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Economic Analysis of Trade-offs between Justices

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Abstract: We argue that economics – as the scientific method of analysing trade-offs – can be helpful (and may even be indispensable) for assessing the trade-offs between intergenerational and intragenerational justice. Economic analysis can delineate the “opportunity set” of politics with respect to the two normative objectives of inter- and intragenerational justice, i.e. it can describe which outcomes are feasible in achieving the two objectives in a given context, and which are not. It can distinguish efficient from inefficient uses of instruments of justice. It can identify the “opportunity cost” of attaining one justice to a higher degree, in terms of less achievement of the other. We find that, under very general conditions, (1) efficiency in the use of instruments of justice implies that there is rivalry between the two justices and the opportunity cost of either justice is positive; (2) negative opportunity costs of achieving one justice exist if there is facilitation between the two justices, which can only happen if instruments of justice are used inefficiently; (3) opportunity costs of achieving one justice are zero if the two justices are independent of each other, which is the case in the interior of the opportunity set where instruments of justice are used inefficiently.

I. Introduction

Justice is a multifarious normative idea about the quality of relationships among members of society. One may argue that there are many “justices”, insofar as different parts of society, different types of relationships, or different substantive areas are addressed. The overall societal goal (“vision”) of sustainability particularly addresses two justices: (i) justice between currently living persons (“intragenerational justice”), and (ii) justice between members of present and future generations (“intergenerational justice”).^{1,2}

With two (or more) different justices as normative objectives of equal rank, it may be that there exists a trade-off between them, that is, performing better with regard to one objective implies performing worse with regard to the other one. In particular, it may

be that fostering intragenerational justice makes it more difficult to attain intergenerational justice, and vice versa. Such a trade-off at the level of normative objectives of equal rank – if it exists – asks for societal resolution. The question is: how to act in the face of different justices? Important examples for such a trade-off include government spending on social welfare vs. investment in public infrastructure and education, or the exploitation vs. conservation of non-renewable natural resources.

In this essay, we argue that economics – as the scientific method of analysing trade-offs – can be helpful (and may even be indispensable) for assessing the trade-offs between different justices. We understand economics as being defined by its method, rather than by its subject matter or by some normative objective,³ and we sketch how to employ this method to analyse trade-offs between justices. An important contribution that economics can make to this analysis is to introduce the secondary normative criterion of *efficiency* which characterises the non-wasteful use of scarce resources to attain the primary normative objectives of justice: a situation is efficient with regard to different objectives if it is not possible to improve on one objective without doing worse on another one. Being derived from primary normative objectives, the criterion of efficiency itself makes a normative claim: it is good to use scarce resources efficiently to attain intra- and intergenerational justice; it is wrong to use scarce resources inefficiently for that purpose.

This approach of using economics as a method to study the efficient use of scarce resources in the attainment of rivaling normative objectives of justice⁴ opens an innovative perspective on what the role of economics should be (as a method) in the discussion of justice, and on how to bridge the gap – systematically and rigorously – between ideal theory and non-ideal politics.

II. Specifying justice(s)

To inform our understanding of intra- and intergenerational justice, the abstract and

general concept of justice needs to be further specified. We take justice to generally refer to the mutual claims of members of the community of justice from the standpoint of impartiality.⁵ This minimum definition leaves ample room for very different, and sometimes much contested, conceptions of justice. Each of them can be described more precisely by specifying a number of elements in a “syntax of justice”.^{6,7} In the following, we specify the essential elements of the syntax to clarify the conceptions of inter- and intragenerational justice.

The community of justice. Justice refers to mutual claims⁸ within a community of justice. We term those holding a particular claim the *claim holders*, and those responsible for the fulfilment of the claim the *claim addressees*.⁹ Intragenerational justice entails claims held by currently living persons (claim holders) towards other currently living persons (claim addressees). Intergenerational justice entails claims held by persons living in the future (“future generations”, claim holders) towards persons living today (claim addressees).¹⁰ It is not necessary that such a claim is explicitly put forward by the claim holder (which may be impossible in the case of intergenerational justice). What matters is that a legitimate claim might be formulated by someone speaking for the claim holder.

Positive and negative claims. Generally, claims can be positive, i.e. defining an entitlement to a certain good,¹¹ or negative, i.e. demanding freedom from harm.¹² Claims are considered legitimate if they could be agreed on from the standpoint of impartiality and equal consideration. For example, intergenerational justice claims could be specified as a positive claim of future generations to certain stocks and systems, such as a democratic political system, a stock of manufactured capital and critical knowledge, or intact ecosystems, implying a responsibility of the present generation to pass on these stocks and systems in a good state to future generations. Future generations may also have a negative claim: not to be

harmful by any activities of the presently living generation, e.g. through increasing systemic risks caused by a dysfunctional global financial system or through nuclear waste left over as a byproduct of present electricity production. Intragenerational justice claims include the positive claim for satisfaction of basic needs, and the negative claim that one's freedoms should not be harmed (human rights).

Judicandum. We use the term *judicandum* to describe that which is to be judged as just or unjust. *Judicanda* can be agents, actions, institutions or states of the world.¹³ When discussing inter- and intragenerational justice, the *judicanda* could be the actions of currently living persons (and the consequences of these actions, such as, say, the distribution of certain primary goods), as the claim addressees of both justices belong to the current generation.

Instruments of justice. We use the term *instrument of justice* to describe that which is to be used to satisfy the legitimate claims of justice. In many conceptions of justice, these will be objects of distribution (answers to the question "What is distributed?"¹⁴), but the satisfaction of legitimate claims could also be achieved via, say, institutional reform to ensure procedural justice. So, the question here is *how* legitimate claims are addressed. For example, one instrument of intergenerational justice could be the investment in public goods such as education and infrastructure, or the distribution of stocks of non-renewable resources between different generations. The aim of intragenerational justice could, for example, require institutional reform of international trade rules ("fairness").

Metric for the judgment. For statements about the degree of attainment of a normative objective, there must be some way to measure the justice of the *judicanda*: one needs a metric to judge whether, and to what extent, a *judicandum* is just or unjust. For this metric, different informational bases have been proposed, such as e.g. capabilities, primary goods, or utility.¹⁵ It is possible to use different metrics for inter- and intragenerational justice.

In sum, judging a certain *judicandum* as inter- or intragenerationally just according to a metric requires first to specify the positive and negative claims of claim holders in

present and future generations against claim addressees in the present generation, which are to be satisfied by certain instruments of justice.

As we discuss two different justices, both of which demand the fulfilment of legitimate claims through the use of instruments of justice by the same addressee, a non-trivial decision problem arises for this addressee – the present generation. We therefore need to have a closer look at the possible relationships of these two justices.

III. Relationships between justices

Generally, the two justices are related both on the "value" side and the "production" side.¹⁶ On the value side, the relationship refers to the desirability, from a societal point of view, of attaining one justice relative to the other one. For example, society may be willing to trade-off one justice against the other,¹⁷ or one justice might strictly dominate the other. In this essay, we build on the minimal and very general premise, widely held in the literature,¹⁸ that both intra- and intergenerational justice are considered by society as desirable normative objectives of equal rank. Beyond that, we do not further discuss the value side.

On the production side, the relationship refers to the feasible outcomes of the use of instruments of justice, that is, combinations of degrees of attainment of both justices. Here, what is feasible is determined by the structure and functioning of the given system, based on natural resource endowments, technology, institutions, etc. The set of all feasible combinations in terms of the two justices is called the "opportunity set". It describes society's options for choice, which are independent of what society considers desirable. That is, the production side and the value side are independent of each other.

Scientific analysis and political implementation have shown that, in general, three relationships may hold on the production side between intra- and intergenerational justice:¹⁹

"Meeting the legitimate claims of the poor to the resource possibly reduces the total resource stock passed on to future generations and, thereby, may be at the expense of intergenerational justice."

1) *Independency:* The objectives of intra- and intergenerational justice can be achieved independently, that is, attaining one objective

to a higher degree does not necessitate any change in the degree to which one attains the other one.²⁰

2) *Facilitation:* Achieving one objective supports achieving the other one, that is, attaining one objective to a higher degree induces a higher degree of attainment of the other one.^{21,22}

3) *Rivalry:* A fundamental rivalry (or "trade-off") exists between the objectives of intra- and intergenerational justice, that is, attaining one objective to a higher degree necessarily reduces the degree to which one attains the other one.²³

For illustration, we give examples from different contexts. Independency is an assumption frequently made in ecological, environmental and resource economics.²⁴ For example, cap-and-trade systems for greenhouse gas emissions imply that the overall intergenerational impact on global climate can be governed independently of the initial intragenerational distribution of emission certificates.²⁵ Facilitation is prominently stated with regard to the provision of public goods. For instance, public investment in education or the improvement of public transportation systems may simultaneously benefit today's poor and future persons. Rivalry is often assumed when the possibility of intragenerational redistribution of access rights to rival resources is heavily limited. In such cases, meeting the legitimate claims of the poor to the resource possibly reduces the total resource stock passed on to future generations and, thereby, may be at the expense of intergenerational justice. For example, if the government spends a higher share of tax revenue to increase social support of the poor without being able to enforce higher taxes on the rich, the government has less revenue to invest in public infrastructure and education.

A host of specific *determinants* – natural, technological and institutional factors – impact on the production relationship between intra- and intergenerational justice, for example because they influence the availability and effectiveness of the instruments of justice. Thereby, they affect which relationship holds. Two examples for such determinants are population development and political restrictions. In many countries of the global North, a population development characterised by higher life expectancy and lower birth rates challenges the existing social security systems. A potential trade-off among the goal to reduce old-age poverty

(intragenerational justice), and the goal to avoid an unacceptably high financial burden on the young generation (intergenerational justice) may occur. Political restrictions limit the political scope for redistribution of resources within a society. If, for instance, the political scope for redistribution of wealth within a society is tight due to resistance against introduction of an inheritance tax, the situation of the poor can only be improved by increasing public expenditures and, thereby, possibly adding to public debt in the long term – therefore causing a trade-off between inter- and intragenerational justice.

Regarding the production relationship between intra- and intergenerational justice in the use and conservation of ecosystem services, Glotzbach and Baumgärtner (in press: Sec. four) found that the determinants impacting on this relationship are the quantity and quality of ecosystem services, population development, the substitutability of ecosystem services by human-made goods and services, technological progress, and institutions and political restrictions. The determinant substitutability of ecosystem services, for instance, influences the character of the relationship between the justices as follows: if an ecosystem service is substitutable by human-made goods and services, an overexploitation of the ecosystem service by members of the present generation to increase intragenerational justice can be compensated by sufficient investment in other forms of physical, social and human capital to secure intergenerational justice – the relationship between the justices is one of independency or facilitation. If an ecosystem service is non-substitutable, an overexploitation of the ecosystem service by members of the present generation to increase intragenerational justice cannot be compensated and, hence, reduces the degree of intergenerational justice – the relationship between the justices is one of rivalry.

In sum, the opportunity set, which embodies information on the production relationships between the two justices in all feasible outcomes, crucially depends on a number of fundamental context-specific determinants.

IV. Scarcity, economic efficiency, and opportunity costs

Irrespective of which production relationship holds between inter- and intragenerational justice, society has to make a decision on how to use some instruments of justice

in the attainment of these objectives. Very often, the use of instruments of justice means employing scarce resources that may be used in alternative ways.²⁶ This is where the key contribution of economics to the study of societal problems comes in: how to use scarce resources efficiently in the attainment of some objectives? According to a classical definition, economics

studies human behaviour as a relationship between [given] ends and scarce means which have alternative uses.²⁷

With this definition, economists generally understand efficiency as non-wastefulness in the use of “scarce means” to attain some “ends” that humans pursue in their actions. In this understanding, ends are open-ended: they are not determined by economics as a method. In principle, it could be any ends

“The contribution of economics to the study of societal problems lies in characterising the (in)efficient use of scarce means in the attainment of multiple primary normative objectives.”

that humans pursue. Here, we focus on intra- and intergenerational justice as two primary normative objectives that humans pursue.²⁸ Drawing on the common definition of efficiency by Pareto (1906),²⁹ one can define efficiency as follows:

An allocation of resources is efficient if it is impossible to move toward the attainment of one social objective without moving away from the attainment of another objective.³⁰

The minimal assumption needed to define efficiency in this way is that, for each justice, the metric of justice allows a distinction to be made between a higher and a lower degree of attainment of the respective justice. In particular, it is neither necessary to assume cardinality of each metric nor commensurability of the two justices.³¹ Thus, this notion of efficiency and the subsequent analysis are very general.

If efficiency is related in this manner to some primary normative objectives, it acquires the status of a secondary normative objective.^{32,33} This means, it is good to use resources efficiently; it is wrong to use them inefficiently. In this perspective, the contribution of economics to the study of societal

problems lies in characterising the (in)efficient use of scarce means in the attainment of multiple primary normative objectives. For this purpose, economics provides a broad set of methods to analyse, display and empirically verify the relationships between these objectives.

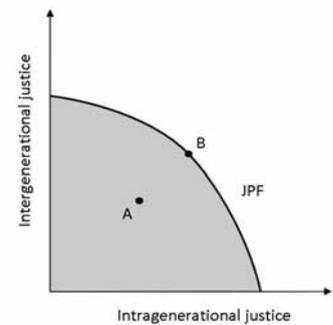


Figure one: Rivalry and independency

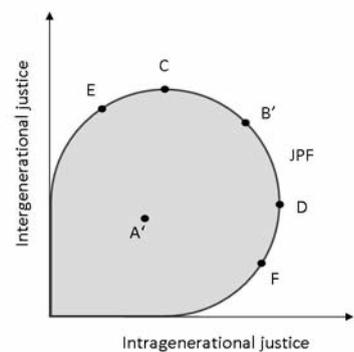


Figure two: Rivalry, facilitation, and independency

Figures one and two illustrate the opportunity set and efficiency in attaining the two normative objectives of intra- and intergenerational justice. The axes indicate the degree of attainment of inter- and intragenerational justice, respectively, based on the respective metrics of justice. Thus each point in the diagram represents an outcome of the use of the instruments of justice. In Figure one, the shaded area depicts all feasible outcomes in the given context, that is, for given resource endowment, technology, institutions, and the like (“opportunity set”). The curve JPF (“justice possibility frontier”) denotes its frontier. Outcomes to the northeast of this curve are not feasible in the given context. Point A represents an outcome where the instruments of justice are used in an inefficient manner as more intergenerational justice could be achieved without sacrificing intragenerational justice. In contrast, the use of the instruments of justice in point B is efficient as no higher degree of attainment of one justice is feasible without reducing the other one. Generally, all

outcomes below the JPF-curve correspond to inefficient uses of the instruments of justice, whereas all outcomes on the curve correspond to efficient uses of these instruments.

Obviously, in point B there is rivalry between intragenerational and intergenerational justice: attaining one to a higher degree necessarily reduces the degree to which one attains the other one. This loss can be measured by the concept of “opportunity cost”. The opportunity cost of increasing, say, intragenerational justice is the corresponding minimal loss of intergenerational justice. In contrast, at point A there is independency between intragenerational and intergenerational justice: attaining one to a higher degree does not necessitate any change in the degree to which one attains the other one. Hence, there are no opportunity costs of increasing one or the other justice. Generally, in all efficient outcomes, i.e. on the JPF-curve, there is rivalry between the two justices and, thus, positive opportunity costs. In all inefficient outcomes, i.e. under the JPF-curve, there is independency between the two justices and, thus, zero opportunity costs.

For example, the opportunity set of Figure one may refer to the use of a non-renewable natural resource such as oil or gas: the resource may be exploited today for social welfare policy (intragenerational justice); alternatively, it may be conserved for future generations (intergenerational justice).

In a different context, the opportunity set may look as in Figure two. The shaded area again depicts all outcomes that are feasible in this context (“opportunity set”), with the JPF-curve as its frontier. As in Figure one, outcomes A’ and B’ correspond to an inefficient and an efficient use, respectively, of the instruments of justice. Obviously, all points on the JPF-curve between C and D represent outcomes of efficient uses of the instrument of justice, because no higher degree of attainment of one justice is feasible without reducing the other one. These outcomes are characterised by rivalry between the two justices and positive opportunity costs of either justice.

Outcome E is inefficient, but as it lies on the JPF, attaining intergenerational justice to a higher degree starting from this point necessarily also leads to a higher degree of intragenerational justice. That is, in outcome E there is facilitation between the two justices. But facilitation is not symmetric: attaining a higher degree of intragenerational justice, starting again from point E, does not

necessarily induce a higher degree of intergenerational justice. Hence, the opportunity cost of increasing intergenerational justice is negative: increasing intergenerational justice does not incur a loss, but a gain of intragenerational justice, and the opportunity cost of increasing intragenerational justice is zero.

“Many questions of justice arise under conditions of scarcity and involve the freedom to make choices. Such questions can be discussed in economic terms.”

In outcome F, the situation is reversed: attaining intragenerational justice to a higher degree facilitates attaining intergenerational justice to a higher degree, but not vice versa; hence, the opportunity cost of increasing intragenerational justice is negative, while the opportunity cost of increasing intergenerational justice is zero. Generally, all (inefficient) uses of instruments of justice along increasing parts of the JPF correspond to outcomes where attaining one justice to a higher degree facilitates attaining the other one, but not vice versa, so that the former has negative opportunity cost, while the latter has zero opportunity cost.

For example, the opportunity set of Figure two may refer to government spending on education, where a broader educational base decreases income inequality within a generation (intragenerational justice), and at the same time increases prospects for economic growth over time (intergenerational justice).

As the figures and examples illustrate, the shape of the opportunity set may differ from context to context, and with it the relationships between the two justices.³⁴ As the opportunity set is fundamentally determined by natural resource endowment, technology, institutions, etc. (cf. Section III), a change in these fundamental determinants may change the opportunity set and the relationships between the two justices. For example, with given endowment of a non-renewable resource, technical progress in resource extraction would shift the JPF-curve in Figure one outwards.

V. Conclusion

Robbins’ (1932) definition of economics delimits the contribution of economics to the study of normative questions. It does not lie in determining what ends to pursue or in developing the means to achieve a normative objective. Rather, the focus of economic ana-

lysis is on efficiency, i.e. non-wastefulness in the use of scarce resources that have alternative uses as means to attain given normative objectives. “Its (economics) contribution lies in pointing out clearly inefficient outcomes, and in identifying the opportunity costs of moving from one efficient outcome to another.”

Thus, in contexts where there is no scarcity or no alternatives exist, economics does not lend itself to the discussion of normative questions. Yet, many questions of justice arise under conditions of scarcity and involve the freedom to make choices. Such questions can be discussed in economic terms.

Economic analysis of inter- and intragenerational justice builds on three fundamental, and rather weak, assumptions:

- (1) On the “value” side, the two justices are considered by society to be of equal rank.
- (2) For each justice, one can measure the degree to which one attains this justice. This measurement does not need to be cardinal but may be ordinal, and the two justices do not need to be commensurable but the two metrics may be in different units.
- (3) For a given context – specified by natural, technological, institutional factors, etc. – one can describe the outcome of using scarce resources (as instruments of justice) in terms of these measures of the two justices.

With these assumptions, the genuine and original contribution of an economic analysis of justice is threefold:

- (1) Economic analysis can delineate the “opportunity set” of politics with respect to the two normative objectives of inter- and intragenerational justice, i.e. it can describe which outcomes are feasible in achieving the two objectives in a given context, and which are not. The opportunity set includes information on whether the production relationship between the two justices in some outcome is one of rivalry (i.e. trade-off), independency, or facilitation; and it distinguishes efficient from inefficient allocations of scarce resources.

As efficiency, when related to the primary normative objectives of intergenerational and intragenerational justice, is a secondary normative objective, one conclusion for policy-making is straightforward: instruments of justice should be used efficiently; they should not be used inefficiently.

One important conclusion about the production relationship between intra- and intergenerational justice follows directly from the very definition of efficiency. In outcomes of efficient resource use there is always rivalry between the different justices – attaining one justice to a higher degree necessarily reduces the degree to which the other is attained. In contrast, in outcomes of inefficient resource use there is either independency between the two justices – the level of attainment of one justice can be improved without doing worse on the other one, or even both can be improved – or facilitation – improving the level of attainment of one justice necessarily also improves the other one.³⁵

(2) Based on the opportunity set, economic analysis can identify the “opportunity cost” of attaining one justice to a higher degree, in terms of less achievement of the other. Positive opportunity costs of achieving one justice exist if there is rivalry between the two normative objectives of intergenerational and intragenerational justice; negative opportunity costs of achieving one justice exist if there is facilitation between the two justices; opportunity costs are zero if there is independency between the two justices. Generally, negative and zero opportunity costs indicate inefficiency in the allocation of resources, while positive opportunity costs indicate an efficient resource allocation.

(3) Economic analysis can identify how the opportunity set changes as its determinants – natural, technological, institutional factors, etc. – change. In particular, it can study how the occurrence and extent of rivalry, independency or facilitation in the relationship between the two justices changes as underlying determinants change. Hence, it may suggest how to manage these underlying determinants in order to decrease the degree of rivalry and to increase the degree of independency or facilitation.

The economic analysis presented here cannot determine which of the efficient outcomes on the justice possibility frontier is preferable. Moving from one efficient outcome to another means incurring opportunity costs – i.e. furthering the degree of attainment of one normative objective at the cost of the other one. Depending on how the relationship between the two normative objectives is shaped on the “value side”, it might well be acceptable to incur these costs – for example, burdening the presently living with a small tax that would prevent future generations from huge damage.

So, economic analysis can give no clear guidance on how to decide among efficient outcomes – i.e. in the case of rivalry between objectives. Its contribution lies in pointing out clearly inefficient outcomes, and in identifying the opportunity costs of moving from one efficient outcome to another.

These insights can help make an informed decision about how to use scarce resources that have alternative uses to attain the two normative objectives of inter- and intragenerational justice in a non-wasteful manner. This seems to be a valuable contribution for societies facing decisions about the use of scarce resources in view of different normative objectives of equal rank. Of course, this would not make hard decisions easy, but at least efficiently difficult.

Notes

- 1 WCED 1987.
- 2 In addition, some conceptions of sustainability also include justice towards nature as a third normative objective of equal rank.
- 3 This is the standard interpretation of modern economics according to Robbins 1932. For an encompassing discussion of this and other interpretations of economics, see Hausman 2007.
- 4 This approach, as applied to the three justices included in the vision of sustainability – intra- and intergenerational justice as well as justice towards nature – has been called “sustainability economics” (Baumgärtner / Quaas 2010, Baumgärtner 2011).
- 5 E.g. Gosepath 2007: 82.
- 6 Baumgärtner / Glotzbach / Stumpf 2011.
- 7 This “syntax” is our approach to structuring what has been called the different “dimensions” (Pogge 2006, Dobson 1998, see also Ott / Döring 2008) of the concept of justice. It allows fully specifying a particular conception of justice.
- 8 Young 1994, Ott / Döring 2008: 59 et seqq.
- 9 The delineation of the community of justice, especially the question of who is to be included as a claim holder, can be drawn according to different criteria such as reciprocity, dignity, ability to experience pain, etc. (e.g. Baumgärtner / Glotzbach / Stumpf 2011).
- 10 The third justice often included in sustainability conceptions, justice towards nature, refers to claims held by “nature”, e.g. higher non-human animals capable of experiencing pain or of pursuing goals, against humanity. Thus, the claim holders differ, while the claim addressees belong to the

group of currently living persons in all three cases. While intra- and intergenerational justice reflect an anthropocentric idea of justice, according to which nature matters to humans exclusively because of its instrumental value, the idea of justice towards nature assigns an intrinsic value to nature (Baumgärtner / Quaas 2010: Sec. 2), so that “nature” becomes a claim holder in its own right.

11 “Goods” should be understood in a wide sense.

12 Cf. Baumgärtner / Glotzbach / Stumpf 2011.

13 Pogge 2006: 863.

14 Sensu Dobson 1998: 73 et seqq.

15 Cf. Pogge 2006: 868.

16 LeGrand 1990: 555.

17 Barry 1965: Sec. 1.

18 E.g. Dobson 1998: 3 et seqq., Ott / Döring 2008, Visser ‘t Hooft 2007: 56, WCED 1987: 43.

19 Here, we extend the argument from Glotzbach / Baumgärtner (in press, Sec. 3) which originally refers to justice with regard to the use and conservation of ecosystems.

20 Independency does not need to be symmetric: achieving one objective may be independent of achieving the other one, but not vice versa.

21 This relationship is similar to the concept of “joint production” in economics, which means that the production of a wanted good necessarily gives rise to additional outputs (cf. Baumgärtner et al. 2006).

22 This facilitation may be one-way, or the other way, or a mutual facilitation between the achievement of the two objectives.

23 Like independency and facilitation, rivalry does not need to be symmetric.

24 E.g. Dasgupta / Heal 1979.

25 E.g. Perman et al. 2003: 219 et seqq.

26 Scarcity is generally considered as central to many important problems of justice (Dobson 1998: 12).

27 Robbins 1932: 15.

28 This goes beyond what economists usually consider as ends (cf. Baumgärtner 2011). Traditionally, economics has been concerned with the end of an ever better satisfaction of human needs and wants. This end can be further specified and operationalised as individual utilities (microeconomics), or as policy goals such as low inflation and low unemployment (macroeconomics).

29 According to the original criterion of Pareto (1906), which assesses allocations based on the wellbeing of individual persons, an allocation of resources is efficient if no one can

be made better off (in terms of this person's individual utility) without making anyone else worse off (in terms of the other person's individual utility).

30 LeGrand 1990: 559.

31 A cardinal metric is one that preserves orderings uniquely up to linear transformations; commensurability of justices means that the metric of both justices is in the same units.

32 LeGrand 1990: 560.

33 Here, we study the relationship, including a potential trade-off, between two primary normative objectives. There is also a discussion on the so-called "equity-efficiency trade-off" (surveyed by e.g. Putterman et al. 1998), where equity and efficiency are treated as normative objectives of equal rank. But efficiency – in contrast to equity – cannot serve as a primary normative objective, so that this trade-off is irrelevant (LeGrand 1990: 566).

34 In addition to the two fundamental shapes of the opportunity set discussed here, other shapes are imaginable. For example, the justice possibility frontier may be linearly downward sloping, implying constant opportunity costs in all efficient outcomes. It may also be convex (resulting e.g. from increasing returns to scale in the use of instruments of justice), and the frontier may not even intersect but asymptotically approach the axes. This would imply that the opportunity costs of one justice may rise to infinity. Yet, all insights into the relationships between the two justices and efficiency that are essential for our main line of argument can already be obtained from the two shapes of the opportunity set presented here. We therefore refrain from discussing additional shapes in detail.

35 In the (inefficient) interior of the opportunity set there is always independency; and facilitation can only occur on the inefficient part of the justice possibility frontier.

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