

WELFARE ECONOMICS ON THE ETHICAL FOUNDATION AND THE ENVIRONMENTAL PROBLEM

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1 Introduction

In 1950 E. Sugimoto said,

Pigou was wrong in thinking that interpersonal comparison of utility was possible and in summing up the amounts of utility of different persons. The criticism of him by New Welfare Economics was therefore right. Nevertheless, Pigou was right insofar as he intended to incorporate 'social value judgment', not personal value judgment, into economics. (Sugimoto 1950, vol.1, 264)

According to Sugimoto, it was a unique idea of the Cambridge School to incorporate social value judgment into economics. To weight individuals' utilities according to their income and then to sum them up was based on a social value judgment. Lionel Robbins, on the contrary, insisted on eliminating any value judgment from economics, and responding to his criticism, the New Welfare Economics originated by Kaldor and Hicks proposed a framework of welfare economics assuming only rational preferences of individuals and ordinal measure of utility, not cardinal utility. The utilities of different individuals thus became not to be summed up.

Bergson and Samuelson criticized the New Welfare Economists for unintentionally requiring a particular value judgment in the sense that they accepted the existing distribution of wealth as a good one and they proposed the social welfare function. On the one hand, Sugimoto interpreted the proposal of

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the social welfare function as trying to incorporate social value judgments without using the concept of cardinal utility. On the other hand, he criticized the social welfare function for being purely theoretical and being without any empirical grounds.

After then K. J. Arrow presented a famous theorem showing that the social welfare function could not be constructed by any democratic procedures from individuals' preferences. Arrow, on the contrary to Sugimoto, thought that the social welfare function should be constructed only from individuals' preferences without any social value judgments, and he proved that was impossible.

Sugimoto pursued a welfare economics based on empirical grounds in the sense that it should assume only rational preferences of individuals or ordinal utilities that cannot be compared interpersonally with one another. At the same time he pursued a welfare economics into which some social value judgments can be incorporated.

Is there any such welfare economics? I have found it in E. J. Mishan.

2 The Welfare Economics of Mishan

E. J. Mishan is well known as an anti-growth economist for his 'Growth: the Price We Pay' (Mishan 1969a). Y. Murakami (1970) criticized him for introducing strong value judgments into logical analyses. Murakami thought logical analyses should include only 'weak value judgments' such as the one in the concept of Pareto optimum.

On the other hand, Mishan is also criticized for reducing the social welfare to the efficiency (Turner 1988, p.121). Turner argued that the social welfare should be a multiple concept including GDP, distributive fairness, environmental quality and etc, while Mishan opposed including these values in cost-benefit analyses. Mishan was criticized by Turner for relying on the 'weak value judgments' only, for the 'efficiency' is closely related to 'Pareto optimum' in the current economic theory.

I will show that, as opposed to Murakami's interpretation, Mishan's anti-growth statements are results of the logic of welfare economics including only 'weak value judgments', and that as opposed to Turner's interpretation, other values of social welfare than the efficiency can be dealt with in a unique way in Mishan's welfare economics.

2.1 The Framework of Mishan's Welfare Economics

Mishan is a New Welfare Economist in the sense that he adopts the 'Pareto criterion' as a welfare criterion (Mishan 1969b, p.23). The Pareto criterion is based on the principle of hypothetical compensation originating from Kaldor and Hicks.

In this principle, an economic change is said to meet the Pareto criterion, or to bring about 'potential' Pareto improvement if the sum of the compensating variations (CVs) of all the individuals involved is greater than zero. 'Potential' means that it is not necessary to bring about 'actual Pareto improvement' in order for an economic change to meet the Pareto criterion. Actual Pareto improvement means that at least one individual is better off without any individuals being worse off, and it is brought about if the gainers compensate the losers for the losses caused by the change when the sum of CVs of all the individuals are greater than zero. That is because a person's CV for an economic change is defined as the maximum amount of money he or she is willing to pay for the change when it is a good change, or as the minus of the minimum amount of money for which he or she is willing to accept the change when it is a bad change. 'Potential' here means that actual compensation is not required in the Pareto criterion. That is why this principle is called as hypothetical compensation.

The 'net benefit criterion' and the 'efficiency criterion' are the other names of the Pareto criterion. The benefit is measured by CV and the net benefits (benefits minus costs) are equal to sum of CVs.

Mishan adopts the distribution criterion as another welfare criterion (Mishan 1969b, pp. 22, 26; Mishan 1981a, p.9), but this criterion is not so sophisticated or operational as the Pareto criterion, and it is only said that a change causing a more equal income distribution is desirable. He classified the other potential welfare criteria in the category of 'equity'. He sometimes include the distribution in it. In the paper reviewing the literature on externality, he discussed distribution, malpractices, culpability, amenity, posterity and information under the title of 'equity'(Mishan 1971, pp.24-25) but he says that they have never used as formal criteria in welfare economics (Mishan 1980, p.144).

In summary, Mishan's welfare economics adopts the Pareto, the distribution and the equity criteria as welfare criteria, of which the Pareto criterion performs the major role. As such, his welfare economics is a traditional New Welfare Economics. What makes Mishan's welfare economics not only traditional but also unique is his idea about how propositions of welfare economics obtain normative senses. He questioned what gave the positive proposition that the sum of CVs were greater than zero the normative meaning that the change therefore *ought* to be brought about. His answer to it was very simple.

He says,

Put otherwise, if the aggregate money value of the change is positive, the change is said to confer a net social benefit, and the criterion of the economic efficiency is met.

On the other hand, such a definition of economic efficiency may be said to be *normative*, or prescriptive, if people believe that it *ought* to be used as a criterion for one or several reasons. It may be said to be operational as well as normative if it would also command an ethical consensus within the society for which it is intended. (Mishan 1982a, p.39)

It is the ethical consensus that gives normative meanings to the Pareto criterion. Mishan argues that the consensus appears in a 'virtual constitution' (Mishan 1969b, p.19). The relation between the Pareto criterion and the social welfare is, therefore, as follows:

if the sanction for the conventional criterion of economic efficiency derives from an ethical consensus, it follows that it is not the *fact* of an increase in society's welfare—assuming that such can be satisfactorily defined and detected—that is warrant for the use of this economic criterion. Rather, it is society's fundamental beliefs about what *ought* to count as a contribution to social welfare. (Mishan 1982, p.41)

Summing up, Mishan's welfare economics is characterized as:

1. The Pareto, distribution and equity criteria are adopted as welfare criteria, of which the Pareto criterion plays the central role.
2. It is the ethical consensus of the society that gives normative meanings to a proposition in welfare economics that an economic change meets a welfare criterion *should* be brought about.

It is important that personal value judgments do not play any part in this welfare economics. It is a factual judgment that should be made by welfare economists whether an ethical consensus exists or not regarding the use of a certain welfare criterion¹.

It can also easily be understood that other values than the efficiency can be treated in the framework described here. Distribution of income can be treated in the criterion of distribution. Other values included in the category of equity can be treated in the same way, though economics has not developed operational way of treating these values². In Mishan's framework these values as well as distribution are treated independently of the efficiency and do not enter into the cost-benefit analysis, which is regarded as a tool to determine whether an economic change brings about positive net social benefits or not. This is the point at which Mishan and Turner differ. I will return to this point later in Section 3.1.

2.2 Critique of Economic Growth Based on the Welfare Economics

Mishan's argument in criticizing economic growth from the point of the 'spillover effects' is broken down into the headings of amenity right, separate facilities, dereliction and congestion of the city and etc.

¹Mishan distinguishes welfare economics from personal political economy in which policies are appraised on the basis of personal value judgments (Mishan 1982b, p.13)

²The concept of 'fairness' developed by Varian (1974, 1976) and Pazner and Schmeidler (1974, 1978) and named as 'superfairness' by Baumol (1986) may be an exception. Their analytic approaches are 'as individualistic as Pareto optimality analysis of resource allocation' and 'require no interpersonal comparisons of utility' (Baumol 1986, p.7). In their approaches, a distribution of goods among individuals in a society is defined as 'fair' when there is no 'envy', which, in turn, is defined as the state where an individual prefers other ones' shares of goods to his own share. Although this concept of fairness is operational, it has a weakness in applicability to actual problems. One of the main results of their analyses is that when starting with the exactly equal distribution of goods there exists a set of fairer distributions which includes Pareto optimal allocations. This proposition, though itself interesting, tells us nothing about which change would be fairer when starting with originally unequal distribution. In reality, fairness matters when the original distribution is unequal.

The whole of the argument is logically derived from the premises of welfare economics, as opposed to Murakami's criticism. I only show here that the proposal of the amenity right is a result of the application of the logic of welfare economics.

Mishan proposed the amenity right in the denial of the so called Coase theorem. The Coase theorem (Coase 1960) asserts that the problem of externalities³ can be solved by the negotiation between sufferers and generators of the externalities, that is, a voluntary agreement between them leads to a unique Pareto optimum allocation of resources irrespective of the entitlement of legal rights if transaction costs are to be neglected.

Mishan denied the Coase theorem by showing that there existed multiple Pareto optimum allocations depending on distribution of welfare. That is because CV (compensating variation) depends on income. The larger one's income, the larger his or her willingness to pay (WTP) for a good economic change (and his or her willingness to accept (WTA) compensation for a bad change) if the income effect is positive⁴. Since a victim's real income is greater when he or she has the right not to suffer from a bad external effect than when he or she does not have it, the absolute value of his or her CV for generation of the effect would be larger than the CV for its removal, on the one hand. On the other hand, the generator of the externality has a larger absolute value of CV for limiting the generation when he or she is initially free to generate it than the value of CV for newly generating the externality when he or she initially has no right to generate it. As a result, the Pareto optimum amount of externality would be smaller when the potential victim has the right not to suffer the externality than when the potential generator has the right to generate it. Therefore, the Pareto criterion has a conservative nature, ie, the Pareto optimum allocation has a tendency to be near to the allocation resulting from all the parties' pursuing their self-interests without any negotiation, when the income effect is positive.

Consequently, the allocation resulting from a voluntary agreement between the parties will change depending on which party is entitled to the right, even if the Pareto optimum allocation is to be brought about by the agreement. Therefore, contrary to the implication of the Coase theorem, the entitlement of rights matters in the allocative sense.

Actually, negotiation incurs costs, which are called as 'transaction costs'. To move to the state which is apparently Pareto optimum when taking no transaction costs into account does not bring about potential Pareto improvement if the transaction costs to move to the state is greater than the net benefits from the reallocation. The existence of transaction costs, therefore, strengthens the conservative nature of the Pareto criterion.

Mishan called the right to enjoy good environment and not to be forced to suffer externalities without permission as 'amenity right', and proposed to establish amenity right on the basis of the above analysis. The reasons for proposing amenity rights are as follows.

First, the eventual state will be very different when the amenity right is established from that in the current regime where the property rights overwhelms the amenity right, and there is no reason why such a change in the law should not be brought about from the allocative viewpoint (Mishan 1971, pp.18-21).

Secondly, such a change of the law should be approved when considering the transaction costs. The transaction costs are considered to be smaller when generators of externalities have initiative to negotiate with potential victims than otherwise because potential victims tend to consist of very large number of residents while the generators tend to be a few large industries (Mishan 1971, p.23). Therefore, it is more likely in the absence of the amenity right that a Pareto improvement is obstructed by the transaction costs.

Thirdly, the amenity right is approved from the point of distribution. That is because potential victims tend to consist of poor people because they have smaller opportunities for escape from environmental spillover effects (Mishan 1971, p.24).

Finally, Mishan mentioned other aspects of equity that strengthen his proposal of the amenity right: (1) the possibility of polluters to generate larger amount of externalities than optimal for his own interest in order to earn more bribe from his victims; (2) the unreciprocal nature of the externality in accordance with "the classical liberal maxim"; (3) the fact that 'too little' spillover may be better than 'too much' spillover "if the rate of growth of spillovers equals or exceeds the growth of GNP, and if one assumed diminishing marginal utility of man-made goods and increasing marginal disutility of man-made bads";

³Coase himself did not assert the Coase theorem and denied more radically the existence of externalities (Coase 1988).

⁴The income effect is positive when the good in question is not an inferior good.

(4) the irreversibility of a range of spillovers; (5) “the time lag between the immediate commercial exploitation of new products and processes” and “the knowledge of their genetical and ecological effects”.

As is shown here, Mishan’s proposal of the amenity legislation is based on the logical analysis of welfare economics.

3 Theoretical Implications of the Welfare Economics on the Ethical Foundation

3.1 Rejection of Weighting in Cost-Benefit Analysis

Mishan’s welfare economics is characterized by the extremely radical refusal of any weighting in cost-benefit analysis. Weighting has been proposed in order to complement the weaknesses of the efficiency criterion (Little and Mirrlees 1969; Maglin, Sen and Dasgupta 1972; Dasgupta and Pearce 1972; Pearce 1983).

As mentioned above, to meet Pareto criterion means only bringing about potential Pareto improvement. A change that meets Pareto criterion can, therefore, worsen the well-beings of some people. As a matter of fact, a change that meets Pareto criterion can make poor people poorer, which will be against the distribution criterion. Furthermore, the cost-benefit analysis based only on the Pareto criterion depends on the current distribution of wealth in the sense that a person’s CV depends on his or her purchasing power, in other words, on his or her current income. A notion follows that the net benefit calculated in cost-benefit analysis is a measure of social welfare biased by the current distribution of income.

Responding to these difficulties, a number of cost-benefit analysts have proposed to give larger weights to poorer people’s CVs than richer people’s CVs in summing them up. Not only distribution but also growth rate, investment, employment and merit wants are regarded as considerations for which some weights may be used (Maglin, Sen and Dasgupta 1972, pp.28-33). Moreover, discount rates for intertemporal evaluation of benefits and costs and foreign exchange rates are themselves regarded as weights (Maglin, Sen and Dasgupta 1972, p.13).

How should these weights be determined? A popular idea is to determine them from the past political decision makings, for example, from the structures of the tax rates in progressive taxation (Weisbrod 1964). In this framework, cost-benefit analysts should find out a set of weights that are consistent with the set of the actually adopted policies⁵.

Mishan called this framework as ‘politico-revisionist’ approach and called the weights so determined as ‘politico-weights’. His critique is based on the following grounds.

First, cost-benefit analysis with the ‘politico-weights’ will produce a meaningless result. A traditional cost-benefit analysis of an economic change produces a sum of CVs, which, when larger than zero, represents a potential Pareto improvement. Potential Pareto improvement, in turn, means everyone’s well-being can be improved if losers are compensated. Distributive effects of the change can be known by other analyses if wanted, and the product of these analyses also have unambiguous meanings. In contrast, a sum of CVs weighted by distributive consideration has no meaning (Mishan 1974 in 1981b, p.161).

Secondly, the weighting cannot prevent cost-benefit analyses entirely from approving changes that make poor people poorer. If one wants to eliminate such changes, he should invoke an analysis of distributive effect rather than the cost-benefit analysis with weights.

Thirdly, the politico-revisionist approach will deny the *raison d’être* of cost-benefit analysis that cost-benefit analysis produces judgments by an economic criterion independent of political considerations (Mishan 1982a, pp.35-36). In this approach the weights must be altered frequently according to the change in political decision makings, economics only serves politicians, whether they are monarchs or

⁵In this connection, Young (1990) revealed that the observed structures of tax rates in progressive taxation can be explained by the ‘equal sacrifice’ hypothesis, though he did not intend to obtain distributive weights for cost-benefit analysis. He assumed everyone’s utility function is identical and having the form, $U(x) = Ax^{1-C} + B$, ($A > 0, C > 1$), where x is income, and he found out the observed tax structures are in accordance with the hypothesis that the tax rates are determined as to meet the equation, $U(x-t)/U(x) = 1-r$, where t is a tax rate and r is a constant rate of loss in utility, which means ‘equal sacrifice’ in utility.

democratically elected representatives, and economists' expertise is used only to quantify the politicians' goals (Mishan 1982, p.34).

Why is Mishan so radical in refusing weights in cost-benefit analysis? His refusal seems to come from his decision that cost-benefit analysis should be based only on the Pareto criterion. However, he admits the use of the distribution criterion in welfare economics as a whole. Why is it not be allowed to base cost-benefit analysis itself on both the criteria? The answer is in what the ethical consensus is.

Politico-revisionist approach is not the only way to introduce weights in cost-benefit analysis. Another one is the 'ethico-revisionist approach'. In this approach a set of weights are alleged to be determined according to ethical considerations. Mishan's critique to this approach is that there exists no ethical consensus about which weights should be used to sum up people's CVs.

According to Mishan, the existence of ethical consensus must be shown by the corresponding 'virtual constitution'. In order to show there is an ethical consensus on using particular weights in cost-benefit analyses, such weights must be used in actual economic calculations in the private as well as in the public sector, ie, prices of goods must be expressed in 'ethico-weighted dollar'. The ethical consensus must have empirical foundations.

In Mishan's welfare economics and in the traditional cost-benefit analysis, the ethical consensus performs a very simple, though important, role to sanction the use of particular welfare criteria. In contrast, in the approach of cost-benefit analysis introducing distributive weights, the ethical consensus is burdened with much more complicated work to calculate the quantitative weights and it is not possible.

3.2 Rejection of Cardinal Utility

Cardinal measure of utility is not, in general, assumed in current economic theories. Nonetheless, it sometimes appears in cost-benefit analysis. It is a feature of the economics on the ethical foundation to reject the cardinal utility, because this welfare economics is in the tradition of New Welfare Economics.

The cardinal measure of utility is often assumed in cost-benefit assessments under uncertainty. This corresponds to the fact that the expected utility theory, which assumes cardinal utility, has been dominant in the economics of uncertainty. Nowadays there is no consensus among economists that the expected utility theory is a valid theory to explain the behaviour of economic agents under uncertainty. That is because many facts have been observed that contradict the expected utility theory. New theories such as the prospect theory (Kahnemann and Tversky 1979), the generalized expected utility theory (Machina 1982), and etc came into existence to explain consistently the behaviour under uncertainty⁶. Nonetheless, most textbooks on cost-benefit analysis have chapters dealing with cost-benefit evaluation under uncertainty in which the expected utility theory performs the main part (Dasgupta and Pearce 1972, chapter 8; Johannsson 1995, chapter 4).

Here I will show the expected utility theory is not only unnecessary in evaluating costs and benefits under uncertainty but also brings about internal inconsistency, taking an example of the evaluation of human health risks.

Many environmental spillovers have effects on human health or life, but some economists argues that human life cannot be evaluated in terms of money (Miyamoto 1989, p.111; Dixon et al. 1986). Certainly it is extremely difficult to value the life of a particular person. To value the loss of a person's life as the lost income that he would earn if he would have survived would be against the principles of cost-benefit analysis because such amount of income has no relationship to his WTA for the loss of life or to his WTP for survival. The WTA for the loss of one's own life would be infinite, and therefore any monetary measurement would have no practical meaning.

Nevertheless it is widely accepted among cost-benefit analysts that human life can be evaluated in monetary terms when loss of life is considered under uncertainty, ie, change in the probability, or risk, of the loss of life is concerned insofar as the probability is sufficiently low. WTA for a small increase in the probability of one's death would not be infinite and not very large. For everyone normally accepts a small increase in the risk of death to save money or time or to enjoy life.

WTP for a decrease or WTA for an increase in the risk of death divided by the quantity of the decrease or the increase is called as 'the value of a *statistical* life'. This represents the cost of the increase in risk per life but not the cost of the loss of a particular life.

⁶For the evaluation of these theories see chapter 4 of Oka 1997.

For example, if a person prefers a method of transportation, say automobile, to another one, say train, because the latter is 50 dollars more expensive per trip than the former in spite that the mortality of the latter is smaller than the former, say by $1/10^5$ per trip, then WTA for this increase of the risk is at most 50 dollars and the value of a statistical life is not more than

$$\frac{50}{10^{-5}} = 5 \text{ million [dollars].}$$

Since WTA is not proportional to the quantity of increase in risk, the value of a statistical life changes when the quantity of increase changes. For example, when the increase of risk becomes 100,000 times greater than that in the above example, this increase would be sufficient to make the probability of death equal to one, hence WTA would become infinite rather than five million dollars, which is 100,000 times 50 dollars. However, in a certain range of the change in risk the value of a life may be thought as constant.

This is the theoretical basis of the evaluation of the human life and a lot of empirical studies have been carried out on this basis⁷. Many authors on the value of a life, however, try to found this theoretical basis on another basis by using the expected utility (Cropper and Freeman 1991; Thaler and Rosen 1976; Shepard and Zeckhauser 1982).

They employs a model where a consumer maximizes the total expected values of utilities he will enjoy from consumptions at all ages in his lifetime taking mortalities into account. In a formal expression, a consumer at the age of j maximizes

$$V_j = \sum_{t=j}^T (1 + \rho)^{j-t} q_{j,t} U(c_t) \quad (1)$$

where V_j is the total expected utility in his lifetime, T is the maximum age a human can reach, ρ is the discount rate, $q_{j,t}$ is the probability to live until the age of t and $U(c_t)$ is the utility from c_t , the consumption at the age of t (Cropper and Freeman 1991). The consumption must meet the constraint

$$\sum_{t=j}^T q_{j,t} (1 + r)^{j-t} c_t = \sum_{t=j}^T q_{j,t} (1 + r)^{j-t} y_t + W_j \quad (2)$$

where r is the interest rate, y_t is the income at the age of t and W_j is the initial asset at the age of j . WTA for the reduction of $q_{j,k}$, the survival rate until the age of k , is defined as the minimum amount to be added to the initial asset W_j that is sufficient to bring about as large total expected utility in a lifetime as before the reduction of the survival rate. This WTA divided by the reduction of the survival rate gives the value of a statistical life.

This further foundation of the theory of the value of a life is, however, not consistent with the reason why the concept of ‘the value of a *statistical* life’ is required. The value of a *statistical* life is needed because WTP or WTA for a certain death of a particular person cannot defined as to be used in cost-benefit calculation and, in particular, because WTA for it becomes infinite. The further foundation based on the expected utility assumes the utility when alive and consuming, $U(c_t)$, and the utility when dead, say $U(0)$. The utility when dead is defined here as quantitatively comparable with the utility when alive. Is this assumption not inconsistent with the fact that WTA for a certain death is infinite?

In fact, the above formulation of maximizing the lifetime expected utility produces a finite WTA for a certain death under plausible assumptions. Appendix below provides the proof and a numerical example of that.

Therefore, the further foundation of the value of a life on the basis of the expected utility is not consistent with this concept itself. Furthermore, this foundation would not have been necessary for the value of a life. The fact that empirical measurements of the value of a life do not actually rely on the foundation is a *prima facie* evidence that it is not necessary. Inquiring the reason further, the value of a statistical life does not contain uncertainty in the sense that concerns the economics of uncertainty. In the economics of uncertainty there exists uncertainty in the supply of goods, while in valuing a

⁷Fisher, Chestnut and Violette 1989 and Cropper and Freeman 1991 review such studies. See also Yamamoto and Oka 1994.

statistical life uncertainty is included in the definition of the good in question, namely ‘risk’, and there is no uncertainty in the supply of it. Therefore the expected utility theory was irrelevant to the value of a statistical life at the beginning. The expected utility theory, the last survivor of the cardinal utility theories is so robust that it appears in such an irrelevant place.

4 Implications of the Welfare Economics on the Ethical Foundation in the Environmental Policy

Both economic and ethical aspects are involved in the environmental problem. Since the welfare economics on the ethical foundation has a clear framework about the relation between positive economics and ethics, it provides useful insights for the arguments on the environmental problem.

4.1 Mishan’s View about the Erosion of the Ethical Consensus

There are many problems of environmental spillovers which can be dealt with in the framework of allocative welfare economics, ie, by applying the Pareto criterion, as shown above in 2.2. There, however, are also the environmental problems that go beyond the framework of allocative economics.

As argued above, welfare economics should base the use of its welfare criteria on the ethical consensus of the society. In particular, the allocative propositions of welfare economics can have a normative meaning only if there is a consensus of the society regarding the use of the Pareto criterion. Whether such consensus exists or not is a factual judgment, and the judgment can change with time.

Mishan himself became to recognize in 1980s that the consensus on using the Pareto criterion had broken down. The Pareto criterion can contradict other values such as distribution and equity. Therefore, if propositions concerning the Pareto criterion are hard to accept from the viewpoints of other values, the Pareto criterion may lose consensus. Mishan’s recognition partly concerns this.

The first fact causing the erosion of the consensus is that a large number of natural resources are rapidly being depleted. This concerns intergenerational distribution. Mishan says

[there is] a division of opinion about whether the valuations currently attributed to “finite” resources (either under existing economic arrangements or under “ideal” competitive arrangements) have any normative significance. Certainly, a number of reputable economists have argued that the existing valuations of fuels and minerals, and their current rates of consumption, cannot be justified by reference to any criterion that would exclude the opinions of future generations. (Mishan 1980, p.154)

The second fact concerns unreliability of consumers’ preferences at market as a basis of the measurement of their welfare. He says

there is a growing agreement that inasmuch as the untoward consequences of consumer innovations (one thinks in this connection of food additives, chemical drugs and pesticides, synthetic materials, and a variety of new gadgets) tend to unfold slowly over time, their valuations at any point of time by the buying public (as determined by the market prices to which individual purchases adjust) may bear no relation whatever to the net utilities conferred over time. (*ibid*)

and says

there appears to be a greater reluctance today among segments of the public — made explicit in debates between economists, lawyers, and sociologists — to accept without reservation the judgment of the market in the face of substantial expenditures on commercial advertising designed to influence the valuations placed on goods by the buying public. (*ibid*)

Allocative propositions of welfare economics lose normative meanings if the ethical consensus has collapsed. As a result, cost-benefit analysis becomes to be able to produce only descriptive propositions. Nevertheless, economists should not try to revive the allocative welfare economics by introducing any weights to take other values into account, because such weights cannot help cost-benefit analysis to get

a consensus again and because introducing weights makes economists lose their standpoint independent of politics (Mishan 1982, pp.44-45).

4.2 Has the Consensus Collapsed Entirely?

Mishan emphasizes the erosion of the ethical consensus on the use of the Pareto criterion, but that is a factual judgment, which can change with time. Moreover, a certain judgment would not have to be applied to all the issues on which cost-benefit analyses are carried out, but it should be allowed that the Pareto criterion commands ethical consensus in some issues while it does not in others. In fact, we can find the changes that may reinforce the ethical sanction on the use of the Pareto criterion as well as the changes that may break down the sanction.

For example, certainly the untoward consequences of food additives, pesticides or other synthetic materials tend to unfold slowly over time, but as they unfold, regulations for them become to be enacted if they have been proved causing adverse effects to consumers, to third parties or to the environment. Insofar as such regulations are effective, consumers' choices and the current prices under the legal framework including the regulations can be respected as a basis of the judgment on the improvement of social welfare. Certainly, it matters whether the establishment of the regulations can catch up with the innovations, but it seems that the determined characteristics of a certain substance can sometimes be applied to other similar substances, which could save time to draft new regulations. In addition, the method of regulation seems to become improved as experiences have been accumulated.

More important is the change in the structure of the problem of hazardous substances. In 1960s in Japan, hazardous substances discharged from industries caused serious diseases specific to the substances. Methylmercury, cadmium and sulfur dioxide were the typical examples of them. The pollution was very heavy but the polluted areas were relatively limited. The victims were typically poorer people who had no choice but to live in the polluted areas. In these problems the allocative welfare economics performed little part in establishing the policies to solve these problems because the distributive and equity aspects overwhelmed the allocative aspect.

Nowadays, the circumstances have changed. Consumers as well as industries make causes of pollution. Not only poorer people but also richer people may suffer damages from it. The contaminations from hazardous substances are relatively in low levels, sometimes their concentrations in the environment are so small that their damages cannot be identified. Nevertheless, the contaminations arouse public concern because the substances may cause serious diseases such as cancer. In order to deal with these problems where the eventual hazardous effects may be serious but the substances that might potentially cause them exist only sparsely, the approach of 'risk assessment' has been developed, in which the risk of a hazardous effect is expressed in terms of the probability of its occurrence.

The allocative welfare economics may find easily the ethical consensus on its being applied to the policies to control these hazardous substances. The development of the concept of the value of a statistical life and the accumulation of its empirical measurements may strengthen the applicability of the Pareto criterion to these problems⁸.

On the other hand, it is also the case that there increasingly emerge new problems the natures of which are beyond the framework of the allocative welfare economics. The problems such as the global warming, the biodiversity loss and the depletion of finite resources cannot be treated not invoking the aspect of intergenerational equity. The concept of 'sustainability' has also close relation to the intergenerational equity and has little to allocative efficiency.

There are also evidence to show that people's subjective valuations to the environmental goods concerning the above global problems are not stable: great disparities between WTA for reducing the environmental goods and WTP for increasing them have been observed. The disparities are too great to explain by the income effect, which has been known to cause such disparities in the traditional theory. In order to explain the disparities, we must accept that people's indifference curves regarding their preferences among goods shift always, which means people's preferences are not stable (Oka 1997, chapter 5). This can be a reason for doubting the effectiveness of the Pareto criterion, which is ultimately based on individuals' subjective preferences, in judging welfare change.

⁸Oka et al 1997 provides an example of the 'risk-benefit analysis' of such substances.

In conclusion, I cannot say whether the current tendency is to increase the applicability of the allocative welfare economics or not, but the framework of the welfare economic on the ethical foundation helps us to characterize the current environmental problems by distinguishing between several aspects of them, and to prescribe appropriate policies for the current environmental problems.

Appendix

The Lagrangean of the miximization of (1) under the constraint (2) is

$$L = \sum_{t=j}^T (1 + \rho)^{j-t} q_{j,t} U(c_t) + \lambda \left[\sum_{t=j}^T q_{j,t} (1 + r)^{j-t} c_t - \sum_{t=j}^T q_{j,t} (1 + r)^{j-t} y_t + W_j \right]$$

To differentiate this with respect to c_t produces the first condition of the maximization,

$$\frac{\partial U}{\partial c_t} = -\lambda \frac{(1 + r)^{j-t}}{(1 + \rho)^{j-t}}. \quad (3)$$

The consumption c_t can be regarded as a function of $q_{j,t}, \rho, r, y_t$ and W_j under the maximization. Differentiating the constraint (2) with respect to W_j produces

$$\sum_{t=j}^T q_{j,t} (1 + r)^{j-t} \frac{\partial c_t}{\partial W_j} = 1. \quad (4)$$

The utility as a result of the maximization can also be regarded as a function of $q_{j,t}, \rho, r, y_t$ and W_j , which is so called ‘indirect utility function’. Differentiating this function with respect to W_j , we obtain

$$\frac{\partial V_j}{\partial W_j} = \sum_{t=j}^T (1 + \rho)^{j-t} q_{j,t} \frac{\partial U}{\partial c_t} \frac{\partial c_t}{\partial W_j} \quad (5)$$

From (3), (4) and (5) we obtain

$$\frac{\partial V_j}{\partial W_j} = -\lambda \quad (6)$$

To calculate the exact differential of the indirect utility function, and to let $d\rho = 0, dr = 0, dy_t = 0 (t = j, \dots, T)$, and $dV_j = 0$ produces

$$\sum_{t=j}^T (1 + \rho)^{j-t} U(c_t) dq_{j,t} - \lambda dW_j = 0. \quad (7)$$

This formula shows how much the initial asset must change in order to keep utility constant under a marginal change in the survival rates. The ratio $dq_{j,t}/dW_j$ must approach to zero when $q_{j,t}$ approaches to zero in order for WTA for a certain death to be infinite. To do so λ must approach to zero, which means $\partial U/\partial c_t$ must also approaches to zero. This means that utility function has an upper limit. This is against the plausible assumption that utility is not saturable. Inversely, if utility is not saturable, then the foundation of the value of a statistical life on the basis of expected utility must imply finite WTA for a certain death.

Shepard and Zeckhauser (1982) presents a simple numerical example for illustrating the above model, which can be used as an example showing that WTA for a certain death is finite.

In their simplest example, life consists of three periods, the mortality for which ($D_k, k = 1, 2, 3$) are 0.1, 0.333, 1, respectively. It means $q_{1,2} = 0.9, q_{1,3} = 0.6, q_{1,4} = 0$. It is assumed that the initial asset is 100, all the incomes are zero and the discount rate is zero. Therefore, $c_1 + c_2 + c_3 = 100$. The utility function is assumed to be $U(c_k) = c_k^{0.2}$. Under these assumptions the maximized lifetime expected utility is calculated to be 5.068 under the consumptions of $c_1 = 41.59, c_2 = 36.45, c_3 = 21.96$. A change that increases the death rate of the second period to 100 % brings about certain death in the period. The amount of initial asset that maintains the lifetime expected utility to be 5.068 in spite of the increase in the death rate in the second period is calculated to be 269.6. Therefore the difference between 269.6 and 100, namely 169.6 is the WTA for a change bringing about a certain death in the second period.

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