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COST BENEFIT ANALYSIS, VALUE OF A STATISTICAL LIFE AND CULTURE: CHALLENGES FOR REGULATION*

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ABSTRACT

The author studies three aspects of human live valuation and its relation with and cost benefit analysis in administrative regulation. More precisely, the author addresses the problem of valuation of a statistical human life and its relation with cost benefit analysis in mortality risk reduction policies. First, studies the debate about Valuation of a Statistical Human Life (VSL) and Cost-Benefit Analysis (CBA) in mortality risks regulation; second, addresses the problem of discount rates in the calculus of VSL and the problem of (dis)counting value of future human lives, and finishes testing if culture (represented as a set of values) has an incidence in risk preferences and, therefore, in willingness to pay for life.

Key words: Cost Benefit Analysis, Value of a Statistical Life, Culture Consequences, Regulation, Cross-country analysis.

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ANÁLISIS COSTO BENEFICIO, VALOR ESTADÍSTICO DE LA VIDA Y CULTURA: RETOS PARA LA REGULACIÓN

RESUMEN

El autor estudia tres aspectos de la valoración de la vida humana y su relación con el análisis costo beneficio en regulación administrativa. Más precisamente, el autor se enfoca en el problema de valor estadístico de la vida (VEV) y su relación con el análisis costo beneficio (ACB) de las políticas de reducción de la mortalidad. Primero, estudia el debate sobre la valoración estadística de la vida y el problema del costo benéfico en la regulación sobre riesgos de mortalidad; segundo, estudiar el problema de las tasas de descuento en el calculo del VEV y el problema de (des)contar valor de vidas humanas futuras, y termina probando si la cultura (representada con un conjunto de valores) tiene alguna incidencia en las preferencias y, por tanto, en la disposición a pagar por la vida.

Palabras clave: *análisis costo beneficio, valor estadístico de la vida, consecuencias de la cultura, regulación, análisis intercultural.*

1. INTRODUCTION

Are human lives priceless? Never! If human lives were allowed to concur without restrictions to the market mechanism as goods, some price they would have[1]. Claims for priceless or the impossibility of determination an exchange value for human lives is only justifiable with regard to the language and reasoning of ethics[2]. In economics, and in the law, the valuation of a human life is an answer and necessary medium in the analysis and mitigation of risk, harm, and fear[3].

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1 In fact, even if it is crude, rude or rough, *human trafficking* is just a market reaction to such prohibition. Such black markets set certain prices for humans, above the possible equilibrium, due to the prohibition.

2 Michael D. Bayles, *The price of life*, 89, Ethics, 20, 20-21, October, 1978.

3 Cfr. Cass Sunstein. Incommensurability and valuation in law. 92 *Mich. L. Rev*., 779-861, 1994.

In this article I will study three aspects of human live valuation and its relation with and cost benefit analysis in regulation. More precisely I will address the problem of valuation of a statistical human life and its relation with cost benefit analysis in mortality risk reduction. First I will study the debate about Valuation of a Statistical Human Life (VSL) and Cost-Benefit Analysis (CBA) in mortality risks regulation; second, I will address two challenges to CBA and VSL, these are the problem of discount rates and the problem of (dis)counting of future human lives, and second, I will try to test if culture (represented as a set of values) has an incidence in risk preferences and therefore, in willingness to pay for life in different countries.

2. VALUATION OF A STATISTICAL LIFE AND CBA

The social value of a life comes from the value that others put to an individual's life. But, statistical methods are less condemnable since they place the determination of life in the actual behavioral actions of people[4].In fact,

> "individuals make decisions everyday that reflect how they value health and mortality risks"[5].

For example, the construction of a highway is costly in terms of human lives. Workers know and have a perception of the probable risks and voluntarily assume the risk at a certain wage. On the other hand, people know or subjectively assume that buying certain products is riskier or less risky that other products at a certain price difference[6]. For example, in the case of product safety, the consumption of risky product is an indicator of the consumer behavior and his determination of the statistical value of his life. Then, using evidence on market choices that involve implicit tradeoffs between risks and money, economists have developed estimates of the vale of a statistical life.

The rationale of the techniques of valuation of a life is based in the determination of the regulation efficiency in terms of cost-benefit. Cost-Benefit Analysis has been in the economics literature since long time ago. Departing from the KALDOR-HICKS efficiency criteria to the sharper SCITOVSKY definition, such mechanism has

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4 CASS SUNSTEIN *et. al*., A Behavioral Approach to Law and Economics, *Behavioral Law and Economics* 13, 14-16, 2002.

5 W. KIP VISCUSI, *The value of a statistical life: a critical review of market estimates throughout the world*, 27 J. Risk and Uncertainty, 5, 1, 2003.

6 BAYLES, *supra*, note 3.

been used in economics as a standard in policy and economics decision. In fact, several sustained that public policy

> "was only justified if it produced social gains in excess of social losses so that it was possible for winners from the policy to compensate losers"[7].

The maximization, then, is a procedure of expected lives saved; this is the number of lives saved due to the probability of risk reduction[8]. In fact, the adoption of regulation not necessarily implies a risk reduction, but a chance of risk reduction. So, if a policy is determined to save 50 lives in a period of 10 years, with a 80% chance, this means that the expected number of lives saved is 40, and therefore the statistical value of lives must not be the net number but the expected number.

Therefore, if the problem of regulation is to reduce risks and increase safety, the goal of such policies should be measured by the number of lives saved. Life then has a value relative to other ends and therefore, there is a tradeoff between life and legal policy ends. Indeed, the question, how much a life values, is only raised to determine if certain policy will be cost efficient or not. Regulators cannot tell how much is the government investing in saving a life by simply dividing their budget for the expected number of lives saved. They must, previously, determine if it is worth to spend certain amount of money in the reduction of three, six or one hundred lives. Therefore, reduction of mortality risks, as a government policy, must comply with certain criteria which lead to a reasonable decision[9]. Several criteria had been proposed to determine the reasonability of such policy measures. Rationality requires that the allocation of resources be done in order to attain the highest possible wealth fare at the lowest possible effort[10]. As the risk-risk analysis is, the cost-benefit analysis seems to be the most important mechanism to attain such reasonability in policy decision making[11].

In conclusion, in death risks, lives saved are simply benefits. The problem, in the side of the costs is not hard to hurdle since the costs of such programs are usually easy to monetize if they all are not monetary. The problem becomes harder when it is necessary to monetize lives in average. This means, not particular lives of particular people with particular incomes and income trends, but to determine a value for a human life in statistical terms, in a way that allows commensurability.

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7 John Persky, *Retrospectives: Cost-Benefit Analysis and the Classical Creed*. 15 J. Econ. Perspectives, 199, 201, Autumn, 2001.

8 Charles Fried, The value of life, 82 *Harv. L. Rev*. 1415, 1420, 1969.

9 W. Kip Viscusi, Mortality Effects of Regulatory Costs and Policy Evaluation Criteria, 25, rand j. Econ. 94, 94-95, spring, 1994.

10 Fried, *supra* note 11 at 1416.

11 omb circular A-4, September 17, 2003.

Usually the literature focures in the willingness to pay approach derived from labor markets, focuring primarily in the estimation of the on-the-job risk exposure, risk-money tradeoffs, and price-risk (price-safety) tradeoffs[12]. The estimation from labor markets is the most developed of the latter. The economists using this methodology use hedonic wage or price models that, controlled by productivity and quality components of the job, determine the price or wages associated with the different choices of risk[13]. The advantage of labor markets is the availability of data and different levels of risks which allow researchers to observe the equilibriums of risk choices others econometric techniques have boen developed: the first and general approach[14] is based in the relation between fatality of risk and wiliness to pay. For example, if a worker faces a risk of 4/100,000 of death, and is willing to pay $50 to reduce such risk to 3/100,000 the workers is valuating his life in 5 million (50*100,000) since the value of his statistical life is

$$\frac{\partial Y}{\partial Risk} = \frac{\$50}{\frac{1}{100{,}000}} = \$5{,}000{,}000$$

Where $\partial Y$is the variation in the income, and $\partial Risk$ is the variation of risk.

A more stylized approach war the developed by Viscusi and others, in which, through labor market data on observed wages and actual workers behavior not surveyed changes in income, and job risks, it is possible determine the value of an statistical life with econometric or multivariate analysis[15]. The estimation is simple, the function to run is:

$$Y = \alpha + \beta\ Risk + \lambda\ Education + \theta\ Gender + \ldots + \varepsilon$$

Where Y is the income, *Risk* is the number of fatalities over the number of cases and, *Education* and *Gender* are other variables that affect and control the estimation of the coefficients. The point here is the identification of *B* since such coefficient defines the value of a statistical life[16].

According to Viscusi[17], the proper way to value the risk reduction benefits derived from governments' policy is a method that leads to determine the "society's

12 Viscusi, *supra* note 6, at 6.

13 *Id.* at 7.

14 Joni Hersch, Materials for the course in Empirical Methods for Legal Analysis, 207 Fall -2005.

15 *Id*.

16 *Id*.

17 Viscusi, *supra* note 5, at 6.

willingness to pay" for the benefits of risk reduction. Given this method, the approach is based in searching the amount a society is willing to pay as general basis for the calculation of the benefits[18]. These calculations of willingness to pay are usually conduced by determining how much people do pay in actual market settings to reduce certain risk of harm[19]. So, under the willingness to pay approach the value of a statistical life is, assuming rationality, the social mean *marginal rate of substitution of own wealth for safety*[20]. That is why, mainstream economic analysis use willingness to pay as the mean of valuation since it is the only way to mimic the market valuations[21].

> "In the case of mortality risk reduction, for example, the benefit is the value of the reduced probability of death that is experienced by the affected population, not the value of the lives that has been saved *ex post*"[22].

Such willingness to pay is combined with the amount of risk that constitutes the problem analyzed; this is, for example, 6,800 people death until 2010 due to Bronchitis. This implies that the benefits of such program, if it is capable of reducing the number cited, is the simple multiplication between the risk and the willingness to pay for a reduction in the risk of contracting chronic bronchitis[23].

It is possible to challenge this approach in several ways: First, the willingness to pay could be no properly calculated, therefore, it is not a real *willingness to pay* but a presumed actual transaction for a "fraction" of life. Second, even if willingness to pay was properly calculated probably it is not the best way to monetize the costs in terms of human lives. Third, probably there was an overstatement of the number of lives saved, or the number of cases. Fourth, probably the agency overvalued or unevaluated the number of lives saved. And fifth, perhaps the agency overvalued or under valued the monetization of lives saved[24].

It is pretty enlightening the approach followed by Freeman[25] when he states that

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18 Cass Sunstein, *Cost Benefit default principles*. 99 Mich, *Law Rev*. 1651, 1706, 2001.

19 *Id*.

20 M.W. Jones-Lee, Paternalistic Altruism and the Value of Statistical Life 102 *The Economic Journal* 80, 1992.

21 Amartya Sen, *The Discipline of Cost-Benefit Analysis.* 29 J. Legal. Stud. 931, 945, 2000)

22 Viscusi, *supra* note 6, at 6.

23 *Id*. *Citing*: Innovative strategies group. Environmental Protection Agency, Regulatory Impact Analysis, Ozone and Particulates, 1998.

24 Cass Sunstein, Cost Benefit default principles, 99 *Mich. Law Rev*. 1651, 1708, 2001.

25 Freeman III, A.M., *The measurement of environmental and resource values*. Resources for the Future, 320, 1993.

> "…the economic question being dealt with here is not about how much an individual would be willing to pay to avoid his or her certain death or how much compensation that individual would require to accept that death. In this respect, the term "value of life" is an unfortunate phrase that does not reflect the true nature of the question at hand. Most people would be willing to pay their total wealth to avoid certain death; and there is probably no finite sum of money that could compensate an individual for the sure loss of life. Rather, the economic question is about how much the individual would be willing to pay to achieve a small reduction in the probability of death during a given period or how much compensation that individual would require to accept a small increase in that probability".

This statement clarifies the end and aim of life valuation for regulatory purposes. The idea is not to ask *how much people or societies are willing to pay for their lives, but how much do they value the governmental efforts to reduce risks.* Therefore, such valuations are likely to be different a cross different individuals, different cities, regions and countries. The reasons are simple: first, the attitudes of people to risk are different in terms of risk aversion[26] and in terms of cultural preferences for risks, and second, as safety is a normal good, those with higher income have a higher willingness to pay[27].

The same behavior is present in a "willingness to accept" approach, where people face the possibility of accepting premium wages or diminutions in rent or other payments in exchange of a higher risk[28]. But the willingness to accept presents a cognitive problem; it gives to individuals the perception of a property right over the decision of getting in a risky situation, therefore, the willingness to accept models tend to develop higher valuations.

On the other hand, cost-benefit analysis involving human lives has several positive points which make it the most feasible in front of many other mechanisms of policy analysis since it informs the public and the government about a regulator's criteria to make decisions[29]. Definitely, cost-benefit is useful for comparing the favorable and unfavorable effects of policies, it permits the comparison between different sets of policies, gives self explanations with reliable evidence about the convenience of certain policy, and provides space to challenge regulatory policy. In addition, determines a unitary monetization of benefits which are usually lower risks, permit external analysis

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26 David Pearce, Valuing Statistical Lives, 18 *Planejamento e Politicas Publicas*. 69, 78, Brazil, December, 1998.

27 *Id.* Also see: Viscusi, *supra*, note 6; Viscusi, *supra*, note 10; Fried, *supra*, note 11.

28 Pearce, *supra*, note 27 at 79.

29 To see some objections to the traditional Cost-Benefit analysis: Duncan Kennedy, Cost-Benefit Analysis of Entitlement Problems: A Critique, 33 *Stan. L. Rev.* 387, 1981. Also see: Amartya Sen, *The Discipline of Cost-Benefit Analysis.* 29 J. Legal. Stud. 931, 2000.

of such monetization and the economic assumptions involved in them, and the distributional consequences of policy[30].

By the same token, in several studies the statistical valuation of a life has been challenged in several ways. The most important challenge comes from the actual preferences of regulation that people has. Some studies reveal that in choosing among different risk of life programs, people care both about the qualitative characteristics of the regulation as the numbers of lives saved[31]. In fact, many answers were inelastic with respect to the numbers of lives saved.

In the survey conducted by Subramanian and Crooper, programs in which the target of regulation was air and/or water pollution, respondents chose these programs regardless of the number of lives saved[32]. On the same grounds, people were less sensitive to the number of lives saved for environmental programs than the number of lives saved in public health programs. Costs, or assumptions about the probable costs of a program, also affected the election between programs, giving a stronger incentive to select programs were the expected costs were lower than in the program compared with[33].

However, maybe the problem with the lives saved approach is the troublesome cognitive effect that a question for the relation between lives and money generates. But also, people tend to weight or being less skeptical of the idea that programs should be balanced according to the numbers of lives saved by each program. Therefore, some of these findings could be questionable because of cognitive problems, and some others seem to be accurate in the same grounds. In addition, empirical evidence has shown that taken people to ask questions in isolation their answers are completely different than the answers given to contextualized or comparative categories[34].

Furthermore, contingent valuation and willingness to pay are a hard case for research. As it posts the case of hypothetical questions about how much are *X, Y* or *Z* groups of people willing to pay for a, b or c object. The problem is that usually such mocked decision analysis, goes against the rational choice model, making, for example, equally valuable prevent 2,000 migratory birds being killed than 20,000 or

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30 Kenneth Arrow, *et. al*., *Is There a Role for Benefit-Cost Analysis in Environmental, Health and Safety Regulation?* 272 Science, 221, 221-23, April, 12 1996.

31 Uma Subramanian & Maureen Crooper, Public Choices Between Life Saving Programs: The Tradeoff Between Qualitative Factors and Lives Saved, 21 J Risk and Uncertainty, 117, 119, 2000.

32 Subramanian & Crooper, *supra*, note 32.

33 Id. at 133.

34 Cass Sunstein, Cognition and cost benefit analysis. 29 J. Legal Stud. 1059, 1071, 2000.

200,000[35]. In the same grounds, it has been proven that people tends to think that certain risky events are more likely to occur than certain other events, just because there is a memory of its occurrence. So, people overestimate highly publicized events but under estimate less publicized events[36]. Regrettably, people are irrational and their preferences and precautions are developed or maintained by the "panic, hysteria" and "baseless fear" of risks that, related to other kinds of risks, are meaningless[37]. Moreover,

> "vivid mental pictures of widespread death …can drive a demand for risk regulation"[38]

with out being such demand the most rational o efficient kind of regulation.

Even mainstream economists accept that cost-benefit analysis for programs on mortality and health risks are not always definitive. Even regulation with a positive benefit-cost balance can incur in wrongful effects. For example, Viscusi discussed the effect of risk reduction and its causality and tradeoff with risk increasing. This is, studied the relation between the regulation of risk and expansion of another risk due to the substitution effect. His findings, in such cases, indicated that high cost regulations are usually counterproductive since they determine a higher risk substitution effect[39]. For example, the regulatory effects on the level of safety are usually intended to decrease risk, but those high levels of safety compensate the wage differentials, which indicate risky jobs, and incentive people to decrease their own mechanisms to reduce risk by health investments[40]. Indeed seems pretty logical that, before a third party effort is effective in the reduction of a risk, such effort could lead individuals to reduce their sacrifices to reduce risks.

Correlated is the systemic effect of regulation, not usually taken into account. A decision to regulate nuclear power could increase the demand for coal-fired power plants which have immediate environmental harm effects and not a potential/probable catastrophic effect as nuclear plants have[41]. Examples as the last one show that

35 Amartya Sen, Environmental Evaluation and Social Choice: Contingent Valuation and the Market Analogy. 46 *Japanese Econ. Rev*. 23, 1995. Sen, *supra*, note, at 946-47.

36 Cfr. Cass Sunstein, *Laws of fear: beyond the precautionary principle*, 2005.

37 Id. at. For example, the question right now would be, what is more risky, to eat meat or eat chicken. Will be more risky in the near future to eat pork? Probably, it isn't yet publicized by the news but the mad pork disease is attacking china, there are 36 cases and 198 with out confirmation. The point is, the first two were events highly publicized by the news, however, their impact on health was minimum compared with some other industrial risks. See: Cass Sunstein, Cognition and cost benefit analysis, 29 J. Legal Stud. 1059, 1067, 2000.

38 Sunstein, *supra*, note 37.

39 Viscusi, *supra,* note 10.

40 Viscusi, *supra,* note 10 at 100.

41 Cass Sunstein, Cognition and cost benefit analysis. 29 J. Legal Stud. 1059, 1069, 2000.

there are health-health or risk-risk tradeoffs made by the regulator most of the time without balancing the effect on the potential number of lives lost or saved.

SUNSTEIN has been more conscious about the subject, and, avoiding mainstream economic analysis supports the necessity and convenience of cost-benefit analysis on the grounds of behavioral economics and cognitive psychology[42]. Among his findings, he suggests that cost-benefit analysis is the best mean to defend and overcome problems related with individual and social cognition. In addition, cost-benefit analysis

> "should be understood as a method for putting "on screen" important social facts that might otherwise escape private and public attention"[43].

Therefore, cost benefit analysis ensures the attendance of priority setting and permits the production of burdens and hurdles of desirable regulation[44].

This view is clearly challenging since, despite of the claims of the author, the point of cost-benefit analysis is not the maximization of the best possible risk regulation, but the maximization of societal interest. Indeed, not every regulation could be understood on grounds of economic efficiency, however, cost benefit analysis, in SUNSTEIN's way, provides to regulators an agnostic tool to attract the support of several groups of people with diverse and competing views. This is only attainable if cost benefit analysis is seen as a way to overcome predictable problems and recognize the risks "to life and health at both the individual and the social levels"[45].

His proposition of a non rival rationality is quite interesting, since trying to avoid rivalry in demand of regulation, he encounters a way to depart from the lives saved criterion,

> "for reasons that cast a clearer light on what it is that they are attempting to maximize".

In synthesis he finds that

> "people are willing to pay a premium to avoid deaths that involve a high degree of pain and suffering",

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42 Cfr. *Id.*

43 *Id*. at 1060-63.

44 *Id*.

45 *Id*., at 945.

second, people are willing to devote more resources to protect children, third "people are willing to pay a premium to aver catastrophes", fourth,

> "people are willing to devote more resources to protect against dangers when the costs of risk avoidance are high",

and finally,

> "people may believe that it is especially important to protect vulnerable or traditionally disadvantaged groups against certain risks"[46].

In conclusion, SUNSTEIN sets seven propositions to complete the theories of cost benefit analysis. First, *identify* and *qualify* the advantages and disadvantages of courses of action; second, *provide quantitative and qualitative descriptions* determining who gets or bears the benefits and costs of regulation, in a way to define "who is helped and who is hurt"; third, *commensurate values to monetary values*; fourth, establish and adjust *floors and limits* to regulation expending, by statutory measures, for example minimum and maximum cost for life-saved; fifth, *adjust* according to qualitative factors, the floors and ceilings of regulation; sixth, *respond to social fear*, this means, not regulating or over regulating but trough education and reassurance; and seventh determine a procedure for *judicial review of risk regulation*, in order to determine, judicially, if certain regulation has created more good than harm[47].

3. THEORETICAL CHALLENGES TO CBA, VSL AND REGULATION

Even thought the aforementioned challenges and contents of the Cost-Benefit Analysis debate are enough to show the "benefits" and "costs" of statistical valuation of lives, there are two points that I want to comment in detail and suggest further analysis. Those are, the problem of discount rates in the determination of the benefits of regulation involving valuation of future human lives, and the incidence of culture in the valuation of human lives.

3.1. (Dis)counting the Value of Future Lives

In the first part of this paper I discussed the problem of determining benefit in the CB analysis. But willingness to pay and risk estimations are not all the variables

46 See: SUNSTEIN, *supra*, note 35, at 1089-91.

47 SUNSTEIN, *supra*, note 35, at 1095.

used in determining the benefits of a policy. Now, I want to address the problem of discount rates. These rates are used in finances to define the present value of investment. Regulation is investment, and in our case the return is lower risks of death. The discount rate is also an important variable in the determination of benefits since it is the limit of valuation of future life. However, the logic of discount rates generates an intergenerational and ethical problem, since them affect and determine the value of future lives. This means, that the discount rate defines how much the government values a life in the future in terms of lives now. Thus, the question is, are discount rates a "fair/neutral" variable in the determination of the benefits of risk reduction programs?

Let me start from the beginning. The logic and foundations of the discount rate are highly questionable. The aim of such rate is to discount the value lost by a dollar today, since it values more than tomorrow. The problems are that there is an opportunity cost and a problem of time preferences. The challenges of opportunity cost are simple: if a government agency can invest one dollar in a project today it has an opportunity cost of investment in a different project. On the other hand, it is a principle of rationality[48] that people prefers a benefit today than in the future, therefore the expected future earnings must be discounted due to such loses[49].

Is the future, then, less valuable than the present? A positive answer has not a problem in pure rational grounds, but, if we approach to the future in a different perspective as an equality approach, such statement could affect the monetization of benefits. What is exactly the point? That if a life is valued today at $4.8 million —as the EPA stated in the National Ambient Air Quality and Particulate Standards—, at a 10% discount rate, such life in 100 years is going to value $348.31. Even worst, in 10 years such life is worth $1,850,608, which is a 38% of the value; this means that future lives are geometrically depreciated.

What happens with different discount rates? The table 1 shows the problem with these rates. As we can see a discount rate of 10% determines a completely different value of a life in the future. This means, that such life has a different value in the future determined by a different discount rate. The benefits of a program are not inflated by no discounting, but, on the other hand, the benefits of a program can be arbitrarily overestimated by the determination of a low discount rate. If we look at the table, we can see that in the year 2020 a life costs $1,783,334 discounted at 2%. On the other hand, discounted at 5% the same life has a Statistical Value of

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48 ANDREA MAS COLLEL, *et. al*., *Microeconomic Theory*, Chapter 1, Preference and Choice, 7, 2001.

49 SUNSTEIN, *supra* note 19, at 1712. A simple function is $VP_t = \frac{V}{(1+r)^n}$, $t = 1,2,...n$ where r is the discount rate. In an infinite panorama, VP=V/r.

$418,578. Furthermore, at a 10% discount rate, such life only costs in 20 years, $40,889.

TABLE 1. VSL in Years.

	Value in years						
Discount Rate	2001	2002	2005	2010	2020	2050	2100
2%	$4,705,882	$4,613,610	$4,347,508	$3,937,672	$3,230,262	$1,783,334	$662,558
3%	$4,660,194	$4,524,460	$4,140,522	$3,571,651	$2,657,644	$1,094,914	$249,758
4%	$4,615,385	$4,437,870	$3,945,250	$3,242,708	$2,190,657	$ 675,421	$ 95,040
5%	$4,571,429	$4,353,741	$3,760,926	$2,946,784	$1,809,070	$ 418,578	$ 36,502
6%	$4,528,302	$4,271,983	$3,586,839	$2,680,295	$1,496,663	$ 260,584	$ 14,147
7%	$4,485,981	$4,192,506	$3,422,334	$2,440,077	$1,240,411	$ 162,949	$ 5,532
8%	$4,444,444	$4,115,226	$3,266,799	$2,223,329	$1,029,831	$ 102,342	$ 2,182
9%	$4,403,670	$4,040,064	$3,119,671	$2,027,572	$ 856,468	$ 64,553	$ 868
10%	$4,363,636	$3,966,942	$2,980,422	$1,850,608	$ 713,489	$ 40,889	$ 348

The differences are huge and can totally affect the outcome of a cost benefit analysis. Think in a program that claims to safe 13 lives each year. In the year 20 the SVL of the lives saved is $42 millions at a 2% discount rate, $23 million at a 5% discount rate, and 9 million at a 10% rate. This means that the election of a discount rate makes an enormous difference in the long run evaluation of the benefits of a risk of death reduction program.

It is true that according with the OMB Circular A-4 the default discount rate is 7%[50] . This eliminate certain disparities between agencies' and programs' valuation of future lives since equalizes the rate as a default. The election of such rate was not arbitrary since it is the estimate of the "average-before tax rate of return to private capital in the U.S. Economy"[51], but, according to the same Circular, it is probably not the best way to determine a discount rate. In fact, the Circular mentioned makes an explicit reference to the circular A-94 in terms of discounting, but such circular makes the same assumptions and does not contribute to the problem we have been discussing[52]. In addition, the Memorandum n° M-05-07, released on January 31, 2005, the Director of the OMB stated that

50 OMB Circular A-94. REVESZ, in Environmental Regulation, Cost-benefit Analysis and the Discounting of Human Lives, 99 *Colum. L. Rev*. 941, 1999, questions the 7% rate abovementioned, because it seems to be too high.

51 OMB circular A-4, 33, September 17, 2003.

52 OMB circular A-94.

"The rates presented in Appendix C do not apply to regulatory analysis or benefit-cost analysis of public investment".

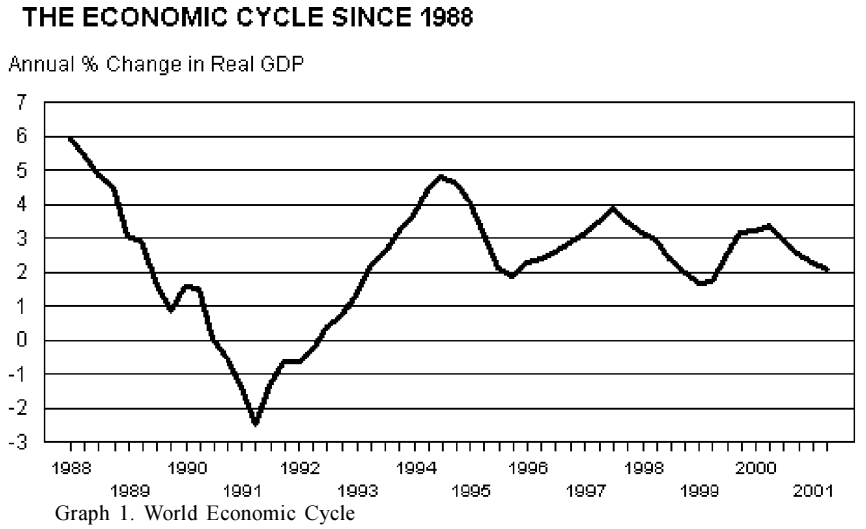
Then,

"they are to be used for lease-purchase and cost-effectiveness analysis, as specified in the Circular."

Thus, the only possible mandatory application of discount rates was overruled. The OBM, showing concern about the ethical issues states that

"some [authors] believe, however, that it is ethically impermissible to discount the utility of future generations. That is, government should treat all generations equally. Even under this approach it would still be correct to discount future costs and consumption benefits generally …due to the expectation that future generations will be wealthier and thus will value a marginal dollar benefit and costs by less than those alive today"[53].

This statement assumes that the future will "always" be better for future generations in terms of dollar value. Unfortunately this could only be true in the long, run, not in the medium or short run. Not necessarily, in five or ten years, the marginal value of a dollar is going to be lower, in fact, macroeconomic evidence suggests that every x years, depending on the structure of the market and the behavior of the fundamentals, depression would be followed by growth and growth by depression (see graph 1). Taking this panorama, clearly discounting not necessarily means an equal treatment of all generations.



Graph 1. World Economic Cycle

53 OMB circular A-4, 36, September 17, 2003.

Several authors have argued about the logic and the problems of discounting in regulation of health and lives. SUNSTEIN, seemed to be worried about the statutory regulation that controls the decisions about discounting of the regulatory agencies[54] . He shows the preoccupation I am trying to highlight here. Some times, the same agency, without any justification but its own discretion, determines the discount rate for the value of a statistical life or the value of health at different rates, some times 3% sometimes 7% or some time 10%, for different programs. Indeed,

> "if the goal of … safety programs were to maximize the number of lives saved, one would expect the cost of saving a life, at the margin, to be equalized among programs. Studies, however, reveal large disparities…"[55].

This is not only an erratic practice that indicates a lack of certainty and standardized procedures involved in the analysis but also shows a power that could be handled as a "good" in a market for regulation. Thus, if the regulator can arbitrarily determine a discount rate, and taking into account that such rate can change the result of the CBA, then, there is an incentive to "take the regulator"[56].

SUNSTEIN suggest another point, perhaps guided by REVESZ writings[57]. He sustains that

> "if a regulation will save ten lives this year and ten lives annually for the next ten years, it cannot be plausibly be urged that the future savings are worth less than the current savings on the ground that a current life saved can be immediately "invested"[58].

In fact, even if you could argue that agents would rationally prefer to save ten lives today than ten lives in ten years, such statement is simply unsustainable in moral grounds. In reality, you could only sustain the opposite: it is better to save ten lives in the future than ten lives today since it is cheaper.

In addition to the aforementioned, REVESZ suggests that there are two problems under the name of discounting: the latent harms, this is the possible exposures to harms that an individual could experience in the future, and the harms to future generations. It is reasonably to say that *latent* harms should count for less than

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54 SUNSTEIN, *supra*, note 19, at 1711-15.

55 SUBRAMANIAN and CROOPER, supra note 32.

56 This means, to *pursue* the regulator to over or underestimate the discount rate and in that way be able to find a negative or a positive test of CBA.

57 Cfr. RICHARD REVESZ, Environmental Regulation, Cost-benefit Analysis and the Discounting of Human Lives, 99 *Colum. L. Rev*. 941, 1999.

58 SUNSTEIN, *supra*, note 19, at 1712.

immediate ones. So, the regulator is stating that prefers harms in the future than harms in the present. Which are the ethical grounds to sustain it?

We can assume that people prefer to tradeoff possible harms today with possible harms tomorrow. But, what about those that had not been borne? The discount of benefits, non-monetary benefits, becomes inappropriate since they are not here to choose, and thus there makes no difference since a year-live saved is not another thing than a year-life saved[59]. This is a simple not only in the value of future lives but in future lives themselves. The government is taking a decision to trade lives today for future lives, discounting future people's preferences.

The ethical question is stronger than the statement of the OMB, who says to agencies,

> "if your rule will have important intergenerational benefits or costs you might consider a *further sensitivity analysis* using a lower but positive discount rate in addition to calculating net benefits using discount rates of 3 and 7 percent"[60].

There is no need in explaining that such margins as 3% to 7% could create huge differences in the final outcome of the cost-benefit relation, and therefore, huge differences in the tradeoff of lives today for future lives.

After discussing for more than ten pages the problems of benefits in cost-benefit analysis, SUNSTEIN suggests that Courts should respect the agencies decision if it is based on *reasonable grounds*. It is evident that discounting at any rate can be reasonably stated —the simple logic of discount rates is enough—. The problem is deeper than judicial revision; there must be statutory regulation that defines strict criteria to agencies and stop the moral hazard that could be involved in the definition of the discount rate.

3.2. Culture and the Value of a Statistical Life: Cross-country analysis

VISCUSI argues that, a variety of factors could account for the disparities in values of statistical lives in different countries. One of those factors is income, which seems to have a clear relationship with the value of a statistical life. According to VISCUSI, the cause of a lower valuation in developing countries is that they are

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59 REVESZ, *supra*, note 58 and SUNSTEIN, *supra,* note 19, at 1714.

60 OMB, *supra*, note 52, at 36.

poorer —which implies that SVL has a linear relation with income— and safety, then, is a normal good[61]. However, VISCUSI also suggests that cultural influences in preferences and labor market institutions could affect the value of a statistical life across countries. Unfortunately, to simplify his analysis goes over such statements and focus his findings in the problem of income and valuation. Two problems arise form such statement: first, to assume that culture and labor market institutions do not have significant incidence in the determination of the value of a statistical life is to avoid the problem of culture and cognition[62]. And second, avoid the question about culture is a overestimates the incidence of income in the tradeoff between risks and prices/wages or risks.

As we can see the calculation of VSL takes into account the effect of income, education, productivity, gender, etc. However, the literature has avoided to study the effect of culture and values in the preference for risks and therefore in the VSL. The question is, then, as culture and values affect the preferences for risks, do these preferences have a significant incidence in valuation of statistical lives?

a. Culture and values

A priori we can assure that the aforementioned variables do not exhaust the causality relationship that permit to explain the different values of a statistical life. This is observed in the number countries with similar economic and institutional structures (labor markets) that, according to the mainstream model, could lead to think that the statistical value of life would be approximated, yet, there are countries with such similarities but high differential gaps in their rates as we just saw.

Can the culture affect the economic behavior of agents? Despite that anthropologists and sociologists categorically affirm, when facing such question, that culture has a strong incidence in the system of preferences and the decisional behavior of agents. Economists as FRANCOIS and ZABOJNIK[63] are still skeptical and set aside the cultural differences and focus their explanations in the unquestionable rational maximizations process[64].

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61 W. KIP VISCUSI, Wealth Effects and Earnings Premiums for Job Hazards", 60 (3) *Rev. Econ. and Statistics* 408, 1978.

62 Cfr. HAZEL ROSE MARKUS & SHINOBU KITAYAMA, *Culture and the Self",* Implications for Cognition, Emotion, and Motivation. 98 *Psychological Review*, (1991). PAUL DIMAGGIO. *Culture and Cognition*, 23 *Annual Review of Sociology*, 263, August 1997.

63 FRANCOIS, PATRICK y ZABOJNIK, JAN, 2001. *Culture and development: an analytical framework*, CentER, Department of Economics, Tilburg University, The Netherlands.

64 The problem is not the rational maximization process; the problem is the exclusion of culture as a part of the tastes of agents. In *Fairness vs. Welfare* KAPLOW and SHAVELL define moral/values tastes as a part of the utility function and therefore a part of social welfare utility function.

As it is explained by HOFSTEDE[65], it is possible to make a measure of certain values immersed in cultures, which define the pattern of behavior of agents and which can be correlated with the VSL determined. HOFSTEDE defined four cultural dimensions comparable among countries that contribute to determine the values' system that, according to our intuition, could have an effect on the VSL. These dimensions are numerically/qualitatively represented with the following indexes: Power Distance Index (PDI); referring to the extent a society included and accept the unequal distribution of power[66]; b) Uncertainty Avoidance Index (UAI), referred as the degree in which certain culture programs its members to feel comfortable before an unforeseen or unforeseeable situations[67]; c) Individualism-Collectivism Index (ICI), as the degree the society reinforces individual or collective achievement and interpersonal relationships and; d) Masculinity-Feminity Index (MAS), the degree the society reinforces, or does not reinforce, the traditional masculine work role model of male achievement, control, and power"[68].

Then, the expected relation ships between the independent variable and the dependent variable are: Income will have a positive relation, then the more income, the higher the VSL. PDI will have a negative relation since the higher the distance with power and the acceptance of inequalities the higher the preferences for valuation of life. ICI will have a positive relationship, since the more individualistic is a society the more the valuation of the self and the lower the risk tradeoffs. And finally, the higher the UAI, the lower the tolerance for uncertainty the lower the preferences for risks, and therefore the higher the valuation of lives.

Expected Relationships.

INCOME	PDI	ICI	MAS	UAI
+	-	+	-	+

b. Data analysis

Using data from several sources[69], we use the Value of a Statistical Life estimated in 16 different countries. We also used HOFSTEDE's indexes to test differences in cultures. We used these indexes due to its likely to make cross-country evaluations, and because permits a simplified access to cultural differences. We also used a

65 GEERT HOFSTEDE, Cultures and organizations: Software of the mind. 1997.

66 GEERT HOFSTEDE, *Cultures' Consequences*, 146, 2001.

67 *Id.*

68 *Id.*

69 VISCUSI, *supra*, note 6; W. KIP VISCUSI, *The Value of Life*. Discussion Paper 517, Olin Center for Law and Economics, Jun, 2005; DAVID O'CONNOR, *Ancillary benefits estimation in developing countries: a comparative*

variable for test the effect of income, measured in *GDP per capita* and evaluated in Purchase Power Parity (ppp). The data is presented in table 2.

TABLE 2. Variables.

Country	VSL	PDI	IDV	MAS	UAI	Income
Argentina	0.74	49	46	56	86	12
Australia	4.2	36	91	61	51	26
Austria	5.2	11	55	79	70	29
Brazil	1.33	69	38	49	76	7
Canada	4.3	39	80	52	48	27
Chile	0.68	63	23	28	86	9
France	1.9	68	71	43	86	26
Hong Kong	1.7	68	25	57	29	26
India	1.4	77	48	56	40	2
Japan	9.7	54	46	95	92	26
Peru	0.62	64	16	42	87	5
South Korea	0.8	60	18	39	85	16
Switzerland	7.45	34	68	70	58	30
Taiwan	0.9	58	17	45	69	17
United Kingdom	4.2	35	89	66	35	27
United States	7	40	91	62	46	34

The correlation matrix (table 3) shows that UAI has a low correlation with the VSL. Also shows that VISCUSI is right in assuming a relation between income and VSL. The other cultural indexes have the expected relation, and MAS has the strongest correlation with VSL.

TABLE 3. Correlation Matrix 1.

Correlation Matrix - Cultural Variables, Income and VSL

Correlations	VSL	PDI	IDV	MAS	UAI	Income
VSL	1.0000					
PDI	-0.5930	1.0000				
IDV	0.5878	-0.5763	1.0000			
MAS	0.8433	-0.5476	0.4224	1.0000		
UAI	-0.1843	0.1947	-0.4731	-0.1933	1.0000	
Income	0.7518	-0.6740	0.6521	0.5525	-0.3511	1.0000

Ran with: Excel, 2003.

To determine the effect of culture, we tested a cross section econometric model, where the objective function was a linear. The objective of this test was

assessment; MARIANA CONTE GRAND, *et. al. estimación del costo económico en Argentina de la mortalidad atribuible al tabaco en adultos*, XXXVIII Jornadas de economía política, 2003; PABLO HOJMAN, *Estimación del valor de las reducciones de riesgo en accidentes vitales*, Pontificia Universidad Católica de Chile.

to define if there is a functional relation between VSL, cultural values represented by the indexes and income. The functional form is

$$y_i = \beta_1 + \beta_2 x_{2I} + \beta_3 x_{3I} + ... + \beta_i x_{Ki} + u_i$$

The first model tested included all the cultural variables and income. The results, included in Table 4 indicate that UAI, PDI and IDV are not significant at 95%. Additional regressions ran, showed that those variables where not even significant at a 90%. Then, to determine a possible model, conducted a elimination process, to determine a model based in the partial r^2.

TABLE 4. Anova – Model 1.

SUMMARY OUTPUT

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	103.5282531	20.70565062	10.81071062	0.000882891
Residual	10	19.15290433	1.915290433		
Total	15	122.6811574			

	Coefficients	Standard Error	t Stat	*Regression Statistics*	
Intercept	-8.533112829	3.496665907	-2.440356916	*Multiple R*	0.91862976
PDI	0.015806882	0.029736634	0.531562586	*R Square*	0.843880636
IDV	0.021531918	0.019101219	1.127253628	*Adjusted R Square*	0.765820953
MAS	0.111525328	0.027293139	4.086203711		
UAI	0.022971237	0.019315615	1.189257371		
Income	0.104947634	0.055818002	1.880178981		

According to this, of the possible models, the most likely to represent a functional relation between culture, income and VSL, was the one that included income and MAS as variables (See table 5). Indicating that income is still one of the most important elements in the definition of VSL, and that culture, represented by the prevalence of masculine behavior and male power, at least in this first test seems unlikely because it goes againt our a priori model. Then, even thought there is a significant relation between the cultural variable and the VSL this relation is not definite and goes against the logic of the model.

TABLE 5. Anova – Model 2.

SUMMARY OUTPUT

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	99.70375429	49.85188	28.20485844	1.8681E-05
Residual	13	22.97740314	1.767493		
Total	15	122.6811574			

	Coefficients	*Standard Error*	*t Stat*	*Regression Statistics*	
Intercept	-5.124513218	1.224470402	-4.18509	**Multiple R**	0.901502268
MAS	0.108381572	0.040979893	2.64475	**R Square**	0.812706339
Income	0.110485406	0.025123008	4.397778	**Adjusted R Square**	0.783891929

The relations and results have several limitations and therefore call for further study –which we will do. These limitations are:

- The Sample is small. Only 16 countries. The problem is that usually the VSL in every country is not published in English, then the research of such data is costly.

- The VSL values tested do not correspond with the same risk. This makes a disparity in the comparison of WTP and Risk preferences. In addition, the methodologies to determine the VSL were not compared.

- The cultural values indexes had been criticized due to their assumptions about masculine and feminine behavior, the collectivist and individualist character of countries and the power relationships. Probably using different data the conclusions will be significant.

- The resultant model reflects VISCUSI's assumptions but don't include the variable that I found more closely related with risk preferences (UAI) and includes a questionable variable as MAS.

4. CONCLUSIONS

Mainstream economists accept that cost-benefit analysis is not always definitive. But, the question is, is there anything better than CBA? SUNSTEIN's propositions recalls this limitation but also the benefits, since CBA it is the best mean to defend and overcome problems related with individual and social cognition, it also provides with a framework analysis, that lead CBA to "be understood as a method for putting

*on scree*n important social facts that might otherwise escape private and public attention"[70] leading to develop not the most efficient regulation[71] but at least the most desirable one.

On the other hand, several issues face the cost benefit analysis theory related with the valuation of a statistical life. First, as we highlighted, discount rates should be properly studied in the calculation of benefits derived from statistical lives. As was said, the discount rate gives to the regulator a great margin of discretionality and therefore gives the regulator a power that will be a part of political markets and could lead to regulatory takings.

Second, it is necessary to study risks and its relation with culture and values. In the econometric analysis we tested the null hypothesis that said that culture had a relationship with the VSL. Unfortunately, the hypothesis could not be sustained since the only statistically significant value was masculinity, which did not seem to have a logical relationship with risk preferences. These results could come from one of three problems: first, that culture has no relation with risk preferences, second, that there is no relation between risk preferences and wiliness to pay for life; or third, that the data set used to test the hypothesis is not accurate to evidence the relationship between culture and risk preferences. The literature cited has stressed the relation between culture, cognition and risks preferences[72] and has proved its close relations. On the other hand, the hedonic wages models have shown to be effective in determining the willingness to accept risks, and therefore the VSL. Then we suggest that the problem is in the data set, therefore more research and further study is necessary.

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70 *Id*. at 1060-63.

71 *Id*.

72 See: *supra*, note 64.

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