currently* and we know it for certain that *exactly one* of the islanders returned back infected from the usual weekly journey (this epidemic will cease to exist from the next week so it won't be threatening the islanders again). This infection is not necessarily deadly (the probability of death is exactly 1%), anyone can recover from that without any problems. Unfortunately, nobody knows (not even the infected person) who that one infected man is. There are exclusively two possibilities: (1) If nobody does anything then every islanders will be infected and will have a risk of dying because of the infection with a probability of 1/100 independent from each other. (This means that it is possible that nobody dies, but it is also possible that one or – if they are less lucky – even two, three or in an extreme case all hundred of them die.) The chance of dying is 1% for everybody, therefore the most probable case will be that 1 islander would die. (2) However, if a doctor gives a vaccination to everybody then nobody will get infected, but the man already infected will *certainly* die on the next day due to the vaccination.

1/a) Which solution would you prefer as an *outsider* judge, so neither you nor any of your acquaintances would able to be infected by the epidemic?

(1) - They should do nothing.
(2) - They should give the vaccination to everybody.

1/b) Which solution would you prefer if you were one of the islanders and your family and friends were islanders, as well?

(1) - Nobody should do anything.
(2) - The doctor should give the vaccination to everybody.

2) Imagine you have to go to a longer journey by bus. You receive 50.000 forints to cover your travelling expenses and you are given the name of the travelling company that will take you to your desired destination place for exactly 50.000

forints. The probability of you dying in an accident suffered during this trip is exactly 8 out of 100.000 people.

However, you have the possibility to travel by the bus of another company that is more safe, but of course more expensive, as well and you have to pay the extra amount for yourself.

2/a) How much extra money would you be willing to pay (if you would be willing any) to decrease the risk of a fatal accident to the half of the original, so to 4 out of 100.000 people?

HUF .....

2/b) How much extra money would you be willing to pay (if you would be willing any) to decrease the risk of a fatal accident to the one eighth of the original, so to 1 out of 100.000 people?

HUF .....

You can also decide to choose another, less safe, so riskier bus instead of the one originally presented and therefore rather ask for and keep part of the 50.000 forints.

2/c) What is the minimum amount that you would in any case ask and keep for yourself from the 50.000 forints to be paid for the journey in return for having to travel by a bus by which the risk of a fatal accident is the double of the original, so 16 out of 100.000 people?

(1) Not even the total amount of 50.000 forints would compensate me for the risk increase.

(2) I would demand at least ..... from the 50.000 forints for taking this higher risk.

2/d) What is the minimum amount that you would in any case ask and keep for yourself from the 50.000 forints to be paid for the journey in return for having to travel by a bus by which the risk of a fatal accident is four times the original, so 32 out of 100.000 people ?

(1) Not even the total amount of 50.000 forints would compensate me for the risk increase.

(2) I would demand at least ..... from the 50.000 forints for taking this higher risk.

3) You have the luck to be offered to take part in a very favourable game without any cheating. You may choose from two alternatives (*A* and *B*) – both of them rewarding for you, the exact amount of your prize only dependent upon the weather on December 24th, so on Christmas Eve this year. There are three possibilities: rainy, snowy or dry weather. If you choose alternative *A* you win 10.000 forints but only if the weather is rainy on that day. If you choose alternative *B* you win the same amount; 10.000 forints but only if the weather is snowy on that day.

3/a) Which alternative do you choose?

(A) - HUF 10.000 if it rains
- HUF 0 if it snows
- HUF 0 if it is dry

(B) - HUF 0 if it rains
- HUF 10.000 if it snows
- HUF 0 if it is dry

3/b) Which one would you choose if the alternatives were the following?

(A) - HUF 0 if it rains
- HUF 10.000 if it snows
- HUF 50.000 if it is dry

(B) - HUF 10.000 if it rains
- HUF 0 if it snows
- HUF 50.000 if it is dry

THANK YOU VERY MUCH FOR YOUR ANSWERS!

APPENDIX 6

Some of last years' Hungarian bomb alarms.

The history of Hungarian bomb alarms is neverending. This present list merely picks out some from the last years, especially the events of year 2003 at random.

Educational institutions from primary schools to universities are favoured sites of bomb alarms. The building of the Faculty of Law of the Szeged József Attila University of Sciences had to be vacated after a telephone call in October 1999, however these kind of attempts to avoid or postpone a written examination are much more frequent in secondary schools. The police was alerted in four different times to rush to four secondary schools by a young man from Kaposvár in the spring of 1997. Almost two thousand and five hundred students and teachers were demanded to leave the premises because of this bomb alarm. The perpetrator of the crime was sentenced to a suspended imprisonment by the court of first instance, but the judge of the appeal court rejected the suspension and sentenced the young man to five months prison with the reasons of a crime causing public danger, threatening thousands of people, row of bomb alarms and "too much work generated" for the bomb disposal squad.

"The underground will explode" – said an unknown man's voice in the central telephone number of the Budapest Transportation Company at half past six in the morning in September 2001. Not having mentioned which line he had been referring to all underground lines of Budapest had to be investigated by the police forces. The fortunately "unproductive" work took six hours, but the underground trains had not stopped but their frequency dropped to about 50%.

Airplanes have also proved to be favoured sites. The Budapest – New York flight had to be turned back in fear of a plastic bomb based on a notification in October 4th 2002. A week later another flight heading for Zürich had no choice but to turn back still in the air space of Hungary because of another bomb alarm. The direct cost of returning a Boeing 737 flight is 3-4 million forints according to the communication of the Hungarian Flight Services.

Not even cultural institutions are spared from those threatening with bombs. The museum of the House of Terror had to be vacated in February 2003, the motivation this time was presumably of political grounds.

Altogether eight letters were found in different institutions in Nyíregyháza in the same month in which the unknown letter-writer threatened to explode the institution. The list of the "exploder" consisted of two primary schools, one secondary school, three kindergartens and two priestly offices. This time the suspect – who had already been wanted by the police – was caught which counted as an exceptional case. The culprit said to have wanted to attract attention.

There was a double bomb alarm in Szekszárd in September. The announcer said to have placed a bomb in a restaurant then – some hours later – in a department store. Both cases – as in all other cases depicted here – proved to be false alarms.

Finally the fire services, the ambulances, the police forces, the bomb disposal squads and the power and gas suppliers were alerted by an unidentified telephone call to go – among other places – to the high school in Nyíregyháza, the Law Court of Bács-Kiskun County in Kecskemét and the Tesco department store in Miskolc in October.

Source: Internet, October 2003.

REFERENCES[112]

MKM Regulation No. 11/1994. (VI. 8.) on the Operation of Educational Institutions.

Act IV of 1978 on the Criminal Code.

Government Regulation No. 217/1998. (XII. 30.) on the Rules of Operation of the General Government.

Government Decree No. 1052/1999. (V. 21.) on the Governmental Task Plan in Connection with the Development of Public Administration for 1999-2000.

Act XXV of 2000 on the Safety of Chemistry.

Parliament Decree No. 38/2000. (V. 5.) on the Defence, Utilisation and Rehabilitation of Stagnant Waters, and the Further Tasks.

Government Decree No. 1057/2001. (VI. 21.) on the Governmental Task Plan in Connection with the Development of Public Administration for 1999-2000.

PSZÁF Directive No. 1/2002. (MK 88.) on the System of Cost-managing Procedure in the Voluntary Pension-, Health-, Mutual and Private Pension Funds.

Government Regulation No. 26/2003. (III. 4.) on the Detailed Rules of the Appropriation of the Region Development Estimate.

Government Regulation No. 27/2003. (III. 4.) on the Detailed Rules of the Appropriation of the Closing up of Regions and Towns Estimate.

MeHVM Regulation No. 4/2003. (V. 8.) on the Detailed Rules of the Appropriation of the Subsidies of Enterpreneurial Areas Estimate.

MeHVM Regulation No. 5/2003. (V. 20.) on the Detailed Rules of the Appropriation of the Subvention of Small Region's Fund Estimate.

*ABRAHAM, C. – THEDIÉ, J. [1960]: Le prix d'une Vie Humaine dans Les Decisions Economiques. Revue Francaise de Recherche Opérationelle.

[112] The references signed by a '*' were available only through an other study.

ACTON, J. P. [1973]: Evaluating Public Programs to Save Lives: The Case of Heart Attacks. Research Report R-73-02. The Rand Corporation, Santa Monica.

ACTON, J. P. [1976]: Measuring the Monetary Value of Lifesaving Programs. *Law and Contemporary Problems*, Vol. 40, No. 4, Autumn, pp. 46-72.

ADORJÁN RICHÁRD [2001]: Az emberi élet értéke Magyarországon. *Statisztikai Szemle*, Vol. 79, No. 8, August, pp. 669-688.

ADORJÁN, R. [2002]: Is the Value of Human Life in Hungary and America Differenet? *NISPAcee Occassional Papers in Public Administration and Public Policy*, Volume III, No. 1, Winter, pp. 3-30.

ADORJÁN RICHÁRD – HOPPÁL ANDREA – MIKÓ LÁSZLÓ – SÜVEGES ANIKÓ (FORD.) [2000]: Közösségi pénzügyek. Elmélet és gyakorlat a közép-európai átmenetben. Aula Kiadó, Budapest.

AHEARNE, J. F. [1993]: Integrating Risk Analysis into Public Policymaking. *Environment*, Volume 35, Number 2, pp. 16-40.

ARNOULD, R. J. – NICHOLS, L. M. [1983]: Wage-Risk Premiums and Workers' Compensation: A Refinement of Estimates of Compensating Wage Differential. *Journal of Political Economy*, Vol. 91, No. 2, pp. 332-340.

ATKINSON, S. E. – HALVERSON, R. [1990]: The Valuation of Risks to Life: Evidence from the Market for Automobiles. *The Review of Economics and Statistics*, February, 72 (1), pp. 133-136.

BARA ZOLTÁN – SZABÓ KATALIN (SZERK.) [1997]: Összehasonlító gazdaságtan. Aula Kiadó, Budapest.

BEATTIE, J. – COVEY, J. – DOLAN, P. – HOPKINS, L. – JONES-LEE, M. W. – LOOMES, G. – PIDGEON, N. – ROBINSON, A. – SPENCER, A. [1998]: On the Contingent Valuation of Safety and the Safety of Contingent Valuation: Part 1 – Caveat Investigator. *Journal of Risk and Uncertainty*, 17, pp. 5-25.

BERGER, M. C. – BLOMQUIST, G. C. – KENKEL, D. – TOLLEY, G. S. [1987]: Valuing Changes in Health Risks: A Comparison of Alternative Measures. *Southern Economic Journal*, 53 (4), pp. 967-984.

BIDDLE, J. E. – ZARKIN, G. A. [1988]: Worker Preferences and Market Compensation for Job Risk. *The Review of Economics and Statistics*, November, 70 (4), pp. 660-667.

BLOMQUIST, G. [1979]: Value of Life Saving: Implications of Consumption Activity. *Journal of Political Economy*, vol. 87, no. 3, pp. 540-558.

BLOMQUIST, G. C. – MILLER, T. R. – LEVY, D. T. [1996]: Values of Risk Reduction Implied by Motorist Use of Protection Equipment. New Evidence from Different Populations. *Journal of Transport Economics and Policy*, January, pp. 55-66.

BLOMQVIST, A. [2002]: Defining the Value of a Statistical Life: A Comment. *Journal of Health Economics*, January, Vol. 21, pp. 169-175.

BOARDMAN, A. E. – GREENBERG, D. H. – VINING, A. R. – WEIMER, D. L. [1996]: Cost-Benefit Analysis: Concepts and Practice. Prentice Hall, USA, New Jersey.

BOWLAND, B. J. – BEGHIN, J. C. [2001]: Robust estimates of value of a statistical life for developing economies. *Journal of Policy Modeling*, Volume 23, Number 4, May, pp. 385-396.

BROOKSHIRE, D. S. – THAYER, M. A. – SCHULZE, W. D. – D'ARGE, R.C. [1982]: Valuing Public Goods: A Comparison of Survey and Hedonic Approaches. *The American Economic Review*, March, Vol. 72, No. 1, pp. 165-177.

BROOME, J. [1978a]: Choice and Value in Economics. *Oxford Economic Papers*, Volume 30, March, Number 1, pp. 313-333.

BROOME, J. [1978b]: Trying to Value A Life. *Journal of Public Economics*, 9, pp. 91-100.

BROOME, J. [1985]: The Economic Value of Life. *Economica*, Vol. 52, No. 207, August, pp. 281-294.

BROOME, J. [1991]: Weighing Goods. Equality, Uncertainty and Time. Basil Blackwell, Cambridge, USA.

BROOME, J. [1999]: Ethics out of Economics. Cambridge University Press, Cambridge.

BROWN, C. [1980]: Equalizing Differences in the Labor Market. *The Quareterly Journal of Economics*, February, pp. 113-134.

BUCHANAN, J. M. – FAITH, R. L. [1979]: Trying Again to Value A Life. *Journal of Public Economics*, 10, pp. 245-248.

CARTHY, T. – CHILTON, S. - COVEY, J. – HOPKINS, L. – JONES-LEE, M. W. – LOOMES, G. – PIDGEON, N. – SPENCER, A. [1999]: On the Contingent Valuation of Safety and the Safety of Contingent Valuation: Part 2 – The CV/SG „Chained" Approach. *Journal of Risk and Uncertainty*, 17:3, pp. 187-213.

CLINCH, J. P. – MURPHY, A. [2001]: Modelling Winners and Loosers in Contingent Valuation of Public Goods: Appropriate Measures and Econometric Analysis. *The Economic Journal*, 111 (April), pp. 420-443.

CROPPER, M. L. – PORTNEY, P. R. [1992]: Discounting Human Lives. *Resources*, Summer, No. 108, pp. 1-4.

CUMMINGS, R. G. – BROOKSHIRE, D. S. – SCHULZE, W. D. [1986]: Valuing Environmental Goods. An Assessment of the Contingent Valuation Method. Rowman and Allenheld Publishers, New Jersey.

CSABA PÉTERNÉ (SZERK.) [1998]: A munkaerő-felmérés módszertana. Statisztikai módszertani füzetek 38. Központi Statisztikai Hivatal, Budapest.

CSEH-SZOMBATHY LÁSZLÓ – FERGE ZSUZSA (SZERK.) [1975]: A szociológiai felvétel módszerei. III. kiadás. Közgazdasági és Jogi Könyvkiadó, Budapest.

CSONTOS LÁSZLÓ – KORNAI JÁNOS – TÓTH ISTVÁN GYÖRGY [1996]: Az állampolgár, az adók és a jóléti rendszer reformja. Egy kérdőíves felmérés tanulságai. *Századvég*, Új Folyam, No. 2., pp. 3-28.

DARDIS, R. [1980]: The Value of a Life: New Evidence from the Marketplace. *The American Economic Review*, December, Vol. 70, No. 5, pp. 1077-1082.

*DAWSON, R. F. F. [1967]: Cost of Road Accidents in Great Britain. Road Research Laboratory, Ministry of Transport, London.

*DAWSON, R. F. F. [1971]: Current Costs of Road Accidents in Great Britain. Road Research Laboratory, Department of the Environment, London.

*DILLINGHAM, A. [1979]: The Injury Risk Structure of Occupations and Wages. Ph.D. dissertation, Cornell University, Ithaca, NY.

DILLINGHAM, A. [1985]: The Influence of Risk Variable Definition On Value-of-life Estimates. *Economic Inquiry*, Vol. XXIII, Number 2, April, pp. 277-294.

DOBBS, I. M. [1999]: Compensating Wage Differentials and the Value of Life. *Economic Letters,* Volume 63, No. 1, April, pp. 103-109.

DOWNS, A. [1990]: Politikai cselekvés a demokráciában: egy racionális modell. *Közgazdasági Szemle*, Vol. XXXVII, No. 9, pp. 993-1011.

*DRÉZE, J. [1962]: L'Utilité Sociale d'une Vie Humaine. Revue Francaise de Recherche Opérationelle.

*DUBLIN, L. I. – LOTKA, A. J. [1930]: The Money Value of a Man. Ronald Press, New York.

DUBOURG, W. R. – JONES-LEE, M. W. – LOOMES, G. [1997]: Imprecise Preferences and Survey Design in Contingent Valuation. *Economica*, Vol. 64, November, No. 256, pp. 681-702.

EPPLE, D. [1987]: Hedonic Prices and Implicit Markets: Estimating Demand and Supply Functions for Differentiated Products. *Journal of Political Economy*, Vol. 95, No. 1, pp. 59-80.

ESŐ PÉTER – LÓRÁNTH GYÖNGYI [1993]: A racionalitás közgazdasági értelmezéséről. 1. Jól viselkednek-e a preferenciák? *Közgazdasági Szemle*, 4. sz., pp. 311-324.

FISHER, A. – CHESTNUT, L. G. – VIOLETTE, D. M. [1989]: The Value of Reducing Risks of Death: A Note On New Evidence. *Journal of Policy Analysis and Management*, Vol. 8, No. 1, pp. 88-100.

Foglalkoztatottság és kereseti arányok 1996-1997 (Munkaügyi adattár). 1998, KSH, Budapest.

FRESCHL GYÖRGY [1983]: Módszertan és esettanulmányok a regressziószámítás köréből. Statisztikai módszertani füzetek 6. Központi Statisztikai Hivatal, Budapest.

FRIEDMAN, M. – SAVAGE, L. J. [1948]: The Utility Analysis of Choices Involving Risks. *Journal of Political Economy*, Vol. 56, pp. 279-304.

*GABA, A. – VISCUSI, W. K. [1996]: Individual Differences in Subjective Risk Thresholds, February, Insead.

GARBACZ, C. [1991]: More Evidence on Smoke Detector Effectiveness and the Value of Saving a Life. *Population Research and Policy Review*, 10, pp. 273-287.

GAREN, J. [1988]: Compensating Wage Differentials and the Endogeneity of Job Riskiness. *The Review of Economics and Statistics*, February, 70 (1), pp. 9-16.

GEGAX, D. – GERKING, S. – SCHULZE, W. [1991]: Perceived Risk and the Marginal Value of Safety. *The Review of Economics and Statistics*, November, 73 (4), pp. 589-596.

GHOSH, D. – LEES, D. – SEAL, W. [1975]: Optimal Motorway Speed and Some Valuation of Time and Life. *The Manchester School of Economic and Social Studies*, 43, June, pp. 134-143.

GILLROY, J. M. – WADE, M. (ED.) [1992]: The Moral Dimensions of Public Policy Choice. Beyond the Market Paradigm. University of Pittsburgh Press, Pittsburgh and London.

GLOVER, J. [1977]: Causing Death and Saving Lives. Penguin Books, Middlesex, England.

GOLDTHORPE, J. H. – HOPE, K. [1974]: The Social Grading of Occupations: A New Approach and Scale. Oxford: Clarendon.

HAJDU OTTÓ [2001]: Összefüggések a lineáris regressziós modellben. *Statisztikai Szemle*, Vol. 79, No. 10-11, pp. 885-898.

HAMMERTON, M. – JONES-LEE, M. W. – ABBOTT, V. [1982]: The Consistency and Coherence of Attitudes to Physical Risk. Some Empirical Evidence. *Journal of Transport Economics and Policy*, May, pp. 181-199.

HAMMITT, J. K. [2002]: Understanding Differences in Estimates of the Value of Mortality Risk. Commentary on: What Determines the Value of Life? A Meta-Analysis. *Journal of Policy Analysis and Management*, Vol. 21, No. 2, pp. 271-273.

HARSANYI, J. C. [1955]: Cardinal Welfare, Individual Ethics, and Interpersonal Comparisons of Utility. *Journal of Political Economy*, Vol. 83, pp. 309-321.

HAUSMAN, J. A. (ED.) [1993]: Contingent Valuation. A Critical Assessment. North-Holland, Amsterdam, London, New York, Tokio.

HERZOG, H. W., JR. – SCHLOTTMANN, A. M. [1990]: Valuing Risk in the Workplace: Market Price, Willingness to Pay, and the Optimal Provision of Safety. *The Review of Economics and Statistics*, August, 72 (3), pp. 463-470.

HOLLÓ PÉTER [2001]: Az emberélet ára. Évente százmilliárd forintba kerülnek a közlekedési balesetek. *Népszabadság*, 7 February 2001, p. 14.

HOROWITZ, J. K. – CARSON, R. T. [1993]: Baseline Risk and Preference for Reductions in Risk-to-Life. *Risk Analysis*, Vol. 13, No. 4, pp. 457-462.

Időszaki tájékoztató: Főbb Munkaügyi Folyamatok 1998. I-IV. negyedév. 1999. március, KSH, Budapest.

IPPOLITO, P. M. – IPPOLITO, R. A. [1984]: Measuring the Value of Life Saving from Consumer Reactions to New Information. *Journal of Public Economics*, 25, pp. 53-81.

JOHANSSON, PER-OLOV [1996]: On the Value of Changes in Life Expectancy. *Journal of Health Economics*, February, Vol. 15, pp. 105-113.

JOHANSSON, PER-OLOV [2001]: Is There a Meaningful Definition of the Value of a Statistical Life? *Journal of Health Economics*, January, Vol. 20, pp. 131-139.

JOHANSSON, PER-OLOV [2002]: Defining the Value of a Statistical Life: Reply. *Journal of Health Economics*, January, Vol. 21, pp. 177-178.

JOHNSON, R. L. – JOHNSON, G. V. [1990]: Economic Valuation of Natural Resources. Issues, Theory and Applications. Westview Press, Boulder, San Francisco and Oxford.

JONES-LEE, M. W. [1976]: The Value of Life. An Economic Analysis. Martin Robertson, London.

JONES-LEE, M. W. [1979]: Trying to Value A Life - Why Broome Does Not Sweep Clean. *Journal of Public Economics*, 10, pp. 249-256.

JONES-LEE, M. W. [1987]: The Economic Value of Life: A Comment. *Economica*, Vol. 54, No. 215, August, pp. 397-400.

JONES-LEE, M. W. [1989]: The Economics of Safety and Physical Risk. Basic Blackwell, Oxford.

JONES-LEE, M. W. – HAMMERTON, M. – PHILIPS, P. R. [1985]: The Value of Safety: Results of a National Sample Survey. *The Economic Journal*, 95, March, pp. 49-72.

JONES-LEE, M. W. – LOOMES, G. [1995]: Scale and Context Effects in the Valuation of Transport Safety. *Journal of Risk and Uncertainty*, 11, pp. 183-203.

JONES-LEE, M. W. – LOOMES, G. – PHILIPS, P. R. [1995]: Valuing the Prevention of Non-fatal Road Injuries: Contingent Valuation vs. Standard Gambles. *Oxford Economic Papers*, Volume 47, October, Number 4, pp. 676-695.

KAHNEMAN, D. – TVERSKY, A. [1979]: Prospect Theory: An Analysis of Decision Under Risk. *Econometrica*, Volume 47, Number 2, March, pp. 263-291.

KELMAN, S. [1981]: Cost-benefit Analysis. An Ethical Critique. *Regulation*, January/February, pp. 33-40.

KORNAI, J. [1992]: The Socialist System. The Political Economy of Communism. Princeton University Press, Princeton, New Jersey.

KOSTERS, M. [1976]: Comments on „The Value of Saving a Life: Evidence from the Labor Market". In: TERLECKYJ, N. E. (ED.): Household Production and Consumption. Cambridge: NBER, pp. 298-301.

KRUPNICK, A. [2002]: The Value of Reducing Risk of Death. Commentary on: What Determines the Value of Life? A Meta-Analysis. *Journal of Policy Analysis and Management*, Vol. 21, No. 2, pp. 275-282.

LAYARD, R. (ED.) [1972]: Cost-Benefit Analysis. Selected Readings. Penguin Education, Harmondsworth, Middlesex, England.

LEIGH, J. P. [1987]: Gender, Firm Size, Industry, and Estimates of the Value-of-life. *Journal of Health Economics*, September, 6(3), pp. 255-273.

LESOURNE, J. [1975]: Cost-Benefit Analysis and Economic Theory. Amsterdam, US: North Holland.

LEWBEL, A. [2003]: Calculating Compensation in Cases of Wrongful Death. Journal of Econometrics, March, 113 (1), pp. 115-128.

LIPSEY, R. E. [1976]: Comments on „The Value of Saving a Life: Evidence from the Labor Market". In: TERLECKYJ, N. E. (ED.): Household Production and Consumption. Cambridge: NBER, pp. 301-302.

LIU, J. T. – HAMMIT, J. K. – LIU, J. L. [1997]: Estimated Hedonic Wage Function and Value of Life in a Developing Country. *Economic Letters*, Volume 57, No. 3, December, pp. 353-358.

LOOMES, G. – SUGDEN, R. [1982]: Regret Theory: An Alternative Theory of Rational Choice Under Uncertainty. *The Economic Journal*, 92, December, pp. 805-824.

LOPEZ, A. – DEXTER, R. N. – REINERT, J. C. [1995]: Valuation Developmental Toxicity Outcomes. *The Environmental Professional*, Volume 17, pp. 186-192.

LOW, S. A. – MCPHETERS, L. R. [1983]: Wage Differentials and Risk of Death: An Empirical Analysis. *Economic Inquiry*, April, Vol. XXI, pp. 271-280.

MAASS, A. [1966]: Benefit-Cost Analysis: Its Relevance to Public Investment Decisions. *Quarterly Journal of Economics*, Vol. LXXX., No. 2, May, pp. 208-226.

MACINTYRE, A. [1992]: Utilitarianism and Cost-Benefit Analysis: An Essay on the Relevance of Moral Philosophy to Bureaucratic Theory. In: GILLROY, J. M. - WADE, M. (ED.) [1992], pp. 179-194.

MACRAE, D. JR. – WHITTINGTON, D. [1986]: The Issue of Standing in Cost-Benefit Analysis. *Journal of Policy Analysis and Management*, 5, No. 4, Summer, pp. 665-682.

MARIN, A. – PSACHAROPOULOS, G. [1982]: The Reward for Risk in the Labor Market: Evidence from the United Kingdom and a Reconciliation with Other Studies. *Journal of Political Economy*, Vol. 90, No. 4, pp. 827-853.

MARKOWITZ, H. M. [1952]: Portfolio Selection. *Journal of Finance*, March, pp. 77-91.

*MELINEK, S. J. – WOOLLEY, S. K. D. – BALDWIN, R. [1973]: Analysis of a Questionnaire on Attitudes to Risk: Fire Research Note 962. Joint Fire Research Organisation, Borehamwood.

MISHAN, E. J. [1971a]: Cost-Benefit Analysis: An Introduction. Praeger, New York.

MISHAN, E. J. [1971b]: Evaluation of Life and Limb: A Theoretical Approach. *Journal of Political Economy*, July/August, Vol. 79, No. 4, pp. 687-705.

MISHAN, E. J. [1973]: Economics for Social Decisions: Elements of Cost-Benefit Analysis. Praeger, New York.

MISHAN, E. J. [1981]: The Value of Trying to Value a Life. *Journal of Public Economics*, Vol. 15, No. 1, pp. 133-137.

MISHAN, E. J. [1988]: Cost-Benefit Analysis. An Informal Introduction. Fourth Edition. Unwin Hyman, London, Boston, Sydney, Wellington.

MITCHELL, R. C. – CARSON, R. T. [1989]: Using Surveys to Value Public Goods: The Contingent Valuation Method. Resources for the Future. Washington DC.

MOORE, M. J. – VISCUSI, W. K. [1988a]: Doubling the Estimated Value of Life: Results Using New Occupational Fatality Data. *Journal of Policy Analysis and Management*, Vol. 7, No. 3, pp. 476-490.

MOORE, M. J. – VISCUSI, W. K. [1988b]: The Quantity-adjusted Value of Life. *Economic Inquiry*, Vol. XXVI, July, pp. 369-388.

MOORE, M. J. – VISCUSI, W. K. [1990]: Compensation Mechanisms for Job Risks. Wages, Workers' Compensation, and Product Liability. Princeton University Press, Princeton, New Jersey.

MOORE, M. J. – VISCUSI, W. K. [1990]: Discounting Environmental Health Risks: New Evidence and Policy Implications. *Journal of Environmental Economics and Management*, 18, pp. S51-S62.

MROZEK, J. R. – TAYLOR, L. O. [2002]: What Determines the Value of Life? A Meta-Analysis. *Journal of Policy Analysis and Management*, Vol. 21, No. 2, pp. 253-270.

NAS, T. F. [1996]: Cost-Benefit Analysis. Theory and Practice. SAGE Publications, Thousand Oaks, London, New Delhi.

NEEDLEMAN, L. [1976]: Valuing Other People's Lives. *The Manchester School of Economic and Social Studies*, 44, pp. 309-342.

*NEUMANN, J. – MORGENSTERN, O. [1944]: Theory of Games and Economic Behavior. Princeton University Press, Princeton, New Jersey.

OLSON, C. [1981]: An Analysis of Wage-differentials Received by Workers on Dangerous Jobs. *Journal of Human Resources*, Vol. XVI, No. 2, Spring, pp. 167-185.

PORTNEY, P. R. [1981]: Housing Prices, Health Effects, and Valuing Reductions in Risk of Death. *Journal of Environmental Economics and Management*, 8, pp. 72-82.

POWER, T. M. [1980]: The Economic Value of the Quality of Life. Westview Special Studies in Contemporary Social Issues. Westview Press, Boulder, Colorado.

READY, R. C. – WHITEHEAD, J. C. – BLOMQUIST, G. C. [1995]: Contingent Valuation When Respondents Are Ambivalent. *Journal of Environmental Economics and Management*, September, 29, pp. 181-196.

*REYNOLDS, D. J. [1956]: The Cost of Road Accidents. *Journal of the Royal Statistical Society*.

ROSEN, S. [1988]: The Value of Changes in Life Expectancy. *Journal of Risk and Uncertainty*, 1, pp. 285-304.

SANDY, R. – ELLIOTT, R. F. [1996]: Unions and Risk: Their Impact on the Level of Compensation for Fatal Risk. *Economica*, Vol. 63, May, No. 250, pp. 291-309.

SASSONE, P. G. – SCHAFFER, W. A. [1978]: Cost-Benefit Analysis: A Handbook. Academic Press, New York.

SAVAGE, L. J. [1954]: The Foundations of Statistics. Wiley, New York.

SCHELLING, T. C. [1968]: The Life You Save May Be Your Own. In: CHASE, S. B. (ED.): Problems in Public Expenditure Analysis. Papers presented at a conference of experts held September 15-16, 1966. Washington, Brookings, pp. 127-176.

SELF, P. [1975]: Econocrats and the Policy Process. The Politics and Philosophy of Cost-Benefit Analysis. MacMillan Press, London.

SEN, A. [1990]: Az egyéni szabadság mint társadalmi elkötelezettség. In: KINDLER JÓZSEF - ZSOLNAI LÁSZLÓ (SZERK.) [1990]: Etika a gazdaságban. Keraban Kiadó, Budapest.

SEN, A. – WILLIAMS, B. (ED.) [1982]: Utilitarianism and Beyond. Cambridge University Press, Cambridge.

SHOGREN, J. F. – STAMLAND, T. [2002]: Skill and the Value of Life. *Journal of Political Economy*, October, Vol. 110, No. 5, pp. 1168-1173.

SMITH, A. [1992]: A nemzetek gazdagsága. E gazdagság természetének és okainak vizsgálata. Közgazdasági és Jogi Könyvkiadó, Budapest.

SMITH, R. S. [1976]: The Occupational Safety and Health Act: Its Goal and Its Achievements. American Enterprise Institute, Washington DC.

SMITH, V. K. [1983]: The Role of Site and Job Characteristics in Hedonic Wage Models. *Journal of Urban Economics*, May, Vol. 13, Number 3, pp. 296-321.

SUGDEN, R. – WILLIAMS, A. [1978]: The principles of practical cost-benefit analysis. Oxford University Press, Oxford.

THALER, R. – ROSEN, S. [1976]: The Value of Saving a Life: Evidence from the Labor Market. In: TERLECKYJ, N.E. (ED.): Household Production and Consumption. Cambridge: NBER, pp. 265-298.

Tízmilliós munkavédelmi bírság. Eltitkolják a munkahelyi baleseteket. *Világgazdaság*, 23 November 2001, www.vilaggazdasag.hu.

TRAVIS, C. C. – PACK, S. R. – FISHER, A. [1987]: Cost-effectiviness as a Factor in Cancer Risk Management. *Environment International*, Vol. 13, pp. 469-474.

TRAVIS, C. C. – RICHTER, S. A. – CROUCH, E. A. C. – WILSON, R. – KLEMA, E. D. [1987]: Cancer Risk Management. A Review of 132 Federal Regulatory Decisions. *Environmental Science and Technology*. Vol. 21, pp. 415-420.

ULPH, A. [1982]: The Role of Ex Ante and Ex Post Decisions in the Valuation of Life. *Journal of Public Economics*, 18, pp. 265-276.

VAN HOUTVEN, G. L. – CROPPER, M. L. [1994]: When Is a Life Too Costly To Save? The Evidence from Environmental Regulations. *Resources*, Winter, pp. 6-10.

VARGA TIBOR [2003]: A támogatások költség-haszon szemléletű elemzésének lehetőségei. In: Agrárgazdasági tanulmányok, 1. szám. Agrárgazdasági Kutató és Informatikai Intézet, Budapest.

VISCUSI, W. K. [1978]: Labor Market Valuations of Life and Limb: Empirical Evidence and Policy Implications. *Public Policy*, Vol. 26, No. 3, Summer, pp. 359-386.

VISCUSI, W. K. [1979]: Employment Hazards. An Investigation of Market Performance. Harvard University Press, Cambridge, Massachusetts, London, England.

VISCUSI, W. K. [1983]: Risk by Choice. Regulating Health and Safety in the Workplace. Harvard University Press.

VISCUSI, W. K. [1986]: The Valuation of Risks to Life and Health: Guidelines for Policy Analysis. In: BENTKOVER, J. D. - COVELLO, T. - MUMPOWER, J. (ED.): Benefits Assessment. The State of the Art. D. Reidel, Dordrecht, pp. 193-210.

VISCUSI, W. K. [1992]: Fatal Tradeoffs. Public and Private Responsibilities for Risk. Oxford University Press, New York, Oxford.

VISCUSI, W. K. [1993]: The Value of Risks to Life and Health. *Journal of Economic Literature*, Vol. XXXI, December, pp. 1912-1946.

VISCUSI, W. K. – EVANS, W. N. [1990]: Utility Functions That Depend on Health Status: Estimates and Economic Implications. *The American Economic Review*, June, Vol. 80, No. 3, pp. 353-374.

VISCUSI, W. K. – MAGAT, W. A. – FORREST, A. [1988]: Altruistic and Private Valuation of Risk Reduction. *Journal of Policy Analysis and Management*, Vol. 7, No. 2, pp. 227-245.

VISCUSI, W. K. – MAGAT, W. A. – HUBER, J. [1991]: Pricing Environmental Health Risks: Survey Assessments of Risk-Risk and Risk-Dollar Trade-Offs for Chronic Bronchitis. *Journal of Environmental Economics and Management*, 21, pp. 32-51.

VISCUSI, W. K. – MOORE, M. J. [1987]: Worker's Compensation: Wage Effects, Benefit Inadequacies, and the Value of Health Losses. *The Review of Economics and Statistics*, May, 69 (2), pp. 249-261.

VISCUSI, W. K. – MOORE, M. J. [1989]: Rates of Time Preference and Valuation of the Duration of Life. *Journal of Public Economics*, 38, pp. 297-317.

VISCUSI, W. K. – O'CONNOR, C. J. [1984]: Adaptive Responses to Chemical Labeling: Are Workers Bayesian Decision Makers? *The American Economic Review*, December, Vol. 74, No. 5, pp. 942-956.

WILLIAMS, A. [1979]: A Note On „Trying to Value A Life". *Journal of Public Economics*, 10, pp. 257-258.

ZECKHAUSER, R. [1975]: Procedures for Valuing Lives. *Public Policy*, Volume 23, No. 4, Fall, pp. 419-464.

ZECKHAUSER, R. – SHEPARD, D. [1976]: Where Now for Saving Lives? Law and Contemporary Problems, Vol. 40, No. 4, Autumn, pp. 5-45.