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Intergenerational Equity

by Wolfgang Buchholz

3.1 The faces of sustainability

During the last decade, sustainability has been proposed as a new guideline for environmental policy. Loosely speaking, sustainability means that we are not allowed to use nature at the cost of our descendants. The only policies that are normatively acceptable are those that leave future generations the same ability as we have to benefit from natural resources

What exactly is meant by sustainability is controversial (see for example Klaassen and Opschoor (1991)). On the one hand, true ecologists postulate leaving nature more or less as it is. Interventions in nature have to be reduced to a minimum (strong sustainability). On the other hand, economists tend to define sustainability in a more sophisticated way. Although natural resources are, at least to some degree, destroyed by production and consumption, provision may be made against a real deterioration of living conditions for future generations. In order to compensate our successors, a stock of man-made capital has to be built up (weak sustainability).

Here, sustainability joins some older ideas formulated just after the first oil crisis in the 1970s: even if production depends on inputs of an exhaustible natural resource, it might be possible to sustain consumption at a strictly positive level even for an infinite number of periods. By the Hartwick rule (see Hartwick (1977) and chapter 4 in this volume) we even know what such a substitution policy might look like: On an efficient path, re-investing the rents accruing to the natural resource will entail equal consumption for all generations and thus effect sustainable development.

3.2 Rationalizing ethical rules

As a normative concept, sustainability can be justified in different ways. It can thus be derived from fairness considerations traceable back to Kant´s categorical imperative (see, for example, Buchholz 1984). In this version it means that no generation will be entitled to raise its consumption beyond that level which is technically possible for *all* generations. Apart from windfall consumption of non-substitutable goods which can only be appropriated *either* by one generation or another, consumption of every generation has to be restricted to the so-called *maximum sustainable yield* which has, as an analytical tool, been utilized in the economics of fishery and forestry for a long time.

In a more modern framework, ethical rules for specific applications are not deducted from general basic norms. Rather, individuals are put *behind a veil of ignorance* where they have no information about their actual positions. In deciding about the preferability of certain intertemporal allocations, they therefore do not know which generation they belong to. In this way the feasible allocations are compared from the perspective of an impartial spectator who is, by the very construction of the veil of ignorance, not able to pursue personal interests. By removing the possibility of egoistically based decisions, the ranking of allocations emerging from this process can be considered as *fair*.

From an economic point of view, this approach to ethical rules appears very attractive as it applies the standard utility-maximizing behaviour of a 'homo oeconomicus' to solve distributional problems. The veil of ignorance construction can be used to derive rules for just allocations between different generations.

3.3 Fair decisions behind the veil of ignorance

A calculation of the distribution of resources between only two generations can be done (see Box: Deciding behind the veil of ignorance). The calculation combines three components which are familiar in economic reasoning:

The first component is *the veil of ignorance construction* as the genuinely economic approach to distributive justice. The result of a choice taken behind the veil of ignorance can be considered as ethically justified.

Secondly, the calculation allows for a *decision rule* for the impartial spectator behind the veil of ignorance who only has to obey to two axioms:

1) the rather uncontroversial *Pareto principle*, which states that the transition from one allocation to another is to be preferred whenever no generation loses and at least one generation gains
2) the *principle of anonymity or symmetry*: behind the veil of ignorance, states that a given consumption profile cannot reasonably be distinguished from its permutation such that both allocations have to be considered as equivalent.

Discounting – time and money

To many people, discounting future values is unfair and arbitrary. Yet without discounting, intertemporal choices would be difficult to make. The rationale for discounting results from a so-called time preference. Let us assume that there is no inflation (which does not change the idea but makes the calculations more complex). Most people are not indifferent to getting either \$1000 today or \$1000 a year from now; they would prefer to have it sooner rather than later. But how about having \$1000 now or \$1500 a year from now? Most of us would probably prefer the latter option. But perhaps there is some amount of money \$1000(1+r) between \$1000 and \$1500 that makes us indifferent to having either \$1000 now or \$1000(1+r) a year from now. The number r which renders the two options equivalent is called the rate of time preference. It is a fundamental component of any discount rate used in order to compare costs and benefits accruing at different points in time. If r=0.025 (2.5%) then we would consider \$1025 a year from now as equivalent to \$1000 now and \$1000 a year from now is equivalent to \$1000/(1+r), that is, approximately \$976 today.

It is easy to extend this concept to time intervals of any length. The present value of \$1000 two years from now is $\$1000/(1+r)^2$ and so on. If a project requires costs of 1000, 100 and 200 now, a year from now and three years from now, respectively, then its discounted sum of costs is $\$1000 + \$100/(1+r) + \$200/(1+r)^3$. If it provides the investor with benefits of \$300, \$400, \$400, and \$300 after the first, second, third, and fourth year, respectively, its discounted sum of benefits is $\$300/(1+r) + \$400/(1+r)^2 + \$400/(1+r)^3 + \$300/(1+r)^4$. The net present value, NPV – a key concept used in cost-benefit analysis – is the difference between the discounted sum of benefits net of costs.

It is easy to check that substituting 2.5% for r in the example above would yield NPV = \$33.35. Mere subtraction of (undiscounted) costs from (undiscounted) benefits would give the difference of \$100. This can be interpreted as NPV with zero discount rate. Thus discounting with positive rates decreases the value of projects whose costs come earlier than benefits. The same example recalculated with 5% discount rate will demonstrate a negative NPV.

Most projects require costs to be borne before benefits can be enjoyed. Environmental projects are often characterized by high costs and by benefits extending over a long period of time. Or the time lapse between launching a project and reaping its fruits can be long (think of how long it will take before the Baltic Sea will be restored as a result of costly abatement activities).

The conclusion some people draw from these facts is that discounting is anti-environmental and anti-sustainable. Indeed, high discount rates may imply negative NPV for projects with benefits that are modest but sustainable over a long period of time. Applying a zero discount rate, however, is not a good solution. Firstly, it is incorrect since people do reveal time preference. Secondly, it is also counterproductive from the environmental point of view; zero or low discount rates favour excessive investment with all its risk of resource exhaustion and environmental degradation and the waste of capital. Most economists emphasize the need for applying realistic discount rates. At the same time, they indicate that it is more appropriate to address sustainability concerns directly rather than by ignoring or underestimating the time preference of an average person.

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This principle is often employed in Social Choice Theory. In the intertemporal context it has a specific interpretation meaning that the impartial spectator exhibits no real time preference, in particular that there is no pure time-discounting. Consumption in both periods is regarded as equally worthwhile.

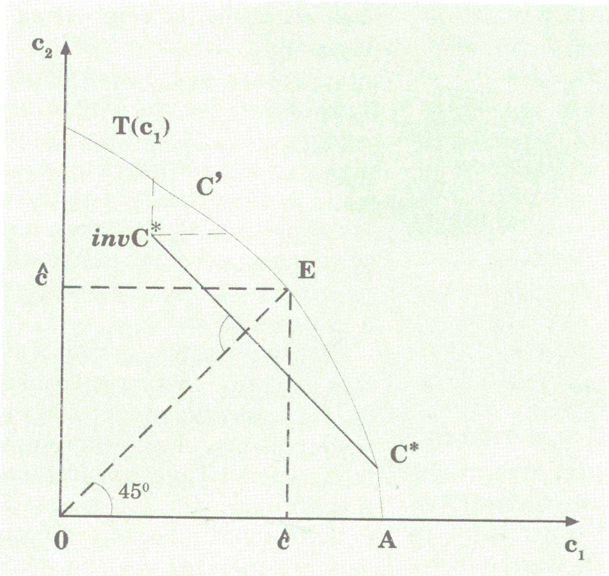
Thirdly, the *standard assumption in growth theory* about the effects of investment is that the *economy* under consideration is assumed to be *productive*, that is, for generation 2 there is a positive net yield of any investment made by generation 1.

If these assumptions are satisfied then it can never be the outcome of the ethical choice to make the later generation worse off than the earlier one. Thus, no *allocation which violates the principle of sustainability is ethically justified*. A lower consumption level for generation 2 than for generation 1 can only result if these axioms are not respected.

The argument given above will break down if, for a given allocation (c_1, c_2) with $c_1 > c_2$, the inverted consumption bundle (c_2, c_1) is valued less than the original one. Then, the individual wants to enjoy the higher consumption level earlier, such that, he or she shows a pure time preference in favour of the present and against the future. Discriminating

DECIDING BEHIND THE VEIL OF IGNORANCE

A diagram is used to describe decisions behind the veil of ignorance for the two generations model (see Howarth and Norgaard (1995) for a similar approach). On the axes of the diagram are depicted the consumption levels c_1 and c_2 of an earlier generation 1 and the subsequent generation 2. The *consumption possibility* curve or transformation curve $c_2 = T(c_1)$ shows which combinations of consumption levels are feasible with the given production technologies and the given endowments of labour force, produced capital and natural resources.



Let $c_{1,max}$ be the maximum level of consumption which can be obtained by the first generation. The corresponding consumption level of the second generation is assumed to be zero which leads to point A in the diagram. If only an amount $c_1 < c_{1,max}$ is consumed by generation 1, the difference $k_1 = c_{1,max} - c_1$ is invested by the first generation. Increasing the investment left to the second generation will raise its consumption possibilities. Thus the consumption possibility curve is strictly decreasing in c_1. According to the *law of diminishing returns* the *marginal* increase of generation 2´s consumption cannot rise with a higher investment k_1. This makes the transformation curve concave. In the extreme, with *constant* marginal returns, the consumption possibility curve is a straight line.

Furthermore, it is assumed that generation 2 can get back every k_1 invested augmented by a non-negative increment $f(c_1)$ which is non-decreasing in k_1. Then $c_2 = T(c_{1,max} - k_1) = k_1 + f(k_1)$. In such a *productive economy* the transformation curve then is everywhere steeper than a negatively sloped 45°–line.

An individual behind the veil of ignorance who does not know in which generation he or she will be placed later on now has to choose a consumption profile (c_1, c_2) along the transformation curve. By assumption, or by invoking the principle of insufficient reason, he or she attaches an equal probability weight ($p = 0.5$) to both possible outcomes.

The central result of this chapter is that under very weak conditions for the decision rule applied behind the veil of ignorance, a strictly decreasing consumption profile will never be chosen by the impartial spectator, that is, if $C^* = (c_1^*, c_2^*)$ denotes the final outcome, $c_2^* \geq c_1^*$ has to hold in a productive economy.

Let us assume the contrary, that is, $c_2^* < c_1^*$. Behind the veil of ignorance it seems plausible that the individual has no preference for a certain *sequence* of consumption levels. Hence, he or she is indifferent to the original consumption bundle (c_1^*, c_2^*) or the inverted one *inv*$C^* = (c_2^*, c_1^*)$. By the productivity assumption, *inv*C^* must lie *below* the transformation curve. Therefore, it is possible to make *both* generations better off than in *inv*C^*. In the diagram, the point C' describes a consumption bundle which is Pareto-superior to *inv*C^*. If the impartial spectator additionally prefers any Pareto-improvement, the initial allocation C^* cannot have been his or her best choice.

No points on the segment AE of the transformation curve are thus selected by any reasonable decision rule. The intuition for this result is simply that the individual behind the veil of ignorance can gain *ex ante* if, for an initially high consumption in period 1, he or she increases his or her investment. This will pay because the productivity assumption holds.

against the later generation in this way is often justified by identifying uncertainty as the crucial feature of time structure. Different generations are not to be treated equally because it cannot be taken for granted that future generations will in fact exist. Whether this argument is relevant to ethical considerations cannot be discussed here.

Furthermore, there are reasons for assuming that the productivity assumption might be violated particularly in the context of natural resources. In the analysis above, a constant population was implicitly assumed. The impartial spectator was identified as an average member of each generation. With a growing population, the same amount of an exhaustible resource such as oil has to be shared by more people in generation 2 than in generation 1. If substitution possibilities are not that good, the productivity axiom then will not hold.

3.4 A comparison between different ethical approaches

By the normative approach described above decreasing consumption paths were excluded as ethically unacceptable. But no particular distibution between the two generations could be determined as the really right one. This may seem unsatisfactory as one would prefer to get a definite rule for allocating resources to different generations. The two well-known ethical approaches which also make use of an impartial spectator behind a veil of ignorance suggest offering more.

On the one hand the economist and Nobel prize laurate J. Harsanyi maintained that under plausible assumptions about rational choice under uncertainty a *utalitarian rule* would be obtained. With such a rule the utility levels of the different generations are summed up in order to select that consumption profile which yields the maximum sum of utilities. This sounds convincing but in fact misses the problem. It turned out that Harsanyi only showed how to describe decisions behind the veil of ignorance. By now his result is judged in the following way: "... Harsanyi´s Impartial Observer Theorem does not justify the view that society should choose that state which maximizes the average utility of society's members. The Impartial Observer Theorem is a representation theorem, and that is all." (Roemer, 1996, p. 150).

On the other hand in his famous book *A Theory of Justice* the social philosopher J. Rawls postulated the application of an *egalitarian rule* to distributional problems between individuals. In the model above this would mean the choice of E=($\hat{c}$, $\hat{c}$) in the diagram in the box. Problems arise, however, if every symmetrical solution in the opportunity set is not Pareto optimal. In this more complicated situation which, however, is not of greater interest here, Rawls proposes to maximize the utility of the least well-off members of the society. This leads to the *maximum rule* which Rawls – in the context of ethical choices – called the *difference principle*. Looked at more closely, this rule is not very convincing as the outcome of a decision behind the veil of uncertainty. Strictly adhering to the difference principle would imply to forgo any additional gain in period 2 in order to achieve equality of consumption in both periods. Why should an individual really prefer the consumption profile (100; 100) to say (99; 100,000)?

The objections to the approaches of Harasanyi and Rawls can be interpreted in a unified way: In order to obtain a specific solution of the distribution problem the impartial spectator would have to be equipped with personal characteristics which, in the end, must remain arbitrary. So the person behind the veil of ingorance will only apply the maximum rule if she is extremely risk averse and wants to avoid any loss which is not very plausible as a behavioural assumption.

By a similar reasoning, even Rawls have shied away from applying difference principle to the intergenerational context. "as it would seem to imply, if anything, that there be no saving at all" (Rawls, p. 291). Instead, Rawls proposes a *just savings principle*: The end of the savings process is set in advance in order such as that economic growth has to be stopped if a satisfactory consumption level is reached. Growth as such which only serves to make rich generations even richer is thus deemed undesirable. By Rawls just saving principle the burden of this deliberately limited accumulation process is to be distirbuted fairly among the generations involved.

Arguing in this way, however, Rawls seems to undervalue completely the relevance of the difference principle for distribution conflicts among generations. Dissaving is excluded at the outset, such that the preservation of society's material base is taken for granted. So the possbility that environmental resources may be wasted by one generation at the cost of its successors, which is at the heart of the sustainability debate, is neglected. But if it is recognized that sustainability constitute a main distributional problem between generations then the difference principle can at least be used to protect future generations against recklessness of their predecessors (Cf. Asheim (1991) and Buchholz (1984)). Nothing more should be expected from a theoretical foundation of the sustainability postulate as an ethical rule.

3.5 Real-world decisions

From a theoretical perspective, sustainability has to be considered as ethically compelling in productive economies. This is the main outcome of our considerations above. The veil of ignorance construction, however, is only hypothetical. Real choices are made in the market or by the political process. The market may – by raising prices of exhaustible resources – indirectly protect future generations.

Political decisions may aim at this objective more purposefully by, for example, taxing energy resources or subsidizing cleaner technologies. The empirical question is whether such conservation policies for the benefit of future generations are to be expected in reality. The chances of that do not seem very good. Unlike the intragenerational case, the veil of ignorance has no empirical significance at all here. Whereas many people in fact must face the possibility of becoming poor because of bad luck, nobody will, for biological reasons, ever have a chance of living in a later generation.

Thus, in the intergenerational context, decisions behind the veil of ignorance are always on behalf of others, and, in the end, future generations completely depend on our benevolence. Self interest as a much more reliable determinant of human behaviour can only serve as a regulative in deriving ethical standards in ideal situations but, unfortunately, not in enforcing these standards in reality.