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Warming: Responsibility, Compensation, and the  
Golden Rule**

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# Normative Approaches to the Issues of Global Warming: Responsibility, Compensation, and the Golden Rule\*

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## 1 Introduction

The analysis of intergenerational equity may be decomposed into four broad categories in accordance with the following two simple criteria. The first criterion is whether we are concerned with the equity issues among generations that are adjacent or overlapping along the time axis, or our concern about intergenerational equity is broad enough to cover even far distant future generations, with which we would never encounter in our life. The second criterion is related to the problem of informational bases of the analysis of intergenerational equity. It asks whether we are ready to assume that utility or welfare information is available for all generations involved, or we are prepared to face the possible lack of utility or welfare information for some of the relevant generations, and conduct our analysis outside the utilitarian or welfaristic informational framework. Among the four categories identified by the combination of these two simple criteria, this paper focuses on the analysis of equity among far distant generations, where there is an intrinsic reason to think that utility or welfare information is hard to obtain, if not logically impossible to surmise, for generations that exist in far distant future.

To crystallize the focal issue of intergenerational equity that we attempt to analyze in this paper, consider the basic nature of the problem of global warming. This is a complex

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phenomenon that the accumulation of greenhouse gases generated from each and every economic activity may exert persistent influence on the global climate at the scale that we have never encountered in the past. As the accumulated greenhouse gases may stay long in the air, the current emission of greenhouse gases may exert persistent effects on many generations even in the far distant future. The complexity of this problem cannot be over-exaggerated. Observe that everybody leading normal economic life is unable to avoid generating greenhouse gases; thus, everybody cannot but be partially responsible for causing the problem of global warming. Furthermore, the full extent of concerned parties goes far beyond the present generation. If we look back along the historical time axis into indefinite past, not only the present economic activities, but also the past economic activities at least since Industrial Revolution have contributed to the accumulation of greenhouse gases. But, almost all past generations, which should be held responsible for the past accumulation of greenhouse gases, had gone already and do not exist anymore to be blamed. If we look ahead along the historical time axis into indefinite future, those generations that would be most affected by global warming would most likely be generations born in far distant future. But, these future generations simply do not as yet exist, and we are left with no information about their population size and human character. We are thus confronted with the serious problem of environmental externalities, a large part of whose culprits being non-existing anymore, and a large part of whose victims being as yet non-existing. In between these non-existing past generations and not-existing future generations lies the present generation that is only partially responsible for the problem at hand.

If the problem of global warming should be kept under control for the sake of equitable treatment of distant future generations, it is clear that the present generation is uniquely situated in the position to take actions. But, the reason why these actions, which may require serious sacrifices and strenuous efforts on the part of those who take actions, should be taken single-handedly by the present generation surely requires rational explanation. This paper represents a modest attempt to seek for such a rational explanation. In what follows, our attempt will be based on the two simple principles. The first principle is relatively new at least in its contemporary resurgence, whereas the second principle is very old indeed. They are going to play respective role in answering the following two imaginary questions that are supposed to be raised by the present generation:

(a) Why should we care about the possible plight of future generations? Those who might most seriously suffer from the problem of global warming would emerge long after we are all gone, and we might never be forced to confront with their plight.

(b) Why should we be single-handedly held responsible? There are many past generations that should at least in part share the blame of what we are jointly responsible. True enough, scientific evidence as well as public awareness of the problem of global warming is much more solid now than it used to be. But we need ethically appealing reason for our duty to take actions unilaterally.

It is for the purpose of coping with the problem (a) that we are invoking the principle of responsibility and compensation. The origin of this principle may be traced back to Aristotle, and its modern resurgence is due largely to Ronald Dworkin (1981a; 1981b; 2000). However, given the nature of the problem we are facing, we need some further reasoning and scaffolding in order to make this principle applicable to the problem at hand. It is for the purpose of coping with the problem (b) that we are invoking one of the oldest ethical principles in human history, viz., the Golden Rule of the Gospel: *Do*

*unto others as ye would that others should do unto you* . It is hoped that the joint use of these principles would help us understand the unilateral duty of the present generation in the face of global warming. At the very least, it is our hope that our modest attempt in this paper would motivate more serious efforts to think rationally and systematically about the ethical problem we are jointly facing now than what have been hitherto made.

The structure of the rest of this paper is as follows. In order to set the stage for our reasoning, Section 2 is devoted to clarifying the structure of global environmental problems such as global warming, and Section 3 discusses the fundamental non-identity problem posed by Derek Parfit (1984) in the specific context of global warming. Section 4 then examines the effectiveness of some normative criteria that have been invoked by traditional welfare economics in the arena of environmental externalities. After these preliminary steps, Section 5 proposes a fundamental normative principle, to be called the *principle of responsibility for selecting a future path*, which is the modified version of Dworkin's principle of responsibility and compensation in the present arena. Section 6 discusses the meaning of the Golden Rule of the Gospel in the context of burden sharing of the cost of anti-global warming policies. In Section 7, we briefly examine heterogeneity within the present generation in the context of sharing cost of responsible policies against global warming. Section 8 concludes with several final observations.

## 2 Temporal Structure of the Problems of Global Warming

Global warming is an example of environmental externalities where the actions of some economic agents unintentionally and incidentally affect the payoffs of other economic agents without being mediated by market mechanisms. However, there are several conspicuous features of the problem that make it unique among many problems of environmental externalities. At the risk of partial overlap with what we have already mentioned, some of these features will be reiterated in this section with the purpose of bringing its uniqueness into clear relief.

### 2.1 Non-Coexistence of the Culprits and the Victims

In the case of environmental disruptions such as water contamination by emission from factories, or noise in the neighborhood of airport, the culprits and the victims of detrimental externalities usually co-exist. In sharp contrast, not all agents involved in the problem of global warming co-exist. Indeed, those generations that would be most severely affected by greenhouse gas emissions come into existence only in the distant future and do not exist at the time of greenhouse gas emissions. Thus, the majority of culprits of the past emissions and the major victims from the resulting global warming do not exist now. Therefore, those who can possibly participate in any attempt to cope with the problem of global warming consist solely of the present generation that, however, accounts for only a tiny fraction of the culprits as a whole. Furthermore, it is difficult, to say the least, to represent the legitimate claims of distant future generations in the present social decision-making procedure when the population size and human identity of these potential people are not known.

## 2.2 Non-Limitation of the Culprits and the Victims

Unlike the typical problem of environmental disruptions, where those who triggered the problem and those who suffered from the problem co-exist and are limited in number, the problem of global warming has a feature that neither the culprits nor the victims are limited in time and/or space. There are at least four reasons why this is the case.

First, *the culprits of global warming are not limited in space*. This is because the emission of greenhouse gases is unavoidable in every normal economic activity, so that every human being cannot but be partially responsible for global warming. It follows that, to control the emission of greenhouse gases effectively, cooperation among people in all countries and region is necessarily called for. The nature of problem is global indeed.

Second, *the culprits of global warming are not limited in time*. This is because the problem of climate change at each time may serve as a link between many past generations and many future generations, where the inter-temporal linkage may extend into indefinite future, and the inter-regional linkage may extend to almost everywhere on the earth. For instance, it is not only the current economic activities, but also the past economic activities ever since Industrial Revolution, that should be counted in the factors that triggered global climate change.

Third, *the victims of global warming are not limited in space*. This is because the climate change at any historical time cannot but affect the living standard of people no matter where they live on the earth.

Fourth, *the victims of global warming are not limited in time*. This is because the emission of greenhouse gases at any historical time may exert influence on the standard of living of indefinite future generations.

## 2.3 Diversities within a Generation

There are two aspects in which people belonging to the same generation may differ substantially from each other. The first is the difference in the levels of economic development of the countries they live, whereas the second is the difference in the consequential outcomes of global warming.

### (1) Differences in the Levels of Economic Development

Within the same generation, countries and regions co-exist with substantial differences in the levels of economic development. Those who live in highly developed countries and regions may benefit from the affluence of goods produced and the richness of the variety of services rendered by large-scale economic activities. They may also benefit from the accumulated stocks of capital equipments, material as well as intellectual infrastructures, which are due to the high level of economic activities accomplished in the past. It is these past economic activities that are also responsible for greenhouse gas emission en route. Thus, among countries and regions with disparate levels of economic development, there exist differences in benefits gained either directly from the flow of economic activities, or indirectly from the stocks of capital and infrastructures, which also create substantial differences in the degree of contributions to the accumulation of greenhouse gases.

### (2) Differences in the Consequential Impacts of Global Warming

Even within the same generation, there are substantial differences in the consequences of global warming among countries and regions. Canada and Russia may well benefit significantly from global warming because permafrost land, or the land considered not

suitable for farming, may become available as suitable farming land, whereas Pacific island countries may face the danger of submersion within 100 years to come.

In view of these possibilities of differential consequences of global warming, the prospect of forming international agreements on the policies to be jointly adopted against global warming and their cost-sharing becomes even more obscure.

### 3 Non-Identity Problem in the Context of Global Warming

To summarize our argument so far, global warming is an externality problem over extremely long period; people involved in the problem will range over many generations; they do not coexist, but only successively appear and/or disappear. This is the basic structure of the problem that we must always keep in mind, but there is another conspicuous feature to be emphasized.

Generally speaking, among infinitely many potential historical paths of human life, the one that describes our actual historical path from the past to the present is already fixed, so are the people who have existed and presently exist along the realized historical path. However, what type of people will emerge in the future, and in what size will they emerge, depend on the actions taken by the present generation, and are thus indeterminate at the point of decision-making. Let us provide some concrete examples to show why this is so.

(1) Let us compare the following two scenarios: (a) to adopt policy measures that strictly limit the use of petroleum in developed countries; and (b) to put no restriction whatsoever. Needless to say, the use of petroleum plays such a crucial role in all facets of human life that the styles of food, clothes and shelter, and convenience and opportunity to travel would all differ immensely depending on which of the two alternative scenarios (a) and (b) would actually be chosen and implemented. Depending on the choice made between these two options, people would meet and many different partners, build up different families and life styles, and accumulate different life experiences. Thus, the end result over several generations would most probably be the emergence of different number of people with completely different individual characteristics.

(2) The total amount of greenhouse gas emissions would depend not only on the size of population, but also on the per head greenhouse gas emissions by the given population. Thus, there would probably be very different results in terms of the scale and characteristics of future generations if we would choose and implement policy measures to control population explosions in developing countries.

(3) If greenhouse gas emissions were not controlled, some island countries in the Pacific might be submerged under water, and the regional distribution of population would be changed immensely. Likewise, population and its regional distribution could be affected to a large extent by the possibility that the areas so far categorized to be permanently frozen become suitable for cultivation due to global warming.

The important point is that the number of people and their individual characteristics are in fact malleable in response to the choice of actions by the present generation. Figure 1 illustrates this fact graphically. The path from the past to the present is uniquely determined. In contrast, numerous paths from present onward are possible, which are contingent on the actions chosen by the present generation as well as the future generations. Let the “present” be time  $t^*$ . Then, whether a certain action is open for choice

at time  $t^*$  depends upon the path of actions  $\mathbf{a}^{t^*-1} = (a^0, \dots, a^{t^*-1})$  realized from the starting point of history at 0 until  $t^*-1$ . The set of all possible actions at time  $t^*$  is denoted  $A^{t^*}(\mathbf{a}^{t^*-1})$ . When the present generation chooses an action  $a^{t^*} \in A^{t^*}(\mathbf{a}^{t^*-1})$ , the set of people who may possibly exist after  $t^*$  is labeled  $N(a^{t^*})$ . Those belonging to the set  $N(a^{t^*})$  are all people who exist on the paths following the branch decided by the action  $a^{t^*}$ . They may be called “potential people after time  $t^*$ .” In general, if it is the case that  $a^{t^*} \neq b^{t^*}$ , then  $N(a^{t^*}) \neq N(b^{t^*})$ . This is the *non-identity problem* for future generations pointed out by Derek Parfit (Parfit 1982, 1984).

[Figure 1 to be inserted around here]

Observe that Parfit’s “non-identity problem” refers to the non-identity of human beings viewed from the biological standpoint. However, human beings are social entities as well as biological entities. Thus, not only biological attributes, but also various social attributes such as preferences, abilities to consume and work, abilities to understand, communicate, and collaborate with other people, and abilities to make sensible judgments should also be considered as important factors, in terms of which individuals are to be identified. It is clear that preferences and abilities are characteristics that are formed endogenously through social interactions over a long period. Furthermore, the effectiveness of a specific ability differs substantially from one social environment to the other. If one considers that the countermeasures for global warming would change social structures and economic environments over a long period, one cannot but find it unavoidable that identity of people in the future would become substantially different in accordance with the choice of various measures against global warming.

To be precise in our wording, the non-identity of human beings as a biological entity should be referred to as the “biological non-identity problem,” and the non-identity of human being as a social entity should be referred to as the “social non-identity problem.” It seems to us that Parfit’s acute observation on the biological non-identity problem is important as well as convincing, but, even if human characters as a biological entity were to remain identical, the social non-identity problems would still appear. For example, people brought up in American-style societies, where motor vehicles are used indispensably, would probably acquire strong preferences for the use of private motor vehicles in their personal life. In contrast, those who are brought up in societies, where an efficient public transportation system has developed in response to the restricted use of petroleum, would more likely less prefer the use of private motor vehicles than otherwise. Thus, the individual characteristics should be expressed by a pair of identifying attribute as a biological entity and that as a social entity. If at least one of these two attributes differs, we regard the human characteristics as non-identical.

Back, then, to the global warming problem, where the future generations have dual aspects, viz., passive aspect and active aspect. On the one hand, they are affected by climate changes caused by the accumulation of greenhouse gases emitted before they were born. On the other hand, they themselves make decisions on the control of greenhouse gas emission, which in turn exert influences on the living standard of the generations born in the further future. Depending on which aspect of the future generations we choose for scrutiny, the non-identity problem has two distinguished implications. In the first place, the preferences of the future generations, which should be the essential informational

basis for the present generation to evaluate the desirability of policies they may take for the sake of the future generations, depend crucially on the policies to be evaluated. In the second place, the standard of value of the future generations, in terms of which they themselves would decide on the policies to control greenhouse gases at their own decision time, are also contingent on the choices made by the present generation. These dual dependencies pose serious problems if the analysis of global warming is to remain within the welfaristic informational framework owing to the serious non-identity problems.

As we have already pointed out, in order to keep climate change under control at any future point of time, it is necessary that many preceding generations take actions to control greenhouse gas emissions (*non-limitations of the culprits in time*). Needless to say, each future generation makes its decision independently of the past decision made by the present generation. Yet the standard of value of the future generation cannot but be formed partly under the influence of the present generation. Thus, the policy choice of the future generations cannot but hinge on the present generation's behavior. Thus, it is by no means straightforward to answer which policy at present is more desirable for the future generations than others. Indeed, we must take into account not only the direct effect of each policy on the global climate of the earth (the *direct effect*), but also the indirect effect through the preferences of future generations (the *preference effect*), as well as on the standard of value of the future generations (the *value standard effect*). This complexity is a logical consequence of biological and social identity problems. The Pandora's box opened by Parfit poses a serious problem in the analysis of global warming indeed.

## 4 Effectiveness of Orthodox Economic Analyses

Confronted with the problem of global warming, how should we determine the distribution of living standards among successive generations as well as different groups of people within the same generation? The standard welfare economics developed various criteria for judging social desirability of one resource allocation vis-à-vis the other. In this section, we examine the effectiveness of these normative criteria in the context of intergenerational resource allocations in the presence of global warming.

### 4.1 Pareto Criterion and the Compensation Principles

If we strictly follow the "new" welfare economics that excludes interpersonal comparisons of welfare, the only normative standard we may use in comparing alternative economic policies is the Pareto criterion. Suppose that we must choose between the outcome of one policy  $a$  and that of another policy  $b$  on the basis of preferences of all the persons involved. If no one prefers the outcome of  $b$  to the outcome of  $a$ , and at least some person prefers the outcome of  $a$ , the policy  $a$  is said to be Pareto superior to the policy  $b$ .

Since most policies involve conflict of interests among concerned persons, it is quite rare that one policy can be judged Pareto superior to another. However, if there is a common numeraire called "money," and if it is possible to transfer money from the persons who benefit to those who lose, then the applicable range of the Pareto criterion can be much expanded through the hypothetical payment of compensations. Indeed, if the amount of money that the beneficiaries are willing to pay to the losers for the endorsement of their preferred policy is in excess of the loss of the sufferers, then appropriate



transfers of money would ensure that the implementation of the policy is Pareto superior to not implementing it. In such cases, the compensation principle proposed by Nicholas Kaldor states that the implementation of the policy is a potential improvement over the status quo even if the appropriate monetary transfers are not actually carried out. It was in view of the unsatisfactory logical performance of Kaldor's compensation principle and that due to John Hicks that Tibor Scitovsky and Paul Samuelson introduced their respective variants of the compensation principle. It is upon these compensation principles that the cost-benefit analysis in applied welfare economics is based.

Are the Pareto criterion and the compensation principles useful in judging on alternative policies against global warming? Because any policy to abate the emission of greenhouse gases necessarily reduces the level of economic activities, it is certain that the present generation would incur some losses. Therefore, in order for the Pareto criterion and the compensation principles to be applicable to the evaluation of the policy against global warming, a transfer of money must be feasible from the distant future generations, which would be the beneficiaries of the policy, to the present generation. However, such a monetary transfer is hard to materialize due to the two features of the problem of global warming: non-coexistence of the culprits and the victims and non-limitation of the culprits and the victims in space.

Because the culprits (the present generation) and the victims (the distant future generations) do not exist simultaneously, the monetary transfers must be carried out over distant time. If all the concerned persons lived in a specific country, then the transfers of money would be easy: the persons at present issue bonds outside the country, and have the persons in the distant future take the responsibility for redeeming the foreign bonds. In this way, intertemporal monetary transfers from the distant future to the present would be made possible. However, there is no national border in the problem of global warming. Because all those who belong to the present generation would get some losses from implementing policies to abate global warming, and all those who belong to the distant future generations would benefit from it, it is simply impossible to use foreign bonds as a device for transferring compensatory payments from the distant future generations to the present generation. The only way to carry out compensatory payments from the distant future generations to the present generation would be to decrease the level of social capital that the present generation should leave for the distant future generations, and to increase the present consumption in exchange. However, it is most likely that the shift of resources from social capital to present consumption increases the present emissions of greenhouse gases. The implementation of policies for an abatement of global warming and an increase in the present consumption would conflict with each other. If compensatory monetary transfers are not feasible, then the Pareto criterion and the compensation principles lose their applicability to the task of judging whether a policy for abatement of global warming should be carried out or not.

So far, we have not invoked Parfit's non-identity problem in our discussion on the applicability of the Pareto criterion and the compensation principles. Let us now accept the relevance of Parfit's non-identity problem. Then, in the context of the problem of global warming, the Pareto criterion and the compensation principles are almost totally useless for choosing among alternative policies. Indeed, when we compare the policy  $a^{t^*}$  and the policy  $b^{t^*}$ , the people who will exist in the future as the outcomes of these policies, viz.,  $N(a^{t^*})$  and  $N(b^{t^*})$ , have different personality characteristics. As we have mentioned before, considering that human beings are social entities, they would naturally

have different preferences even if they are biologically the same. Therefore, ranking the outcomes by means of preferences of those concerned, which is the only informational basis used by the Pareto criterion and the compensation principles, becomes logically almost impossible.

In fact, it is too much to say that there never exists a case where the Pareto criterion can be applied to the issues related to global warming. Indeed, the Pareto criterion can play a role in the situation where the policy  $a^{t^*}$  and the policy  $b^{t^*}$  may have the same effect on the future generations, but the costs incurred to the present generation are different. The Pareto criterion applied to such a situation would function as the principle of cost minimization of policies that bring about the same consequences vis-à-vis global warming. However, in reality, there may rarely exist two different policies having the same consequences on the future generations with only the costs incurred to the present generation being different. For example, the policy choice between (i) whether the emission rights of greenhouse gases are traded or not, and (ii) if traded, in which way and under what restrictions the trade is to be implemented, would affect which areas on the earth the greenhouse gases would be reduced. This would then inevitably create some differences in the characteristics of the future generations. As is suggested by this example, the residual possibility of applying the Pareto criterion and/or the compensation principles to the problem of global warming seems to be quite narrowly circumscribed.

## 4.2 Solution through Negotiations by the Concerned Agents

It was Ronald Coase (1906) who proposed a well-known resolution to the problem of externalities, which is based on the direct negotiations between the culprits and the victims of negative environmental externalities. His proposition, known as the “Coase theorem,” states that, when the negotiation costs can be ignored, the externality problems are solved efficiently through negotiations of the concerned agents as long as it is clearly stipulated who are endowed with the property rights to begin with. Take, for example, the case of airport noise. If “the right to live a quiet life” (or “the right to produce noise without outside interference”) is endowed *ab initio*, an agreement can be formed on the levels of noise as well as monetary compensation through negotiations between the concerned agents. This would lead to an efficient solution of the problem of environmental externalities, although there would be significant difference in income distribution depending on how the rights are distributed in the first place.

In the context of the problem of global warming, it should be clear that the resolution through the direct negotiations in the spirit of Coase is impossible. This is because the time structure of the problem does not allow the culprits (those who emit greenhouse gases) and the victims (those who suffer from the resulting global warming) to exist simultaneously. It is true that, in a purely normative argument, we might assume a counterfactual situation in which all the concerned parties meet together to negotiate, and derive a normative principle by reasoning out rational choices made in the counterfactual situation of direct negotiation. Even in this hypothetical and counterfactual setting, however, we must admit that it is impossible to nominate rationally the agents who can properly represent the distant future generations if we accept Parfit’s non-identity problem. Would they be the agents of people who would exist if some measures were taken at present against global warming, or those if the measures were not taken? In

the former case, the people whom the agents represent would not exist when the policy measures against global warming were not implemented. Therefore, they could not be qualified to ask for compensation for the losses that would occur when no policy measures were implemented. In the latter case, the people whom the agents represent would not exist when the policy measures against global warming were implemented. Hence, the agents would become disqualified to represent the future generations and negotiate with the present generation once the present generation decided to implement such policy measures against global warming. In either case, it is fundamentally impossible to use rational negotiations between the concerned agents as the basis of normative theory in the context of global warming.

### 4.3 Rights and Duties

Social justice is often expressed in terms of rights and duties. The common argument about “the rights and duties between generations” in the context of global warming would be something like this: “the future generations have the right to request the present generation to abate global warming, whereas the present generation has the corresponding duty owed to the future generations.” However, there are logical difficulties in articulating the relationship between the future generations and the present generation in terms of such simple right-duty relationship if we accept the non-identity problem.

Let the policy  $a^{t^*}$  mean “implementing policy measures against global warming at time  $t^*$ , and the policy  $b^{t^*}$  mean “not implementing policy measures against global warming at all.” In each case, the characteristics of people who exist in the future are different:  $N(a^{t^*})$  for policy  $a^{t^*}$  and  $N(b^{t^*})$  for policy  $b^{t^*}$ . Let us now ask: To which group of people,  $N(a^{t^*})$  or  $N(b^{t^*})$ , does the right to request the present generation to restrain the progression of global warming belong? Or: To which group of people,  $N(a^{t^*})$  or  $N(b^{t^*})$ , does the present generation owe the duty?

First, suppose that the group  $N(b^{t^*})$ , who would live in the world of progressed warming, has the right. However, once the present generation fulfills the duty corresponding to the exercise of the right by the future generations  $N(b^{t^*})$ , the people that would exist in the future is the group  $N(a^{t^*})$ , and not  $N(b^{t^*})$  any more. The people of the group  $N(b^{t^*})$  would never live in the world with restrained warming, and the exercise of the right means denying their own existence on the earth. John Stuart Mill (1859) once insisted that one cannot justify the slave contract to sell his own freedom under the name of the freedom of choice. Similarly, when one sets the right to decide one’s own circumstances, it is irrational to set the right including the right to deny his own existence.

On the other hand, there is no rational ground that the group  $N(a^{t^*})$ , who would exist in the world only with restrained warming, should have the right to demand the present generation to restrain global warming. If global warming were not restrained, then it is the group  $N(b^{t^*})$  who would exist, and the group  $N(a^{t^*})$  would not exist any longer. Hence, a similar argument parallel to the one given above would hold true. One possible counter-argument to this line of reasoning would be that the people who belong to the group  $N(a^{t^*})$  should rather be entitled to claim a strong right to the present generation to restrain global warming because, if it were not abated, the people of  $N(a^{t^*})$  would be denied of their very existence. However, it is possible to secure this right for the people in  $N(a^{t^*})$  only by depriving a similar right from the people in  $N(b^{t^*})$ . There seem to be no sound ground that justify such a discriminatory conferment of rights. It seems to us

that the non-identity problem makes it impossible to base the counter-measures against global warming upon the duty of the present generation to the distant future generations.

In closing this section, let us call the reader's attention to the fact that we have carefully separated the argument that hinges on the acceptance of Parfit's non-identity problem, and the argument that does not. Given the controversial nature of Parfit's non-identity problem, it is our belief that this separation would be useful in confirming the solidity of our argument.

## 5 Responsibility and Compensation in the Choice of Future Path

We have shown that it is logically impossible to find the normative basis of policy evaluation in the context of global warming by means of the Pareto criterion, the compensation principles, or the Coase paradigm of bilateral negotiations. It is also argued that it is impossible to base the policy measures against global warming on the present generation's duty to the rights of distant future generations. Should we be resigned in an agnosticism to the effect that "logically speaking, there is no normative criterion for the reasoned choice of the present generation, because the people who would exist in the distant future on the chosen path could not but be different, depending on the current choice made by the present generation." We must develop alternative normative principles in order to be freed from this trap of agnosticism.

As one of the elements of such a new theory, we would like to focus on the principle of responsibility and compensation, which has been introduced into welfare economics through recent studies by Ronald Dworkin (1981a; 1981b; 2000), John Roemer (1985; 1986) and Marc Fleurbaey (1995; 1998). What Fleurbaey (1998) christened "the responsibility by control" is the principle to the effect that one should be held responsible for the outcome of one's own voluntary choice, over which one has a full power of control. In other words, the voluntary exercise of "freedom of choice" accompanies the concomitant responsibility on the part of a person in charge of the act of choice. Even if the choice results in a loss, the responsibility thereof cannot be shifted to anybody else as long as the choice is made voluntarily.

According to this principle, there is no justifiable reason for a person who developed special tastes for expensive cars to ask for "compensation" to the society, just because the degree of satisfaction of his desire is very low unless that expensive car is made available to him through supplementary income provided by the society. The reason is that the low level of his utility satisfaction is caused by his expensive tastes, which Dworkin (1981a) christened the "champaign tastes," nourished by the exercise of his own free will. In such a case, the person himself should take responsibility for his own voluntary choice and should not shift the burden of his expensive tastes to the society. On the other hand, if a person is suffering from misfortune by birth, or social contingencies that cannot be attributed to his own voluntary choice, he should not be charged with personal responsibility for his plight. In the latter case, social "compensation" must be paid for the losses caused by the non-responsible factors. Take, for example, an unfortunate person who became disabled due to an accident caused by someone else's drunken driving. It is clear that he should receive social compensation, because he is suffering from a loss caused by an extraneous factor, for which he should not be held

responsible. It is true that the responsibility of compensatory payment to him should mostly belong to the individual who did drunken driving, but it is the society that should assume responsibility for developing an institutional framework for compensatory payments through a due procedure, and monitor the realization of the compensatory payments to the victim.

With this principle in mind, an important fact about global warming that comes to the fore is that the economic activities of the present generation, which emit greenhouse gases and affect the personal characteristics of future generations, are subject to the exclusive control of the present generation. Thus, according to the principle of responsibility and compensation, the present generation should be held responsible for the problem of global warming in view of their full autonomy to control the policy choices to decide on a path of the future world.

Note, however, that there is a fundamental difference between the theoretical structure envisaged by Dworkin, Roemer and Fleurbaey and the structure of the problem of global warming, which prevents us from applying the Dworkin-Roemer-Fleurbaey theory directly to the problem of global warming. Recollect that the Dworkin-Roemer-Fleurbaey theory is implicitly assuming that either the subject who is responsible for the act of choice and the subject who is affected by the outcomes thereof are the same, or even when they are different subjects, they co-exist at the same point of time. Consider the two previous examples again. The example of “champaign tastes” is the case where the subjects are the same, whereas the example of an accident by drunken driving is the case where the subjects are different, but the drunken driver and the victim co-exist at the same point of time. As we have emphasized, however, one of the crucial features of the problem of global warming is that the responsible subject is the present generation, whereas the affected subjects are the distant future generations that do not exist at the time the present generation make their choice. Furthermore, depending on the consequences of the choice made by the present generation, the personality characteristics of the subjects who experience the consequences thereof are determined. In view of this unique feature of the problem of global warming, the meaning of choice of action made by the present generation and the concomitant responsibility requires more careful scrutiny.

Observe that the choice made by the present generation is nothing but the choice of a path from now to the indefinite future, which determines both the personal identity of the distant future generations as well as their living standard. From the viewpoint of the potential future generations, there is no way of going back along the historical path and making a choice afresh. In this sense, the choice of the present generation is one-sided, external, and irrevocable. Therefore, the first and primary meaning of responsibility that the present generation should owe to the distant future generations is the responsibility to choose a historical path that is accountable as a socially best choice based on some clear and rational standard. This responsibility is worth the nomenclature of accountability.

The second meaning of responsibility and compensation in the context of the problem of global warming may be understood by focusing on the salient future of the consequential path chosen by the present generation. To fix ideas, suppose that there are three alternative policies available for choice by the present generation. The first alternative is to stop global warming. The second alternative is to leave global warming unhindered, but improve the level of social capital accumulation to compensate for the detrimental consequences falling upon the distant future generations. The third alternative is to leave global warming unhindered, and take no compensatory measure to improve the fate

of the distant future generations. Depending on which policy out of these alternatives is chosen by the present generation, the personality characteristics of people who would exist in the distant future would be determined, and their welfare levels would also be determined. Regardless of what type of people would exist in the future, the distant future generations cannot be held responsible for the choice of the present generation. In other words, the choice of the present generation is a non-responsible factor that determines the fate of the distant future generations from outside. If the present generation chooses the third policy alternative, the distant future people who then emerge would suffer from global warming, which is a consequence of a non-responsible choice made in the past, without receiving any compensation in exchange. Such a path cannot be normatively justified. In contrast, if the present generation chooses the second policy alternative, the distant future people who would then emerge would also suffer from global warming, but they would be receiving compensations by the medium of the accumulated social capital. When the deterioration of environment is inevitable, the present generation should accept responsibility to choose a future path which would avoid the existence of distant future people who would only suffer from non-responsible factors. This is the second meaning of responsibility in the present context.

The responsibility of the present generation in this second sense should not be construed as the responsibility to compensate for the violation of right of the distant future generations. As was explained in Section 4, the conception of such a right has a logical difficulty due to the non-identity problem. Quite to the contrary, our principle of responsibility and compensation states that the present generation should not choose a path leading to the existence of distant future people who suffer from a loss unilaterally imposed on them by the action of the present generation. This is a normative principle that should be fulfilled by the present generation regardless of the preferences and/or rights of the distant future generations.

## **6 Golden-Rule of the Gospel in the Context of Global Warming**

Suppose, for the sake of further argument, that the responsibility of the present generation for the distant future generations are taken for granted. It does not matter whether or not this acceptance of responsibility is in accordance with the line of argument that we have developed in the previous section. Even then, however, there still remains an argument to be answered, which may proceed as follows. Granting that the present generation is indeed responsible for the fate of the distant future generations, such a responsibility does not fall uniquely upon the present generation. Indeed, all the past generations since Industrial Revolution are situated in the equally responsible position. Why, then, should the present generation be held single-handedly responsible for the unilateral policy action against global warming?

To cope with this argument, our plea is phrased in terms of one of the oldest ethical principles, which has been expressed in various forms in different cultures and contexts almost throughout the recorded human history. The so-called Golden Rule of the Gospel reads as follows: “Do unto others as ye would that others should do unto you.” In our present context, where the past generations and the future generations are asymmetrically situated vis-à-vis the present generation as the time flies only in one direction, the

reference acts of other generations viewed from the standpoint of the present generation cannot but be the acts of the past generations. Thus, the Golden Rule of the Gospel should be interpreted with reference to the present generation as follows: Do unto the future generations as ye would that the past generations should have done unto you. You, the present generation, are placed in the position to assume unilateral responsibility for the future generations because your predecessors, the past generations, had not taken responsible actions against global warming. It does not matter whether it was due to the lack of scientific evidence on, or wide public perception of, global warming, or it was triggered by deliberate shift of responsibility to the future generations including the present generation that the past generations had not done as you think they should have done unto you. If you feel like that, the Golden Rule of the Gospel, as we see it, verdicts that you should be ready to accept your unique responsibility for the fortune, not *despite* the failure of the past generations to act likewise, but *because of* the failure of the past generations to act likewise.

## 7 Heterogeneity of People within the Present Generation

Before concluding this paper, a brief observation on the role assigned to the past generations vis-à-vis the present generations in our analytical scenario of global warming may be in order. As was mentioned several times before, not only the current economic activities of the present generation, but also all the economic activities of the past generations ever since Industrial Revolution have contributed to the human-made accumulation of greenhouse gases. It is in this sense that the past generation is at least equally responsible as the present generation for the problem of global warming in the distant future. This aspect of intergenerational linkage has already received our close attention in the previous sections. In addition to this, past economic activities have also exerted strong influence on the distribution of living standards among people within the present generation. Those people who reside in the developed countries and regions, where the past economic activities have led not only to the accumulation of greenhouse gases, but also to the accumulation of tangible assets embodying advanced science and technology as well as of intangible assets in the form of intellectual infrastructure including stable social and economic systems, may be able to enjoy high living standard not only from the current flow of advanced goods and services, but also from the stock of tangible and intangible assets left by their predecessors. In other words, people in the present generation who reside in the advanced countries and regions inherit from the past generations not only negative environmental externalities, but also positive environmental externalities, to the latter of which they owe a large part of their high living standard. This is in conspicuous contrast with those people in the present generation who reside in the less-developed countries and regions, where their hope for high living standard hinges squarely on the present and future expansion of economic activities that may accompany further increase in the accumulation of greenhouse gases. This heterogeneity within the present generation should be kept in mind when we are in the stage of determining how the burden should be shared within the present generation for the sake of keeping global warming under control.

According to the “benefits principle” on cost sharing for the provision of public goods, those people in the present generation who are residing in developed countries and

regions and receiving greater benefits directly and indirectly from the economic activities of the past generations should bear a heavier burden than those people in the present generation who are residing in less developed countries and regions. It is true that some people in the present generation who are residing in developed countries and regions may have ancestries who have no relation whatsoever with the economic activities of those countries and regions in the past. For example, their emigration/immigration may have taken place, or the borders may have been changed, after these activities had already taken place. Note, however, the freedom to leave economically developed countries and regions is always guaranteed. Thus, to the extent that people who choose to continue their residence in the countries and regions where they are now and receive benefits from the high level of capital and infrastructure accumulation in the past, they should not be construed to be exempt from bearing a greater burden.

Let us close this section with a brief remark on the heterogeneity among the distant future generations. As we have already observed, the effects of global warming are sharply different between countries and regions in the distant future. Those people residing in the islands on the Pacific Ocean may face the crisis of submergence by the advancement of global warming, which has no reason to be attributed to their own responsibility. Yet, they may be forced to emigrate from the country they are attached as a result of the choice made by other people in the distant past. Just as in the case where social compensations are paid for the residents who are forced to leave the area which is close to the prospective dam site, it is legitimate that social compensations would be made to rectify the disadvantages imposed on them from outside.

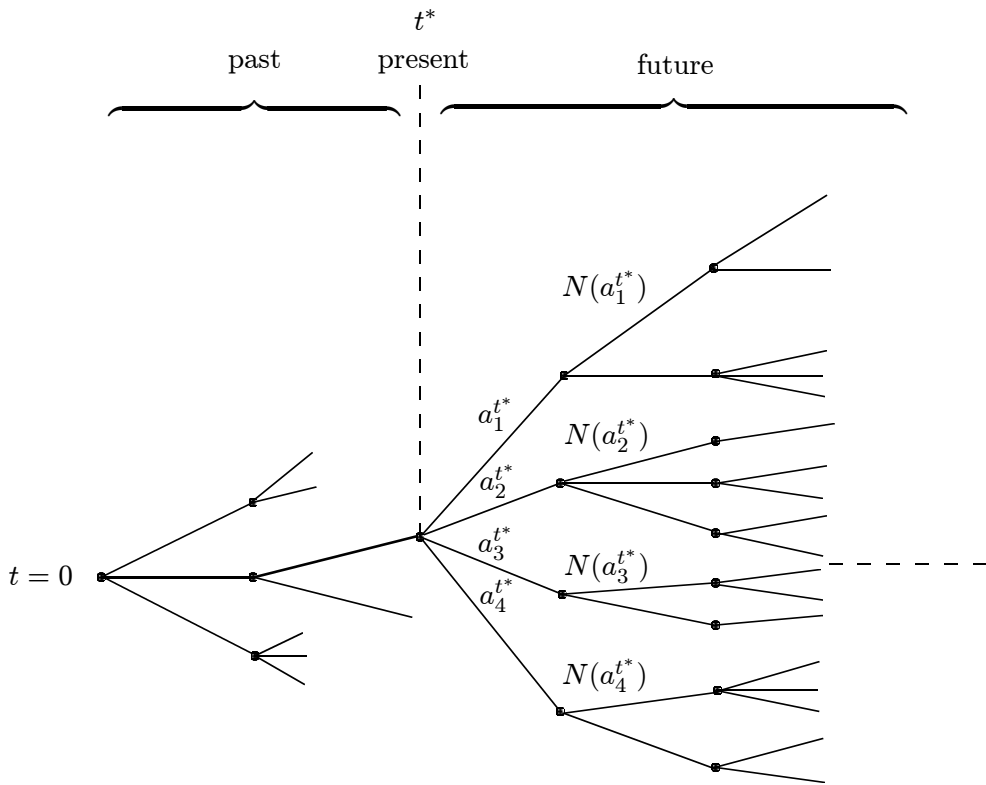
## 8 Concluding Remarks

Back, then, to the two questions that we posed in Introduction of this paper. The first question asked the following: (a) *Why should we care about the possible plight of future generations? Those who might most seriously suffer from the problem of global warming would emerge long after we are all gone, and we might never be forced to confront with their plight.* The second question asked the following: (b) *Why should we single-handedly held responsible? There are many past generations that should at least in part share the blame of what we are jointly responsible. True enough, scientific evidence as well as public awareness of the problem of global warming is much more solid now than it used to be. But we need ethically appealing reason for our duty to take actions unilaterally.* The contention of this paper may be boiled down to the following two assertions. In the first place, the modified version of the principle of responsibility and compensation in the form of responsibility for selecting a future path can provide us with a reasonable answer to the question (a). In the second place, the modified version of the Golden Rule of the Gospel can provide us with an ethical reason that we should assume unilateral responsibility to take action against global warming, thereby providing us with a reasonable answer to the question (b).

It is clear that this paper leaves many further problems unresolved. To begin with, our modified principle of responsibility and compensation may be able to explain why the present generation should act responsibly in the sense of taking accountable action against global warming, but it falls much short of explaining what constitutes the accountable action itself. Besides, our analysis ends far before we can prescribe an analytical formula



for sharing cost for coping with the problem of global warming. The modest purpose of this paper will be served if we could kick off further discussions on the problem (a) and (b) and their reasoned resolutions, which are logically prior to the problem of analytical description of rational choice of acts against global warming as well as the design of cost-sharing formulas.



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