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A utilitarian notion of

responsibility for sustainability

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Abstract: We develop and formalize a utilitarian notion of responsibility for sustainability which is inspired by Singer's (1972) principle and the Brundtland Commission's concept of sustainability (WCED 1987). We relate this notion of responsibility to established criteria for the assessment of intertemporal societal choice, namely Pareto-efficiency, (discounted) utilitarian welfare maximization, and sustainability. Using a simple two-generations-resource-model, we find the following. Sustainability and responsibility for sustainability are equivalent if and only if sustainability is feasible. If it is not, there still exists a responsible allocation which is also Pareto-efficient. Further, the utilitarian welfare maximum with no discounting always fulfills the criterion of responsibility. Discounting may be responsible to a certain extent if sustainability is feasible. If sustainability is not feasible, discounting future satisfaction of basic needs is not responsible.

JEL Classification: D63, D90, Q01, G56

Keywords: Sustainability, responsibility, utilitarianism, basic needs, discounting, natural resources, Pareto efficiency, ethics

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1 Introduction

Sustainability is a very broad concept of justice. As such it poses an imperative on currently living collective and individual actors. This imperative of sustainability implies intra- as well as intergenerational justice. More specifically, as defined by the Brundlandt Commission (WCED 1987), sustainability refers to the satisfaction of basic needs of present and future generations. To realize sustainability, the present generation ought to act sustainably which implies at least two obligations: one directed towards currently living individuals and the other towards the future.

Acting sustainably means to take specific actions in accordance with the norm of sustainability in a concrete action context. An action context is characterized by a feasible set of actions, given system structures and dynamics, and knowledge of the system. This may create a gap between the imperative to act sustainably and the action context since the set of feasible actions and the knowledge of the system may be limited. This paper aims to fill this gap by conceptualizing an actor's *responsibility* for sustainability.

The concept of responsibility – as it has emerged from practical philosophy, political science, and law – links abstract norms with specific contexts. One feature of responsibility is that it is limited by available knowledge, power to act and the rights of the responsibility or duty bearer. Therefore, the imperative of sustainability cannot imply a responsibility of current generations to attain a particular future state of the world. It does imply, though, the responsibility to use the best available knowledge and power, according to Brundtland (WCED 1987), to meet the needs of the present without compromising the ability of future generations to meet their needs under the presently given conditions of knowledge, power and rights of the present generation. Knowledge and power thus limit responsibility.

Now, how far reaches the responsibility of the current generation given its knowledge and power to act are limited and given that it has rights itself? We analyze this question normatively by limiting the responsibility for Brundtland sustainability with Singer's principle. Singer (1972) basically claims that minimizing suffering due to unsatisfied basic needs is morally more important than maximizing wants. It is thus a slightly modified version of the utilitarian principle of maximizing total happiness. We discuss Singer's principle more deeply and link it to the notion of sustainability. The principle normatively completes our utilitarian notion of responsibility as it precisely defines its limits.

To illustrate the meaning of the utilitarian notion of responsibility thus developed, we apply it in a simple economic model and relate it to established criteria for the assessment of intertemporal societal choice, namely Pareto-efficiency, (discounted) utilitarian welfare maximization, and sustainability. The model comprises two non-overlapping generations. They share a natural resource from which they produce a consumption good that allows them to satisfy their basic needs. We thus model a simple resource allocation problem, however with a unidirectional power structure: the first generation can decide which share of the

resource to use for itself and which share to hand over to the second generation. This simple setup allows us to analyze and compare which allocations satisfy different normative criteria.

Our results show that sustainabilty and responsibility for sustainability are equivalent if and only if sustainability is feasible. If it is not, there still exists a responsible allocation which is also Pareto-efficient. Further, the utilitarian welfare maximum with no discounting always fulfills the criterion of responsibility. Discounting may be rsponsible to a certain extent if sustainability is feasible. If sustainability is not feasible, discounting future satisfaction of basic needs is not responsible.

The paper is organized as follows. Section 2 defines and discusses the concepts of sustainability and responsibility, thus preparing the conceptual, normative basis for the analysis. Section 3 introduces the economic model. Section 4 gives formal definitions and characterizations, through necessary and sufficient conditions, of the normative criteria. Section 5 presents our results. Section 6 concludes.

2 Normative foundations

Sustainability

Sustainability, as we understand it, is a very broad concept of justice. It combines the ideas of global intragenerational justice and of intergenerational justice, and often also includes jsutice towards nature. We apply a specific anthropocentric notion of sustainability, namely the Brundtland Commission's definition: "Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WVCED 1987: 43). This definition includes elements of intra- and intergenerational justice but not towards nature. It is in part result-oriented as it aims at the satisfaction of basic needs of the present generation, and in part prerequisite-oriented as it aims at maintaining the future ability to satisfy basic needs.

The term "needs" is further specified as it means "[…] the essential needs of the world's poor, to which overriding priority should be given" (Brundtland 1987: 43). In our analysis, we follow Max-Neef (1991) in that essential, "[…] fundamental human needs are finite, few and classifiable; and […] fundamental human needs […] are the same in all cultures and in all historical periods" (Max-Neef 1991: 18). Such basic needs[1] are for example protection, subsistence or participation.

Being a concept of justice, sustainability poses an imperative on currently living actors. Such actors ought to act in accordance with the norm of sustainability, they ought to act sustainably. Taking a specific action always occurs in a concrete action context in which exists a set of feasible actions and in which knowledge about given system structures and dynamics are crucial to choose actions that deliver desired outcomes. There thus exists a gap between the abstract norm of sustainability and action contexts.

[1] We use basic needs synonimously with essential needs and with fundamental needs.

Responsibility

This gap can be closed with the concept of responsibility. The primary meaning of responsibility is being the perpetrator of one's own actions, that is, "[…] one ascribes an action to oneself and allows for it to be thus ascribed" (Baumgärtner et al. 2007: 227). The primary meaning has no moral relevance itself, it simply states that *A* is responsible for *X* if she is the perpetrator of *X*. It is a precondition of morality, as one can only be morally praised or blamed for an action, if it can be ascribed to oneself.

When we speak of 'assuming responsibility', "[…] we sometimes use 'responsibility' as a synonym for obligation" (Williams 2008: 458). This is what Baumgärtner et al. (2007) call the secondary meaning of responsibility. In this meaning, responsibility attains a moral meaning when moral obligations arise which an obligation-bearer morally has to accept, that is, *A* ought to do *X* (positive responsibility) or ought not to do *X* (negative responsibility). Such obligations arise for different reasons, one of which are rights individuals have due to principles of justice.

Williams (2008) defines a third meaning with responsibility as a virtue: "Responsibility [as a virtue] represents the readiness to respond to a plurality of normative demands" (Williams 2008: 459). In other words, the virtue of responsibility is important whenever individuals are facing a plurality of normative obligations. The Brundtland notion of sustainability already contains two obligations: satisfying the basic needs of the present and not compromising the ability of future generations to meet their own needs.

To further define our notion of responsibility, we need to specify whose responsibility for sustainability we analyze. In general, this could be an individual, a group of individuals, a corporation, a nation state and so on. The minimum requirement for being responsible is to be a person, which Locke (1959: 264) defines as: "A thinking intelligent being that has reason and reflection and can consider itself as itself, the same thinking thing, in different times and places." A person is thus defined by intelligence, capacity for reason, self-awareness and consciousness of time and space. We will further consider currently-living persons.

As we have now defined the subject (persons), object (basic needs of present and future generation) and justification (sustainability as justice) of our notion of responsibility, we proceed with the extent of responsibility. What are the limits of a person's responsibility for sustainability? There are two fundamental limits. One is the widely endorsed 'ought-implies-can' (OIC) criterion. Its rationale is that the concept of obligation or responsibility presupposes the possibility of compliance: "[a]ction-guiding principles must fit human capacities, or they become strange in a damaging way: pointless" (Griffin 1992: 123). The second limit concerns the rights of the duty-bearers. How much is a duty-bearer obliged to do in order to fulfill the responsibility towards others? We will discuss this question applying Singer's principle.

Singer's principle

To lay out the principle, we must make the normative assumption that unsatisfied basic needs are something bad. Persons suffer when their basic needs are not satisfied. Singer's principle

states that "if it is in our power to prevent something bad from happening, without thereby sacrificing anything of comparable moral importance, we ought, morally, to do it" (Singer 1972: 231). The principle emphasizes the responsibility of currently living persons to act sustainably. But it also specifies the extent. It proceeds defining 'comparable moral importance' in the way that persons have to give "to the point of marginal utility, at which by giving more one would cause oneself and one's dependents as much suffering as one would prevent […]" (Singer 1972: 234). The relation of the rights of currently living duty-bearers and of presently or prospectively suffering persons, is thus clearly defined. The responsibility does not end until positive and negative marginal effects of doing more are equal.

The rationale of Singer's principle differs from general utilitarian theory as it implies minimizing of something bad or suffering but not maximization of the good or welfare. In this sense, it is very well suited to limit responsibility for Brundtland sustainability as the latter only defines that basic needs should be satisfied and not what ought to be done beyond that point.

Utilitarian notion of responsibility for sustainability

To sum up, our notion of responsibility for sustainability can be summarized as follows:

Currently living indivdual persons are responsible for the *needs* of present and future persons with respect to *meeting the needs* of present persons and not *compromising the ability* of future persons to meet their needs to the extent of their *capacity to act* and to the point of *marginal utility*.

3 Model

In our model, there are two non-overlapping generations $t=1,2$.[2] Both have preferences over consumption C_t that are characterized by two different functional forms – below and above a consumption level C^{BN} at which their basic needs are satisfied. C^{BN} is normalized to *1* and yields a utility level $U_t(C^{BN}) = U_t^{BN}$.

We further assume that to the extent that their basic needs are not yet satisfied, that is for $C_t<C^{BN}$, both generations have identical preferences. In terms of Singer's ethics, unsatisfied basic needs means that persons are suffering. In their suffering, our assumption states that any further unit of food, shelter or medicine has the same marginal effect on every suffering person. In other words, we assume persons to be equal in their suffering. Beyond the threshold where basic needs are met, that is for $C_t \geq C^{BN}$, their preferences may or may not be identical. The utility functions are given by:

$$U_t = \begin{cases} C_t^{\alpha} & \text{for } C_t < C^{BN} \\ C_t^{\alpha_t} & \text{for } C_t \geq C^{BN} \end{cases}, \qquad (1)$$

[2] For simplification, we assume that each generation consists of one representative person.

with $0<\alpha_t<\alpha<1$. Marginal utility from consumption is thus strictly larger if the basic needs are not met than if they are met. The utility functions are depicted in Figure 1:

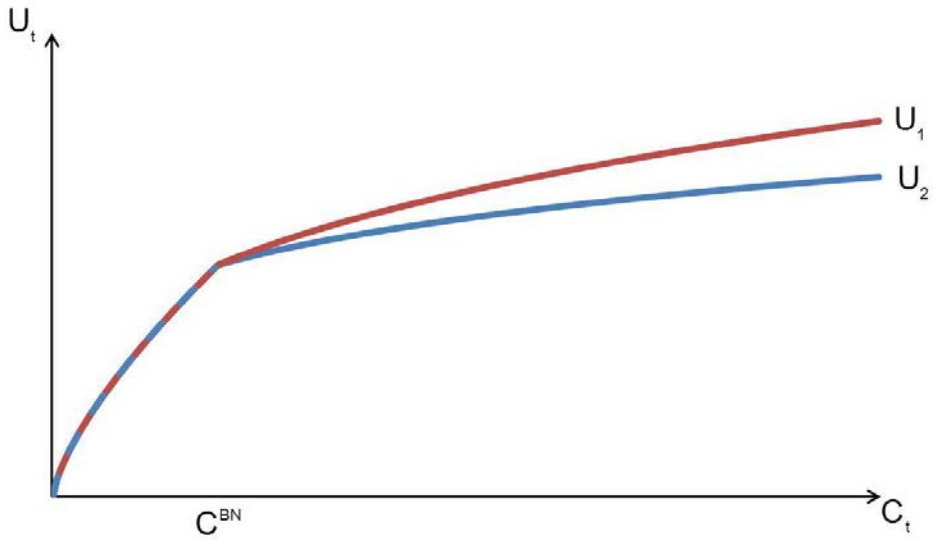

Figure 1: Utility functions

Consumption is being generated from the (consumptive) use of a resource stock $\bar{R} > 0$. This stock is allocated between both generations such that

$$\bar{R} \geq R_1 + R_2 \,. \tag{2}$$

Each generation has a simple linear production technology represented by the function:

$$C_1(R_1) = R_1 \,, \tag{3}$$

$$C_2(R_2) = \gamma R_2 \,. \tag{4}$$

$\gamma > 0$ is an exogenous factor which can be broadly interpreted: either as productivity change or as renewability of the resource. There is no waste in production such that every unit produced will be consumed.

These assumptions allow us to define a minimal resource endowment R^{min} which exactly allows for both generations to satisfy their basic needs:

$$R^{\min} = 1 + \frac{1}{\gamma}. \tag{5}$$

4 Definitions

Within our model, we define resource allocations to be sustainable, responsible, Pareto-efficient, and Discounted utilitarian welfare maximal. Further, we characterize these resource allocations with necessary and sufficient conditions. Each of these allocations is feasible, if

the sum of the resource endowments is not larger than the resource stock $\overline{R}$ as defined by Eq. (2).

In line with the Brundtland-cponception (WCED 1987), sustainable allocations are defined as meeting the basic needs of both generations.

Definition 1 (Sustainable allocations)

A feasible allocation $\left(R_1^S,R_2^S\right)$ is called *sustainable* if and only if it yields for all *t=1,2*

$$C_t(R_t^S)\geq C^{BN}=1\ . \tag{6}$$

With this definition, sustainable allocations are characterized as follows.

Lemma 1

A feasible allocation $\left(R_1^S,R_2^S\right)$ is *sustainable* if and only if it meets the following conditions:

$$R_1^S \geq 1 \text{ and } R_2^S \geq 1/\gamma\ . \tag{7}$$

The conditions for sustainable allocations are intuitive: both generations need a minimal resource endowment defined by Eq. (7) to be able to satisfy their basic needs. The minimal endowment of the second generation is contingent on γ. If γ is large (high technological progress), the second generation needs a small share of resource. As small γ (ecological decline) requires a large resource share for the second generation. Further, Eq. (7) shows that feasibility of sustainable allocations requires that $\bar{R} \geq R^{min}$.

Applying our notion of responsibility from Section 2 to this notion of sustainability, we continue with the formal definition and necessary and sufficient conditions of responsible allocations.

Definition 2 (Responsible allocations)

A feasible allocation $\left(R_1^R,R_2^R\right)$ is called *responsible* if and only if it yields for all *t=1,2*

$$C_t(R_t^R) \geq C^{BN} = 1 \text{ for } \overline{R} \geq R^{min}, \tag{8}$$

$$\partial U_1/\partial C_1 = \partial U_2/\partial C_2 \text{ and } \overline{R} = R_1 + R_2 \text{ for } \overline{R} < R^{min}. \tag{9}$$

Our definition of responsible allocations distinguishes situations in which it is possible to satisfy the basic needs of both generations (Eq. (8)), and situations in which this is not possible (Eq. (9)). If it is possible, obviously all allocations in which basic needs of both generations are satisfied, are responsible. However, if the resource stock is too small, there still exists a responsible allocation: the whole resource stock must be distributed such that there are equal marginal utilities from consumption. This ensures that suffering in the sense of Singer is minimized.

With this definition, responsible allocations are characterized as follows.

Lemma 2

A feasible allocation $\left(R_1^R, R_2^R\right)$ is *responsible* if and only if it meets the following conditions:

$$\mathrm{R}_1^{\mathrm{R}} \geq 1 \text{ and } \mathrm{R}_2^{\mathrm{R}} \geq 1/\gamma \text{ for } \overline{\mathrm{R}} \geq \mathrm{R}^{\mathrm{Min}}\,, \tag{10}$$

$$\mathrm{R}_1^{\mathrm{R}} = \gamma \mathrm{R}_2^{\mathrm{R}} \text{ and } \overline{\mathrm{R}} = \mathrm{R}_1^{\mathrm{R}} + \mathrm{R}_2^{\mathrm{R}} \text{ for } \overline{\mathrm{R}} < \mathrm{R}^{\mathrm{Min}}\,. \tag{11}$$

Lemma 2 shows that responsible allocations have two characterizations. One (Eq. (10)) in case the underlying normative aim (here: sustainability) is feasible, and one (Eq. (11)) in case it is not.

Now we define Pareto-efficient allocations.

Definition 3 (Pareto-efficient allocations)

A feasible allocation $\left(R_1^P, R_2^P\right)$ is called *Pareto-efficient* if and only if there does not exist a feasible allocation (R_1^{-P}, R_2^{-P}) such that $U_t\left(C_t(R_t^{-P})\right) > U_t\left(C_t(R_t^P)\right)$ and $U_s\left(C_s(R_s^{-P})\right) \geq U_s\left(C_s(R_s^P)\right)$ for all *s,t=1,2* and $t \neq s$.

With this definition, Pareto-efficient allocations are characterized as follows.

Lemma 3

A feasible allocation $\left(R_1^P, R_2^P\right)$ is *Pareto-efficient* if and only if it meets the following condition:

$$\overline{\mathrm{R}} = \mathrm{R}_1^{\mathrm{P}} + \mathrm{R}_2^{\mathrm{P}}\,. \tag{12}$$

Since our model consists of one resource which can only be transformed into one good, all allocations which use the whole resource stock $\overline{R}$ must be Pareto-efficient.

Next we define allocations which are a discounted utilitarian welfare maximum.

Definition 4 (Discounted utilitarian welfare maximum)

A feasible allocation (R_1^W, R_2^W) is called a *discounted utilitarian welfare maximum* if and only if it solves:

$$\max_{\mathrm{R}_1,\mathrm{R}_2} \mathrm{W} = \mathrm{U}_1\left(\mathrm{C}_1(\mathrm{R}_1)\right) + \delta \mathrm{U}_2\left(\mathrm{C}_2(\mathrm{R}_2)\right) \text{ s.t. } \overline{\mathrm{R}} = \mathrm{R}_1 + \mathrm{R}_2 \tag{13}$$

In this definition, δ is a discount factor with $\delta \geq 0$ which is the weight of the utility of the second generation in the overall welfare function. The special case of $\delta = 1$ means that no discounting takes place.

With this definition, discounted utilitarian welfare maxima are characterized as follows.

Lemma 4

A feasible allocation $\left(R_1^W, R_2^W\right)$ is a *Discounted utilitarian welfare maximum* if and only if it meets the following condition:

$$\alpha_1 (R_1^W)^{\alpha_1} = \delta\alpha_2 (\gamma R_2^W)^{\alpha_2} \text{ and } \bar{R} = R_1^W + R_2^W \text{ for } \bar{R} \geq R^{min}, \tag{14}$$

$$(R_1^W)^{\alpha} = \delta(\gamma R_2^W)^{\alpha} \text{ and } \bar{R} = R_1^W + R_2^W \text{ for } \bar{R} < R^{min}. \tag{15}$$

Discounted utilitarian welfare maxima are characterized by equal discounted marginal utility of both generations. Marginal utility of the second generation is weighed differently by the discount factor than marginal utility of the first generation.

Generally, there are three reasons for discounting (Gollier 2010). First, there is individual or societal impatience or time preference. However, ever since Pigou (1920) this argument has been used to describe human behavior rather than normatively justifying discounting. Second, there is the assumption of decreasing marginal utility and future economic growth (Ramsey 1928). If there are more goods available in the future due to economic growth and if marginal utility is decreasing, intergenerational equity allows for discounting. Third, uncertainty about future outcomes allows for discounting as it makes future well-being uncertain.

5 Results

In this section, we present our results. First, we discuss the properties of responsible allocations. Further, we relate the necessary and sufficient conditions for responsible allocations with the conditions for sustainable, Pareto-efficient, and discounted utilitarian welfare maximum allocations.

Proposition 1 (reponsibility)

If $\bar{R} \geq R^{min}$, there exist infinitely many responsible allocations. If $\bar{R} < R^{Min}$, there exists a single responsible allocation.

Proof: Eq. (10) shows that there are infinite responsible allocations iff $\bar{R} \geq R^{Min}$. Eq. (11) shows that there exists one responsible allocations iff $\bar{R} < R^{Min}$.

This means, that in any case there exists a responsible allocation. If sustainability is feasible, that is if $\bar{R} \geq R^{min}$, there exist infinitely many responsible allocations. This is due to the Brundtland notion of sustainability which is blind for distributional questions once all basic needs are satisfied. Our notion of responsibility adds to this as it defines one responsible allocation for $\bar{R} < R^{min}$ when sustainability is not feasible. At this allocation, $\bar{R}$ must be used completely $(\bar{R} = R_1 + R_2)$ and marginal utilities from consumption must be equal as in Singer's principle $(R_1^R = \gamma R_2^R)$.

Proposition 2 (sustainability)
If $\bar{R} \geq R^{min}$, each responsible allocation is also sustainable, and vice versa. In contrast, if $\bar{R} < R^{min}$, the responsible allocation is not sustainable. Responsibility for sustainability is, hence, equivalent to sustainability if and only if sustainability is feasible.

Proof: Eq. (10) shows that there are infinitely many responsible allocations for $\bar{R} \geq R^{min}$. Comparison of Eq. (7) with (10) shows that all allocations satisfying Eq. (10) must also satisfy Eq. (7). Comparison of Eq. (7) with (11) shows that an allocation satisfying Eq. (11) cannot satisfy Eq. (7). □

Our model illustrates the common and diverging properties of the criteria of sustainability and of responsibility for sustainability. They are equivalent whenever a sustainable allocation is feasible. If it is not, they differ since then a responsible allocation exists while a sustainable allocation does not exist. Responsibility thus defines action guide even if its normative foundation (here: sustainability) is not feasible.

Proposition 3 (Pareto-efficiency)
If $\bar{R} \geq R^{min}$, there exist some responsible allocations which are also Pareto-efficient, but neither all responsible allocations are Pareto-efficient nor all Pareto-efficient allocations are responsible. If $\bar{R} < R^{min}$, the responsible allocation is Pareto-efficient.

Proof: Comparison of Eq. (12) with (10) shows that some but not all allocations satisfying Eq. (10) also satisfy Eq. (12), e.g. $R_1 = 1$ and $R_2 = 1/\gamma$ for $\bar{R} > R^{min}$ satisfies Eq. (10) but not Eq. (12) while all $R_1 = 1 + \varepsilon$ and $R_2 = 1/\gamma$ for $\bar{R} = R^{Min} + \varepsilon$ with $\varepsilon \geq 0$ satisfy Eq. (10) and Eq. (12). Comparison of Eq. (12) with Eq. (11) shows that an allocation satisfying Eq. (11) also satisfies Eq. (12), as Eq. (12) is part of Eq. (11). But not all allocations satisfying Eq. (12) satisfy Eq. (11), e.g. $R_1 = 1\text{-}\varepsilon$ and $R_2 = 1/\gamma$ for $\bar{R} = R^{min} - \varepsilon$ with $\varepsilon \geq 0$. □

Since the Brundtland notion of sustainability does not require Pareto-efficiency, the criterion of responsibility for sustainability does not require Pareto-efficiency if and only if sustainable allocations are feasible. The Brundtland notion merely defines a minimum standard and allows for wasteful allocations once the standard is achieved.

If sustainability is not feasible, the criterion of responsibility requires Pareto-efficiency in order to minimize suffering in the sense of Singer.

Proposition 4 (discounted utilitarian welfare maximum)
There uniquely exists a discounted utilitarian welfare maximum. If no discounting takes place, $\delta = 1$, the utilitarian welfare maximum allocation is responsible. If, in contrast, discounting takes place, $\delta \neq 1$, the following holds:

For $\bar{R} \geq R^{min}$, the discounted utilitarian welfare maximum is a responsible allocation iff

$$\frac{\alpha_1}{\alpha_2}\left(\bar{R} - \frac{1}{\gamma}\right)^{\alpha_1 - 1} \leq \delta \leq \frac{\alpha_1}{\alpha_2}\left(\gamma(\bar{R} - 1)\right)^{1-\alpha_2}. \quad (16)$$

For $\bar{R} < R^{min}$, the discounted utilitarian welfare maximum is not a responsible allocation.

Proof: For $\delta = 1$, comparison of Eq. (15) with Eq. (10) shows that all allocations satisfying Eq. (15) must also satisfy Eq. (10). The same holds for and with Eq. (14) and Eq. (10) since $\alpha_t<\alpha$ for all $t=1,2$. For $\delta \neq 1$, using $R_2^R \geq 1/\gamma$ from Eq. (10) and $R_1^R \geq 1$ in Eq. (14) yields Eq. (16). Comparison of Eq. (15) with Eq. (11) shows that an allocation satisfying Eq. (15) cannot satisfy Eq. (11). □

Let us first discuss the case without discounting, that is $\delta = 1$. If sustainable allocations are feasible (i.e. $\bar{R} \geq R^{min}$), the utilitarian welfare maximum must be sustainable and responsible since marginal utility of both generations is strictly larger when the basic needs are satisfied (see Eq. (1)). Any non-sustainable allocation may thus not be a utilitarian welfare maximum. As there exist infinitely many sustainable and responsible allocations in this case, the utilitarian welfare maximum is merely on out of many responsible allocations. If sustainable allocations are not feasible (i.e. $\bar{R} < R^{min}$), Singer's principle requires from responsible allocations to minimize suffering which is simply a negative formulation of maximizing happiness and thus of the principle of Utilitarianism. It follows that the responsible allocation in this case must be a utilitarian welfare maximum.

Now, let us discuss discounting, that is $\delta \neq 1$. Discounting yields a sustainable and responsible allocation iff sustainable allocations are feasible and iff the discount rate is within the range from Eq. (16). The intuition is as follows. The Brundtland notion of sustainability merely defines a minimum standard of sustainability as satisfied basic needs. If this standard is feasible, discount rates that do not favor any generation too strongly yield sustainable allocations. Discount rates not satisfying (16) however, yield allocations in which the basic needs of one second generation cannot be satisfied and which are thus neither sustainable nor responsible.

The range from Eq. (16) has intuitive following properties. Intuitively, large technological progress (γ) allows for larger discounting of future utility. A large resource stock ($\bar{R}$) allows for a large discounting in general. Further, a large (small) ratio of α_1/α_2 allows for larger (smaller) discounting of future utility as it implies that marginal utility of the first generation is higher than of the second generation.

If sustainable allocations are not feasible, discounting is not responsible. Any non equal valuation of utility between generations may not minimize suffering and thus may not be responsible. This result is interesting in the light of the two ethically relevant arguments for discounting: growth with decreasing marginal utility and uncertainty.

The argument of growth with decreasing marginal utility cannot be upheld in favor of discounting if sustainability is not feasible, because it is already in the criterion of equal marginal utility. If there is growth in terms of a large γ, Eq. (11) shows that this yields a larger resource share for the first generation in the responsible allocation. Any further discounting can thus not be justified with this argument. The case of uncertainty is different. In our model, we assumed that there is no uncertainty. It may thus not be an argument for

discounting. Uncertainty, about e.g. γ, may very well justify discounting when sustainability is not feasible.

Figure 2 summarizes our main results for $\bar{R} \geq R^{min}$:

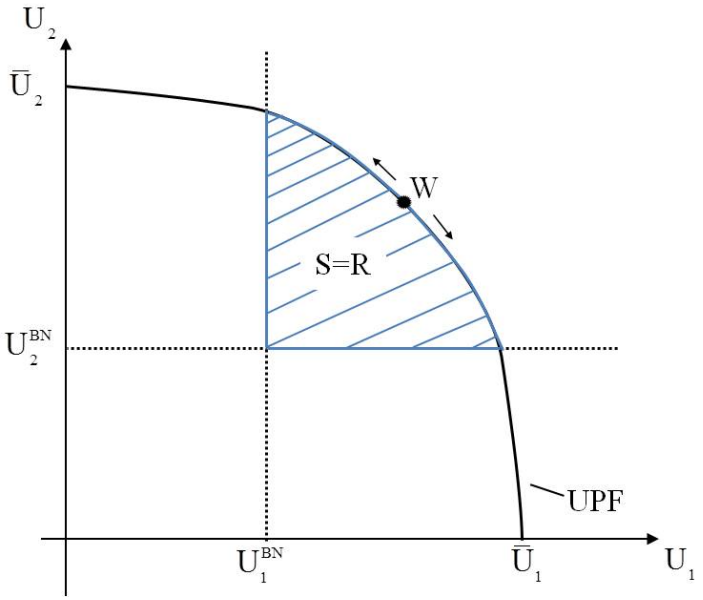

Figure 2: Illustration of responsible (R, dashed area), sustainable (S, dashed area), Pareto-efficient (UPF), utilitarian welfare maximum (W) and discounted utilitarian welfare maximum (D) allocations for $\bar{R} \geq R^{min}$.

The utility possibility frontier (UPF) connecting $\bar{U}_2$ and $\bar{U}_1$ contains all Pareto-efficient allocations. On the UPF, we find the utilitarian welfare maximum (W) well above those utility levels yielding satisfied basic needs, U_1^{BN} and U_2^{BN}. The discounted utilitarian welfare maximum (D) lies also on the UPF somewhere between W and $\bar{U}_1$, contingent on the discount rate. An increasing discount rate moves D towards $\bar{U}_1$. As the discount rate increases above the threshhold of Eq. (16), D moves below U_2^{BN} and thus yields an allocation which is neither sustainable nor responsible. Allocations that are sustainable (S) and responsible (R) are depicted by the dashed area which consists of the triangle between U_1^{BN}, U_2^{BN} and the UPF.

The picture changes fundamentally for $\bar{R} < R^{min}$ as shown in Figure 3:

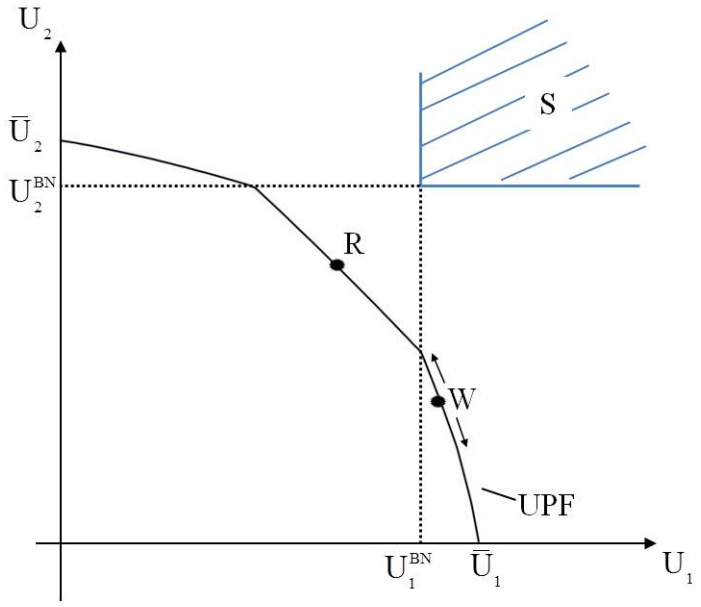

Figure 3: Illustration of responsible (R), sustainable (S, dashed area), Pareto-efficient (UPF), utilitarian welfare maximum (W) and discounted utilitarian welfare maximum (D) allocations for $\bar{R} < R^{min}$.

Again, the UPF is connecting $\bar{U}_2$ and $\bar{U}_1$ and contains all Pareto-efficient allocations. However now, there is only one responsible allocation (R) which equals W. R and W lie on the UPF but below satisfied basic needs levels. Since sustainability is not fesible, all sustainable allocations (S, dahed area) lie outside the UPF. We further see that D lies somewhere between R (=W) and $\bar{U}_1$, again contingent on the discount rate δ. As any $\delta < 1$ yields a D below R, the discounted utilitarian welfare maximum cannot be responsible. But as shown in Figure 3, it may lead to am allocation in which the first generation has its basic needs satisfied.

6 Conclusion

We have developed and formalized a utilitarian notion of responsibility which is inspired by Singer's (1972) principle and the Brundtland Commission's concept of sustainability (WCED 1987). Our results show that sustainabilty and responsibility for sustainability are equivalent if and only if sustainability is feasible. If it is not, there still exists a responsible allocation which is also Pareto-efficient. Further, the utilitarian welfare maximum with no discounting always fulfills the criterion of responsibility. Discounting may be rsponsible to a certain extent if sustainability is feasible. If sustainability is not feasible, discounting future satisfaction of basic needs is not responsible.

Our analysis demonstrates that reponsibility can be clearly and unambiguously conceptualized. Such a concept of responsibility is, albeit simple, neither trivial nor redundant, but adds specificity to the discussion about sustainabilty in two respects: (1) it clearly specifies how to act if sustainability is not feasible; (2) in any case, it specifies the balance between the claims of present and future generations.

With these achievements, also the limits of our analysis are clear: we have built on a specific idea of sustainability and on a specific ethics, both of which focus on the satisfaction of basic needs (and, thus, go together very well). For other aspects of sustainability they are less well suited, and other notions of responsibility will be needed.

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