


ARTICLE

# On the measurement of need-based justice

Nils Springhorn 

Institute for Social Sciences, Carl von Ossietzky University Oldenburg, 26111 Oldenburg, Germany  
Email: [n.springhorn@uol.de](mailto:n.springhorn@uol.de)

(Received 7 September 2018; revised 13 August 2021; accepted 31 August 2021; first published online 22 December 2021)

## Abstract

Need-based justice is an important ingredient for a pluralistic theory of justice. But how can need-based justice be measured? I will argue that need-based justice cannot be measured by measuring need-satisfaction. This is because need-based justice does not only depend on need-satisfaction, but also on opportunities to avoid or at least mitigate undersupply. Depending on these opportunities, one and the same degree of undersupply can be unjust to different degrees. In this article, I establish a number of desiderata that a measure of need-based justice has to comply with. Resulting measures treat avoidable undersupply as the main source of injustice.

**Keywords:** Measurement of need-based justice; need-based justice; measurement of justice; reasons for injustice; avoidable undersupply

## 1. Introduction

Why measure need-based justice? I think most would argue in the following way: If, for instance, an individual is endowed with 100 units of a good (for example income per month, daily food ration, living space etc.), while only exhibiting a need for 50 units, then from a perspective of need-based justice, this case has to be judged differently from cases wherein an individual with the same endowment has a different need. Examples could be a need of either 150 or 200 units. In the first case, the individual is oversupplied, while in the second and third cases the individual is undersupplied, and in the third case the individual is more strongly undersupplied than in the second case. In broader terms, the reason for measuring need-based justice is that from the perspective of need-based justice, one and the same endowment can be just or unjust to varying degrees.

My main contribution to measuring need-based justice is to show that approaches like these are too simple. On the basis of the need and endowment of an individual, you can make statements about her need-satisfaction or her supply situation, but in general you cannot make statements about need-based justice. This is because you do not know anything about possible alternatives.

© The Author(s), 2021. Published by Cambridge University Press. This is an Open Access article, distributed under the terms of the Creative Commons Attribution licence (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted re-use, distribution and reproduction, provided the original article is properly cited.

I will argue that unavoidable undersupply cannot be judged as unjust, and that one and the same degree of undersupply can be unjust to different degrees related to what better alternatives are feasible. The more opportunities to avoid or at least mitigate undersupply are given, the more unjust undersupply is and the fewer negative consequences are associated with mitigating undersupply, the more unjust undersupply is.

I start with an introduction to the framework of need-based justice. First there are two brief notes to the concept of need ('The ambiguity of 'Need' and 'Need'). Then I locate need-based justice in the more general field of justice ('Locating Need-based Justice'). Afterwards, I present some empirical findings related to need-based justice ('Empirical Findings') before I present the current state of measuring need-based justice ('Measuring Need-based Justice'). There I clarify that I am not interested in a measurement of the perception of justice but instead in normative reasoning ('Empirical and Normative Approaches'). This is followed by an introduction to the axiomatic approach and the way in which I follow it ('Axiomatic Approach'). I introduce the difference between one-dimensional and multi-dimensional measurement and argue why, although the multi-dimensional measurement is more appropriate to measure need-based justice in the long run, the one-dimensional measurement is worthy of detailed study ('One-dimensional and Multi-dimensional Measurement'). After giving necessary notations and definitions, I give an overview of existing contributions to measuring need-based justice with a focus on the measures of Jasso (1978, 1999), Miller (1999), Siebel (2017) and Traub *et al.* (2017) ('Approaches'). My contribution begins with a critical examination of these contributions ('Deficits of these Approaches'). Next to some specific criticisms, my main objection is that these approaches do not consider whether there is an opportunity to mitigate undersupply (at least that they do not explicitly), although this is very relevant for judging need-based justice.

The section 'A new Approach on Measuring Need-based Justice' details a new approach that takes this into account. First, I ask for reasons for need-based justice and reasons for need-based injustice ('Reasons for Need-based justice' and 'Reasons for Need-based injustice'). I argue that oversupply is not unjust *per se*, but can cause injustice if undersupplied individuals exist. Oversupply is unjust for the undersupplied, because if oversupply exists, the opportunity to mitigate undersupply is given. In the next section ('Different Degrees of Need-based Injustice') and subsection ('Different Degrees of Opportunities to Mitigate Undersupply') I examine different scenarios to look for different opportunities to mitigate undersupply. For the sake of simplicity, I confine myself to different opportunities to mitigate undersupply that are given by different endowments of other individuals (but at least I give an outlook on how to proceed in a more general way). For example: If the endowment of oversupplied individuals increases, the injustice for undersupplied individuals increases because the opportunity to mitigate undersupply increases. A, in some sense more general, and in some sense alternative, line of argument is given in the next section ('Different Consequences of Mitigating Undersupply'). There I take different burdens into account, that are associated with mitigating undersupply by transferring endowment to undersupplied individuals. For example, the withholding of a transfer is more unjust the less severe the associated burden is.

That is another argument for why growing endowment of oversupplied individuals increases injustice for undersupplied individuals. The burden is related to the need-satisfaction of potential transfer donors, which is why I take the needs of these into account. Moreover, I consider that the burden related to losing an amount of endowment is greater the worse the need-satisfaction is. Therefore, overall injustice decreases by transferring endowment from individuals that are better off to individuals that are worse off. In the section ‘A new Approach on Measuring Need-based Justice’ several desiderata for measuring need-based justice are detailed. In the section ‘The Individual Level’ a measure is defined that fulfils them all. Although the whole article focuses on the justice evaluation for a single individual, a brief outlook is given on aggregation (‘The Aggregated Level – an Outlook’).

Towards the end, I make a few notes about special topics. First (‘Remarks on the Relation between the Measurement of Need-based Justice and Poverty Measurement’) there is an interesting difference between measuring need-based justice and measuring poverty. While it is debatable whether the poverty of the poor increases when the wealth of the rich increases, from a perspective of need-based justice, I think, the matter is clear: injustice is increasing. The second note is dedicated to the differentiation of comparative and non-comparative measures (‘Remarks on Comparability and Non-comparability’). Most measures of justice or poverty can be categorized as either comparative or non-comparative, which means that they either judge justice by comparing individuals or judge justice by individual attributes. My guess is that this does not fit for measures of need-based justice, because the crucial point is to compare the given situation of an individual with feasible alternatives in need-satisfaction and not with other individuals. This is also a kind of comparison, but not in the usual sense. The last note is about relations between the justice principles need, equality and effort (‘Remarks on the Relations between the Justice Principles Need, Equality and Effort’). Next to an outside relation between these principles which is given by an interplay of different justice principles in a pluralistic framework, there are inside relations. As a result of the fact that overall injustice decreases by transferring endowment from individuals that are better off to individuals that are worse off, in cases where the overall endowment is smaller than the overall need, the overall injustice reaches its minimum by a distribution of endowment that leads to equality in need-satisfaction. That is interesting because some researchers require equality in need-satisfaction, which I am not doing for a number of reasons. As mentioned above, for the sake of simplicity, I confine different opportunities to mitigate undersupply to those which are given by different endowments of other individuals. In a more sophisticated approach, it must be considered whether an undersupplied individual can or cannot improve his situation by achieving more endowment himself. Therefore, the question of how effort can be taken into account is also relevant within the framework of need-based justice.

## 2. The ambiguity of ‘need’

The term ‘need’ is ambiguous. If an individual is endowed with 100 units and her need is 60 units, there are two ways to comprehend it. It may mean that she has

100 units at her disposal, but she only needs 60 units, therefore she has 40 units *more* than necessary. And it may mean that she has 100 units at her disposal, but she needs 160 units, therefore 60 units are missing, which defines the need. I will follow the former. Need is the threshold the endowment should meet and not a gap that should be filled. In the following, I will also adapt references to the best of my knowledge if necessary.

### 3. Need

The question of what the need of an individual is cannot be discussed without reference to the question what the endowment of the individual should be sufficient for. The answers differ widely. The possibly most influential approach to classify needs is Maslow's (1943) theory of human motivation. The theory holds that there is a hierarchy of needs with physiological needs at the bottom, outranked by safety, love/belonging, and esteem needs, and with self-actualization at the top. The lower the need is in the hierarchy, the stronger it is. Absolute concepts of poverty like the basic needs approach (Streeten *et al.* 1981) rely on expert knowledge regarding the minimum cost diet that secures physical survival of an individual (Seidl 1988). Studying the living conditions of the working class in York, Rowntree (1901) for instance defined 'families whose total earnings are insufficient to obtain the minimum necessities for the maintenance of merely physical efficiency' (1901: 86) as poor. Living standards in a society can grow or shrink. Restricting needs purely to physical survival would ignore the fact that the satisfaction of both physiological and psychological needs contributes to mental health and thus the wellbeing of people (Deci and Ryan 2000; Ryan and Deci 2000). Sociological relative deprivation theories (Runciman 1966; Townsend 1974) carry the subjectivity of needs to the extreme. According to Runciman (1966) a person is in need if she does not have something, somebody else has it, she wants to have it, and she thinks that obtaining it is realistic. Both the purely absolute and the relative view of need and poverty were harshly criticized by Sen (1983). He proposed the concept of absolute neediness instead. A person is absolutely needy if she does not have the capability, say, in terms of income, to partake in the commonly accepted activities of the community. This is the so-called capabilities approach (Nussbaum 2000, 2011; Sen 2009). But there are more. For example, Braybrooke (1987) argues for the goal of a normal course of life, Daniels (1979) for a normal range of opportunities, Schuppert (2013) for agency and Sher (2014) for 'leverage', meaning the capacity to acquire additional goods. A general discussion of the goals at which need fulfilment could aim is given by Miller (1999: sec. 10).

Nearly all of these approaches can be discussed individually or collectively, which means one can take differences between individuals into account and discuss values of need that depend on individual attributes and therefore differ from individual to individual in general, or one value that fits all. Which path to take may depend on the research focus. Looking at economics, individual differences are likely to cancel each other out statistically, so it cannot be a surprise that economists often work with one value for all – which is typically referred to as the poverty line. But it

will be clear to everyone that a value for all is an oversimplification that does not do justice to the individual. Therefore, more sophisticated approaches in economics take the differences into account by using equivalence scales. For example, the equivalent income of a household represents that income which, if given to a reference household – typically a single adult – will allow it to attain the same welfare level. Examples for equivalence scales can be found in Atkinson and Bourguignon (1982), Donaldson and Pendakur (1999) or Ebert and Moyes (2003).

However, this article is on measuring need-based justice and not on identifying or measuring need. As in ethical poverty measurement (pioneered by Sen 1976), I assume that in a first step need has to be acknowledged at a societal level. I will assume that this acknowledgement procedure takes individual need generating attributes into account. I will assume that an acknowledgement procedure has already taken place, and that there is a consensus that the endowment of an individual should not fall below her individual need. Therefore, I consider the individuals' need as exogenously given variables.

#### 4. Locating need-based justice

Need-based justice is a special kind of justice, or in other words, the concept of justice in general is a concept superordinate to need-based justice. I follow Konow and Schwettmann (2016) in the belief that justice in a general sense is pluralistic and context dependent. Justice is pluralistic if it consists of multiple justice criteria such as equality, equity, effort or even need. It is context-dependent if the weight that is given to each criterion depends on impersonal factors (related to culture, tradition, shared history etc.) and personal attributes (such as age, capabilities, education, the existence of a disability). Justice in a general sense results from the interplay of different justice principles, one of which is need-based justice (Konow 2001, 2003). Need, in addition to the two top dogs equality and equity, is often regarded as a central component of a pluralistic theory of justice (Konow 2001, 2003; Konow and Schwettmann 2016).

Because the topic of this article is (measuring) need-based justice – as one of several justice principles which interplay – for reasons of readability, I will henceforth often speak of justice when in fact I mean need-based justice. Thereby I dispense with cumbersome formulations such as 'just from the perspective of need-based justice' or 'unjust concerning need'. If another or a general concept of justice is meant, then this will be stated explicitly. But this shall not mean that I assign a higher status to the principle of need-based justice as compared with other principles of justice, or that I intend to equate need-based justice with justice.

#### 5. Need-based justice

##### 5.1. Empirical findings

That the principle of need-based justice is often given a dominant role, particularly in cases in which the endowment of an individual is smaller than her need, is shown in empirical studies. For example, Lamm and Schwinger (1980, 1983) found that

needier individuals get more money allocated even if they had contributed equally to a project. Yaari and Bar-Hillel (1984) found a preference for distributing fruits in such a way that the need for vitamins is met even if the metabolic efficiencies of the individuals differ. Frohlich *et al.* (1987) as well as Traub *et al.* (2005) found a strong prevalence of the ‘Boulding principle’ (Traub *et al.* 2005), that is the maximization of the average payoff constraint by a floor given by need. For a survey see Gaertner and Schokkaert (2012). It is therefore surprising how little attention has so far been paid to measuring need-based justice.

## 5.2. Measuring need-based justice

### 5.2.1. Empirical and normative approaches

In the justification of theories of justice (as in many other areas) there is a tension between empirical approaches and normative approaches, which is also reflected in the measurement of justice. Simplified, the aim of purely empirical approaches is to model the actual perception of justice, while the aim of purely normative approaches is to find a function that fulfils well-founded requirements for measuring need-based justice. Measures of need-based justice can be developed from both perspectives. I think both approaches have their justification and at best, they enrich each other.

In this article I am interested in normative reasoning. That is why I do not consider principles that are relevant for modelling justice perception, such as the Hatfield Principle ‘equality [or justice] is in the eye of the beholder’ (Walster *et al.* 1973: 154), which describes that justice judgments are observer-specific – or in other words that the position of the judge must be taken into account when modelling the perception of justice. For example, the judgement of one’s own situation is often different from the judgement of another’s situation, although they may be in the same situation. Instead of this, I think that – like in poverty measurement – an anonymity axiom should hold (Kockläuner 2012: 13) in a normative approach. This axiom states that a measure should be independent of which individual possesses a given combination of attributes or in other words, the measure should not be observer specific. But that does not mean that I think that an individual who feels judged unjustly is wrong because a measure gives the correct value. The values a measure gives result from properties the measure has, and these are stated within the framework of the axiomatic method (and can be criticized – see the next section).

### 5.2.2. The axiomatic approach

The axiomatic approach is widely appreciated as it reduces the state of a theory to its core and allows an elegant and concise representation. In hardcore practice, the whole theory can be traced back to as small a number of axioms as possible, from which all propositions of the theory can be derived. The axioms must be necessary and sufficient to derive the entire theory from them.

But there is another reason for using the axiomatic approach, described by one of the great specialists of the deductive method, Tarski (1965). According to him, the axiomatic approach can be understood as a research methodology (I sum it up

and adapt it to the development of measures). An essential part of the procedure is the reasoning and collecting of single properties that a measure should possess. These requirements are noted in axioms. Based on a set of axioms, one can answer various questions using this technique. For example, you can show the compatibility or non-compatibility of properties, you can deduce further properties that are given if single or multiple axioms are fulfilled, you can categorise measures by the axioms and the deduced properties, you can show the uniqueness of a measure – if given –, or otherwise the (mathematical) class to which a measure belongs, and more. The real strength of the axiomatic method lies in its ability to examine various combinations of well-founded axioms. For example, if the original or an extended combination is not compatible, you must take a step back and adjust at least one axiom or drop it. It is the same when a combination leads to unsustainable, implausible or undesirable derivations. But on the other hand, anyone who accepts the axioms must accept the consequences.

So, following the axiomatic approach, the question whether “justice is in the eye of the beholder” arises in another way. If someone thinks that the situation of any individual is judged unjust, he is free to criticize, adapt or drop all or single axioms, to add axioms or propose a completely new set of axioms. He, as well as the researcher who takes up such a finding, is obliged to state the reasons for his judgement, by doing so. The axioms may lie in the eye of the beholder in a certain sense – but not the results.

But the development of measures of need-based justice is in its infancy, which is why I do not exhaust the potential of the axiomatic approach in this article. The focus of this work is on the reasoning of fundamental properties that such a measure should possess. Next to the reasoning and collecting of single properties that a measure should possess, the only deductive steps that I take are to show the compatibility of these properties by giving a measure that is possessed by them all and in the deduction of one more property. Therefore, it might be a bit exaggerated to say that the axiomatic method is used here. But although I regard the contributions presented in this article as important, I do not think that they answer all questions of measuring need-based justice. They are only a first step. That is why this article is designed to ensure that further work can be carried out within the framework of the axiomatic method, and this is why I do not use the term ‘axioms’, but the weaker term ‘desiderata’.

### *5.2.3. One-dimensional and multi-dimensional measurement*

As can be seen from Maslow’s hierarchy of needs, there are needs of various kinds. How just is it, if an individual’s need of a first type is satisfied but not her need of a second type? How can one aggregate this,<sup>1</sup> and get a measure that is not only related to one type of need (one-dimensional measurement), but to two or more (multi-dimensional measurement)? This question also arises in poverty

---

<sup>1</sup>This aggregation should not be confused with the aggregation level mentioned. The aggregation of different types of needs occurs at the individual level. Otherwise, when I speak of the aggregation level, I mean the aggregation of individual justice evaluations.

measurement. You can be rich in one dimension and poor in another and there is a vast literature on pros and cons of different approaches (a good introduction is given by Thorbecke (2007), a comprehensive summary of various multi-dimensional poverty measures can be found at Kockläuner (2012)). I think this is as relevant in need-based justice measurement as in poverty measurement. But it is not possible to simply transfer multidimensional approaches from poverty measurement to the measurement of need-based justice, because, as I will explain, there are already significant differences in one-dimensional measurement. Therefore, in this article I will stick to one-dimensional measurement.<sup>2</sup>

#### 5.2.4. Notations and definitions

I consider a set  $I$  of individuals. The total number of individuals is denoted by  $\#I$  (in order not to get confused with several notations of need that use the letter 'n', which is typically used to denote this number). The need of a specific individual  $i, j, \dots \in I$  is denoted with  $n_i, n_j, \dots$ . The profile (vector) of the need of all individuals is denoted by  $\mathbf{n} := (n_1, \dots, n_{\#I})$ . It is assumed that every individual  $i$  that is considered has a need of the good in question  $n_i > 0$ , because individuals without need are irrelevant from the perspective of need-based justice. Analogous to the need, the endowment of specific individuals  $i, j, \dots \in I$  is denoted with  $e_i, e_j, \dots$ . Every individual  $i$  is endowed with an endowment  $e_i \geq 0$ , that means that they are endowed to a certain non-negative degree with the good in question or not, but for the sake of simplicity I do not take any negative endowments into account (that in some cases could be interpreted as debts). The profile of endowments is denoted with  $\mathbf{e} := (e_1, \dots, e_{\#I})$ .

Note, that there is an essential difference between endowment and need. The need and endowment of an individual can change intrinsically (a child has usually a different need than an adult, the endowment at the beginning of the month is typically greater than at the end). But while the total endowment can be distributed differently by redistribution (that entails a change in the endowment of both concerned individuals – which, however, is not intrinsic, but extrinsic), the total need cannot.

The need and the endowment of an individual allow statements to be made about the individual's supply situation or need-satisfaction. If  $e_i = n_i$ , the individual is exactly supplied, her need is exactly satisfied or met, if  $e_i \geq n_i$  the individual is supplied, her need is satisfied or met, if  $e_i > n_i$  the individual is oversupplied, her need is more than satisfied, if  $e_i < n_i$  the individual is undersupplied, her need is not satisfied or met.

A measure of overall need-based justice is a mapping  $J$  from at least  $(\mathbf{e}, \mathbf{n})$  to at least a subset of  $\mathbb{R}$ . Some authors – and I follow them – explicitly consider measures

<sup>2</sup>This means that one dimension of need is taken into account (for example, only the need for food and not also for living space (which would be another dimension of need)). In parallel, the endowment is considered in the same dimension. If need and endowment are considered in one dimension, the measurement is called one-dimensional (and not two-dimensional because of the two influencing variables need and endowment).



of need-based justice for single individuals in addition to measures of need-based justice for overall justice. In such a case, I index the measure:  $J_i$ .

In the following, I will also transfer these notations, definitions and terminology to approaches of other authors in order to discuss them in a uniform framework.

### 5.2.5. Approaches

Approaches to a theoretical justification and to a measurement of need-based justice can indeed already be found in Plato (1973) and Aristotle (2009: Book V). But they are less explicit, so it is a laborious work, and some interpretations are needed to work out measures of need-based justice from their statements. Siebel (2017) has done this work.

According to him the Platonic measurement is best described as a measure of non-comparative deprivation, which is given by measuring the difference of the actual need-satisfaction of an individual and the ‘Platonic ideal’ of at least need-satisfaction (this, like the following, is a summary and simplification of the approaches – for details see the original). That means, if the endowment of an individual is at least as large as her need, this is just respectively not unjust from a perspective of need-based justice (I will come back later to why it is important to distinguish between just and not unjust) and, if the endowment of an individual is smaller than his need, this is unjust. Thereby the degree of injustice is given by the (absolute) difference of the value of a measure that measures the actual undersupply of an individual (Siebel gives the formula  $|\min(\ln(e_i/n_i), 0)|$  for this<sup>3</sup>) and the value this measure takes if the individual endowment meets the individual need (for  $|\min(\ln(e_i/n_i), 0)|$  this is 0 and can therefore be ignored). Thereby he comes to the following (aggregated) formalisation (Siebel 2017: 5, 13):

$$J_{\text{Plato}}(\mathbf{e}, \mathbf{n}) := \frac{1}{\#I} \sum_{i \in I} \left( \left| \min \left( \ln \left( \frac{e_i}{n_i} \right), 0 \right) \right| \right)^4$$

The Aristotelian measurement can be described according to Siebel in contrast to Plato as a measure of comparative deprivation, which is given by measuring the difference of the actual need-satisfaction of an individual and the ‘Aristotelian ideal’ of equal need-satisfaction for all individuals. The actual need-satisfaction of an individual is not compared to the situation where the need is met, as with Plato, but to the situation where everyone’s need is met to the same degree. The degree of injustice is evaluated by the (absolute) difference of the value of a measure that measures the actual need-satisfaction of an individual (Siebel gives the formula  $\ln(e_i/n_i)$  for this<sup>5</sup>) and the value this measure takes in case of equal need-satisfaction for all (which is given by Siebel as  $\ln(\sum_{i \in I} e_i / \sum_{i \in I} n_i)$ ). Thereby he comes to the following (aggregated) formalization (Siebel 2017: 3f., 13):

<sup>3</sup>It should be noted that this is not a formalization of the “raw form” of either Plato’s reflections or Siebel’s interpretation of Plato. In the formalization Siebel makes adjustments with the aim of integrating this measure into his own measure (see the part on Siebel below). In particular, the logarithm is not to be found in Plato. Siebel takes it from Jasso’s measure (see the part on Jasso below).

<sup>4</sup>I have set the bars for the absolute value function differently from Siebel because I think he made a mistake here.

<sup>5</sup>Also here further considerations that do not follow directly from Aristotle matter – see the footnote on Plato.

$$J_{\text{Aristotle}}(\mathbf{e}, \mathbf{n}) := \frac{1}{\#I} \sum_{i \in I} \left| \ln\left(\frac{e_i}{n_i}\right) - \ln\left(\frac{\sum_{i \in I} e_i}{\sum_{i \in I} n_i}\right) \right|.$$

Siebel himself proposes a measure that considers both the absolute deprivation as well as the relative deprivation to be relevant for measuring need-based justice. Therefore, he explicitly refers to his interpretations of Plato and Aristotle and creates a ‘Platotelian’ measure, that is given by a weighted average of the Platonic and the Aristotelian measure (Siebel 2017: 14):

$$\begin{aligned} J_{\text{Siebel}}(\mathbf{e}, \mathbf{n}) &:= -a * J_{\text{Plato}}(\mathbf{e}, \mathbf{n}) + (1 - a) * J_{\text{Aristotle}}(\mathbf{e}, \mathbf{n}) \\ &= -a * \frac{1}{\#I} \sum_{i \in I} \left( \left| \min\left(\ln\left(\frac{e_i}{n_i}\right), 0\right) \right| \right) \\ &\quad + (1 - a) * \frac{1}{\#I} \sum_{i \in I} \left| \ln\left(\frac{e_i}{n_i}\right) - \ln\left(\frac{\sum_{i \in I} e_i}{\sum_{i \in I} n_i}\right) \right|, \end{aligned}$$

with  $0 \leq a \leq 1$ .

Next to Siebel, Miller is one of the few who has explicitly thought about measuring need-based justice in modern times (Miller 1999: sec. 10). He makes many good and important arguments. Unfortunately, he does not give a calculation formula for the numerical examples that illustrate his arguments (but because he gives many numerical examples, it can be assumed that he had a calculation formula in mind). I think Miller’s idea is best summarized with summing up the (absolute) differences in undersupply (Miller 1999: 217f.). One way to formalize this is the following:

$$J_{\text{Miller}}(\mathbf{e}, \mathbf{n}) := \sum_{i=1}^{\#I-1} \sum_{j=i+1}^{\#I} \left| |\min(e_i - n_i, 0)| - |\min(e_j - n_j, 0)| \right|.$$

In some sense, this can also be understood as a combination of the Platonic and the Aristotelian measure. For every undersupplied individual, Miller evaluates the difference of the endowment of the individual and her need to determine the need gaps. Then he sums up the absolute differences of all these gaps. Thereby he considers the absolute deprivation and the inequality in need-satisfaction. The latter is because the sum of the absolute gap differences increases with increasing differences of the gaps.

Other measures of need-based justice are given by Traub *et al.* (2017). Their approach highlights the ‘(in-)efficiency’ of the distribution of the overall endowment. For that they evaluate that part of the overall endowment that is not used to satisfy an individual’s need, by summing up the differences between the individual endowment and the individual need of the oversupplied individuals and put this in relation to the overall endowment. From their perspective, this share is allocated inefficiently and causes injustice. The measure of need-based justice they propose is a combination of measuring need-satisfaction and measuring inefficiency. If the need-satisfaction of the undersupplied individuals decreases, the overall injustice increases and vice versa. But also, if the inefficiency increases, the overall injustice increases and vice versa. Traub *et al.* propose several measures, the most advanced is the following (Traub *et al.* 2017: 8):

$$J_{\text{Traub}}(\mathbf{e}, n) := \frac{\Gamma}{\#I} \sum_{i \in I} \gamma_i^b,$$

with  $\gamma_i := \min(e_i/n, 1)$  for measuring the need-satisfaction (note that Traub *et al.* do not consider individual need, but assume the same need for all individuals),

$$\Gamma := \begin{cases} 1 - \sum_{i \in I} \max(e_i - n, 0) / \sum_{i \in I} e_i, & \text{if an undersupplied individual exists} \\ 1, & \text{else,} \end{cases}$$

and  $0 < b < 1$ .

In addition, there is a wealth of publications on measuring poverty, justice (as a concept superordinate to need-based justice), distributive justice and inequality in which need-based justice is mentioned in passing and/or which can be understood as contributions to the measurement of need-based justice.

Some of these are from Jasso. Because I will follow Jasso in methodological procedure, I explain her approach in more detail. In particular, I consider it very profitable that Jasso not only – as the other authors do – examines aggregated measures, but explicitly and extensively turns to measures that make justice statements on the individual level as the starting point. In my view, this contributes to clearer and more detailed examination and argumentation.

Starting in 1978, Jasso recommended justice measures, and in extensive publications these have been normatively and theoretically examined and substantiated<sup>6</sup> as well as empirically applied.<sup>7,8</sup> Jasso's measures are not explicitly measures of need-based justice but more general measures of justice. However, they can be understood as measures of need-based justice because the influencing variables are the actual value of a good an individual has on the one hand and a comparative value that is acknowledged as just on the other. Jasso does not put any restrictions on the comparative value. In her empirical studies, she assumes that the comparative value acknowledged as just results from individual attributes such as age, gender or a potential disability. Thus, her measures seem to be good candidates for measuring need-based justice if the individual's need is used as the just comparative value.

According to Jasso, for an individual  $i$  justice evaluation can be expressed by the following so-called 'justice evaluation function' (Jasso 1978: 1417):

$$J_{\text{Jasso } i}(e_i, n_i) := \ln\left(\frac{e_i}{n_i}\right).$$

There is perfect justice for the individual in question if its endowment and need match. If the endowment is smaller than the need, the individual is unjustly undersupplied and if the endowment is larger than the need, the individual is unjustly oversupplied. The logarithm leads to non-linear growth of (in)justice: if in the case of undersupply there is a large difference between the endowment and the need, then a small change in one of these variables has a larger

<sup>6</sup>See Jasso (1978, 1980, 1983, 1988, 1990, 1996, 1999), Jasso and Wegener (1997).

<sup>7</sup>See Jasso (1978, 1996, 2006, 2007), Jasso and Webster (1999), Jasso and Resh (2002), Jasso and Meyersson Milgrom (2008).

<sup>8</sup>An excellent introduction to the work of Jasso may be found in Liebig (1997: 131–141).

influence on the justice evaluation than when the variables are close to one another, or when the individual is oversupplied.

As an aggregated measure, Jasso first proposes the arithmetic mean of the individual justice evaluations (Jasso 1999: 144):

$$J_{\text{Jasso1}}(\mathbf{e}, \mathbf{n}) := \frac{1}{\#\mathbf{I}} \sum_{i \in \mathbf{I}} \ln\left(\frac{e_i}{n_i}\right).$$

But because this measure displays perfect justice also when some individuals are undersupplied and others oversupplied, and the individual evaluations cancel out to 0, she introduces the arithmetic mean of the absolute values of the individual justice evaluations (Jasso 1999: 144):

$$J_{\text{Jasso2}}(\mathbf{e}, \mathbf{n}) := \frac{1}{\#\mathbf{I}} \sum_{i \in \mathbf{I}} \left| \ln\left(\frac{e_i}{n_i}\right) \right|^9.$$

This measure takes the value 0 only if all individuals are endowed perfectly just. As Jasso herself notes (but does not fix), the disadvantage of this measure is that it always takes positive values (except in the case that all are exactly supplied) and thus the important distinction between on average undersupplied societies and on average oversupplied societies is lost.

### 5.2.6. Deficits of these approaches

The approaches have in common that in all of them (except Aristotle's, I'll come to that later) undersupply is determined as one or even the exclusive source of injustice. I see that as problematic. I think that the difficulties involved can best be seen by starting with a focus on a single individual (the way Jasso does). For this purpose, consider a completely isolated individual, for example a lonely castaway on a deserted island:

Scenario 1: A separated lonely castaway  $i$  has a need of 100 units and an endowment of 20 units. Therefore, he is extremely undersupplied.

In everyday usage, it is permitted to say that his endowment is not need-based in the sense of being not in line with his demands. However, conceptual caution is required. If nothing more is to be expressed than that the castaway's endowment does not satisfy his need, then this is unproblematic. This, however, would be a statement about the *need-satisfaction* or the *supply situation* of an individual, but not a judgement of *justice*. As a justice judgement, the statement proves to be problematic. Let us assume, for the sake of clarity, that the castaway's situation

---

<sup>9</sup>It should not come as a surprise that this measure is very similar to the measure Siebel proposes for Plato, because Siebel makes the formalisation of his interpretation of Plato in the knowledge of and in relation to Jasso's measure (see the footnote above). However, the conception and argumentation of Plato and Jasso differ: for Plato, in the case of undersupply, it is a matter of comparing the given supply situation with a supply situation in which the individual in question is not undersupplied. For Jasso, it is a matter of comparing the given endowment of an individual with its endowment that is considered just. I do not want to claim that the approaches are clearly different. But it would be wrong to equate them solely on the basis of formal similarity (which is given by Siebel and not by Plato).

cannot be improved. There are no resources on the island to increase his endowment, aid deliveries are not possible (and he was thrown into this situation by a chain of unfortunate but unavoidable circumstances, so that questions of responsibility do not matter). The example is constructed for the purpose of raising the question of whether statements about the need-based justice for an individual can be derived solely from the supply situation of the individual, or in other words, from his need and his endowment. In such a case of unavoidable undersupply, I find it inappropriate to speak of justice or injustice. I cannot see that a judgement of justice can be made in such a case. My impression is rather that one makes a categorical error when doing so. Unavoidable undersupply (as well as unavoidable oversupply) of an individual cannot be considered as just or unjust. To do so is a little bit like Newton judging the fall of an apple as unjust. In other words, there are situations that are neither just, nor unjust, but both not just *and* not unjust – and of particular importance here is that they are not unjust.

But the measures of (according to Siebel) Plato, Miller, Siebel, Traub *et al.*, and Jasso indicate that the situation of *i* is unjust (for Siebel this is more precisely valid if the Platonic component is not weighted with 0 and his measure is thus identical with that of (according to him) Aristotle). Jasso makes it easy to verify this, because she explicitly refers to the individual level and gives a mathematical formulation with her justice evaluation function. In Scenario 1, the function takes a value lower than 0 and thus indicates injustice, quite simply because the endowment is smaller than the need. The other authors do not explicitly address how to deal with the case of a single individual. If one sets  $I = \{i\}$ , the situation for *i* is designated as unjust. Because there is no inequality and no inefficiency, only undersupply determines need-based justice and, measured by this, the situation is unjust. Why undersupply grounds injustice (in Scenario 1 and beyond) and why it can even be equated with it in terms of measurement theory is not explained. I think Scenario 1 shows the necessity for this.

However, I have the impression that this purely formal procedure may not do justice to the ideas of these approaches, because the components of inequality or inefficiency, which are so important for these approaches, do not play any role in the case of a single individual. Therefore, scenarios in which this is the case will also be considered. For this purpose, assume that the individual *i* is not stranded alone on the island, but together with individual *j*:

Scenario 2: Both individuals have a need of 100 units. *i* has as before an endowment of 20 units and is therefore extremely undersupplied. *j* has an endowment of 200 units and is therefore significantly over-supplied.

The overall situation in Scenario 2 is shown to be unjust by all measures. Next to the undersupply of *i*, this is due to inequality (*i* has 20 units, *j* has 200, *i*'s need is met by 20%, *j*'s need by 200%) or inefficiency (100 of the 220 units of the total endowment are not used to meet need). At the individual level, it would probably be argued that the situation is unjust for *i* because *i* is undersupplied and/or *j* is better supplied than *i* and/or *j* is oversupplied while *i* is undersupplied. I agree with the judgement that the situation for *i* as well as the overall situation is unjust, but for different reasons (which I will outline below). The reasons given do not seem convincing to me.

Miller himself criticizes his own conception (but offers no alternative), because considering equality implies that injustice decreases also if all individual supply situations fall to the supply situation of the worst supplied individual or below, as long as the supply situations are equal. I think that this consequence discredits all approaches that take inequality into account. To be able to increase need-based justice by pushing everyone down to a low (albeit equal) level is as paradoxical as it gets. This concerns not only Miller, but also Aristotle and Siebel. Siebel may be able to get off the hook in this respect because the Platonic part of his measure can compensate for this – depending on the weighting of the Platonic part (while inequality decreases, the undersupply of *j* increases if the endowment of *j* converges to that of *i*). However, since Siebel does not specify how the components of his measure – which are in conflict in this aspect – are to be weighted, this cannot be seen as a solution. Depending on the weighting, the measure is more or less affected and if the Platonic part is weighted with 0, the measure is fully exposed to criticism. Furthermore, the question arises what in addition to measuring equality the specification of measuring need-based justice is except for measuring need-satisfaction. Following Konow and Schwettmann (2016), equality is one of several justice principles that has to be weighted next to others. If one measures need-based justice by weighting need-satisfaction and equality, what is measuring need-based justice other than measuring need-satisfaction? Scenario 1 gives reasons to doubt that measuring need-satisfaction is an appropriate way for measuring need-based justice. More fundamentally, one must ask whether and if so, for what reason any comparisons between individuals are appropriate at all when measuring need-based justice (Plato, for example, has a different view). I am not saying that *j*'s supply situation has no influence on the assessment of *i*'s need-based justice (and as I will explain below, I do see an influence in this respect). But I can also imagine bad reasons for such influence. In addition to a possible mixing of justice principles (especially need-based justice and equality), this includes the danger of seeing injustice – pointedly expressed – in the fact that *j* is (over-)supplied or not as badly supplied as *i*, rather than in the fact that *i* is undersupplied or not as well supplied as *j*.<sup>10</sup> The authors' explanations are too unspecific to be able to exclude such and similar reasons. In this respect, I see the approach by Traub *et al.* as an important step in the right direction (even if they do not take individual need into account and thereby lag behind all other approaches in this respect). With regard to Scenario 2, one can understand their approach in the *formal* version as follows: It is not that *j* has a greater endowment than *i*, or more generally: that *j* is better supplied than *i* (and thus the inequality) that accounts for injustice (for *i*), but that *j* has more than he needs, while *i* is undersupplied. If *j* gave *i* some of his endowment, *i*'s supply situation could be improved. That *j* does not do this is – to use their term, which I find unfortunate – inefficient and generates injustice. Understood in this way, the approach does not (directly) compare the supply situation of individuals but takes into account the supply

<sup>10</sup>I cannot see how the former – that someone is well supplied – could justify injustice from the perspective of need-based justice (inequality or motives such as envy or resentment are – even if understandable and possibly relevant for a more general assessment of justice – not reasons that count from the perspective of need-based justice).

situation of oversupplied individuals when assessing the supply situation of undersupplied individuals. Unfortunately, the authors do not say this and perhaps they did not intend it. The concept of inefficiency used by them remains abstract, one can only speculate about the argumentative/conceptual background to a large extent and there is no confirmation of this understanding. One argument against this understanding is that inefficiency not only has a multiplicative effect on the measurement of the need-satisfaction of the undersupplied individual (so that one could think that – simplified – undersupply multiplied by inefficiency results in injustice), but also on the measurement of the need-satisfaction of the oversupplied individual. This seems problematic to me, because  $j$ 's situation can hardly be considered unjust from the perspective of need-based justice. Not only would further explanations be desirable here, but this may also be taken as an example of the advantages of Jasso's approach with its clear distinction between the individual and the aggregate level, as this would make it possible to recognize what exactly is seen as an injustice-generating element. Furthermore, the question arises why inefficiency is made (exclusively) dependent on oversupply. Is there not also inefficiency if all individuals are undersupplied to varying degrees, so that efficiency can be increased if individuals who are (significantly) better supplied than others transfer a part of their endowment to the more undersupplied (thus the case that oversupplied individuals could support undersupplied individuals (but do not do so, which generates injustice) would only be a special case)? In such a case, however, this approach also equates the measurement of need-based justice with a measurement of need-satisfaction, which again raises the question of why undersupply (per se) causes injustice. The lack of an answer to this question is, in my view, an essential point of criticism to which all approaches are exposed (Aristotle, as said, excluded, who for other reasons disqualifies himself). My impression is that this question cannot be answered because there are simply no reasons to derive injustice (exclusively) from undersupply. In my view, the decisive factor for the assessment of injustice from a perspective of need-based justice is not the supply situation of an individual, but rather the answer to the question of whether in the case of undersupply, the supply situation of an affected individual could be improved, and what (negative) consequences are associated with this improvement. The fact that the authors do not take this into account or address this at all is, in my view, the central deficit of the approaches. I will attempt to address this in the following sections. At the end of section 6 and section 7, I will briefly discuss some parallels and differences between my considerations and these approaches.

## 6. A new approach on measuring need-based justice

This section is about the development of an *individual* justice evaluation function  $J_i$  (and not an aggregation function). In doing so, I follow the path taken by Jasso. This can be a bit confusing in some places, because the arguments of the resulting function are  $\mathbf{e}$  and  $\mathbf{n}$  (and not  $e_i$  and  $n_i$  as in Jasso's approach):  $J_i: (\mathbf{e}, \mathbf{n}) \rightarrow \mathbb{R}$ . This is because, in my opinion, the assessment of justice for an individual also depends (or can depend) on the supply situation of other individuals.

### 6.1. Reasons for need-based justice

The central issue of need-based justice is how to deal with undersupply. There might be questions of various degrees of justice or injustice in cases of oversupply. If for instance a patient receives more medicine than he needs, this might not only be dangerous, it might also be seen as unjust. Questions like these resolve themselves if endowment is understood as endowment at one's disposal as I will do here. The medicine is at your disposal, but you don't have to take all of it. If the endowment at disposal of an individual at least meets her need, from a perspective of need-based justice this is just. If not, this can be unjust, and it can be unjust to different degrees.

Do not misunderstand me. Oversupply, or inefficiency in the sense of Traub *et al.*, can cause injustice if there are undersupplied individuals. But it is not unjust per se if an individual is oversupplied (otherwise you would have to judge the situation of individuals in a land of milk and honey as unjust). Therefore, as I will explain below, I place the associated injustice among the undersupplied and not among the oversupplied.

In result I will focus on measuring *injustice*. The situations of supplied individuals are judged the same: They are just, which means that from a perspective of measuring *injustice* they are not unjust.

This gives the first half of a desideratum called 'Point of no injustice' for measuring individual need-based (in)justice: there is one and only one function value of a measure of need-based justice  $J_i$ , denoted by  $j_{\text{no injustice}}$ , that is taken if  $e_i = n_i$ . If  $e_i > n_i$ ,  $J_i(\mathbf{e}, \mathbf{n}) = j_{\text{no injustice}}$  too. This is only the first half of this desideratum, because the satisfaction of need is only a sufficient condition for judging the supply situation of an individual as not unjust. There are more reasons that will follow.

### 6.2. Reasons for need-based injustice

I follow the common view that one can measure the degree of the need-satisfaction of an individual based on her endowment and her need. But in cases of undersupply, you neither can say anything about the degree of justice or injustice from a perspective of need-based-justice, nor can you say anything about need-based justice at all on the basis of the individual's endowment and need.

In my view, only the existence and awareness of at least one feasible, better alternative to the supply situation of an undersupplied individual allow the situation to be judged as unjust. The alternative has to be feasible, because you always can construct purely hypothetical better alternatives. So, for example, it is always conceivable that the lonely castaway in Scenario 1 is better endowed. But this is not relevant to judge the given situation. It has to be known, because if there are feasible better alternatives nobody is aware of, these alternatives may as well not exist. If for example the need of the castaway is food and there are thousands of fruits just a hundred metres to his left, but he goes to the right looking for food, a feasible better alternative is given, but it is irrelevant for the judgement of justice.



For a better understanding, remember Scenario 1 and Scenario 2. Whereas there are no known, feasible, better alternatives to the supply situation of  $i$  in Scenario 1 (that is the way this scenario is constructed) it is obvious that a known, feasible, better alternative exists in Scenario 2. This is so, because the overall endowment is sufficiently large to satisfy the need of  $i$  (this holds even next to a satisfaction of the need of  $j$ , but at this point I want to focus on  $i$ ). So, the situation of  $i$  must be judged differently in Scenario 2 than in Scenario 1, because in Scenario 1 there is no known, feasible opportunity to improve the situation of  $i$ , while the undersupply of  $i$  in Scenario 2 can be avoided. From a perspective of need-based justice this is a fundamental difference. If undersupply cannot be avoided (or at least mitigated – I will come to this later) it is sad, it is bad, but it is not unjust. It is the possible avoidance that makes a situation unjust.

This is the first step into arguing why measures of need-satisfaction (or more general measures with the two individual input variables need and endowment) cannot measure need-based justice. Measures with these input variables cannot consider whether undersupply *can* be avoided or not. So, you have to think about measuring need-based justice in a general way other than measuring need-satisfaction. For measuring need-based justice you first have to distinguish between cases of sufficient supply and undersupply, and then, for the cases of undersupply, between those cases in which known, feasible, better alternatives exist and those in which these do not exist. If at least one known, feasible, better alternative is given, the situation of an undersupplied individual is unjust, and it can be unjust to varying degrees. If an individual  $i$  is undersupplied and another individual  $j$  exists alongside  $i$  and  $j$  has an endowment greater than 0, a known, feasible, better alternative obviously exists for  $i$ . This alternative could be realized by a transfer of endowment from  $j$  to  $i$ . I explicitly do not want to equate known, feasible, better alternatives with the opportunity of a transfer, but if the opportunity of a transfer exists, a known, feasible, better alternative exists. For the sake of simplicity, however, I will limit myself to this in the following (more on this in the next subsection).

The considerations of this subsection allow to complete the desideratum for separating injustice and no injustice. Injustice is given, if two conditions are met: Firstly, the individual has to be undersupplied, and secondly there has to be a known, feasible opportunity to improve the situation of this individual (which *inter alia* is given when other individuals could transfer endowment to the undersupplied individual). If none of these conditions is met, the situation of an individual cannot be assessed as unjust:

**Desideratum II. (Point of no injustice)** *There is one and only one function value  $j_{no\ injustice}$  so that for all  $i \in I$  the following holds:*

$$J_i(\mathbf{e}, \mathbf{n}) = j_{no\ injustice} \text{ if and only if } e_i \geq n_i \text{ or } \sum_{j \in I \setminus \{i\}} e_j = 0.$$

$\sum_{j \in I \setminus \{i\}} e_j = 0$  means, that there is no potential transfer donor, which means, in the simplified version discussed here, that no known, feasible, better alternative to the supply situation of  $i$  exists or in other words, that, in a case of undersupply, there is no known, feasible opportunity to mitigate the undersupply of  $i$ .

### 6.3. Different degrees of need-based injustice

#### 6.3.1. Different degrees of opportunities to mitigate undersupply

There can be varying degrees of opportunities to avoid or at least mitigate undersupply. To understand what this is about, think of the individual *j* finding food on the island and keeping it to himself. This is the case as used and presented in varying severities in the following Scenarios 3 and 4 (from now on I discuss *ceteris paribus* cases, that means everything is assumed to be invariable except for one variable):

Scenario 3: Both individuals once again have a need of 100 units. *i* again has an endowment of 20 units. *j*, however, does not have 200 units, but 400. While *i*'s undersupply does not change, *j*'s oversupply grows.

Scenario 4: Both individuals once again have a need of 100 units. *i* again has an endowment of 20 units. *j*, however, does not have 400 units, but 800. While *i*'s undersupply does not change, *j*'s oversupply grows and grows.

I have the strong intuition that the situation of *i* in Scenario 3 is more unjust than in Scenario 2 and that the injustice increases further from Scenario 3 to Scenario 4. I suppose that Miller, Siebel and Traub *et al.* would share my view, but for different reasons. Siebel and Miller would argue with growing inequality and Traub *et al.* with growing inefficiency. But in my view, there are two other lines of argument for this. One is related to different burdens for *j*, associated with the avoidance of the undersupply of *i*. This will be discussed in the next section. The other, that is addressed here, is related to different degrees of opportunity to avoid the undersupply of *i*: the greater the opportunity to avoid undersupply, the more unjust undersupply is.

My thinking about this is strongly influenced by formal modal logic. In formal modal logic you have a clearly defined formal framework to decide if a world – related to another world – is possible or not and if it is possible, to which degree. I think that this framework is transmissible to the question whether a known, realizable, better alternative to a given undersupply of an individual exists or not (you have to look for accessible possible worlds, in which the individual is better off) and if it exists, the degree of opportunity to avoid the undersupply can be quantified. In my eyes this would be the best way to formalize the questions discussed here. However, this approach is very complicated. You need a big formal framework, although some of the questions discussed here are easier to handle. Therefore, I do not use the modal logic inspired approach, whereby all following statements are covered by this.

The previous section gives a hint of an easier way to measure the degree of opportunity to avoid the undersupply of *i*. It is the measurement of the overall endowment *i* does not benefit from. I explicitly do not want to equate the one with the other, but an increasing overall endowment, from which *i* does not benefit, is a special case of an increasing degree of opportunity to avoid the undersupply of *i*. For the sake of simplicity, in the following I will measure the degree of opportunity to avoid the undersupply of *i* by measuring the endowment of the other. If the endowment of the other increases, the degree of opportunity to avoid the undersupply of *i* increases and with the latter the injustice for *i*.

Vice versa that means that the injustice of the undersupplied  $i$  decreases from Scenario 4 to Scenario 3 and from Scenario 3 to Scenario 2. Let's see how far we can go with this and take a look at the following scenarios. They only differ in the endowment of  $j$ , which is decreasing more and more until it is 0 (the scenarios are chosen to exemplify categorical changes that will be discussed in this and the next subsection).

Scenario 5: Both individuals have a need of 100 units.  $i$  is endowed with 20 units.  $j$  is endowed with 170 units.

Scenario 6: Both individuals have a need of 100 units.  $i$  is endowed with 20 units.  $j$  is endowed with 100 units.

Scenario 7: Both individuals have a need of 100 units.  $i$  is endowed with 20 units.  $j$  is endowed with 70 units.

Scenario 8: Both individuals have a need of 100 units.  $i$  is endowed with 20 units.  $j$  is endowed with 20 units.

Scenario 9: Both individuals have a need of 100 units.  $i$  is endowed with 20 units.  $j$  is endowed with 10 units.

Scenario 10: Both individuals have a need of 100 units.  $i$  is endowed with 20 units.  $j$  is endowed with 0 units.

Scenario 5 is categorically different from the scenarios before, because unlike before, the total endowment is not sufficient to satisfy the need of both  $i$  and  $j$ . There is the opportunity to avoid the undersupply of  $i$ , but if the undersupply of  $i$  would be avoided by a transfer of endowment from  $j$  to  $i$ ,  $j$  would be undersupplied. Nevertheless, I think the decreasing of injustice for  $i$  continues with decreasing endowment of  $j$  (from Scenario 4 over Scenario 3 and Scenario 2 to Scenario 5 and so on). This is for two reasons. Firstly, because the injustice is not bound to the opportunity to *avoid* undersupply but to the opportunity to *mitigate* undersupply (see the next paragraph). And secondly, because you have to take the consequences of mitigating undersupply into account (see the next section).

Scenario 7 is the first scenario in this series where no opportunity to avoid the undersupply of  $i$  is given, because the overall endowment in this scenario has fallen under the need of  $i$ . So, this is the hard case of Scenario 5 related to the question of whether unavoidability of undersupply is relevant for judging the situation of undersupplied  $i$  as unjust. It is not, because there are known, feasible, better alternatives for  $i$  and that is the criterion that matters. This is not bound to the opportunity to *avoid* undersupply but to the opportunity to *mitigate* undersupply. Avoidance of undersupply is only a special case of mitigating undersupply. In Scenario 7 as well as in Scenario 5, the opportunity to mitigate undersupply is given and that is why the undersupply of  $i$  is unjust. But the injustice decreases, because the degree of opportunity to mitigate undersupply decreases related to the decreasing endowment of  $j$ . This holds in all cases where the endowment of  $j$  is greater than 0. But what about the case – given in Scenario 10 – where the endowment of  $j$  is equal to 0? This is a case very

similar to Scenario 1 (the separated lonely castaway). In Scenario 10 as well as in Scenario 1 no known, realizable, better alternative for the supply situation of  $i$  exists. As long as  $j$ 's endowment is greater than 0 there is a known, realizable, better alternative for the supply situation of  $i$ , which allows the judgement that the situation of undersupplied  $i$  is unjust. If no known, realizable, better alternative for the supply situation of  $i$  exists, the situation of undersupplied  $i$  is *not* unjust. So, the injustice for undersupplied  $i$  decreases with a decreasing degree of opportunity to mitigate the undersupply of  $i$  related to the endowment of  $j$  – the situation of  $i$  becomes less and less unjust – up to a point where no opportunity to mitigate the undersupply of  $i$  related to the endowment of  $j$  is given. At this point, the undersupply of  $i$  is not unjust. The considerations concerning the separated lonely castaway and the considerations concerning decreasing opportunities to improve need-satisfaction of undersupplied individuals *are therefore in line*.

In general, the injustice of an undersupplied individual increases with growing opportunities to mitigate the undersupply, which is given if the endowment of another individual increases, and the injustice of an undersupplied individual decreases with shrinking opportunities to mitigate the undersupply, which is given if the endowment of another individual decreases. This gives the following desideratum:

**Desideratum I2. (Monotonicity in the endowment of the other)** *For all  $i \in I$  the following holds: if  $0 < e_i < n_i$  and  $\sum_{j \in I \setminus \{i\}} e_j > 0$ , then the following applies to a measure of need-based justice  $J_i$ :*

*$J_i$  is strictly monotonically decreasing in  $\sum_{j \in I \setminus \{i\}} e_j$ .*

The conditions for this and the following desiderata are explained as follows: The desiderata are only relevant in cases of undersupply of  $i$ , because otherwise the situation is not unjust for her (and this section deals with different degrees of injustice). That is why  $e_i < n_i$  is presupposed. Accordingly, in the simplified version discussed here, where the opportunity to mitigate undersupply of  $i$  is reduced to the existence of a potential transfer donor, its existence is assumed by  $\sum_{j \in I \setminus \{i\}} e_j > 0$ , because otherwise the situation for  $i$  is not unjust. The assumption  $e_i > 0$  is assumed for the purpose of simplification. In principle, all considerations also apply in the case that  $e_i = 0$  (remember that case  $e_i < 0$  has been excluded in general just as it is assumed in general that  $n_i > 0$ ). But to take this case into account, the formalization would become more complex to an extent that does not seem justified to me, since all other cases can be handled much more simply.<sup>11</sup>

One thing to keep in mind here, and for the future examples is that if *injustice* increases/decreases, this is shown by a measure of need-based *justice* in the opposite direction. If *injustice* increases/decreases, a measure of need-based *justice* decreases/increases.

<sup>11</sup>One option would be to map the need-satisfaction to  $\mathbb{R}$  and the need-based justice into a second dimension.

### 6.3.2. *Different consequences of mitigating undersupply*

One reason why the injustice for undersupplied *i* is decreasing from Scenario 4 over Scenarios 3, 2, 5 and so on to Scenario 10, is the decreasing degree of opportunity to mitigate the undersupply of *i* with decreasing endowment of *j*. But I think there is another. One must consider that mitigating the undersupply of *i* can be associated with negative consequences.

One of these negative consequences is the burden or harm that *j* may suffer by an improvement of the situation of *i*. Scenario 5 is only the first scenario in this series where this aspect emerges, but it has to be considered in general, albeit with varying degrees. Take a look back to Scenario 2, Scenario 3 and Scenario 4. With increasing endowment of *j*, *j* would feel it less and less if a transfer to *i*'s benefit were made. It is therefore more unjust for *i* when such a transfer is withheld.<sup>12</sup> Vice versa with decreasing endowment of *j*, *j* would feel it more and more if said transfer were made. It is therefore less unjust for *i* when such a transfer is withheld. In these scenarios, the aspect of harming *j* was not that relevant, because an exact need-satisfaction of *i* was there associated with only a decreasing oversupply of *j*. With decreasing endowment of *j* this changes. Scenario 6 is the first scenario in this series where every improvement of the situation of *i* by transferring endowment from *j* to *i* would result in a change of the supply category *j* belongs to. *j* would fall from supplied to undersupplied. In all further scenarios, *j*'s undersupply would increase with an improvement of the situation of *i*. Scenario 8 is moreover the first scenario in this series where every improvement of the situation of *i* results in a supply situation of *j* that is worse than the supply situation of *i*. In Scenario 9, *j* is undersupplied and worse off than *i*. Every improvement of the supply situation of *i* would increase the already existing disadvantages compared with *i*. This provides another argument to judge the undersupply of *i* to different degrees. If the endowment of *j* increases, it becomes more unjust if a transfer to *i*'s benefit is withheld and if the endowment of *j* decreases, it becomes less unjust if a transfer to *i*'s benefit is withheld. For good luck this is in line with the degree of opportunity to improve the situation of *i*. But it draws attention to the need of *j*. The harm that *j* suffers is not only related to her endowment but also to her own need.

For instance, if in Scenario 2 *j* would not have a need of 100 units, but of 2000, then *j* would not be oversupplied with an endowment of 200 units, but undersupplied. Related to a measurement of need-satisfaction by the ratio of endowment and need, *j* neither would be better supplied than *i*. This is a scenario that is very similar to Scenario 9, where *j* is undersupplied and worse off than *i*. Thus, *i*'s situation should be evaluated differently from in Scenario 2. A transfer to the benefit of *i* would burden *j* even more, in the sense that his already large undersupply would increase, and not, as in Scenario 2, that his

<sup>12</sup>At this point, it is worthwhile to point out that acknowledged need entails a willingness for transfers. We would certainly have to attest for, if not a definitional, then at least a performative contradiction if society acknowledges that certain needs should be fulfilled (see the section "Need") but there is no corresponding minimum obligation of solidarity to contribute to that fulfilment, at least in certain cases and to certain extents. To this regard, there are strong similarities to the violation of reasonable expectation, such as discussed in Schramme (2006) under the heading 'Formale Gerechtigkeit' ('Formal Justice').

large oversupply would be reduced. The exclusion of a transfer and the related non-realisation of a better supply situation would therefore be less unjust for  $i$  than in Scenario 2.

In general, the injustice for an undersupplied individual decreases with growing negative consequences associated with mitigating the other individual's undersupply, which is given if the need of another individual increases, and the injustice of an undersupplied individual increases with shrinking negative consequences associated with mitigating the individual's undersupply, which is given, if the need of another individual decreases. This is recorded in the following desideratum:

**Desideratum I3. (Monotonicity in the need of the other)** For all  $i \in I$  the following holds: if  $0 < e_i < n_i$  and  $\sum_{j \in I \setminus \{i\}} e_j > 0$ , then the following applies to a measure of need-based justice  $J_i$ :

$J_i$  is strictly monotonically increasing in  $\sum_{j \in I \setminus \{i\}} n_j$ .

### 6.3.3. Need-satisfaction

The previous considerations were mostly aimed at the impact of  $j$ 's endowment and need on judging the justice of the situation of  $i$ . But of course, if  $i$  is undersupplied, the endowment and need of  $i$  have an impact too. These influences are mostly common sense in recent times, which is why I abstain from detailed explanations.

If the endowment of an undersupplied individual increases, and the opportunity to improve the situation of  $i$  exists, the injustice for  $i$  decreases and vice versa:

**Desideratum I4. (Monotonicity in the individual's endowment)** For all  $i \in I$  the following holds: if  $0 < e_i < n_i$  and  $\sum_{j \in I \setminus \{i\}} e_j > 0$ , then the following applies to a measure of need-based justice  $J_i$ :

$J_i$  is strictly monotonically increasing in  $e_i$ .

The same in somewhat opposite direction holds for the need of  $i$ . If the need of an undersupplied individual increases, and the opportunity to improve the situation of  $i$  exists, the injustice for  $i$  increases and vice versa:

**Desideratum I5. (Monotonicity in the individual's need)** For all  $i \in I$  the following holds: if  $0 < e_i < n_i$  and  $\sum_{j \in I \setminus \{i\}} e_j > 0$ , then the following applies to a measure of need-based justice  $J_i$ :

$J_i$  is strictly monotonically decreasing in  $n_i$ .

Gaining or losing one unit is related to the need-satisfaction unjust to different degrees. For example, a stranded, significantly oversupplied individual gaining or losing one fruit is related to the question of choosing what she likes most and is less relevant the larger the oversupply is. On the contrary, for an undersupplied

individual gaining or losing one fruit might be a question of life and death and is therefore more relevant the larger the undersupply is. From a perspective of need-based justice, oversupply is (in my view) not unjust, which is why these differences do not have to be considered in cases of oversupply. But in cases of undersupply, it is relevant whether the endowment of a nearly supplied individual changes or the endowment of a significantly undersupplied individual changes to the same amount. In the latter case, the injustice increases more than in the first case. This is stated in the following desideratum<sup>13</sup>:

**Desideratum I6. (Sensitivity in the individual's endowment)** *For all  $i \in I$  the following holds: if  $0 < e_i < n_i$  and  $\sum_{j \in I \setminus \{i\}} e_j > 0$ , then the following applies to a measure of need-based justice  $J_i$ :*

$$\frac{\partial}{\partial e_i} J_i \text{ is strictly monotonically decreasing in } e_i.$$

Finally, some technical aspects that should be considered: justice should not be measured in the unit of the considered good (e.g. number of fruits, kilograms or dollars). That's why measures of justice must be unitless. And the justice evaluation should not change with changes in scale (e.g. from kilogram to gram or dollar to euro). That's why they have to be scale-invariant.

**Desideratum I7. (Unitlessness and Scale Invariance)** *The following applies to a measure of need-based justice  $J_i$ :*

*$J_i$  is unitless:  $\text{unit}(J_i) = \mathbf{one}$ <sup>14</sup> and*

*$J_i$  is scale invariant:  $J_i(\mathbf{e}, \mathbf{n}) = J_i(a * \mathbf{e}, a * \mathbf{n})$ ,  $a \in \mathbb{R}^+$ .*

#### 6.3.4. Summary of the last subsections

So, the need-satisfaction of an individual is a relevant factor for judging the situation of said individual from a perspective of need-based justice. But in cases of undersupply, it may be less impactful to judgement when compared with the opportunity to mitigate the undersupply related to the associated negative consequences. If the opportunity to mitigate the undersupply increases/decreases, the injustice for an undersupplied individual increases/decreases and if the associated negative consequences increase/decrease, the injustice for an undersupplied individual decreases/increases. The opportunity to mitigate the undersupply of an individual at least also depends on the endowment of other individuals, whereby these influence the degree of injustice for the individual at issue. The associated negative consequences at least also depend on the need-satisfaction of other individuals, whereby next to their endowment also their

<sup>13</sup>More generally, these statements apply not only to endowment but to the need-satisfaction; but for the sake of brevity I will limit myself to the important statement regarding endowment.

<sup>14</sup>According to the International System of Units.

need has to be taken into account to determine the degree of injustice for the individual at issue.

As far as I know, these lines of argument are completely new in measuring (need-based) justice. There are no approaches which cause injustice by taking opportunities to mitigate undersupply into account and there are no approaches which measure injustice by taking different degrees of opportunities to mitigate undersupply and associated consequences into account.

Finally, a brief comparative look at the approaches in particular by Siebel and Traub *et al.* should be taken.

Following the argumentation presented here, the injustice for  $i$  decreases from Scenario 4, via Scenario 3, 2, 5, 6, etc. to Scenario 10 (because the opportunity to mitigate the undersupply of  $i$  decreases and the negative consequences for  $j$  associated with an improvement of the supply situation of  $i$  increase), following the argumentation of Traub *et al.* this only applies to the scenarios 4, 3, 2, 5, 6. From Scenario 6 onwards, there is no inefficiency due to oversupply, so that the need-based justice for  $i$  is assessed solely on the basis of its undersupply, and this does not change (the measures of Jasso and Plato (according to Siebel) show also the same injustice for  $i$  in all these scenarios for this reason). So, beyond the differences in reasoning, maybe the approach of Traub *et al.* can be seen as a special case of the more general approach presented here.

Since the Platonic component of Siebel's measure is always the same in all scenarios, the changes for  $i$  in his measure are determined exclusively by the Aristotelian component. Thus, injustice for  $i$  decreases from Scenario 4, via Scenario 3, 2, 5, 6, 7 to Scenario 8 (because inequality decreases), but then increases again (because inequality increases) (this also applies to the measures of Aristotle (according to Siebel) and Miller). Depending on how strongly one weights the Aristotelian component, this effect appears stronger or weaker, but as long as the Aristotelian component is not weighted with 0, the effect does not disappear. From a perspective of need-based justice, I cannot see any reason why a deterioration of the situation of  $j$ , or more generally, any individual that is worse off than  $i$ , should result in an increasing injustice for  $i$  (even if  $i$  is undersupplied). So, the equality principle provides reasonable results only in 'one direction' and that, as mentioned, for bad reasons.

## 7. A measure of need-based justice

### 7.1. The individual level

An example for a measure of need-based justice, that fulfils all desiderata is given by the following function (which can be understood as an extension of Jasso's justice evaluation function):

$$J_i(\mathbf{e}, \mathbf{n}) := \min \left\{ 0, \ln \left( \frac{e_i}{n_i} \right) * \frac{\sum_{j \in I \setminus \{i\}} e_j}{\sum_{j \in I \setminus \{i\}} n_j} \right\}.$$

Note, that the justice evaluation for  $i$  does not only depend on the endowment of  $i$ ,  $e_i$ , and the need of  $i$ ,  $n_i$ , but on the profiles  $\mathbf{e}$  and  $\mathbf{n}$ , as the justice evaluation for  $i$  depends also (in cases of undersupply) on the degree of opportunity to



mitigate the undersupply of  $i$  and the associated consequences, which are related to the endowment and need of all other individuals.

A good way to understand the structure of this measure is the following: First, cases of supply and undersupply shall be differentiated. Therefore, a measure of need-satisfaction is implemented. For fulfilling not only the Desideratum 14 (Monotonicity in the individual's endowment) and 15 (Monotonicity in the individual's need), but also the Desideratum 17 (Unitlessness and Scale Invariance), the ratio

$$\frac{e_i}{n_i}$$

(the argument of the logarithm) is chosen (this does not prove that the resulting measure fulfils the desiderata, because the next steps could cancel the validity; proof that the resulting measure fulfils the desiderata is given in the Appendix). To fulfil Desiderata 16 (Sensitivity in the individual's endowment) the logarithm is implemented (implementing the logarithm at this position simplifies further considerations):

$$\ln\left(\frac{e_i}{n_i}\right).$$

This sets the point of no injustice to 0, because this is the function value that is taken if  $e_i = n_i$ . To break down oversupply to this point, the minimum function is implemented:

$$\min\left\{0, \ln\left(\frac{e_i}{n_i}\right)\right\}.$$

Thereby cases of supply are all judged as equally unjust, namely not unjust, while cases of undersupply are unjust to different degrees related to the degree of undersupply. To take the varying opportunities of mitigating undersupply into account, the measure of need-satisfaction respectively its logarithm is multiplied with the sum of the endowments of the other individuals:

$$\min\left\{0, \ln\left(\frac{e_i}{n_i}\right) * \sum_{j \in I \setminus \{i\}} e_j\right\}.$$

This is an important step, because, if  $i$  is undersupplied, one and the same supply situation of  $i$  is weighted by degrees of opportunity to mitigate the undersupply of  $i$  related to the endowment of the other individuals. With growing opportunities to mitigate (or even avoid) the undersupply of  $i$ , the undersupply of  $i$  is judged more and more unjust. Thereby Desideratum 12 (Monotonicity in the endowment of the other) is fulfilled. And moreover, Desideratum 11 is also fulfilled, because if no opportunity to mitigate undersupply is given (the sum over the endowment of the other individuals is equal to 0), the function value comes to the point of no injustice. But you lose Desideratum 17 (Unitlessness and Scale Invariance). The reparation of this is a by-product of the next step. If you take the negative consequences of mitigating the undersupply of  $i$  into account by dividing

through the sum of the need of the other individuals, not only Desideratum I3 (Monotonicity in the need of the other) is additionally fulfilled, but also Desideratum I7:

$$\min \left\{ 0, \ln \left( \frac{e_i}{n_i} \right) * \frac{\sum_{j \in I \setminus \{i\}} e_j}{\sum_{j \in I \setminus \{i\}} n_j} \right\}.$$

Because this step-by-step procedure does not guarantee that the measure meets all desiderata in combination, the proof can be found in the Appendix.

There are other measures that meet all desiderata in combination, so the desiderata themselves do not determine the functional form. This is unsatisfactory. But as mentioned above, the focus of this article is on the reasoning of fundamental properties that a measure should possess. Determining the functional form is the subject of current research. Here this measure is used for concretization and illustration and proves the compatibility of the required properties.

Finally let's have a look back at the scenarios discussed above. It was criticized that measures of need-satisfaction (or more generally speaking, measures with the two input variables endowment and need of the individual) provide identical judgements of justice for  $i$  in the very different scenarios presented above and that the approaches taken so far provide the same results, at least for some scenarios, which have to be assessed very differently. By contrast, the required desiderata of a measure of need-based justice lead to differing judgements. In the case of the measure proposed here, we get for the scenarios the following gradations:

$$\begin{aligned} J_i((20, 800), (100, 100)) &\approx -12.88 < \\ J_i((20, 400), (100, 100)) &\approx -6.44 < \\ J_i((20, 200), (100, 100)) &\approx -3.22 < \\ J_i((20, 170), (100, 100)) &\approx -2.74 < \\ J_i((20, 100), (100, 100)) &\approx -1.61 < \\ J_i((20, 70), (100, 100)) &\approx -1.13 < \\ J_i((20, 20), (100, 100)) &\approx -0.32 < \\ J_i((20, 10), (100, 100)) &\approx -0.16 < \\ J_i((20, 0), (100, 100)) &= 0 \end{aligned}$$

This means that the injustice for the undersupplied individual  $i$  is the largest in that scenario, in which  $j$  is the most oversupplied. If there is no opportunity to improve the supply situation of  $i$ , because  $j$ 's endowment is 0, there is no injustice for  $i$ . If the opportunity to improve the supply situation of  $i$  increases, because the endowment of  $j$  increases or more generally speaking the supply situation of  $j$  improves, then the injustice for  $i$  increases. It was this gradation that was worked out in the discussion on the above scenarios.

### 7.2. The aggregated level - an outlook

The focus of this article is on the individual level. Therefore, I will not cover the aggregated level in detail, but I would like to briefly touch upon some interesting points. By choosing, for example, the arithmetic mean of the single evaluations as an aggregation function, the result reads as follows:

$$J(\mathbf{e}, \mathbf{n}) := \frac{1}{\#\mathbb{I}} \sum_{i \in \mathbb{I}} J_i(\mathbf{e}, \mathbf{n})$$

$$= \frac{1}{\#\mathbb{I}} \sum_{i \in \mathbb{I}} \min \left\{ 0, \ln \left( \frac{e_i}{n_i} \right) * \frac{\sum_{j \in \mathbb{I} \setminus \{i\}} e_j}{\sum_{j \in \mathbb{I} \setminus \{i\}} n_j} \right\}.$$

If all individuals are sufficiently supplied, the measure displays no injustice. This is also the case if there is no opportunity to mitigate the undersupply of *any* individual (which is only given if the overall endowment is equal to 0). If there is at least one undersupplied individual which does not possess the total endowment ( $>0$ ), then the measure displays injustice. Therefore, the disadvantages of Jasso's measures do not occur. Oversupply cannot cancel out undersupply, and societies in which at least one individual is undersupplied are clearly distinguishable from societies in which no individual is unjustly undersupplied.

If the overall endowment increases, the injustice of every undersupplied individual that does not benefit from it increases, because the opportunity to mitigate their undersupply increases. This is especially the case if there are undersupplied individuals next to oversupplied ones, and the oversupplied individuals benefit exclusively from the increasing overall endowment. In cases like these, the justice evaluation for the oversupplied does not change, but the injustice for the undersupplied grows. This result is very similar to the approach of Traub *et al.*, who see this by focussing on inefficiency. But it is not confined to increasing endowment of the oversupplied. Also, in cases with no oversupplied individuals, increasing the endowment of individuals which are less unjustly supplied than others increases the overall injustice. To understand why, you should draw attention to progressive transfers. Here this is understood to mean that a progressive transfer from an individual  $j$  to an individual  $i$  is given, if  $j$  is less unjustly supplied than  $i$  before the transfer and not more unjustly supplied after the transfer. In cases that meet these conditions, the decreasing injustice for a transfer recipient is larger than the increasing injustice for a transfer donor (in absolute numbers), because of the desideratum of sensitivity in the individual's endowment. Therefore, the overall injustice decreases with progressive transfers. For a given overall endowment (and fixed needs), total injustice is at its minimum if no progressive transfers are possible and this is the case if all individuals are supplied to the same degree of injustice. Any deviation from this increases the overall injustice and the greater the deviations are, the greater the injustice is. That is somewhat surprising, because equality was not required, and I have several times been very sceptical about requiring it. Therefore, it is important to recognize the difference: for a given amount of overall endowment and a profile of needs, the distribution of endowment that leads to equality in (in-)justice minimizes injustice but does not eliminate it.

Therefore, the problem addressed by Miller, according to which the equality principle does not distinguish cases of undersupply to different degrees if all individuals are equally poorly supplied (because equality eliminates injustice), does not occur.

Unfortunately, there are also some properties of this aggregate measure that are not defensible. The reasons for this are that the two aspects that influence the individual assessments of justice – undersupply and the opportunity to mitigate undersupply (under consideration of the associated negative consequences) – can lead to opposing effects at the aggregate level. If, for example, the endowment of an undersupplied individual increases, thus reducing the injustice for this individual, the injustice for all other undersupplied individuals increases, because the opportunities to improve their supply situation increase. There are constellations in which the exemplary aggregated measure shows appropriate properties in this respect, but also those in which this is not the case. This is the area where the most important questions for further research lie. However, since they concern the mutual offsetting of changes in justice at the individual level, they clearly belong to the aggregate level and not to the individual level, which is why I do not pursue them here. I assume that a similarly detailed study as was done here for the individual level can provide answers to these questions.

## 8. Special Notes

### **8.1. Remarks on the relation between the measurement of need-based justice and poverty measurement**

There is an important difference between a measurement of need-based justice and a measurement of poverty. In poverty measurement, under the buzzword of the focus axiom (or censored measure), the question is discussed how to deal with the rich. If they are taken into account, this can lead to debatable results. For example, societies with very many poor individuals on the one hand and some very rich individuals on the other can be stated as – on average – rich. Growing wealth of the rich can diminish poverty. But if they are not considered, this can also lead to debatable results. For example, two societies with  $x$  poor people can be shown to be equally poor, even though in one society the  $x$  poor make up only 1% of the population and in the other society they make up 99% (because there are different numbers of non-poor people). There is a whole range of pros and cons for and against considering the rich (and closely related for absolute and relative poverty measures). With regard to the measurement of need-based justice, by contrast, the matter is straightforward. Admittedly, the impression can arise that the measurement of need-based justice follows a focus axiom. Oversupply is – as discussed, for good reasons – not seen to be unjust, so oversupplied (rich) individuals could also be ignored in the aggregation in the following sense: an aggregation of the undersupplied provides the same value as an aggregation of all individuals. However, the impression that the measurement of need-based justice follows a focus axiom would be wrong, because the supply situation of each non-undersupplied individual (rich) influences the assessment of each undersupplied one, since it (also) depends on the supply situation of the

non-undersupplied (rich) individuals whether the supply situation of an undersupplied individual can be improved and how the associated consequences are to be assessed. The supply situation of the non-undersupplied (rich) is thus already an integral part of a justice assessment of the undersupply at the individual level (and not only at the aggregated level) and therefore also influences the aggregation if the non-undersupplied (rich) do not make a (direct) contribution at the aggregation (that is what I meant by the phrase that I do not place injustice resulting from oversupply among the oversupplied, but among the undersupplied). If the wealth of the rich grows, the injustice for every undersupplied grows, just as in the case that the number of non-undersupplied (rich) grows while the number of undersupplied remains the same. The reason for this in both cases is that the opportunity to mitigate undersupply is growing without associated negative consequences undermining this. The fact that how to deal with the rich is an open question in poverty measurement, while, in my opinion, this question does not exist in the measurement of need-based justice, is a major difference between poverty measurement and need-based justice measurement.

### **8.2. Remarks on comparativity and non-comparativity**

Most measures of justice or poverty can be categorized as either comparative or non-comparative (see Feinberg 1974). Following the general understanding, comparative measures would determine what is just for an individual by comparing this individual with others. The justice principle of equality for example is a purely comparative principle. In contrast to this, purely non-comparative measures ignore the others when judging the justice of an individual. If you try to measure need-based justice exclusively on the basis of need and endowment of an individual, this is a non-comparative approach. I think that measures of need-based justice are both, comparative and non-comparative, but not in the general understanding of the former concept. In a certain sense, measures of need-based justice have two components. One – the measurement of the need-satisfaction – is classically non-comparative. The measurement is upon the two individual attributes need and endowment. The other – the measurement of the degree of opportunity to mitigate undersupply – is non-classically comparative. It compares the supply situation of an individual (in cases of undersupply), not with the supply situation of the other, but with (known, feasible) alternatives to the given supply situation. I am afraid that this point in this article could be lost because, for the sake of simplicity, the opportunity to mitigate undersupply is reduced to the endowment of the other individuals. But the concept behind this is not comparing individuals, but alternatives. Remember, from a perspective of need-based justice, the reason for judging the situation of an undersupplied individual as unjust is not about others having something. That others have something implies that the situation of the undersupplied is not unalterable. If others have something, a known, feasible, better alternative to the undersupply of the individual exists. The existence of such an alternative is the reason for judging the situation of an undersupplied individual as unjust. And the nature of the alternatives (the opportunities as well as the consequences that are

associated with them) determines the degree of injustice. The comparative element of measuring need-based justice is therefore not classical, for it is not a comparison of individuals, but a comparison of the given situation with alternative situations.

### 8.3. Remarks on the relations between the justice principles need, equality and effort

First of all, the considerations made so far do not make me dissociate myself from the notion that justice in a general sense results from the interplay of different justice principles, of which need-based justice is merely one. But the considerations lead to the result that equality in undersupply is least unjust if undersupply cannot be avoided. So, there is a relation between need-based justice and the equality principle, that is not given by taking the need principles and the equality principle and weighting them. I have put forward several arguments as to why one should be sceptical about the principle of equality within the framework of a measurement of need-based justice and which reasons are opposed to its application. These arguments were related to the *requirement* of the principle of equality. Therefore, it is a very interesting outcome that equality in need-satisfaction minimizes overall injustice, based on requirements that do not include the equality principle. In this respect, one can speak of an intrinsic relationship between the principle of need-based justice and the principle of equality. I think that there is also an intrinsic relationship between measuring need-based justice and the effort principle that is not given by weighting these principles next to another but given by the opportunities to mitigate undersupply. As said, it is a simplification to confine these to opportunities which are given by the endowment of others. A more sophisticated approach would also consider the opportunities to mitigate the undersupply of an individual, by taking into account what an individual himself can contribute to mitigate his undersupply by increasing his own endowment. At this point an intrinsic relationship between measuring need-based justice and the effort principle is given. More generally, this addresses questions of the responsibility of the own supply situation. Next to the question how to handle undersupply resulting from laziness, the corresponding question on the need side is how to handle undersupply resulting from a large need caused by carelessness and related questions of moral hazard, resulting from false incentives. To implement this is subject of current research.

## 9. Conclusion

Next to some approaches in measuring poverty and justice in which need-based justice is mentioned in passing and/or which allow it to be understood as contributions to the measurement of need-based justice, there are fewer approaches that focus on it explicitly. What all these approaches have in common is that they recognize the need-satisfaction of an individual – measured in terms of its need and endowment – as a central or even (at least under certain circumstances) the exclusive influencing variable for measuring need-based justice. I think it is inadequate to proceed that way. Need and endowment

of an individual allow one to make statements about the need-satisfaction of the individual but knowing only the need and endowment of an individual does not enable one to assess the state of need-based justice for said individual.

To argue for this, I discuss the case of an undersupplied castaway stranded alone on an island. Knowing her need and endowment does not allow one to assess need-based justice, because it does not give any information about alternatives. Only knowledge of at least one feasible, better alternative to the given supply situation of an undersupplied individual allows one to judge its situation as unjust. From the perspective of need-based justice, it is very relevant whether the undersupply can be avoided or at least mitigated or not. If it cannot be mitigated, undersupply is bad, it is sad, but it is not unjust. If it can be mitigated, undersupply is unjust, and it can be unjust to varying degrees. These different degrees depend on the degree of need-satisfaction of the individual at issue *and* the opportunities to mitigate her undersupply related to associated negative consequences. While taking different degrees of need-satisfaction into account is widely held, taking different opportunities to mitigate undersupply related to associated negative consequences into account is – as far as I know – completely new in measuring need-based justice and there are no approaches on how to handle and formalize this. I have given a brief outline on how this could be done in parallel to formal modal logic. A sophisticated approach would have to consider, next to the overall endowment and the overall need of other individuals, also effort, responsibility, resulting moral hazard and some more aspects. For the sake of simplicity and for doing a first step in this direction, I have focused in this article on the influence of the overall endowment and the overall need of other individuals. If the overall endowment of other individuals increases, this is associated with growing opportunities of mitigating undersupply for the undersupplied. Therefore, it is more and more unjust if a transfer of endowment does not occur and the injustice for an undersupplied individual increases. If the overall need of other individuals decreases, mitigating undersupply by transferring endowment would be associated with growing negative consequences, because of growing burdens on the transfer donors. The worse they are supplied, the greater their burden is. Therefore, it is less and less unjust for an undersupplied individual if a transfer of endowment to his benefit does not occur and the injustice decreases. Due to the simplification that opportunities to mitigate undersupply are reduced to the opportunity to transfer endowment and associated negative consequences are attached to the need of others, it is possible to compare this approach to other approaches, especially to the measures of need-based justice proposed by Miller, Siebel and Traub *et al.* (whereby a one to one comparison is partly difficult, as I focus on the individual level, and they focus on the aggregated level). I name deficits in these approaches and show some differences and parallels to a measure that results from the desiderata presented here, whereby – although for different reasons – one parallel is particularly striking: if the need-satisfaction of oversupplied individuals increases, all approaches show an increasing injustice (for an undersupplied individual). Miller and Siebel would reason this with growing inequality, Traub *et al.* with growing inefficiency and the approach presented here argues with growing opportunities to mitigate undersupply related to

associated burdens. This consensus in result may be an indication that this is a particularly important point for the measurement of need-based justice. The approach proposed here provides a new and much more detailed rationale for this. At the same time, the consensus in this result may be the biggest difference between measuring need-based justice and measuring poverty. While it seems uncontroversial that injustice increases when the wealth of the rich grows, in poverty measurement it is debatable (for good reasons) whether in such a case one can speak of increasing poverty.

As said, I do not think that the results of this article represent a completed theory of measuring need-based justice. That was not the goal either. The aim was to draw attention to the fact that need-based justice cannot be measured with measures of need-satisfaction, because this does not consider whether and to what degree undersupply can be mitigated, which is next to need-satisfaction the crucial point for the proper judgement of need-based justice. Moreover, the goal was to formulate the properties revealed as most important for a measure of need-based justice. I hope that succeeded. But there is still a lot to do. It is unsatisfactory that the functional form of a measure of need-based justice is not completely determined by the desiderata. Therefore, further research should focus on if and how that can be done. This approach is a one-dimensional measurement, although multi-dimensional measurement would be more appropriate. It would be desirable to examine whether and how the results of multidimensional poverty measurement can be transferred to the measurement of need-based justice, despite the differences in one-dimensional measurement. The focus of this article was deliberately on the individual level. A similarly detailed examination of the aggregated level should therefore follow. The simplification that opportunities to mitigate undersupply are reduced to the opportunity to transfer endowment and that associated negative consequences are attached to the need of others is just that: a simplification. In this regard, a more comprehensive framework, including further ways of mitigating undersupply and further ways of considering associated negative consequences (and possibly positive ones beyond improving the supply situation), would be desirable. I believe that this article is a good starting point for this.

**Acknowledgements.** I would like to thank all members of the research group Need-based Justice and Distribution Procedures (FOR 2104) for their support and fruitful discussions, particularly Mark Siebel and Markus Tepe. Furthermore, I would like to acknowledge the reviewers for their detailed and constructive criticism and their motivating words. Last but not least, I would like to thank the German Research Foundation for their support (DFG grant SI 1731/2-1 and DFG grant TE 10222-2).

## References

- Aristotle** 2009. *The Nicomachean Ethics*. Transl. D. Ross. Oxford: Oxford University Press.
- Atkinson A.B. and F. Bourguignon** 1982. The comparison of multi-dimensioned distributions of economic status. *Review of Economic Studies* **49**, 183–201.
- Braybrooke D.** 1987. *Meeting Needs*. Princeton, NJ: Princeton University Press.
- Daniels N.** 1979. Wide reflective equilibrium and theory acceptance in ethics. *Journal of Philosophy* **76**, 256–282.
- Deci E.L. and R.M. Ryan** 2000. The ‘what’ and ‘why’ of goal pursuits: human needs and the self-determination of behavior. *Psychological Inquiry* **11**, 227–268.



- Donaldson D. and K. Pendakur** 1999. *Equivalent-Income Functions and Income-Dependent Equivalence Scales*. Discussion Paper No. 99-16. Vancouver: Department of Economics, University of British Columbia.
- Ebert U. and P. Moyes** 2003. Equivalence scales reconsidered. *Econometrica* **71**, 319–343.
- Feinberg J.** 1974. Noncomparative justice. *Philosophical Review* **83**, 297–338.
- Frohlich N. and J.A. Oppenheimer** 1992. *Choosing Justice: An Experimental Approach to Ethical Theory*. Berkeley, CA: University of California Press.
- Frohlich N., J. Oppenheimer and C. Eavey** 1987. Choices of principles of distributive justice in experimental groups. *American Journal of Political Science* **31**, 606–636.
- Gaertner W. and E. Schokkaert** 2012. *Empirical Social Choice: Questionnaire-Experimental Studies on Distributive Justice*. Cambridge: Cambridge University Press.
- Jasso G.** 1978. On the justice of earnings: a new specification of the justice evaluation function. *American Journal of Sociology* **83**, 1398–1419.
- Jasso G.** 1980. A new theory of distributive justice. *American Sociological Review* **45**, 3–32.
- Jasso G.** 1983. Fairness of individual rewards and fairness of the reward distribution: specifying the inconsistency between the micro and macro principles of justice. *Social Psychology Quarterly* **46**, 185–199.
- Jasso G.** 1988. Principles of theoretical analysis. *Sociological Theory* **6**, 1–20.
- Jasso G.** 1990. Methods for the theoretical and empirical analysis of comparison processes. *Sociological Methodology* **20**, 369–419.
- Jasso G.** 1996. Exploring the reciprocal relations between theoretical and empirical work: the case of the justice evaluation function (paper in honor of Robert K. Merton). *Sociological Methods & Research* **24**, 253–303.
- Jasso G.** 1999. How much injustice is there in the world? Two new justice indexes. *American Sociological Review* **64**, 133–168.
- Jasso G.** 2006. Factorial survey methods for studying beliefs and judgments. *Sociological Methods & Research* **34**, 334–423.
- Jasso G.** 2007. *Studying Justice: Measurement, Estimation, and Analysis of the Actual Reward and the Just Reward*. IZA Discussion Paper No. 2592. Bonn: Institute for the Study of Labor (IZA).
- Jasso G. and E.M. Meyersson Milgrom** 2008. Distributive justice and CEO compensation. *Acta Sociologica* **51**, 123–143.
- Jasso G. and N. Resh** 2002. Exploring the sense of justice about grades. *European Sociological Review* **18**, 333–351.
- Jasso G. and M. Webster** 1999. Assessing the gender gap in just earnings and its underlying mechanisms. *Social Psychology Quarterly* **62**, 367–380.
- Jasso G. and B. Wegener** 1997. Methods for empirical justice analysis: part 1. Framework, models, and quantities. *Social Justice Research* **10**, 393–430.
- Kockläuner G.** 2012. *Methoden der Armutsmessung*. Berlin: Logos Verlag.
- Konow J.** 2001. Fair and square: the four sides of distributive justice. *Journal of Economic Behavior & Organization* **46**, 137–164.
- Konow J.** 2003. Which is the fairest one of all? A positive analysis of justice theories. *Journal of Economic Literature* **41**, 1188–1239.
- Konow J. and L. Schwettmann** 2016. The economics of justice. In *Handbook of Social Justice Theory and Research*, ed. C. Sabbagh and M. Schmitt, 83–106. New York, NY: Springer Verlag.
- Lamm H. and T. Schwinger** 1980. Norms concerning distributive justice: are needs taken into consideration in allocation decisions? *Social Psychology Quarterly* **43**, 425–429.
- Lamm H. and T. Schwinger** 1983. Need consideration in allocation decisions: is it just? *Journal of Social Psychology* **119**, 205–209.
- Liebig S.** 1997. *Soziale Gerechtigkeitsforschung und Gerechtigkeit in Unternehmen*. München: Hampp.
- Maslow A.H.** 1943. A theory of human motivation. *Psychological Review* **50**, 370–396.
- Miller D.** 1999. *Principles of Social Justice*. Cambridge, MA: Harvard University Press.
- Nussbaum M.C.** 2000. *Women and Human Development: The Capabilities Approach*. Cambridge: Cambridge University Press.
- Nussbaum M.C.** 2011. *Creating Capabilities: The Human Development Approach*. Cambridge, MA: Belknap Press of Harvard University Press.

- Plato 1973. *The Republic and Other Works*. Transl. B. Jowett. New York, NY: Anchor Books.
- Rowntree B.S. 1901. *Poverty: A Study of Town Life*. London: Macmillan and Co.
- Runciman W.G. 1966. *Relative Deprivation and Social Justice: A Study of Attitudes to Social Inequality in Twentieth-Century England*. London: Routledge and Kegan Paul.
- Ryan R.M. and E.L. Deci 2000. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist* 55, 68–78.
- Schramme T. 2006. *Gerechtigkeit und Soziale Praxis*. Frankfurt am Main: Campus.
- Schuppert F. 2013. Distinguishing basic needs and fundamental interests. *Critical Review of International Social and Political Philosophy* 16, 24–44.
- Seidl C. 1988. Poverty measurement: a survey. In *Welfare and Efficiency in Public Economics*, ed. D. Bös, M. Rose and C. Seidl, 71–147. Berlin: Springer.
- Sen A. 1976. Poverty: an ordinal approach to measurement. *Econometrica* 44, 219–231.
- Sen A. 1983. Poor, relatively speaking. *Oxford Economic Papers* 35, 153–169.
- Sen A. 2009. *The Idea of Justice*. Cambridge, MA: Harvard University Press.
- Sher G. 2014. *Equality for Inegalitarians*. Cambridge: Cambridge University Press.
- Siebel M. 2017. *To Each According to His Needs: Measuring Need-Based Justice*. FOR2104 Working Paper 2017-14. Hamburg: Helmut Schmidt University.
- Streeten P., S. Burki, M. Ul-Haq, N. Hicks and F. Stewart 1981. *First Things First: Meeting Basic Human Needs in Developing Countries*. New York, NY: Oxford University Press.
- Tarski A. 1965. *Introduction to Logic and to the Methodology of Deductive Sciences*. 3rd edn, Rev. New York, NY: Oxford University Press.
- Thorbecke E. 2007. Multidimensional poverty: conceptual and measurement issues. In *The Many Dimensions of Poverty*, ed. N. Kakwani and J. Silber, 3–19. London: Palgrave Macmillan.
- Townsend P. 1974. Poverty as relative deprivation: resources and style of living. In *Poverty, Inequality and Class Structure*, ed. D. Wedderburn, 15–41. Cambridge: Cambridge University Press.
- Traub S., C. Seidl, U. Schmidt and M.V. Levati 2005. Friedman, Harsanyi, Rawls, Boulding – or somebody else? An experimental investigation of distributive justice. *Social Choice and Welfare* 24, 283–309.
- Traub S., M. Bauer, M. Siebel, N. Springhorn and A. Weiß 2017. *On the Measurement of Need-Based Justice*. FOR2104 Working Paper 2017-12. Hamburg: Helmut Schmidt University.
- Walster E., E. Berscheid and W.G. Walster 1973. New directions in equity research. *Journal of Personality and Social Psychology* 25, 151–176.
- Yaari M.E. and M. Bar-Hillel 1984. On dividing justly. *Social Choice and Welfare* 1, 1–24.

## Appendix 1

Proposition: The measure

$$J_i(\mathbf{e}, \mathbf{n}) := \min \left\{ 0, \ln \left( \frac{e_i}{n_i} \right) * \frac{\sum_{j \in I \setminus \{i\}} e_j}{\sum_{j \in I \setminus \{i\}} n_j} \right\}.$$

fulfils the desiderata I1 to I7.

Proof:

It is generally assumed that  $n_i > 0$  for all  $i \in I$  (see the section ‘Notations and definitions’).

### Desideratum I1 (Point of no injustice)

$J_{\text{no injustice}} = 0$  is only taken if  $e_i \geq n_i$  or  $\sum_{j \in I \setminus \{i\}} e_j = 0$ .

**Desideratum I2 (Monotonicity in the endowment of the other)**

If  $0 < e_i < n_i$  and  $\sum_{j \in I \setminus \{i\}} e_j > 0$  the following holds:

$$\frac{\partial}{\partial e_j} J_i(\mathbf{e}, \mathbf{n}) = \ln\left(\frac{e_i}{n_i}\right) * \frac{1}{\sum_{j \in I \setminus \{i\}} n_j} < 0.$$

**Desideratum I3 (Monotonicity in the need of the other)**

If  $0 < e_i < n_i$  and  $\sum_{j \in I \setminus \{i\}} e_j > 0$  the following holds:

$$\frac{\partial}{\partial n_j} J_i(\mathbf{e}, \mathbf{n}) = -\ln\left(\frac{e_i}{n_i}\right) * \frac{\sum_{j \in I \setminus \{i\}} e_j}{\left(\sum_{j \in I \setminus \{i\}} n_j\right)^2} > 0.$$

**Desideratum I4 (Monotonicity in the individual’s endowment)**

If  $0 < e_i < n_i$  and  $\sum_{j \in I \setminus \{i\}} e_j > 0$  the following holds:

$$\frac{\partial}{\partial e_i} J_i(\mathbf{e}, \mathbf{n}) = \frac{1}{e_i} * \frac{\sum_{j \in I \setminus \{i\}} e_j}{\sum_{j \in I \setminus \{i\}} n_j} > 0.$$

**Desideratum I5 (Monotonicity in the individual’s need)**

If  $0 < e_i < n_i$  and  $\sum_{j \in I \setminus \{i\}} e_j > 0$  the following holds:

$$\frac{\partial}{\partial n_i} J_i(\mathbf{e}, \mathbf{n}) = -\frac{1}{n_i} * \frac{\sum_{j \in I \setminus \{i\}} e_j}{\sum_{j \in I \setminus \{i\}} n_j} < 0.$$

**Desideratum I6 (Sensitivity in the individual’s endowment)**

If  $0 < e_i < n_i$  and  $\sum_{j \in I \setminus \{i\}} e_j > 0$  the following holds:

$$\frac{\partial^2}{\partial e_i^2} J_i(\mathbf{e}, \mathbf{n}) = -\frac{1}{e_i^2} * \frac{\sum_{j \in I \setminus \{i\}} e_j}{\sum_{j \in I \setminus \{i\}} n_j} < 0.$$

**Desideratum I7 (Unitlessness and Scale Invariance)**

Is given because of the quotients.

□

**Nils Springhorn** is a Research Associate at the Institute of Philosophy, Carl von Ossietzky University Oldenburg and at the Institute for Social Sciences, Carl von Ossietzky University Oldenburg. He is a member of the research group Need-based Justice and Distribution Procedures (FOR 2104) funded by the German Research Foundation. Beyond that, he works as a risk analyst in a bank.