Measuring Need-Based Justice – Empirically and Formally

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1 Introduction[1]

Nullmeier (2020, p. 193) has suggested that a "theory of need-based justice should be based on the promotion of both normative and empirical research". In this chapter, the formal part (Sections 2.1–2.3) introduces measures of need-based justice. Such measures are meant to compute how just distributions of a specific good are based on how well they satisfy the corresponding needs. Their input is, therefore, the individuals' endowments and needs, and their output is a number representing the distribution's degree of need-based justice. Given that need-based justice plays a central role in many theories of justice, and given the enormous number of inequality measures, it is quite surprising that almost no measure of need-based justice has been proposed so far. To close this gap, we suggested three measures resting on varying notions of need-based justice. According to these measures, a distribution is unjust (i) the more it deviates from absolute need satisfaction and equal degrees of need satisfaction, (ii) the more the given undersupply could have been mitigated by transfers, and (iii) the more resources are used for oversupply instead of need satisfaction. Before introducing and comparing our measures in Section 2.2, we have a critical eye on two proposals from the literature in Section 2.1. The comparison of our measures reveals, among other things, that only two of them satisfy need-oriented relatives of axioms that are prominent in poverty measurement.

[1] This chapter presents results from the project "Measures of Need-based Justice, Expertise and Coherence", which has been part of the DFG research group FOR2104 "Need-based Justice and Distributive Procedures" (DFG Grants SI 1731/2-1 and SI 1731/2-2). We would like to thank the whole research group for many years of stimulating interdisciplinary cooperation in a remarkably friendly atmosphere. Special thanks go to Bernhard Kittel and Stefan Traub for looking after this atmosphere, and to Stefan, our co-opted project member, for stimulating a philosophers' project with economic ideas.

The empirical part (Sections 3.1–3.4) reports on vignette studies that were conducted to find out how people evaluate the justice of given distributions and how they distribute goods when aiming at justice. The main goal was to measure the significance ascribed to need. Among other things, this significance was compared with the significance ascribed to effort or equality. In line with Nullmeier (2020, pp. 193–197, 206f.), need-based justice is considered a central ingredient in a pluralistic theory of justice. Furthermore, we examined whether need's influence on the outcome changes when the person with the need is accountable for their higher amount. The results underscore Nullmeier's (2020, 204) thesis that corrective justice may interfere with distributive justice: "Self-inflicted need gaps usually lead to punishment in the form of (partial) denial of the meeting of these needs." Finally, we measured the changing influence of different kinds of needs. Nullmeier (2020, 201) states that "survival cannot be the only criterion for deciding what is necessary". However, even if there are additional needs that are not directed at bare survival, it remains to be seen whether they are attributed differing degrees of importance. We were able to show, inter alia, that it makes a significant difference whether a person needs something for bare survival or for participation in social life. The chapter concludes with some implications of our research for a theory of need-based justice (Section 4).

2 The Formal Perspective: Measures of Need-Based Justice

Perhaps the most famous attempt to measure needs is the Human Development Index (HDI) developed in the context of the United Nations Development Programme. This measure is based on operationalisations of the capabilities approach (Sen 1999, Nussbaum 2011). The HDI incorporates three dimensions: health (indicator: life expectancy), education (indicators: expected and mean years of schooling), and standard of living (indicator: gross national income per capita). However, the HDI at best provides the extent to which these needs are *on average* fulfilled in a country. It disregards inequalities in need satisfaction within countries and therefore neglects the *comparative* aspect of need-based justice (see Section 2.2). Moreover, since the purpose of the HDI is to capture gross human development, its focus is quite different from ours. We are not seeking an indicator of *overall* need-satisfaction but would like to determine how just distributions of a *specific* good, such as housing space, are with respect to the satisfaction of the corresponding need. The task is to compare, in a mathematical way, the parties' need for and endowments of a particular good in order to arrive at a number that represents the degree of need-based justice of the good's distribution.

For the same reason, although need is an important ingredient in social welfare orderings (Ebert 1984), equivalence scales (Ebert and Moyes 2003), the sequential Lorenz dominance criterion (Atkinson and Bourguignon 1987), and its descendants (Moyes 2012), these models can hardly be compared to the ones proposed in this chapter. The former try to cope with the fact that the wellbeing of a household does not only depend on its income but also on its needs, which are determined, among other things, by the household's size. Accordingly, these accounts do not consider an income distribution as equally just because every household has the same earnings, and they do not consider a household poor just because its earnings undercut a certain threshold. The measures, or orderings, of inequality and poverty attached to these accounts rather make use of "household types" as a further input that reflects a household's needs. Hence, inequality in this sense can be understood as inequality in the satisfaction of needs and thus as representing the comparative aspect of need-based justice. Again, however, these accounts are supposed to give blanket information about the satisfaction of *all* of the households' needs. By contrast, we aimed at information about the satisfaction of needs for a *specific* good.

To be as precise as possible, some notation and terminology are needed. Let there be a set I of n individuals. These individuals could be persons, but we may equally think of households, companies, and so forth. Each individual $i \in I$ is endowed with a particular amount ω_i of a good and exhibits a certain need ν_i of that good. An individual i is *under*supplied if their need is not satisfied, viz., $\omega_i < \nu_i$; they are *over*supplied if $\omega_i > \nu_i$; and they receive an *exact* supply if $\omega_i = \nu_i$. A measure of need-based justice may then be characterised as a function whose arguments are the individual endowments ω_1 to ω_n, as well as the individual needs ν_1 to ν_n, and whose values are numbers representing a degree of need-based justice (cf. Traub et al. 2017, p. 6).

The quantitative information given by a measure is chiefly called for in situations of scarcity. When the total amount of a good does not suffice to satisfy all needs, the question arises of which distribution would be the least unjust. This question cannot be answered without doing some mathematics. For even if the answer is simply that we should see to it that as many needs as possible are satisfied, the operation of addition is in play. Or consider the answer that the amount of unmet need should be minimised. This answer remains vague until it is clarified how unmet need is to be calculated. Moreover, mathematics is a helpful impetus for stating more precisely what need-based justice is, or to distinguish different kinds of need-based justice that are often conflated, thus achieving a more nuanced understanding of this topic (cf. the arguments for using graphs in Kagan 2012, p. 46).

In Section 2.1, we introduce two measures of need-based justice known from the existing literature. They have already been discussed in Siebel and Schramme (2020, pp. 42–45). In Section 2.2, we present and compare three new measures from our project that further develop the idea of need-based justice.

2.1 The Measures of Miller and Jasso

Need-based justice could be measured by simply counting the individuals whose needs are unsatisfied. The higher this number, the more unjust the distribution. However, this index is way too simple because it does not take into account the *extent* to which needs are unsatisfied and the *proportion* of unsatisfied needs. A distribution across 10 individuals all of whose needs are almost met would be as unfair as a distribution across 10 individuals who are severely undersupplied. Still more, it would make no difference if the undersupplied were joined by people who receive much more than they need. The latter shows that Sen's (1981, p. 186) focus axiom for the measurement of poverty must not be transferred to need-based justice.[2] The focus axiom states that the degree of poverty ought to be sensitive merely to changes in the poor. By contrast, need-based justice also depends on the rich, meaning the people whose needs are satisfied.

To solve this problem, a more sophisticated index may help to calculate the ratio of individuals with unsatisfied needs to the entire population of individuals. This index bears an analogy to the so-called headcount ratio, which measures poverty by the fraction of people who are below the poverty line. Frankfurt (1987, p. 31) seems to advocate it when recommending that scarce resources be distributed "in such a way that as many people as possible have enough or, in other words, to maximize the incidence of sufficiency". Just like the simple measure, however, the more sophisticated one ignores the *extent* of undersupply (cf. Casal 2007, p. 298). A distribution in which 40% lack half of what they need will be regarded just as unfair as a distribution in which 40% lack only a tiny amount. To avoid such an oversimplification, we need an account of the *degree* to which people are (under-) supplied.

Siebel and Schramme (2020, pp. 42–45) introduced and critiqued two measures that account for degrees of need satisfaction. The first one was proposed by Miller (1999, pp. 217f.). His measure is based on the idea that the more inequality there is in unmet need, the more unjust the distribution. To mathematise unmet need, Miller suggests taking the *difference* between an individual's endowment and their need.[3]

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2 Cf. Springhorn (2022, pp. 493f.). For an overview of poverty measures, cf. Seidl (1988).

3 Cf. Miller (1999, p. 320, fn. 27). Surprisingly, Miller (1999, 221) later reformulates the underlying principle in terms of the *ratio*: "if my needs are half-satisfied, so should yours be".

Likewise, the divergence between two unsatisfied needs is given by the difference between the corresponding need gaps, measured in absolute values. The overall injustice of a distribution is then calculated by adding up all of the need gaps. For example, if there are three households needing 90 m^2 each, and the first household receives 90 m^2 (need gap 0 m^2), the second household 60 m^2 (need gap –30 m^2), and the third household 30 m^2 (need gap –60 m^2), then the injustice is $|0\ m^2 - -30\ m^2| + |0\ m^2 - -60\ m^2| + |-30\ m^2 - -60\ m^2|$ and thus 120 m^2.[4]

Miller (1999, p. 219) is well aware that his measure is not without shortcomings. Firstly, it is subject to the levelling-down objection: it allows for one absurd solution in which justice can be met by decreasing endowments for all because this may equalise unmet need.[5] Moreover, oversupplied people do not enter into Miller's calculation, with the result that his index satisfies the focus axiom: the degree of need-based justice is sensitive merely to changes in the undersupplied. Finally, since Miller measures unmet need by the *difference* between what the person has and what they needs, his index provides values in the unit by which the corresponding good is measured. If the good is, say, vitamin C measured in milligrams, then justice will also be measured in milligrams. This is odd in itself because milligrams do not seem to be meaningful justice units (cf. Jasso 1978, p. 1403). In addition, it has the unwelcome consequence that Miller's index is neither unit-invariant nor scale-invariant (cf. Springhorn 2022, p. 488), two axioms that are prominent in measuring poverty. That is, the values for the previous example do not stay the same if housing space is measured in square inches instead of square meters; and they change if both endowments and needs are doubled or multiplied by another number.

This does not hold for the index that can be extracted from Jasso's theory of justice.[6] According to Jasso, the degree of justice of an endowment is given by the natural logarithm of the ratio between *actual* endowment and *just* endowment. To obtain a measure of *need*-based justice, it immediately suggests itself to equate the just endowment with the *need* of the individual at hand, thereby arriving at $\ln(\omega_i / \nu_i)$. This measure emits the value 0, representing perfect justice when endowment and

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4 In Hassoun's (2009, p. 262) view, Miller does not simply equate need-based injustice with inequality in need gaps but "adds the total amount of remaining need to this inequality to give a score for need improvement". Although Hassoun's interpretation conflicts with how Miller describes his own measure, surprisingly, Hassoun is still able to explain the injustice values assigned by Miller (1999, p. 218) when he discusses a concrete example (cf. Siebel 2017, p. 7; Siebel and Schramme 2020, pp. 43f.).

5 Cf. the levelling-down objection to egalitarianism discussed by Nozick (1974, p. 229) and Temkin (1993, pp. 247f.).

6 Cf., inter alia, Jasso (1978, 1980, 1990, 1999, 2007), Jasso and Wegener (1997).

need are identical; it provides negative numbers in cases of undersupply and positive numbers in cases of oversupply.

Since the logarithmic function merely provides justice values for single individuals, the question arises of how to aggregate these numbers in order to arrive at a value for a whole distribution. Jasso (1999, p. 144) discusses two candidates, the arithmetic mean of the individual degrees of justice and the arithmetic mean of their absolute values. Both accounts are problematic. The mean of the individual degrees of justice merges positive values for oversupply and negative values for undersupply and thereby allows for unfortunate compensation. For example, a distribution exactly satisfying the needs of two persons would be as just as a distribution in which one of them gets half of what she needs and the other twice as much. The mean will be the same, namely 0, but the latter distribution is obviously not as just as the former. Although the mean of the absolute values is superior in this respect, there may be identical values regardless of whether there is only undersupply or only oversupply. For example, the injustice emerging from two individuals endowed with half of what they need is identical to the injustice of two individuals possessing twice as much (cf. Springhorn 2022, p. 477).

A further disadvantage of Jasso's measure is that it does not only treat *under*supply as unjust but also *over*supply. Thereby, it implements one of the four basic principles of need-based justice distinguished by Siebel and Schramme (2020, pp. 38–42). Two of these principles can be traced back to Plato's *Republic*, where we find a forerunner of the phrase "To each their own" (cf. Plato 1973, pp. 433e–434a, 433a). An application of this idea to distribution suggests that everyone should receive what is due to them. To obtain a conception of *need*-based justice, we may again equate these legitimate endowments with the *needs* of the recipients. Following this idea, everyone receives their own if everyone receives what they need.

However, the slogan "To each what they need" is still ambiguous. It could mean that neither more nor less is allowed such that all deviations from exact satisfaction of needs, i.e., both undersupply and oversupply, are unjust. On the other hand, the slogan could be understood as saying that only undersupply is unfair because the crucial point is that no one receives less than they need. Anyway, under both interpretations the slogan is purely qualitative in merely stating under which conditions a distribution is just or not. But we can sift out relative principles at least, viz., principles establishing which of two distributions is more unjust. In the notation introduced beforehand, the two variants of the Platonic conception read as follows:

(PC1) A distribution among the individuals in a set I is just with respect to needs if and only if $\omega_i = \nu_i$ for all $i \in I$; and it is increasingly unjust the more the ω_i lie below or above the corresponding ν_i.

(PC2) A distribution among the individuals in a set I is just with respect to needs if and only if $\omega_i \geq \nu_i$ for all $i \in I$; and it is increasingly unjust the more the ω_i lie below the corresponding ν_i.

These principles are *noncomparative* in the sense of Feinberg's (1974, p. 300) "Noncomparative Justice": "When our task is to do noncomparative justice to each of a large number of individuals, we do not compare them with each other, but rather we compare each in turn with an objective standard and judge each (as we say) 'on his merits.'" Laying aside the question of whether needs are *objective* standards, this is exactly what we do when we apply (PC1) or (PC2). For each individual, we make an isolated comparison of its endowment with its need, and we declare the whole distribution just if these individual comparisons turn out all right.

The measure derived from Jasso's theory of justice conforms to (PC1) because it condemns both undersupply and oversupply as unjust.[7] Pointing in the same direction, Kagan (2012, pp. 82f.) argues in *The Geometry of Desert* that there is a level of wellbeing beyond which people do not deserve more because no one deserves unlimited wellbeing. But Kagan is concerned with desert, and it seems that need is different in this respect. Needs are not marks for precision landing but minimal requirements. Exceeding them leads to injustice if there remain undersupplied parties. It may also lead to injustice if the oversupply of some parties is greater than the oversupply of others. But this does not imply that universal oversupply necessarily generates injustice.[8] Otherwise, the land of milk and honey would be unfair just because everyone has more than they need.

Analogous difficulties affect Robeyns' (2017, p. 2) limitarianism, according to which "it is not morally permissible to have more resources than are needed to fully flourishing [sic] in life". Fully flourishing in life might be a more ambitious goal than satisfaction of needs. But exceeding this ambitious goal also appears to be unjust as long as there are some people who are not able to fully flourish in life, and possibly if the surplus is unequally distributed. Excess by itself does not seem to generate injustice. All in all, (PC2) appears to be more appropriate than (PC1), at least when we remain with noncomparative justice.

2.2 The Measures of Siebel, Springhorn, and Traub and Colleagues

The main impetus of Siebel's account is that a measure of need-based justice ought not to be based solely on a Platonic principle precisely because these principles merely capture the *noncomparative* element of need-based justice.[9] Consider two

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7 Another example is to be found in Bauer (2022).

8 Cf. Feinberg (1974, p. 306), Kagan (2012, pp. 179f.), Nullmeier (2020, p. 203).

9 An initial version of Siebel's measure is to be found in the working paper Siebel (2017).

households, both needing 120 m^2 of living space. In the first distribution one household receives 360 m^2 while the other receives 60 m^2; in the second distribution the first household receives 120 m^2 while the latter household again receives 60 m^2. Then (PC2) correctly stigmatises both distributions as unjust because household 2 has only half of what it needs. However, there is a further injustice concerning needs not registered by (PC2). Household 1 is massively oversupplied in the first scenario and supplied exactly in accordance with their needs in the second. Hence, in the first scenario, household 1 would suffer no serious harm if it passed 60 m^2 to household 2 in order to satisfy the latter's need. In the second scenario, by contrast, even a small transfer would result in household 1 being undersupplied. The first distribution, therefore, seems to be more unjust than the second one. The Platonic conception is not able to reproduce this line of reasoning because exact supply is attributed the same influence on justice as extreme oversupply, and this holds even when there are undersupplied individuals.

For this reason, Siebel adds a *comparative* element, which can be found in Aristotle. In book V of the *Nicomachean Ethics*, Aristotle (2009, pp. 84f.) presents his famous proportionality conception of justice:

> The just, then, is a species of the proportionate […]. For proportion is equality of ratios, and involves four terms at least […]; and the just, too, involves at least four terms, and the ratio between one pair is the same as that between the other pair; for there is a similar distinction between the persons and between the things. As the term A, then, is to B, so will C be to D, and therefore, alternando, as A is to C, B will be to D.

The "things" are the actual endowments of the persons. Aristotle is thus saying that a distribution is just if the ratio between these endowments is identical with the ratio between the "persons". But what does the latter mean? Let us assume that Aristotle is talking here about what the persons *should* receive. Then a distribution among two persons is just if the ratio between what one person receives and what she should receive is identical with the ratio between what the other person receives and what she should receive. In other words, we are to ensure equal ratios between actual and legitimate endowments in order that no one has an advantage over the other.[10]

Again, we obtain a conception of *need*-based justice if we equate the legitimate endowments with the *needs* of the recipients. This specification results in the following principle:

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[10] Aristotle's conception of distributive justice was applied by sociologists as early as the 1950s (cf. Sayles 1958, Homans 1961, Patchen 1961, Adams 1965, Walster et al. 1976).

(AC1) A distribution among the individuals in a set I is just with respect to needs if and only if the ratio ω_i / ν_i is the same for all $i \in I$; and it is increasingly unjust the more the ratios ω_i / ν_i diverge.

If there are two families, one of them requiring 120 m^2 of housing space and the other one 90 m^2, then endowing both with 60 m^2 is unfair according to (AC1). For the first family has to make do with half of what it needs, whereas the second family gets at least two-thirds and thus has a relative advantage. According to Feinberg (1974, p. 299), "[a]ll comparative justice involves, in one way or another, equality in the treatment accorded all the members of a class". The Aristotelian conception is comparative in this sense because it requires equality of need-satisfaction, the latter being attained if all ratios between endowments and needs are identical.

According to Nullmeier (2020, pp. 202f.), such principles exceed a "monistic theory of need-based justice" because "the principle of need is combined with a second principle", which is in this case "proportionality". But this would mean that a theory stating that a distribution is more just the more needs are satisfied is not monistic either because it includes a second criterion of justice, namely headcount. We rather propose taking proportionality as the *mathematical* part of (AC1) while the *name-giving* part is (AC1)'s focus on needs. A theory stating that goods should be distributed in proportion to effort contains the same mathematical formula but will be called "effort-based" because it focuses on effort.

(AC1) determines that goods should be distributed in proportion to needs not only under but also above the threshold. By analogy with the Platonic conception (PC2), however, one could argue as follows: If all needs are met, then other principles, such as desert or equality, might see to it that a distribution is unjust, but there is nothing to complain about from the perspective of *need*-based justice (cf. Woozley 1973, p. 34). The corresponding variant of the Aristotelian conception states:

(AC2) A distribution among the individuals in a set I is just with respect to needs if and only if either $\omega_i \geq \nu_i$ for all $i \in I$ or the ratio ω_i / ν_i is the same for all $i \in I$; and it is increasingly unjust in the second case the more the ratios ω_i / ν_i diverge.

Whereas it seems quite clear that the Platonic variant (PC2) is to be preferred over (PC1), there is no obvious choice among the Aristotelian variants. Strong sufficientarians, such as Frankfurt (1987, p. 21), will endorse (AC2) because they do not only hold the positive thesis that people must have enough to live a decent life but also the negative thesis that "if everyone had enough, it would be of no moral consequence whether some had more than others" (cf. Casal 2007 for a critique).

In contrast, Feinberg (1974, p. 315) points out that comparative considerations may still play a role if all parties are well provided for. He suggests that noncomparative justice is *more serious* because not getting what one needs is worse than being oversupplied to a smaller degree than others (cf. Feinberg 1974, p. 317). But this does not entail that different levels of oversupply have *no* influence on need-based justice. Among other things, they seem unfair if they result in different increases in well-being. Let there be a single household needing 60 m^2 and a family needing 120 m^2, as well as space of more than 180 m^2 to be distributed. Presumably, a fifty-fifty divide of the surplus would give undue preference to the single person insofar as the per-person increase in comfort is higher. It therefore appears fairer to follow (AC1) by dividing the surplus in proportion to the households' needs.

The Aristotelian principles (AC1) and (AC2) are both able to discriminate between the cases that were problematic for the Platonic conceptions. Nonetheless, taken by themselves they are insufficient because they only take into account how much the ratios of endowments to needs resemble each other and thereby ignore the noncomparative issue of whether needs are satisfied in the first place. Hence, even if the households in question have to live in flats all too small, a distribution is just according to both variants of Aristotle's conception if all of them have only half of what they require.[11] If there is no more housing space available, such a distribution may be called "as fair as possible given the circumstances". But this should be understood as saying that the distribution is the least unjust.

Siebel's "Plaristonic" approach thus consists in merging a Platonic with an Aristotelian principle. To keep the first attempt short and simple, he suggests combining (PC2) with (AC1). The underlying idea is that need-based *justice* consists in need *satisfaction* complying with the ideals prescribed by these principles. The Platonic part states that needs are to be met. But need-based justice does not exhaust itself with need satisfaction because, in line with Aristotelian principles, it also includes equal levels of need satisfaction. That is, Siebel is not only interested in whether all parties have their needs met but whether what they receive is able to fulfil their needs to the same extent.

To convert this qualitative account into a measure, Siebel suggests implementing the simple idea that a distribution is increasingly unjust the more the actual levels of need satisfaction diverge from the ideal levels. To be more precise, a distribution is increasingly unjust the more divergence there is from satisfied needs (the Platonic ideal) and from equal degrees of need satisfaction (the Aristotelian ideal). The general recipe for such a measure reads as follows:

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[11] Cf. Feinberg (1974, p. 300), Jasso (1978, p. 1402), and Miller (2007, p. 9).

(1) We need a function S_i for measuring to what extent an individual i's need is satisfied. The arguments of this function are i's endowment ω_i and its need v_i.

(2) Given the measure of need satisfaction, we have to determine to what extent the needs of the individuals should be satisfied according to the Platonic and the Aristotelian ideals.

(3) The next step is to find functions PD_i and AD_i to measure how much an individual's actual degree of need satisfaction diverges from the degrees advocated by the given ideals. The arguments of these functions are the values of S_i and the ideal degrees from (2).

(4) The numbers obtained in step (3) tell us how much *individual* degrees of need satisfaction diverge from the ideals. Since we are concerned with distributions among at least two individuals, we have to specify the divergence within the whole group. In other words, we need aggregation functions PD and AD for the *overall* divergence from the Aristotelian and the Platonic ideals. The arguments are the values of PD_i and AD_i, i.e., the individual divergences.

(5) Finally, to combine both kinds of deviation, a function is needed to bring together the values of PD and AD. Since its output is the overall deviation from both ideals, this function constitutes the Plaristonic measure of need-based justice.

Having completed our discussion of Siebel's index, we will next evaluate Springhorn's approach.[12] His index differs from the others developed in our project insofar as it is located at the individual level. This does not mean that, like Jasso's measure, it assigns an individual a justice value merely on the basis of *their* endowment and need. Rather, it assigns justice values to individuals on the basis of the endowments and needs of *all* parties involved.

The core thesis behind Springhorn's index is that undersupply is increasingly unjust the more it could have been mitigated by transfers. That is, while receiving more than needed is never unjust, receiving less than needed is unfair if there is an opportunity to increase the endowment by taking something from other parties. Note that this idea has two remarkable consequences. First of all, if an individual is undersupplied but the others have nothing to donate, the undersupply will not be unjust because it cannot be mitigated (cf. Springhorn 2022, pp. 482, 484f.). This is

[12] An initial version of this index was presented in the working paper Springhorn (2017) and the final version in Springhorn (2022).

clearly at odds with the Platonic principles mentioned in the previous section. For these principles rule that having less than needed is invariably unjust, no matter whether others can help or not. Furthermore, undersupply is unjust on Springhorn's account even if the other parties are worse off than the individual in question. Hence, Springhorn leaves out whether mitigation of undersupply occurs at the cost of a worse off individual.

Another consequence of Springhorn's core thesis is that, in contrast to the Aristotelian principles, identical degrees of need satisfaction do not necessarily lead to justice. Consider two households possessing only half of the income they need. If there are no other households with income, it is, of course, not possible to simultaneously improve the situation of both households. However, since the situation for each individual household can be improved by transferring money from the other household, the conditions of both would be considered unjust according to Springhorn's measure.

Springhorn (2022, pp. 490f.) presents his index as emerging in five steps. We describe it in four steps of a slightly different order because this seems easier to relate to. Firstly, like Siebel, Springhorn takes the ratio of endowment and need, ω_i / ν_i, to represent individual degrees of need satisfaction. Secondly, he prefixes Jasso's logarithm in order to guarantee a certain type of sensitivity that will be explained when we come to differences between the measures. Thirdly, he multiplies the logarithm by the ratio of the total endowment to the total need of the other individuals involved in the distribution. In this way, undersupply is weighted by the opportunity to mitigate it, where the latter is given by the percentage to which the needs of the other parties are satisfiable on average. For example, if there is a surplus, then the injustice assigned to the undersupply of the individual in question is greater the higher the surplus. If there is scarcity, then the injustice decreases with increasing scarcity. Fourthly, since Springhorn wants all cases of oversupply to be judged in the same way as exact supply, namely as being just, he makes use of the minimum of the value described and 0.

Although Springhorn's formula measures the injustice of individual endowments, there is an outlook on the justice of whole distributions (cf. Springhorn 2022, pp. 492f.). To aggregate single values, one could simply use their arithmetic mean. In contrast to Jasso's account, this does not lead to the unfortunate compensation of undersupply by oversupply because a single individual that has less than they need generates injustice. However, Springhorn also points to an effect he views as a disadvantage. When the endowment of an undersupplied party rises, the injustice of the whole distribution is not automatically reduced. The reason is that, while the injustice for this individual will be smaller, the injustice for all other undersupplied parties will be greater because the possibility of upgrading them increases.

Finally, we come to Traub et al.'s index. Their considerations are similar to Springhorn's proposition that undersupply is increasingly unjust the more it could have been mitigated by transfers. The measure by Traub et al. assumes that a distribution is increasingly unjust the more resources are used for oversupply instead of need satisfaction, or in short, the more it is inefficient (cf. Traub et al. 2017, pp. 8–10).

The starting point of Traub et al. is the same as for the other indices, namely, a measure of need satisfaction. However, there are two deviations from the former accounts. Firstly, corresponding to poverty measurement, which assumes a common poverty line, Traub states that the individuals have identical needs ν. If there are differences between them resulting in differing needs, these are to be factored in by an equivalence scale that adjusts endowments. Secondly, Traub and colleagues do not use the ratio ω_i/ν, but the minimum of this ratio and 1. The reason is that they want to avoid varying degrees of oversupply. If an individual's endowment ω_i is greater than the common need ν, the minimum sees to it that need satisfaction does not exceed 1. Accordingly, no matter whether an individual's endowment is equal to their need, slightly greater, or significantly greater, the degree of need satisfaction is always 1 (cf. Traub et al. 2017, p. 5).

The next step consists of defining the "allocation efficiency" of a distribution, which depends on two factors. One of them is the aggregate surplus L, i.e., the sum of the differences between the endowments and needs of the oversupplied parties. The other one is the overall endowment Ω, i.e., the sum of all endowments. Roughly, the allocation efficiency is given by $1–L/\Omega$. The more surplus there is in relation to the overall endowment, the less efficient the distribution is because a higher percentage of the resources is not used for meeting needs. The maximum efficiency 1 is reached when there is no oversupply, meaning that L is 0 (cf. Traub et al. 2017, pp. 5f.).

The index Traub et al. favour characterises injustice as depending on three factors. The degree of injustice is greater (i) the smaller the efficiency, (ii) the fewer supplied parties there are, and (iii) the smaller the need satisfaction of the undersupplied parties. Traub et al. conclude with proofs showing that this index satisfies certain axioms, as well as numerical examples illustrating the characteristics of the index (cf. Traub et al. 2017, pp. 10–14).

Having introduced the three measures developed in our project, we draw a brief comparison between them starting with some similarities.

Similarity 1: In the background of all of the measures, there is a clear distinction between need-based *justice* and need *satisfaction*. That is, our measures do not equate these quantities by simply taking a distribution to be increasingly unjust

when fewer needs are met. Rather, they avoid such an oversimplification by regarding need-based justice as somewhat dependent on need satisfaction, but not identical to it (cf. Springhorn 2022, pp. 477–480).

Similarity 2: A further common feature is that measurement of need satisfaction is based on Aristotle's ratio of endowment to need.[13] Of course, while Siebel and Springhorn just take ω_i / ν_i, Traub et al. use the minimum of this ratio and 1 in order to avoid differing degrees of oversupply. But this difference is less significant than the ones we find when comparing the ratio with the other proposals on the table, namely Jasso's logarithm of this ratio, $\ln(\omega_i / \nu_i)$, and Miller's difference of endowment and need, $\omega_i - \nu_i$.[14]

A key advantage of Aristotle's and Jasso's accounts is that, unlike Miller's, they are unit-invariant and scale-invariant. However, in contrast to Aristotle's ratio, Jasso's logarithm of this ratio is subject to at least three difficulties. First of all, it introduces an evaluation that could be seen as inappropriate in this context. Since the logarithm is a nonlinear function, undersupply automatically carries greater weight than oversupply of equal absolute value. For example, giving a family 20 m^2 *less* than its need of 100 m^2 results in a higher deviation from the value for exact need satisfaction than giving 20 m^2 *more*. It might make sense to say that the undersupply is more *unjust* than the oversupply, but it is odd to say that the undersupply itself, i.e., its extent, is greater than the oversupply. Moreover, the logarithm is not defined for 0. Hence, endowments of 0 are either not allowed or must be captured by the limit $\ln(\omega_i / \nu_i)$ strives towards when ω_i is getting smaller, i.e., $-\infty$. But then zero endowments gain an overwhelming influence. Finally, in contrast to the logarithm of the ratio, the pure ratio allows for an intuitively accessible interpretation because it provides a percentage to express the extent to which the given need is satisfied. For example, 0.8 means that 80% of the need is satisfied and 1.2 means that 120% of the need is satisfied.

Kagan (2012) warns against using the ratio within a theory of desert. His belief is that comparative desert is achieved when the ratios of wellbeing to virtue are identical. However, two of his arguments are based on *negative* numbers for levels of wellbeing and virtue.[15] They are thus not applicable to need-based justice because there exist neither negative endowments nor negative needs. But Kagan

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13 In the preliminary version, Siebel (2107, pp. 11f.) makes use of Jasso's logarithm (cf. Springhorn 2022, p. 474, fn. 3). This choice is critiqued by Miller (2020, p. 289).

14 While we are concerned here with need *satisfaction*, Eriksson (2012) examines which of these measures better fits experimental data on *justice* evaluations.

15 Cf. Kagan (2012, pp. 355, 357) and Walster et al. (1976, pp. 3f.). The latter have also pointed out that equality of ratios can lead to absurd results when negative quantities are allowed.

(2012, p. 356) also points to difficulties arising from *zero* levels of virtue, and these difficulties *are* transferable. The ratio between endowment and need is inappropriate if an individual has no need for the given good because division by 0 is not allowed. Hence, the following considerations are restricted to scenarios in which every party needs at least a small amount of the good in question. This is an innocent constraint because individuals without need do not matter when we are interested in need-based justice.

Similarity 3: In Section 2.1, we already pointed out that an index of need-based justice differs from a poverty index by not being subject to the focus axiom. That is, changes in the income of the rich, as far as they do not result in poverty, should not have an influence on how poor a society is. In contrast, changes in the endowments of people whose needs are satisfied can have an influence on need-based justice even when they do not result in undersupply. The indices developed in our project have this insight in common. As we will see below, however, they differ with respect to other axioms from poverty measurements.

Similarity 4: The final commonality is that the indices in question have a maximum representing justice, while smaller numbers represent degrees of injustice. The maximum of Siebel's and Springhorn's measure is 0, the measure by Traub et al. has a maximum of 1. Feinberg (1974, p. 297) wrote the following in a footnote of "Noncomparative Justice":

> As many writers have observed, it is much more convenient, when doing moral philosophy, to speak of injustice than to keep to the positive term, justice. That greater convenience is an undeniable fact, but I shall not speculate here whether it has any theoretical significance.

We think it has theoretical significance. There are clearly different degrees of *injustice*, and we refer to them by saying, e.g., that a distribution is "more", "less", "only slightly", or "highly unjust". But such gradations, taken literally, hardly make sense in the case of *justice* because a distribution cannot be more just than just. Of course, we use formulations such as "This is more just" or "This is less just". A closer look reveals, though, that "more just" means *less unjust* and "less just" means *more unjust*. The negative term "injustice" is thus more convenient than the positive term "justice" because it allows for gradations to be taken literally. We will now turn to the important differences.

Difference 1: Above all, the measures are grounded in different conceptions of need-based justice. To put these conceptions in a nutshell:

> *Siebel*: A distribution is increasingly unjust the more it deviates from absolute need satisfaction and equal degrees of need satisfaction.

Springhorn: A distribution is increasingly unjust the more the given undersupply could have been mitigated by transfers.

Traub and colleagues: A distribution is increasingly unjust the more resources are used for oversupply instead of need satisfaction.

Since the underlying conceptions are different, it is no surprise that the corresponding measures display differences in their specific properties.

Difference 2: For a quite essential difference, Siebel's account differs from those of Springhorn as well as Traub et al. in not satisfying further analogues to poverty axioms besides the focus axiom. For example, Springhorn (2022, pp. 487f., 500) and Traub et al. (2017, pp. 7f., 10f.) prove that their measures show *monotonicity* in endowments. Roughly, if an undersupplied individual receives a larger amount of the good, then injustice decreases; if the endowment decreases, injustice increases. There is also *sensitivity* in endowments. Among other things, when the endowment of an undersupplied individual is increased by a fixed amount, then the decrease in injustice is greater the larger the initial undersupply of the individual.[16] Consider two households, both needing 120 m^2 of living space. While one of them owns 90 m^2, the other one owns only 60 m^2. If the living space of both households is raised by 15 m^2, injustice diminishes more drastically in the case of the second household because 15 m^2 is a larger proportion of 60 m^2 than of 90 m^2.

The Platonic part of Siebel's measure is monotonic. When the endowment of an undersupplied individual grows, then this part registers less injustice because there is a larger amount of need satisfaction. However, since the Aristotelian part requires identical degrees of need satisfaction, it can happen that overall injustice increases when an undersupplied individual receives more. Although the distribution converges to the Platonic ideal of full need satisfaction, it might have reached a point at which it diverges too much from the Aristotelian ideal of equal need satisfaction (cf. Springhorn 2022, p. 489). For the same reason, sensitivity does not generally hold. Raising the endowment of a worse off individual can result in a smaller decrease in injustice than raising the endowment of an individual who is better off because the resulting disparity in need satisfaction becomes larger.

Difference 3: A less essential variation is that, whereas Siebel's and Springhorn's indices have no minimum, the index by Traub et al. has one, namely 0, representing the highest degree of injustice (cf. Traub et al. 2017, p. 6). The minimum is reached when all parties involved receive nothing (cf. Traub et al. 2017, p. 10).

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[16] The sensitivity axiom shows some resemblance to the "Priority View" supported by Parfit (1997, p. 213) and Crisp (2003, p. 751). Regarding axioms of monotonicity and sensitivity for need-based justice, see Bauer (2019).

Springhorn's measure does not provide a value in this case because the logarithm $\ln(\omega_i/v_i)$ is not defined if ω_i is 0. It remains to be discussed whether a minimum makes sense. After all, one could argue that injustice further increases when one party receives nothing while the other one's oversupply increases. The Aristotelian principle (AC1) supports this concern.

Difference 4: The previous variation is connected with a more serious one concerning the treatment of all-embracing oversupply. When everyone has what they need, the measures of Springhorn (2022, p. 492) and Traub et al. (2017, p. 6) provide the maximum value independently of how much each endowment exceeds the need threshold. In other words, the *comparative* dimension of need-based justice does not matter in situations of overall abundance. The argument is that there may still be a reason to complain of injustice when all needs are met, but such a reason is not grounded in need but in a different principle of justice, such as effort or equality. Thus considered, need-based justice is one of the ingredients in a *pluralistic* theory of justice. For example, a pluralistic theory might combine need and effort by ruling that a distribution is just when all needs are satisfied and the surplus, if there is one, is distributed in proportion to effort (cf. Boulding 1962, p. 83).

In connection with the Aristotelian principles (AC1) and (AC2), however, we have seen that there is also reason for thinking that different degrees of oversupply may generate injustice. For when a surplus is redistributed, the wellbeing of the involved parties may increase in proportion to their need threshold. For example, if there is a single person and a family, it seems unfair to equally distribute excess living space among them because the comfort of the single person will be boosted to a higher degree. Rather, the one-person household should get less than the family. But this would mean that comparative considerations on need, e.g., equal degrees of need satisfaction, still play a role in situations of abundance (cf. Feinberg 1974, pp. 315–317), which is captured by Siebel's measure.

2.3 Summary

Although need-based justice is an important kind of distributive justice, there exist hardly any measures of how just distributions of a specific good are with respect to satisfaction of the corresponding needs. To fill this gap, we proposed three indices of need-based justice that implement diverse ideas and therefore have different features. After considering and critiquing two further measures proposed in the literature, we compared these indices in Section 2.2.

Future research could merge the formal perspective and the empirical perspective we are about to present in the following sections by testing the empirical adequacy of measures of need-based justice, that is, by comparing them with empiri-

cally found evaluations of need-based justice. To take a single example, Springhorn's measure significantly differs from the ones by Siebel and Traub et al. in letting an individual's undersupply be just if it cannot be mitigated by transfers because the other parties do not possess any amount of the good in question. Hence, one could think about studies in which vignettes of such scenarios are introduced in order to examine whether subjects deem undersupply just in these cases. Furthermore, different measures may compete with each other in terms of how well they mirror the justice evaluations and distributive decisions of participants in empirical studies. To this end, we need scenarios in which the competing measures give clearly different verdicts.

Whatever the result of such research may be, it will be in line with Nullmeier's (2020, p. 193) proposition that, "Progress in the field of need-based justice can only fruitfully take place in the mode of an *empirically enlightened normative theory* and a *normatively informed positive theory*."

3 The Empirical Perspective: Studies on Need-Based Justice

In the following, we introduce three empirical studies. The first one (Section 3.1) examines how laypeople's evaluations of distributive situations are influenced by information about need and especially a need threshold. The second study (Section 3.2) reviews third-party distributive decisions and how they are affected by information about need, effort, and accountability. The final study (Section 3.3) investigates how participants evaluate different kinds of needs and how these influence third-party distributive decisions.

3.1 Needs as Reference Points

If people consider need as an important distributive principle, then there should be a connection between the extent of need satisfaction following a distribution and how just that distribution is perceived to be. With the study presented in this section, we took a first step to find out more about this connection.[17]

We assume that people do not think of a distribution in purely binary terms, i.e., as just or unjust, but also make more fine-grained differentiations concerning the distribution's *degree* of justice. The corresponding justice evaluation function may be assumed to be monotonically increasing with respect to a person's endowment: the more a person receives, the more need-based justice there is (contrast

[17] This study was first published as a working paper (Weiss et al. 2017). A strongly revised version can be found in the working paper Bauer et al. (2023). Parts of the data have also been analysed in a working paper by Bauer (2018), which was later published as Bauer (2019).

Section 2.2). But how about the function's other properties? For example, what influence does a need threshold – the point of perfectly met need – exert on it? How does the function behave below, above, and at such a need threshold? Different theories of distributive justice, such as prioritarianism, sufficientarianism, and utilitarianism, would make different predictions. We investigated laypeople's justice evaluations to shed some light on their justice evaluation functions and how they are influenced by such a threshold.

For that purpose, we designed a vignette study with two between-subjects treatments, one of which referenced need while the other did not. The aim was to compare subjects' justice evaluations regarding a set of hypothetical distributive situations presented to them. In the *Need Treatment*, subjects were asked to imagine that it would be the state's obligation to meet people's need for housing. The need we introduced was an amount of living space (1000 fictive units per household) that people of the region in question consider necessary for a decent life. In conformity with Nullmeier's (2020, pp. 191–193) first thesis, we thus presented need as an intersubjectively acknowledged amount of some good that is required to live in decency. To free the evaluations from comparative considerations, we further told participants that households are basically identical and will receive the same amount of living space. In the *No-Need Treatment*, everything was exactly the same aside from the fact that we left out all information concerning need.

109 people participated in this study, mostly students of various disciplines with a median age of 25 years and roughly an equal distribution of gender. They were shown a total of 11 scenarios in which different amounts of living space are provided, ranging from nothing up to 2000 units, and increased in increments of 200 units. In between-subjects treatments, our participants saw either the vignette of the Need or the No-Need Treatment. They were then presented with two different tasks, a *Global Rating Task* and a *Relative Rating Task*. In the former, subjects were shown all 11 scenarios below each other on a single screen. Next to every scenario, a slider was available to rate the scenario's justice on a scale from 0% ("not at all just") to 100% ("perfectly just"). This is akin to methods from psychometrics, welfare economics, and sociological justice research. In the Relative Rating task, participants were presented with pairs of scenarios that are adjacent in terms of living space (i.e., 0 and 200 units, 200 and 400 units, and so forth). In this task, they rated the difference in justice between the two scenarios on an 11-point scale, i.e., how much more just one scenario is than the other, ranging from 1 ("equally (un)just") to 11 ("much more just").

Figure 1 depicts the mean justice evaluations, as well as their 95% confidence intervals, for the Global Rating Task and both treatments on a [0,1] scale in dependence of units of living space (0, 200, 400, and so forth). In the No-Need Treatment,

justice evaluations seem to rise nearly linearly with increasing units of space. In the Need Treatment, however, there is a clearly visible jump in the evaluations at the need threshold of 1000 units. Moreover, evaluations of endowments below the threshold are (except for the case of 0 units) significantly lower in the Need Treatment compared to the No-Need Treatment. At and above the threshold, they are (except for the cases of 1600 units or more) significantly higher.

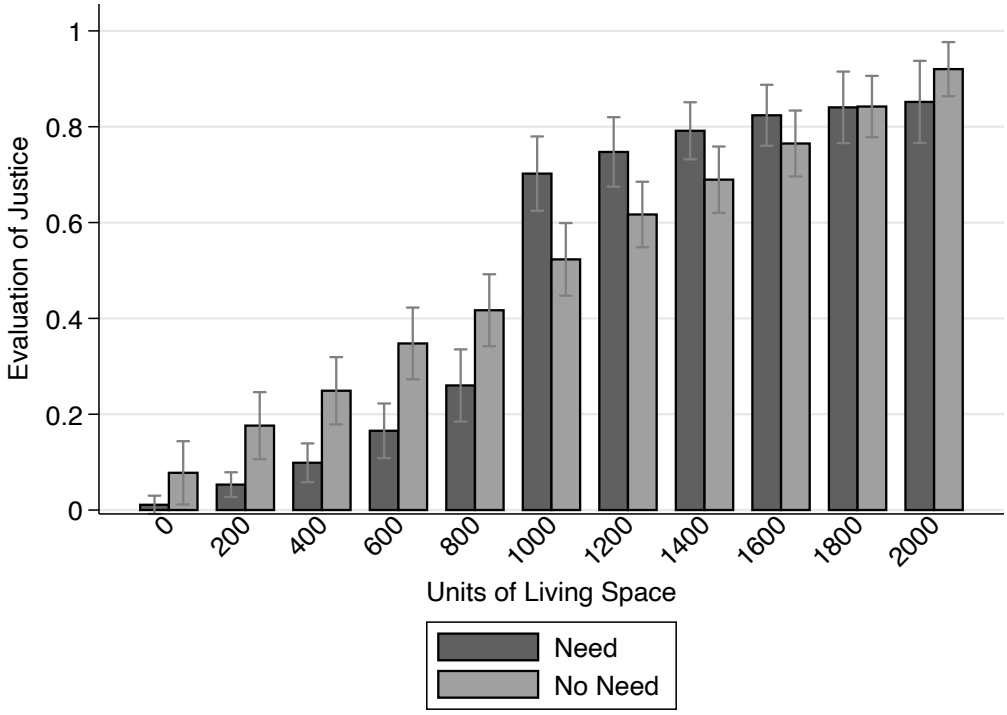

Figure 1: Mean justice evaluations in the Global Rating Task by treatment

These features are further supported by the Relative Rating Task. Pairwise justice comparisons on the 11-point scale meander around 3 and 4 points in the No-Need Treatment. In the Need Treatment, comparisons below the threshold result in relatively low increases of justice ratings, namely about 1 or 2 points, which are also significantly lower than in the No-Need Treatment (except for the comparison of 600 and 800 units). Ratings increase steeply, viz., by 7 points when the need threshold is met. Ratings in the Need Treatment are also significantly higher than in the No-Need Treatment. Above the threshold, the pairwise comparisons result in ratings of about 3 to 5 points with no notable difference between treatments.

Hence, information about a need threshold leads to a *sigmoid* justice evaluation function: below the need threshold it is convex, above the threshold it is concave. Note that the convexity of the function below the threshold raises an ethical problem. For it would mean that injustice can be reduced to a higher amount by helping those who have only slightly less than they need than by helping those who have

the least. The corresponding precept would violate the "Priority View": "benefiting people matters more the worse off these people are" (Crisp 2003, p. 751). We are thus confronted with a clash between normative and positive theory (cf. Nullmeier 2020, p. 193).

A result that does not violate normative theory is that introducing a need threshold, beside changing the shape of the justice evaluation function, also leads to *converging* evaluations. After all, the panel-level standard deviation is significantly lower in the Need Treatment compared to the No-Need Treatment. This points to the possibility that need as a criterion for distributive justice might be helpful in reaching a normative consensus because it generates more coherence among evaluations.

A closer look at the individual justice ratings reveals that our participants show quite diverse patterns. Apparently, there is no universal tendency in judging the different scenarios but five distinct types. In the Need Treatment, the evaluation function of 8 subjects is hump-shaped, reaching a maximum at or somewhat above the need threshold before starting to decline again, indicating that they consider oversupply to be unfair. We call this *strict sufficientarianism*. Another 4 subjects show binary evaluations, i.e., evaluations that are (close to) 0 for scenarios with undersupply and 1 for scenarios with supply or oversupply. Hence, those participants seem to consider distributive justice not as a gradual matter; undersupply is equally unjust, no matter the degree. This way of distinguishing between insufficient and sufficient endowments we call *qualitative sufficientarianism*. The evaluations of 7 further participants increase with units of living space below the need threshold, reaching a maximum of 1 when arriving at the threshold, and then remaining at 1 for scenarios of oversupply. Since there is a differentiation between degrees of unjust insufficiency, this is called *quantitative sufficientarianism* by us. Contrary to this, 16 subjects evaluate scenarios with undersupply as equally unjust, while their evaluations increase at and above the threshold. We dub this evaluation of undersupply *strict prioritarianism*. Finally, the ratings of another 17 subjects rise with increasing units of living space, which we term *utilitarianism*.

In the No-Need Treatment, the picture is less heterogeneous. A clear majority shows an increasing justice evaluation function: more living space is perceived as more just. Hence, utilitarian concerns appear to dominate this treatment. Interestingly enough, however, we can observe some instances of the other types as well. It seems that, even without information on need, 1000 units of living space served as a reference point in some cases, perhaps simply because it was exactly half of the maximum amount.

To sum up, information about need is highly relevant to evaluating distributive justice. However, in our study, we found quite different patterns of evaluations. The

analysis of individual justice ratings showed that a large proportion of the subjects can be assigned to one of three justice types: sufficientarianism, prioritarianism, or utilitarianism. Whether or not using need thresholds as reference points is desirable from a normative point of view is up for discussion. Focusing on those who are already close to a certain threshold might lead to the neglect of those who are farthest away and therefore are the more needy.

3.2 Need and Accountability

Our first study has shown that information on need clearly influences justice evaluations. In the next study, we turn to subjects as impartial decision makers.[18] They were shown a vignette in which we asked them to imagine two hypothetical persons. The persons' homes are heated with firewood, and each has enough to survive the coming winter. Additional wood is needed, however, to avoid feeling cold. To ensure this, the community they live in permits them to cut wood in the community forest. Since the persons are short of money, this is their only means of getting the needed firewood. Our subjects' task was to distribute the chopped wood among the two persons in a way they think is most just.

While, without any further information, an equal allocation of resources might be the logical default, we introduced factors that differentiate person A from B and could thus justify unequal distributions of firewood. They were presented as heterogenous regarding (i) their *need*, i.e., the quantity of firewood necessary to avoid feeling cold, (ii) their *productivity*, i.e., the quantity of firewood chopped, and (iii) their *accountability*, i.e., whether they are responsible for their greater need or having chopped less than the other.

The variations in need and productivity were implemented on the within-subjects level. The cases were split into two scenarios presented to each subject in a randomised order. In the *Need Scenario*, both persons have chopped an equal amount of wood across all cases but experience different quantities of need. In the *Productivity Scenario*, they have the same need but have chopped different amounts of wood. The persons can be categorised with respect to their supply situation, namely as having chopped less wood than they need, as having chopped exactly as much wood as they need, or as having chopped more wood than they need. Each participant made five distributive decisions per scenario. The ten cases are displayed in Figure 2 and Table 1.

Regarding the variation in accountability, our study was composed of two between-subjects treatments. In the *High Accountability Treatment*, participants were

[18] This study was first introduced as a working paper (Bauer et al. 2020) and was later published as Bauer et al. (2022).

informed that person A has kept on smoking heavily despite warnings from their doctor. This gave rise to a metabolic disease, which is why A needs a warmer room or has cut less wood than B. In the *Low Accountability Treatment*, the metabolic disease of A is not evoked by their actions but congenital.

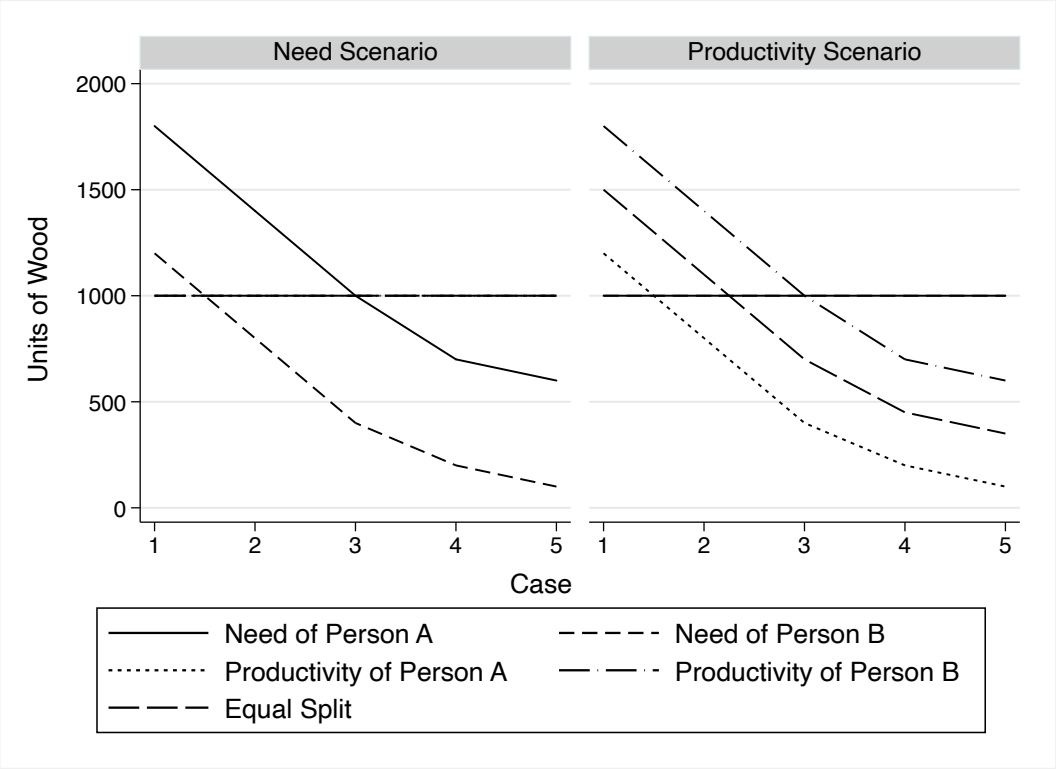

Figure 2: Parametrization by scenario and case

	Need Scenario					Productivity Scenario				
Case	1	2	3	4	5	1	2	3	4	5
Need A	1800	1400	1000	700	600	1000	1000	1000	1000	1000
Need B	1200	800	400	200	100	1000	1000	1000	1000	1000
Productivity A	1000	1000	1000	1000	1000	1200	800	400	200	100
Productivity B	1000	1000	1000	1000	1000	1800	1400	1000	700	600
Equal Split	1000	1000	1000	1000	1000	1500	1100	700	450	350
Productivity Share A	0.50	0.50	0.50	0.50	0.50	0.40	0.36	0.29	22	14
Need Share A	0.60	0.64	0.71	0.78	0.86	0.5	0.5	0.5	0.5	0.5

Table 1: Parametrization by scenario and case

With this study, we wanted to measure the quantitative impact that information about need, productivity, and accountability has on participants' distributive decisions. Note that the systematic variation of accountability for higher neediness or lower productivity is not the only novel feature. Contrary to many other studies, we let our participants freely distribute the available amount among A and B, that is, without offering them a preselected set of distributions.

We assumed that the decisions reveal how far need is acknowledged by the subjects and to what extent this is influenced by the factors we vary. To analyse this, we constructed two outcome measures. First, since the number of logs to be distributed among the two persons varies across certain cases, we had a look at the normalised *share of logs distributed to person A*, where A is always worse off than B. For that purpose, we simply divided the logs distributed to A by the total number of logs available. Secondly, because an equal split can be seen as a logical default, departures from equality hint at the presence of factors that are deemed relevant for distributive justice. Hence, we additionally examined the normalised *deviation from an equal split in favour of person A*. For the sake of normalisation, we first determined the *need share* of A, which is given by dividing the need of A by the combined need of A and B, as well as A's *productivity share*, which is given by dividing that person's productivity by the total productivity. As can be seen in Table 1, the need share of person A increases in the Need Scenario, while the productivity share decreases in the Productivity Scenario.

Among the hypotheses we wanted to test was, first, that person A, who is always worse off than B, receives more on average than she has produced but less than she needs because participants will try to at least partially compensate A for her disadvantage. Secondly, we assumed that this willingness to compensate the worse off person would be reduced if she is accountable for needing more wood or having chopped less wood. For example, in the Accountability Treatment, we should see a lower share distributed to A. Thirdly, the Need Scenario and the Productivity Scenario are mirror images of each other. For example, when A has a need share of 0.6 in the Need Scenario, she has a productivity share of 0.4 in the Productivity Scenario. We assumed that the share our participants allocate to A is oriented towards such relative values instead of the absolute numbers we presented to them. Therefore, the shares we observe in the scenarios should be symmetrical insofar as the deviation from an equal split should be the same between scenarios.

Figure 3 displays the average choices of our participants, a random sample of 200 people from an online access panel, stratified by the three characteristics gender, age, and equivalent household net income. The left panel contains bar charts of A's share by treatment and scenario, the right panel contains range plots of the deviation by treatment and scenario. The short-dashed lines on the left represent the need share of A, and the dashed lines A's productivity share. As becomes apparent, the mean share of logs A receives is significantly higher than her productivity share and lower than her need share across all treatments, scenarios and cases, supporting our hypothesis on *partial compensation*. Our hypothesis regarding *accountability* is also supported by the data because the treatment effect on the share is clearly visible and significant (except for the first case of the Need Scenario). This also

holds for the deviation displayed on the right side. Both in the Need Scenario and the Productivity Scenario, all five cases show significant effects that are negative in the Need Scenario and positive in the Productivity Scenario. The hypothesis of *symmetry*, however, has to be rejected. Our participants tended to deviate more from an equal split when person A's worse situation was due to her lower productivity than when it was due to her greater need.

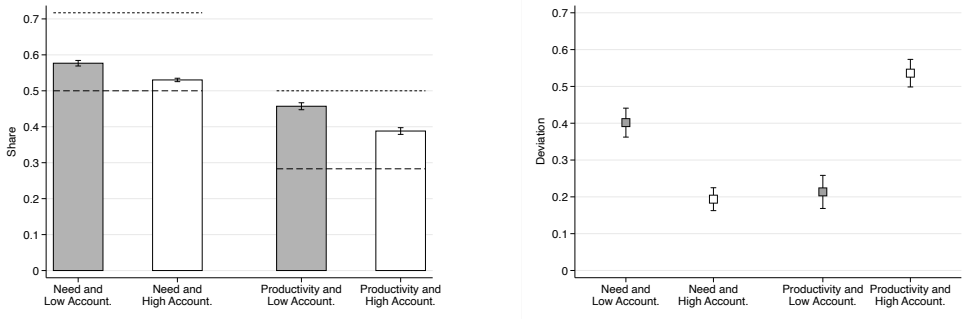

Figure 3: Share and deviation by scenario and treatment

Just as in our first study, we also investigated subjects' *individual* distributions. We first sorted the choices they made into several mutually exclusive groups. For the Need Scenario, we obtained the choices "A gets less than the equal split", "A gets the equal split", "A is partially compensated", "A gets her need share", and "A gets more than her need share". For the Productivity Scenario, we obtained "A gets less than her productivity share", "A gets her productivity share", "A is partially compensated", "A gets the equal split", and "A gets more than the equal split". In a second step, we examined whether participants consistently made the same choices in all cases of a scenario.

For the Need Scenario, equal split, partial compensation, and need share account for most of the choices, namely 89% in the Low Accountability Treatment and 92% in the High Accountability Treatment. When person A is responsible for their situation, choices significantly shift towards an equal split, increasing from 44% to 66%. A portion of choices could additionally be explained by what we call "net split". Here, A and B receive the number of logs they need plus or minus half of the oversupply or the undersupply, respectively. A total of 8% of the choices in the Low Accountability Treatment and 5% in the High Accountability Treatment are in line with this principle; in case 2 it is even 23% and 12%.

In the Productivity Scenario, 85% of the choices in the Low Accountability Treatment and 94% of the choices in the High Accountability Treatment allot person A's productivity share to her, compensate her partially, or split the logs equally among A and B. The equal-split choices decrease significantly in the High Accountability Treatment, from 35% to 19%. There is a notable percentage of choices, 14%

and 5%, in which participants gave more than 50% of the logs to A even though A and B have the same need and A was less productive than B, which we call a "swap" principle. Furthermore, individual choices favour A less in the High Accountability Treatment, providing further evidence in favour of our hypothesis on accountability.

Finally, we examined how coherent choices of distribution principles are. In the Need Scenario, the four principles that were chosen most often were equal split, partial compensation, A's need share, and net split. In the Productivity Scenario, we have equal split, partial compensation, A's productivity share, and swap. The number of participants sticking to one of these principles across all cases is 17.6% (Low Accountability) and 38.5% (High Accountability) in the Need Scenario as well as 24.2% (Low Accountability) and 29.4% (High Accountability) in the Productivity Scenario. Net split was never used consistently. Hence, the coherence of choices is relatively poor.

3.3 Kinds of Needs

For our third study, we built upon the vignette presented in the previous section.[19] A random sample of 100 participants from an online access panel, stratified by the three characteristics gender, age, and equivalent household net income, was introduced to hypothetical persons in need of firewood. This time, however, we altered *what* they need the wood for. As Nullmeier (2020, p. 201) put it, "survival cannot be the only criterion for deciding what is necessary". There are further needs, but they may be of varying importance. Four different kinds of needs were presented to our subjects. In the first experiment, they had to rate the importance of each kind. In the second experiment, they had to make allocation decisions between two hypothetical persons experiencing the same or different kinds of needs.

The participants in the first experiment were asked to imagine four different people in need of firewood for different reasons. One of the persons needs the wood for *Survival*, which means that they rely on it to not get life-threateningly ill during the coming winter. Another one needs the wood for *Decency*, which means that the wood is required to ensure that it does not get inhumanly cold in their home. The third person needs wood for *Belonging*, meaning that it is common practice to meet up in the community centre, with everyone bringing some wood to heat the centre. Finally, the wood can be needed for a certain type of *Autonomy*. In this case, the person has a studio in which they spend their free time to create art. To be able to do so, they need to heat the studio with firewood. To ease comprehension and make

[19] The third study has been published as a working paper (Bauer et al. 2023).

the different kinds of needs as salient as possible, each vignette was accompanied by an illustration, as depicted in Figure 4.

Figure 4: Illustrations of the four kinds of needs, Survival (upper left), Decency (upper right), Belonging (lower left), and Autonomy (lower right), drawn by Douwe Dijkstra

After having learned about the four kinds of needs, each kind was presented to subjects on a single screen in randomised order. A full-sized version of the illustration was shown, while a single sentence summed up what the wood was needed for in the given situation. Subjects were then asked to indicate, on a scale from 1 ("doesn't need the wood at all") to 7 ("absolutely needs the wood"), how much they think the person needs the wood in this situation.

Given the normative literature from philosophy, we expected that the importance of the kinds of needs that are more basic in theory is evaluated higher on average than the importance of those kinds of needs that are less basic in theory. Looking at the means of our participants' evaluations, we supposed that they are highest for Survival, followed, in this order, by Decency, Belonging, and Autonomy. As can be seen in Figure 5, this is exactly what we found. Additionally, a one-way analysis of variance reveals that pairwise comparisons of all kinds of needs show significant differences. We can thus conclude that our participants' hierarchy of the needs' importance is aligned with the one we predicted from normative theory.

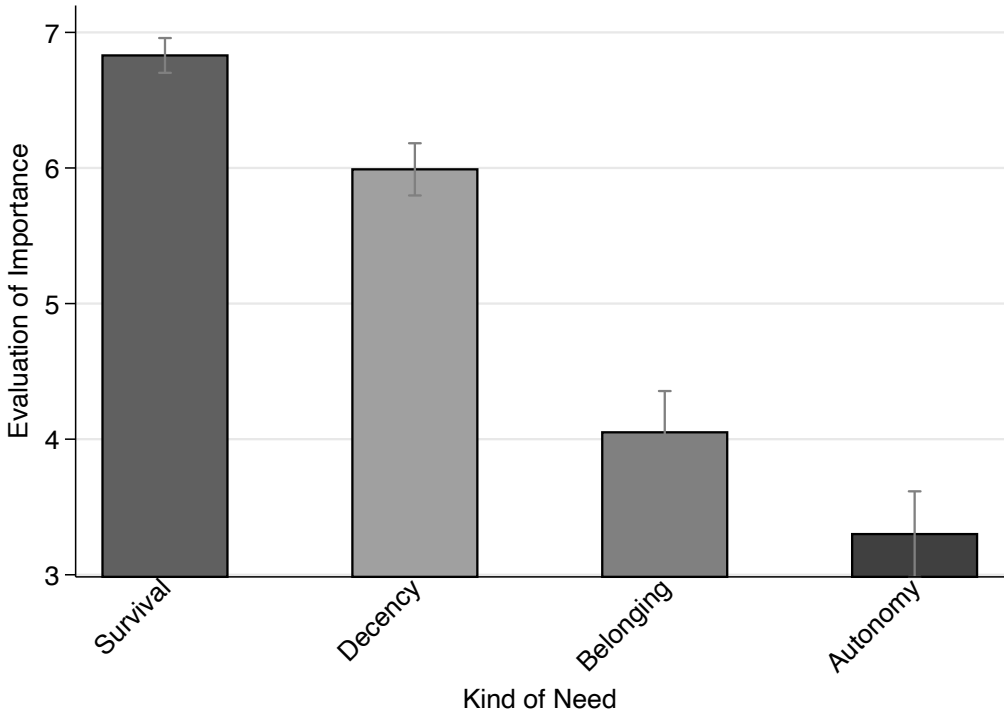

Figure 5: Means of ascribed importance to the four kinds of needs

In our second experiment, a random sample of 200 participants from an online access panel, stratified by the three characteristics gender, age, and equivalent household net income, was again introduced to our four kinds of needs. Here the description was closer to the original vignette presented in Section 3.2 by describing

two persons who experience one of the four kinds of needs each in different constellations. Afterwards, participants were shown a number of cases in which persons A and B had either the same kind of need (*Paired Cases*) or different kinds (*Mixed Cases*). In each case, there was a fixed amount of wood both had chopped. Participants' task was to distribute this wood among A and B in the way they thought to be most just. The amount available (1000 logs), however, was just enough to meet the need of *one* person. Each case was presented with illustrations and a short caption indicating the kinds of needs A and B experienced.

As a within-subjects variation, those cases were presented in two scenarios, an *Equal Productivity Scenario*, where each person has chopped 500 logs, and an *Unequal Productivity Scenario*, where A has chopped 200 logs and B 800 logs. Each scenario consisted of seven cases, with six of them being Mixed Cases, as depicted in Table 2. Additionally, each subject saw one randomly chosen Paired Case. The order of the scenarios as well as the order of cases and the positions of persons A and B on the screen were randomised.

Person	Case					
	1	2	3	4	5	6
A	Survival	Survival	Survival	Decency	Decency	Belonging
B	Decency	Belonging	Autonomy	Belonging	Autonomy	Autonomy

Table 2: Cases presented to participants in the Equal Productivity Scenario and the Unequal Productivity Scenario

In light of the theoretical literature and the findings from the first experiment, we hypothesised that the kinds of needs are perceived as varyingly important. If a party experiences a kind of need that is more basic in theory, subjects grant this party more firewood than the other one. More exactly, we expected the differences to reflect the hierarchy already known: Survival > Decency > Belonging > Autonomy. Additionally, we assumed that our subjects make coherent decisions in the sense of being additive. Additivity obtains if the difference between two kinds of needs that are not next to each other in the hierarchy equals the sum of the differences between the covered needs. For example, the difference between Survival and Belonging should be equal to the difference between Survival and Decency plus the difference between Decency and Belonging. Our final hypothesis was that the two scenarios affect distributive decisions. In the Unequal Productivity Scenario, where person A has chopped notably less wood than B, we expected A to receive significantly less wood than in the Equal Productivity Scenario.

To test our hypotheses, we looked at the *mean differences* between the endowments to A and B. Figure 6 shows these differences for the four Paired Cases, viz., the cases with identical kind of need, by the two scenarios. In the Equal Productivity

Scenario, participants distribute nearly equally between A and B. In the Unequal Productivity Scenario, however, where A has cut way fewer logs than B, A gets fewer logs. The quantity seems to depend on the kinds of needs A and B experience. If the wood is needed for Survival, the low productivity of A is only slightly reflected in distribution decisions: A appears to be compensated with a nearly equal amount. For Decency, the mean difference grows, and it is largest for Belonging and Autonomy. However, even in those cases A gets more wood than he has cut.

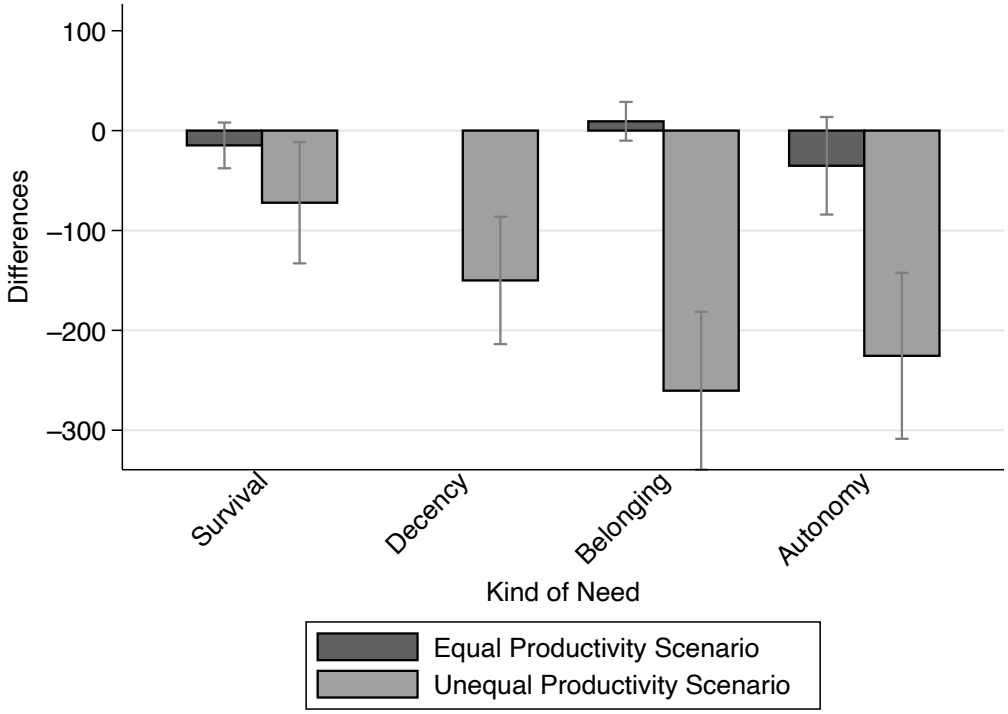

Figure 6: Mean differences for the Paired Cases by scenario

Furthermore, we examined the Mixed Cases, viz., cases with differing kinds of needs. Figure 7 shows the mean differences for the six possible combinations arising from our four kinds of needs (see Table 2), both for the Equal Productivity Scenario and the Unequal Productivity Scenario. For all combinations, mean differences are smaller in the Unequal Productivity Scenario. This means that participants gave less wood to the person with the more basic need when he contributed less to the amount available for distribution. Since we have specified that 1000 logs are just enough to satisfy one person's need, this hints at a lower willingness to compensate a more basic need if the person experiencing it has contributed less to the amount available. However, even in the Unequal Productivity Scenario, the less productive person gets partially compensated in nearly all combinations.

We also see that the mean differences are larger for combinations of kinds of needs that are not next to each other in the hierarchy. The difference is largest for

the combination Survival–Autonomy, just as in the theory, as it covers all four kinds of needs. Combinations embracing three kinds of needs, i.e., Survival–Belonging and Decency–Autonomy, exhibit a smaller difference. The smallest differences can be observed for combinations that are made up of kinds of needs directly next to each other in the hierarchy. Still more, Figure 7 hints at additivity. We tested this with two one-way ANOVAs (one for every Productivity Scenario) with Bonferroni correction. The result was that the additions have total values that do not differ significantly from the benchmark combinations. Therefore, we concluded that our subjects' distribution decisions were coherent.

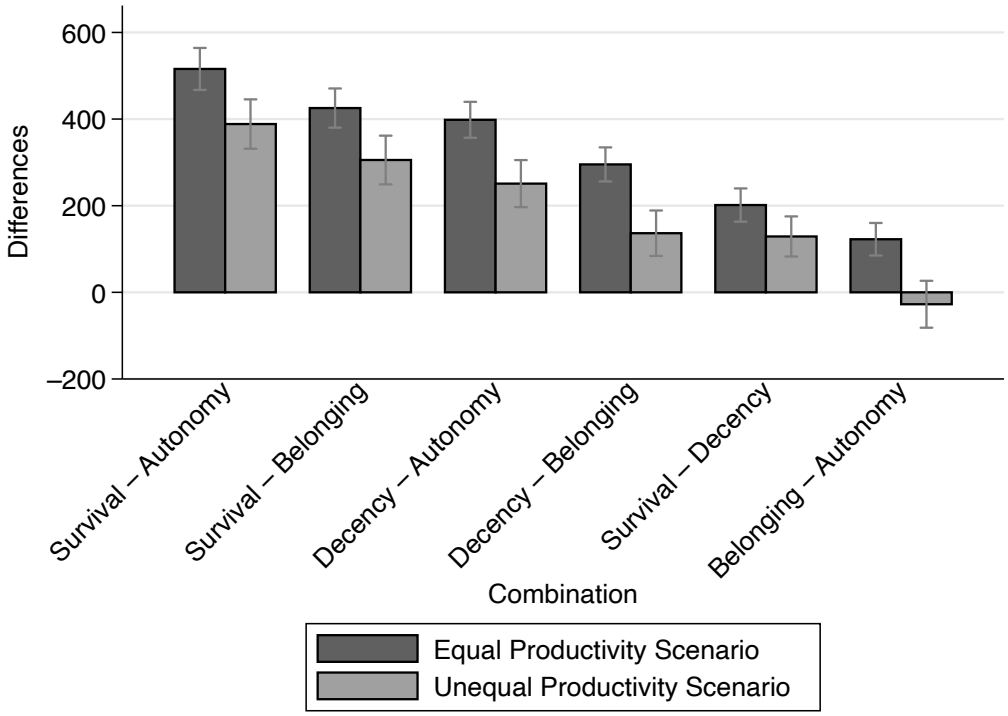

Figure 7: Mean differences for the Mixed Cases by scenario

3.4 Summary

The first study (Section 3.1) focused on laypeople's evaluations of given distributions. Those evaluations, we saw, are influenced by information about need. The introduced need threshold served as a reference point relative to which distributive justice was assessed. Besides, we found a lower standard deviation when information about need was present, indicating that the available information led to more coherent justice evaluations.

The second study (Section 3.2) investigated third-party distributive decisions. One of the main results was that subjects tend to partially compensate people who experience higher need. However, when a person is accountable for their higher

need, willingness to compensate decreases. As Nullmeier (2020, p. 204) stipulated: "Socially and politically recognized needs are often not met or only met to a limited extent if the origins of the need gap can be attributed to the person in need and his or her intentional behaviour."

Our last study (Section 3.3) dealt with different kinds of needs. The first experiment showed that participants evaluate kinds of needs as variably important, thereby following a particular hierarchy. The second experiment revealed that participants also differentiate between those kinds of needs when making third-party distributive decisions. More basic kinds of needs are deemed more worthy of compensation than less basic ones. Furthermore, participants' decisions are influenced by information about productivity, and they are coherent over the different kinds of needs.

4 Conclusion

In closing, we want to offer some suggestions for, and perhaps also constraints on, a theory of need-based justice that our findings imply. These implications are mainly oriented towards the theses Nullmeier (2020) presented in "Towards a Theory of Need-Based Justice". They emerge from individual considerations of the formal part and the empirical part, as well as from an overall view.

Firstly, poverty is undoubtedly a main impediment to need satisfaction. It is therefore tempting to assume that an index of need-based justice can be modelled on a poverty index. Our theoretical reflections have shown that this is problematic. For example, whereas the focus axiom is a plausible constraint on a poverty index, its need-oriented relative has to be rejected. More precisely, while the conditions of the rich do not influence how poor a society is, the endowments of oversupplied people influence need-based justice. It remains to be seen, however, which further poverty axioms *are* relevant to the measurement of need-based justice.

Secondly, need-based justice can be a non-monolithic affair. The three measures developed in the project lean on diverse concepts, none of which appears to be in a position to claim primacy. The injustice of a distribution may be generated by (i) the deviation from absolute need satisfaction and equal degrees of need satisfaction, (ii) the chance to mitigate undersupply by transfers, and (iii) the resources used for oversupply instead of need satisfaction. The fact that the resulting measures differ in essential properties, e.g., in the satisfaction of certain axioms, does not mean that some of them have to be dismissed. Instead, "need-based justice" could be a polysemous term whose different uses fit a variety of situations. It would be no surprise, then, that different authors advocate different axioms.

Thirdly, in line with Nullmeier's (2020, p. 193) dictum that a "theory of need-based justice should be based on the promotion of both normative and empirical research",[20] we must examine the *empirical* adequacy of measures of need-based justice. Even if there is polysemy, there could be a measure that comes closest to empirically found justice evaluations and distributive decisions.[21] Such a measure has the advantage that it best captures "what the people think", to use Miller's (1999, p. 61) vivid phrase.

Fourthly, one of our studies showed that theory and empirical evidence may clash. On average, our participants evaluated undersupply in a *convex* manner: the more an endowment approaches the need threshold, the greater the decrease in injustice. For example, if the threshold is 1000 units of living space, receiving 800 instead of 600 units results in a greater decrease of injustice than receiving 400 instead of 200 units. A policy following convexity states that less undersupplied people should be prioritised when a surplus is to be distributed. Such a policy can be justified by *sufficientarianism*: if the general aim is to furnish as many people as possible with what they need, a surplus should be given to those people whose needs can be satisfied more easily because their need gap is relatively small. But *prioritarianism*, which states that we have to prioritise the worst off, is a serious competitor to sufficientarianism. Nullmeier (2020, p. 193) stated that "normative considerations should not be […] instrumentalized for the affirmation of the given as a normative ideal". We need to take this caveat seriously. Our empirical result appears to support sufficientarianism. It remains to be seen, though, how participants react when they realise that their judgements promote neglect of the worst off. For the result of such a study could confirm prioritarianism.

Fifthly, we come to a terminological matter. Nullmeier (2020, p. 203) suggests that "the principle of need is combined with a second principle" when it is claimed that, e.g., a surplus should be distributed in proportion to need. The second principle here would be "proportionality". We do not see the benefit in restricting the use of "need-based justice" in such a way. Rather, we would consider a principle of need-based justice to be a principle focusing on the satisfaction of *needs* instead of, say, recognition of *effort*. Understood in this way, the rule that a surplus should be distributed in proportion to need is a principle of need-based justice, while the rule that it should be distributed in proportion to effort is a principle of effort-based justice.

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[20] For further perspectives on the interdependences of normative theories and empirical research, see Bauer and Meyerhuber (2020).

[21] Cf. Koscholke and Jekel's (2015) study on the empirical adequacy of probabilistic measures of coherence. They found that one of the measures being discussed is able to strongly approximate subjects' judgements.

Taking into account proportions or, say, differences, is much more a *modus* rather than a *principle*.

Sixthly, this does not undermine Nullmeier's (2020, pp. 193–197, 206f.) thesis that need-based justice is a central part of a *pluralistic* theory of justice. It might very well be the case that the principle of need has to be supplemented by further principles in order to obtain a full theory of justice. A candidate suggested by our empirical research is effort. From a normative perspective, one may argue that a distribution is just if all needs are satisfied and a possible surplus is split in proportion to effort. This means that the criterion of need gains priority in the sense of Nullmeier's (2020, p. 207) "lexineed" principle: "before any other criterion comes into play, the complete satisfaction of all needs must take place".

Seventhly, in contrast to the aforementioned normative principle, we found empirical evidence that, although need is a strong principle, it is moderated by effort even in situations of scarcity. Information on need significantly changes people's judgements on distributive justice, leading away from equal distributions, which would be the default mode when no other normatively relevant information is present. It does not only change the shape of the justice evaluation function but also leads to converging evaluations. Need could thus be seen as a principle that allows for more consent because it generates more coherence among evaluations. However, if there is also information on effort, the influence of need is diminished. To be sure, a person who needs more than others is always partially compensated for her disadvantage, no matter how productive she was. Hence, the principle of need is still influential. But the compensation is smaller if the person is less productive.

Eighthly, *accountability* is a further moderator. Nullmeier (2020, p. 204) points out that distributive justice may come into conflict with corrective justice. In one of our studies, the willingness to compensate the worse off person decreases when this person is accountable for needing more or producing less than another person. When a higher need or lower productivity is self-inflicted, corrective justice appears to come into play insofar as people are punished. Whether or not this is justified from a normative point of view, it has to be taken into consideration by any theory of need-based justice that aims at political implementation.

Finally, a theory of need-based justice has to account for the fact that there is a hierarchy of different kinds of needs (cf. Nullmeier 2020, p. 201). Here we found a match between theory and empirical results. In the normative literature, needs are differentiated by how basic they are. For example, bare survival is more basic than living in decent circumstances, e.g., having a warm home. Moreover, the latter is more basic than participating in social life, which is in turn more basic than self-actualisation, e.g., by producing art. The subjects in our experiments followed this

hierarchy. Among other things, the more basic a need, the more resources they allocated to the person with this need. Again, however, this effect is moderated by effort. There is a lower willingness to compensate a more basic need if the person experiencing it has contributed less to the available resources. This is additional support for a *pluralistic* theory of distributive justice that may centre need but also has to make allowances for further principles, such as effort and equality.

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