

# Allocating an indivisible good. A questionnaire-experimental study of intercultural differences\*

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## Abstract

We present the results of a questionnaire study in Belgium, Burkina Faso and Indonesia focusing on the problem of the just allocation of an indivisible good. The formal axioms proposed in social choice theory are helpful in structuring the response patterns. Interindividual differences can be interpreted in a meaningful way in terms of basic intuitions about desert, efficiency and compensation. Belgian students are most resource-egalitarian, Burkinese students attach a large weight to innate capacities, Indonesian students focus on actual production. The crucial no-envy criterion is supported by a majority of respondents, but this majority becomes small if there is an unavoidable conflict between no-envy and the "responsibility" requirement of the stand-alone upper bound.

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## 1 Introduction

Questionnaire research has over the past years gained a proper place within normative economics<sup>1</sup>. Normative economic theory formalizes and structures in one way or another basic "feelings" or "intuitions" about justice as they are present in society. Even while agreeing with Bossert (1998) that "essential elements of a debate over normative issues are critical reflection and thorough assessment of

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<sup>1</sup>See e.g. Gaertner (2006). Konow (2003) provides an overview of the literature.

the arguments being used" and that survey research can never be a substitute for careful economic thinking, we still feel that it is useful to investigate what are the prevailing opinions in society and how they relate to economic theory. If these studies show that important social intuitions are missing in the theory, this may give inspiration to improve or refine the latter. If different opinions prevail in different societies, questions arise about the context-dependency of the theoretical framework. It is clear, however, that actual behavior will be guided by a mixture of self-interest and ethical motivations. Questionnaire research can never be a substitute for experimental work, since its rationale and objectives are different.

One can basically recognize two distinct approaches towards questionnaire research. A first approach could be labeled the "opinion discovery research". In this work, the formulation of the questions relates closely to what non-specialists might think about topics such as the fair distribution of divisible or indivisible goods, or about income inequality and poverty. Typical examples are Schokkaert and Lagrou (1983), Schokkaert and Capéau (1991) and Konow (2001). The advantage of this approach is that it remains close to the psychological reality of everyday opinions and to the bulk of the psychological and sociological literature. It is not always easy to link the results to normative economic thinking, however. Uninformed opinions are rather vague, ambiguous and often inconsistent. While this first approach may yield interesting suggestions about lacunae and biases in normative theory, it is difficult to "test" the relevancy of a refined theory since the questions lack the nuances to cover theoretical subtleties.

A second approach could be called the "axiom acceptance research". It starts from a specific theoretical problem originating from philosophical or economic discourse and examines the acceptance of the related formal axioms proposed in the literature. These formal axioms are then translated and incorporated into (hypothetical) cases that are more or less close to everyday life situations and respondents are asked to answer either numerical or verbal questions or both. Pioneering work in this area has been done by Yaari and Bar-Hillel (1984) about distributive justice and welfarism and by Amiel and Cowell (1992) about inequality measurement. These pioneering contributions have sparked off a stream of similar publications (among which Amiel and Cowell, 1999; Gaertner, 1994; Gaertner and Jungeilges, 2002; Harrison and Seidl, 1994; Schokkaert and Overlaet, 1989; Schokkaert and Devooght, 2003; Traub et al., 2005). This approach has the advantage of making an explicit connection between the theory and the questionnaire research. Yet it is not unproblematic either. Formal axioms may not always correspond to a relevant psychological reality. As psychological research has shown (Deutsch, 1983), conceptions of justice vary over different socio-historical periods, different cultures and different personality-types and it is not obvious if and how economists should integrate these kind of social influences in their design of theoretical axioms.

We believe that it is sound to consider both approaches as complementary. Each approach may provide a useful contribution to understand on the one hand the often complex psychological and social reality and on the other hand the theoretical structure of normative problems. To be useful for economics, the

former approach should be careful in formulating well-structured questions. To be empirically relevant, the latter approach should be careful in formulating understandable real-world problems. In fact, since recent social choice theories often focus on well-defined distributional problems in a specific economic environment, they easily lend themselves to such an analysis.

This paper is an example of the second approach. We will start from an easily understandable problem, that of allocating an indivisible good. This problem has led to a huge amount of theoretical work. We will look at the relevancy of some crucial axioms capturing basic ideas of "solidarity" and "responsibility". More specifically, we will focus on the so-called "no-envy" criterion, that plays a crucial role in the recent literature on fair allocations. It states that no agent should prefer the bundle of any other agent to his own bundle. We will analyze how and when this egalitarian intuition can come into conflict with intuitions about desert and responsibility. Moreover, we will explicitly "test" the relevancy of theory in an intercultural context since the empirical survey has been conducted in three countries on three different continents (Belgium, Burkina Faso, and Indonesia).

Section 2 sketches the problem of allocating an indivisible good, introduces the crucial axioms and describes some distributional rules. Section 3 presents the methodology of the questionnaire-experimental survey. Section 4 gives an overview of the results. Section 5 reports on the verbal testing of the axioms, with special attention for the Pareto-principle. Finally, section 6 concludes with some suggestions for both theoretical and empirical work.

## 2 The formal problem: allocating an indivisible good

We first describe the formal structure of the problem of allocating an indivisible good. We then propose some possible solutions, as proposed in the literature. Finally, we link the formal problem to basic popular intuitions.

### 2.1 The problem and some axioms<sup>2</sup>

Suppose there are  $n$  individuals, indexed by  $i = 1, \dots, n$ , interested to get one indivisible good. These persons are identical in all respects but one: each of them has her own personal preference for the good in question. Assuming that preferences are measurable in monetary terms and that there are no income effects, we can represent the preferences of person  $i$  with a scalar measure  $a_i$  of her willingness-to-pay for the indivisible good (WTP). All the WTPs are collected in a vector  $a = (a_1, a_2, \dots, a_n)$ , where we assume (without loss of generality) that  $a_1 \geq a_2 \geq \dots \geq a_n$ . We will also assume that  $a_n > 0$ . Since the good is indivisible, only one person can get it. The others, however, can be compensated in one way or another. Let us indicate the resulting allocation as

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<sup>2</sup>We follow the notation of Moulin (1990).

$z = (z_1, z_2, \dots, z_n)$  with  $z_i = (\varepsilon_i, t_i)$  and

$$\begin{aligned} \varepsilon_i &= 1 \text{ if person } i \text{ gets the good} \\ &= 0 \text{ if person } i \text{ does not get the good} \\ t_i &\quad \text{the compensation received (or paid) by person } i. \end{aligned}$$

Feasibility implies that there exists an individual  $i$  for which  $\varepsilon_i = 1$  and that for all other individuals  $j \neq i, \varepsilon_j = 0$ . Moreover,

$$\text{if } \varepsilon_i = 1, \text{ then } t_i = - \sum_{j \neq i} t_j, \quad (1)$$

i.e. the total compensation paid by the receiver of the good has to be distributed over all the others. Given our assumptions on preferences we can write the expected utility of individual  $i$  ( $i = 1, \dots, n$ ) as

$$S_i = \varepsilon_i a_i + t_i, \quad (2)$$

i.e.  $S_i$  is a linear function of  $i$ 's willingness to pay and the transfer she has received (or paid).

The most direct distributional question then of course is: who should get the indivisible good? Given that there is compensation, it is clearly preferable to give the good to person 1 (with the highest WTP). Indeed, in this simple model this is the only efficient solution. Since it follows from (1) and (2) that  $\sum_i S_i = a_k$  if person  $k$  gets the good, the prescription to give the good to person 1 follows immediately from imposing

**Condition 1** *PARETO-EFFICIENCY (PE)*.

$$\sum_i S_i = \max \{a_i\}_{i \in N} \equiv a_1. \quad (3)$$

In the following analysis we always assume that this condition is satisfied. The more difficult question is how to define an attractive compensation scheme, because this may imply possibly conflicting ethical requirements. A useful reference point is the egalitarian division rule, in which

$$\forall i, S_i = \frac{a_1}{n}. \quad (4)$$

While simple and transparent, this rule does not take into account any information on the individual WTPs. This immediately suggests a conflict with what could be seen as a basic requirement of desert: is it reasonable to award individual  $k \neq 1$  a compensation which is larger than her own WTP, i.e. than what she would get if she were the only person in society and therefore were able to fully enjoy the pleasure of the indivisible good? Does this not mean that individual 1 is in a certain sense exploited by individual  $k$ ? A minimal requirement of "desert" or "responsibility" therefore may be:

**Condition 2** *STAND-ALONE UPPER BOUND (SAUB)*.

$$\forall i, S_i \leq a_i. \quad (5)$$

It is immediately clear that the egalitarian solution does not satisfy SAUB if there exists an individual  $i$  such that  $a_i < a_1/n$ . It may therefore be worthwhile to look for other approaches which do take into consideration the information about individual WTP.

In this regard, the so-called "no-envy" criterion has occupied a prominent role in the recent social choice literature. In general terms, it requires that after compensation no person should prefer the bundle of anyone else to his own bundle. For our problem of allocating an indivisible good, this no-envy criterion can be specified as follows:

**Condition 3** *NO ENVY (NE)*.

$$\forall i, \varepsilon_i = 0 \Rightarrow t_i = t \text{ and } a_i - (n-1)t \leq t, \quad (6)$$

$$\varepsilon_i = 1 \Rightarrow a_i - (n-1)t \geq t. \quad (7)$$

Equation (6) states that all persons who do not get the good should get the same compensation. Otherwise, those who receive a smaller compensation would envy the others. Moreover, those who do not get the good should not prefer to give up their own compensation in order to get the good themselves and compensate the others. Equation (7) states that the one who gets the good should not prefer to get the compensation  $t$  instead of the good itself. Therefore, his WTP minus the total amount of compensation he has to pay should not be less than the compensation each other gets from him. It is clear that conditions (6) and (7) can only be satisfied simultaneously if person 1 gets the indivisible good. Therefore, *in this model* NE implies PE. In general, we can write:

$$\forall j \neq 1, \frac{a_1}{n} \geq t \geq \frac{a_j}{n}. \quad (8)$$

Note that the egalitarian rule satisfies NE with  $t = a_1/n$  (see eq.(4)). There are of course other rules which also satisfy NE. However, none of these other rules solves the conflict with SAUB: as (8) shows, nothing prevents  $t$  from becoming larger than some  $a_j$ . We will therefore have to look for a weaker compensation requirement than NE if we want SAUB to be satisfied in all possible circumstances.

One possible approach could be to guarantee to all individuals at least a minimum compensation. It seems reasonable to assume that this minimum should depend on her WTP. Let us therefore write it as  $\psi(a_i)$ . Of course, for these minimal compensations to be feasible, their total amount should never exceed the WTP of the individual who gets the good. Thus, given that PE is satisfied, feasibility implies that  $\sum_i \psi(a_i) \leq a_1$ . Moulin (1992) has shown that the largest minimum that can be guaranteed to everybody is given by  $(a_i/n)$ .

An economic agent will receive this amount of minimal compensation in the case that all individuals possess the same preferences (or WTPs). Hence, the name unanimity lower bound given to the following condition:

**Condition 4** *MINIMAL COMPENSATION or UNANIMITY LOWER BOUND (ULB).*

$$\forall i, S_i \geq \psi(a_i) = \frac{a_i}{n} \quad (9)$$

Condition ULB can be interpreted through its analogy with the egalitarian rule. The latter rule guarantees that the person who finally gets the indivisible good after compensation keeps at least as much as all the others of the group. Take now any other person and consider his situation if he acted in the same way, i.e. distributed the "proceeds" (his WTP) equally over all the members of the group. He would then end up exactly with the lower bound as defined in (9): one can indeed argue that this is the minimal compensation any individual is allowed to demand in order to forsake the good and that in a fair allocation no one should receive less. Note that the egalitarian rule obviously satisfies ULB since  $a_1/n \geq a_i/n$  for all  $i$ . Note also that equations (8) and (9) immediately show that NE implies ULB. In this respect, Moulin (1990) draws a connection between the compensation ideas implied by NE and ULB. The latter can be seen as 'equal opportunities ex ante', i.e. before the preferences of others have been revealed. The former can be interpreted as 'equal opportunities ex post' since the absence of envy implies that there is no interpersonal conflict in the final ex post allocation. It therefore stands to reason that ULB is a weaker requirement. In fact, contrary to NE, ULB is compatible with SAUB (or maximal compensation).

## 2.2 Some rules

The literature has proposed different rules to solve the problem of allocating an indivisible good. We only introduce for ease of reference the rules that have been implemented in our empirical work. The simplest one is the **egalitarian rule** (4), that was already introduced before. This rule is the most favorable to the individuals with a low WTP since they get the highest equal share possible. As we have seen, it satisfies NE and ULB but can come in conflict with SAUB. Alternatively, among the rules satisfying NE the so-called **rule NE2** is the least favorable for the individuals with a low WTP:

$$S_1 = a_1 - \frac{n-1}{n}a_2, \quad (10)$$

$$\forall i \neq 1, S_i = \frac{a_2}{n}. \quad (11)$$

An intermediate **rule NE3**, also satisfying the no-envy condition can be defined as follows:

$$\begin{aligned} \forall i \neq 1, \text{ if } a_n \leq \frac{a_1}{n} \text{ then } S_i &= \max\left(\frac{a_2}{n}, a_n\right), \\ \forall i \neq 1, \text{ if } a_n > \frac{a_1}{n} \text{ then } S_i &= \frac{a_1}{n}, \\ S_1 &= a_1 - \sum_{j \neq 1} S_j. \end{aligned}$$

Of course, given that all these rules satisfy NE, they also satisfy ULB. However, they are in general not compatible with SAUB. One popular rule satisfying both SAUB and ULB (but *not* NE) is the **Shapley rule**. The following story is useful to understand its interpretation in this setting (Moulin, 1988). Define the "cost"  $C$  of allocating the good to individual 1 as  $C = \sum_i a_i - a_1$ . Now suppose individual  $i$  comes first in a random order of all individuals. Individual  $i$  then has to pay  $\min(C, a_i)$ . If  $a_i < C$  we turn to the second individual in the row (say individual  $j$ ) who then has to pay  $\min(C - a_i, a_j)$ . We continue with a third individual and so on until the complete cost is covered. This whole procedure can be repeated for all possible permutations of the individuals. The Shapley rule then allocates to each individual  $i$  the average he has obtained over all these possible permutations. Another possible rule, which will be used in our empirical work, is **Moulin's version of egalitarianism (MEG)**. This parametric rule, introduced in Moulin (1985) is defined as

$$S_i = a_i \rho_i + \frac{a_1 - \sum_{j=1}^n a_j \rho_j}{n}, \quad (12)$$

$$\text{with } \forall i, \rho_i \geq 0, \sum_{i=1}^n \rho_i = 1 \text{ and } \exists i \neq 1 \text{ with } \rho_i > 0.$$

### 2.3 A broader interpretation

In subsection 2.1 the problem of allocating an indivisible good has been formulated in formal terms. These formal axioms, however, capture basic intuitions which are prevalent in society (Konow, 2003). Resource egalitarianism is a principle on its own. More sophisticated egalitarian approaches start from the idea that the agent who gets the indivisible good carries the responsibility to compensate the others and should treat them equally or at least should leave opportunities equal - while individual preferences play a role in defining "equality" or "equal opportunities". The no-envy criterion captures the idea that in a "just" society no one would prefer to trade places. Both ULB and SAUB reflect ideas about rights, with the former drawing from a mainly egalitarian interpretation and the latter reflecting considerations of merit or desert. Although we cannot expect lay people to think about justice in terms of the specific formal

axioms proposed by economic theory, we can hypothesize that the general intuitions behind the axioms are relevant. Moreover, we can also hypothesize that simple egalitarianism is a principle on its own, that SAUB will be more popular among respondents who attach a large weight to desert and that ULB and certainly NE will be more prominent among respondents who prefer an approach in which compensation is a function of willingness-to-pay. While our empirical approach focuses on the formal testing of the axioms, we will also interpret our results in terms of this broader setting. We think that this is one way to bridge the gap between the "opinion discovery research" and the "axiom acceptance research".

### 3 Empirical setting

To explore the intercultural dimension of justice perceptions, we organized a questionnaire study in three countries on three different continents: Belgium, Burkina Faso and Indonesia. In each country the questionnaires were distributed in a random way and were filled out anonymously by first-year university students during an economics class. We made sure that none of the students had ever been exposed to any specific teaching on formal theories of justice that could have affected the answers. Table 1 below provides more detailed information on the samples. There are various reasons for choosing students as the respondent sample. Not only are students readily available, the fact that the study was organized at a university also gave us the opportunity to have it administered by former colleagues who were well aware of its purpose and its methodological requirements. They also helped with the translation of the questions and checked them for possible cultural sensitivities. Moreover, by concentrating on students we could control for much interindividual variation in personal characteristics (such as age and schooling). This gives us a better basis to interpret the remaining differences between the samples as resulting from differences in national (or cultural) background.

**Table 1. The sample**

<b>Belgium</b>	<b>Burkina Faso</b>	<b>Indonesia</b>
University of Leuven Faculty of Business	University of Ouagadougou Faculty of Law	University of Bandung Faculty of Business
N=178	N=177	N=403

The questionnaire consisted of three broad sections, of which the last section was devoted to the problem of allocating an indivisible good<sup>3</sup>. In this third section two simple numerical cases were presented. In line with the methodology proposed by Amiel and Cowell (1992), we also added some verbal questions for direct testing of the axioms. The results for these questions are summarized in

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<sup>3</sup>The other sections focused on the axiomatic structure of the conflict between responsibility and compensation. We have reported on these results in Schokkaert and Devooght (2003).



the next section. The story for the numerical cases was designed as a distribution problem within a production economy setting. Two variations of the same story were presented to the respondents. The common part of the story went as follows:

*John, Peter and Mark work on one and the same farm. Up to now, they did all the work (ploughing, weeding, harvesting) manually. Now an NGO provides them with a plough. The plough they receive is for free. Working with the plough requires no additional effort. It is impossible that all three persons work with the plough. For practical reasons only one person can work with it. If John were allowed to work with the newly acquired plough, he could enlarge the harvest by an amount of XXX kg. Peter could create an extra harvest of XXX kg with the plough, while Mark would succeed in creating an extra XXX kg.*

The spaces marked XXX represent the elements which vary between both cases and are given in Table 2. It is obvious that the difference resides in the extra amount of output that Peter and Mark are supposed to be able to generate if they work with the plough. This variation has crucial implications from the point of view of the axioms: while in case 1 it is possible to satisfy NE and SAUB at the same time, in case 2 both requirements are necessarily conflicting. The latter follows from the fact that in case 2  $a_{\text{Mark}} < a_{\text{Peter}}/3$ , and hence it is not possible to find a compensation  $t$  such that  $a_{\text{Mark}} \geq t \geq a_{\text{Peter}}/3$  (compare eqs.(5) and (8)).

**Table 2. Two cases**

	<b>John</b>	<b>Peter</b>	<b>Mark</b>
<b>CASE 1</b>	120	60	30
<b>CASE 2</b>	120	90	24

After the description of the case, the respondents first had to answer a preliminary question: given the productive capabilities of the economic agents, who should be allowed to use the plough? In the next (and most important) step, they were asked to select what, in their opinion, would be a fair distribution of the additional harvest, *given* that the most productive agent had been allowed to use the plough. Eight possible distributions were proposed as listed in the left section of Tables 3 and 4. Note that most of the suggested distributions follow from applying the rules that have been proposed in the literature and described in the previous section. The middle section of Table 3 and Table 4 indicates whether each particular allocation violates the fairness conditions discussed above: NE, ULB, and SAUB. A "no" in the table means that the distribution does not satisfy the axiom, an empty box means that the distribution does not violate the axiom.<sup>4</sup>

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<sup>4</sup>Of course, this information was not given to the respondents, who are not supposed to

## 4 Results: allocating an indivisible good

Since the formulation of the questions and the different solutions were chosen in such a way as to represent formal conditions of fairness, the respondents' judgements provide the possibility of testing the acceptance of these conditions in an indirect way. The preliminary question (about who should get the plough) is a test of Pareto-efficiency PE. It turns out that almost no respondents violate the axiom. The most productive farmer (John) is selected by 99% of the Belgian sample, 98% of the Burkinese sample and 94% of the Indonesian sample. Remember that PE is a rather straightforward requirement here: giving the plough to the most productive farmer makes the harvest to be divided among the three farmers as large as possible (120 kg). We will return to the acceptance of the PE-axiom in the next section.

More interesting are the results about the division of the surplus. The results for cases 1 and 2 are shown in Tables 3 and 4 respectively<sup>5</sup>. Tables 5a and 5b summarize the findings with respect to the two most crucial axioms: SAUB and NE.

It is striking that the distributions proposed by the rules from the theoretical literature are overall rather popular. Indeed, distributions such as B and F are not chosen very often, although simply looking at the numbers does not immediately suggest that they are theoretically less interesting than, e.g. distributions C or E. A second striking finding when looking at tables 3 and 4 is the almost constant popularity of the simple resource egalitarian rule. It is the dominating choice in both Belgium and Burkina Faso, but not in Indonesia.<sup>6</sup> Note that the egalitarian distribution does not satisfy SAUB, in that it gives the least productive Mark a larger share of the additional harvest than he could earn on his own. It is possible that some respondents deliberately want to compensate for differences in innate capabilities such as productive capacity, and that this tendency is weaker in Indonesia than in the two other countries. It is also possible, however, that resource egalitarianism is an attractive idea on its own, or that the egalitarian division is chosen simply because it is an easy focal solution.

What about the crucial (conflicting) axioms NE and SAUB? The no-envy condition is very popular in case 1 (see Table 5a): the chosen distributions satisfy it for 78% of the Belgian sample, 71% of the Indonesian sample and 65% of the Burkinese sample.<sup>7</sup> The Indonesian result is remarkable: although

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know the formal axioms. They only had to read the story and were then confronted with the simple list of possible options.

<sup>5</sup>The question about the division of the surplus assumed that John received the plough. The exact formulation was as follows: "Suppose John is the one who is allowed to work with the plough throughout the whole season. What do you think would be a fair distribution of the extra harvest (120 kg)?"

<sup>6</sup>Both in Table 3 and in Table 4, one can reject the hypothesis that the response patterns for the three countries are identical. In Table 3 the p-value for the  $\chi^2(12)$ -test is 3.24E-08, in Table 4 the p-value for the  $\chi^2(14)$ -test is 6.45E-09.

<sup>7</sup>The differences between the three countries are statistically significant: the p-value for the  $\chi^2(4)$ -test is 2.08E-10.

the simple resource egalitarian rule is not popular in Indonesia, rules NE3 and NE2 are. To interpret this result, it is instructive to look at a characteristic feature of NE, as summarized in (6): all the individuals who do *not* get the plough get the same compensation  $t$ , independent of their own productivity. Resource egalitarianism adds to this that the final outcome is also the same for the individual who does receive the plough. From an ethical point of view, this is an important extension. Let us say that solutions satisfy condition NE\*, if they satisfy NE while not being resource egalitarian. Then, in the specific setting of this problem, NE\* does not differentiate between individuals on the basis of differences in innate productivity, but (contrary to resource egalitarianism) it does take into account differences in actual production. Indonesian students seem to attach a larger weight to the latter. On the other hand, the fact that NE\* is less popular in Burkina Faso suggests that Burkinese students attach a larger weight to innate capacities, whether they are realized or not. This is confirmed by the relative popularity of the SAUB axiom in Burkina Faso. In fact, this axiom also relates to the remuneration of innate capacities: nobody should get more than he could produce on his own.

**Table 3. Results for case 1**

(The numbers in the last three columns are the percentages of respondents choosing the division given in the relevant row)

	John	Peter	Mark	NE	ULB	SAUB	Burkina	Belgium	Indonesia
<b>A (egalitarian)</b>	40	40	40			no	28	39	15
<b>B</b>	45	45	30	no			2	2	1
<b>C (NE3)</b>	60	30	30				29	35	43
<b>D (NE2)</b>	80	20	20				7	4	13
<b>E (Shapley)</b>	75	30	15	no			27	16	22
<b>F</b>	85	25	10	no			5	2	3
<b>G</b>	90	30	0	no	no		0	0	0
<b>H</b>	120	0	0	no	no		2	2	3

In case 2 (Table 5b) it is no longer possible to satisfy NE and SAUB at the same time. It is immediately obvious that this leads in all countries to a sharp decline in the acceptance of NE. At the same time, the relative popularity of NE\* in Indonesia and of SAUB in Burkina Faso are confirmed.<sup>8</sup>

<sup>8</sup>The hypothesis that there are no differences between the countries is rejected by a  $\chi^2(4)$ -

As noted in the previous section, the ULB axiom is a weak compensation requirement. It is almost never violated in case 1 and rarely violated in case 2. This strongly suggests that most respondents accept the need for some compensation. Yet, looking at solution F in case 2 raises some additional questions. In that division, which is selected by a sizable minority of the respondents, the second "poorest" individual (Peter) does not receive the lower bound defined by ULB. While according to ULB he should get at least 30, in the actual division he only gets 26. This division differs from G and H in two respects: first, the violation of ULB does not concern the poorest, but the second poorest individual; and second, in division F nobody gets a zero output. Both the concern for the poor and the reluctance to award zero to some individuals are also found in other studies (see, e.g., Bosmans and Schokkaert, 2006). The sensitivity of the relative popularity of the ULB axiom for these additional considerations should be further investigated.

**Table 4. Results for case 2**

(The numbers in the last three columns are the percentages of respondents choosing the division given in the relevant row. The distribution in row D is MEG (see eq.(12) with  $\rho_i = 1/n$ .)

	<b>John</b>	<b>Peter</b>	<b>Mark</b>	<b>NE</b>	<b>ULB</b>	<b>SAUB</b>	<b>Burkina</b>	<b>Belgium</b>	<b>Indonesia</b>
<b>A (egalitarian)</b>	40	40	40			no	27	39	15
<b>B</b>	48	48	24	no			4	2	2
<b>C (NE2, NE3)</b>	60	30	30			no	23	24	41
<b>D (MEG)</b>	54	44	22	no			20	12	13
<b>E (Shapley)</b>	63	45	12	no			17	17	22
<b>F</b>	86	26	8	no	no		8	3	5
<b>G</b>	75	45	0	no	no		0	1	0
<b>H</b>	120	0	0	no	no		2	2	3

One can interpret all these results basically in two ways. The first is as a formalized description of the basic intuitions about justice in different societies. We could then summarize our findings by saying that resource egalitarianism is most popular in Belgium and that the respect for innate capabilities is larger

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test with  $p = 1.96E-11$ .

in Indonesia and in Burkina Faso. We could even hypothesize a possible refinement: the relative popularity of NE and SAUB suggests that the Indonesian students give a larger weight to actual production, while the Burkinese students look at potential productivity. These findings are in line with the results that have been reported by Schokkaert and Devooght (2003) for the same samples but for very different cases (on compensating in the health care sector and in income distribution). We should be cautious in drawing the conclusion that these patterns really reflect intercultural differences, however, because differences in the social background of our respondents could also be part of the explanation. The Indonesian university of Bandung recruits its students mainly among Catholics of Chinese origin - and it is often suggested that this is the most entrepreneurially oriented segment of the Indonesian population. More research is needed to discriminate between these different hypotheses. What seems clear, however, is that formal economic theory is useful in structuring the empirical work about basic justice opinions in society. It enables us to formulate different approaches in a clear and unambiguous way and therefore helps to see interindividual (and possibly intercultural) differences more sharply. Theoretical insights into the relationship between axioms (intuitions about justice) on the one hand and specific distribution rules on the other hand enable us to analyze real world opinions in a more transparent way.

**Table 5a. Acceptance of NE and/or SAUB in Case 1**

<b>CASE 1</b>	<b>Burkina Faso</b>	<b>Belgium</b>	<b>Indonesia</b>
<b>NE, not SAUB (egalitarian)</b>	28	39	15
<b>NE + SAUB</b>	37	39	56
<b>SAUB (not NE)</b>	35	22	29

**Table 5b. Acceptance of NE and/or SAUB in Case 2**

<b>CASE 2</b>	<b>Burkina Faso</b>	<b>Belgium</b>	<b>Indonesia</b>
<b>NE, not SAUB (egalitarian)</b>	27	39	14
<b>NE (not SAUB)</b>	23	24	42
<b>SAUB (not NE)</b>	50	37	44

A more ambitious interpretation would be to see our results as a "testing" of the empirical acceptance of the formal axioms. One could then be tempted to draw the conclusion that the Pareto-principle is almost universally accepted, that ULB is also extremely popular and that the no-envy principle still attracts more than two thirds of our samples. Caution is needed in drawing this kind of conclusions, however. First, choosing a rule which does not violate a given axiom does not imply that one also accepts the axiom in other circumstances. The choice of cases can therefore strongly influence the results. We suggested already that the popularity of ULB might be much lower if we had introduced

more cases involving the second (and not the poorest) individual and if we had always given at least a minimal non-zero compensation to everybody. Secondly, the acceptance of axioms may also depend on the general setting of the case. We situated the problem of allocating an indivisible good in a specific production context. It is not evident that we would have obtained the same findings in a different setting. Additional insights in this respect are obtained by looking at the results for the verbal questions.

## 5 A qualification: the results for the verbal questions

In line with the questionnaire-experimental method of Amiel and Cowell [1992], we supplemented the numerical cases with verbal questions in which the conditions were presented to respondents in plain language. Let us first look at the results for NE and SAUB. For SAUB, the question ran as follows:

*In a given situation with a given number of people each can individually produce a certain amount of food. Suppose now that these people work together and in group achieve a certain size of harvest. They now have to distribute the common harvest. They could use as a distribution rule that no member of the group, in the distribution of the common yield, receives more than he or she could produce on his or her own. Do you find this a just rule?*

For NE, the questionnaire then continued:

*The following general rule also deals with a distribution among a group of persons. Each person provides a specific contribution to the total harvest of the group. One could accept the general rule that after the total distribution of the harvest no one should prefer the allocation someone else has received to his own allocation. Do you find this a just rule?*

The results are given in the first rows of Table 6. They can be compared with the results for the numerical questions, as given in Table 5. For Indonesia, the results in the two tables are reasonably consistent. In Belgium and in Burkina Faso, both the no-envy criterion and the SAUB axiom are less popular in their verbal form than in the numerical cases. This is especially striking for NE in Belgium and for SAUB in Burkina Faso. Overall, the results strongly suggest that one should indeed be cautious in interpreting the results for the numerical cases as a direct testing of the acceptance of the formal axioms.<sup>9</sup>

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<sup>9</sup>Both for SAUB and NE a  $\chi^2(2)$ -test indicates that the differences between the three countries are significant (with  $p = 1.01E-05$  and  $p = 2.85E-10$  respectively). This is only due to Indonesia, however. The hypothesis that there are no differences between Belgium and Burkina Faso cannot be rejected for either of the two axioms.

That caution is needed becomes even more obvious when we look at the results for the Pareto-principle. In fact, as we noted before, the setting of the allocation of an indivisible good has the very particular characteristic that Pareto-efficiency is implied by the no envy-condition. Given the obvious link between "efficiency" and the potential for compensation (out of production) in this model, there is not really a conflict between efficiency and solidarity. It is then not surprising that near consensus is reached about Pareto-efficiency. To have a stricter test of the Pareto principle, we therefore added in the questionnaire a verbal story which was situated in a very different setting than the allocation of a plough and allowed us to refine the trade-off between "efficiency" and "redistribution". First, respondents had to answer the following question:

*Suppose that a certain amount of food is distributed between some persons. You can dispose of an additional amount of food but this amount can or may only be allocated to one person. This person therefore will get a greater amount of food. All the other persons will keep their former amounts and thus get nothing less. Do you find this possible distribution an improvement compared to the original distribution?*

Those who answered "yes" to this question were confronted with the following problem:

*Suppose now that this additional amount of food necessarily has to be allocated to the person who already has the greatest amount in the original distribution. The richest will become richer but no one of the other persons will be worse off. Do you find that, in this special case, the new distribution is still an improvement compared to the original distribution?*

If the answer on the first question was "no", the follow up-question read as follows:

*Suppose now that this additional amount of food necessarily has to be allocated to the person who has the smallest amount in the original distribution. The poorest will improve his situation but no one of the other persons will be worse off. Do you find that, in this special case, the new distribution is still worse than the original distribution?*

The answers on these questions are summarized in the last four rows of table 6. The first Y/N indicator refers to the answers on the initial question, the second Y/N indicator to the answers on the follow up question. The sum of the elements in the two rows indicated by YY and YN gives therefore the percentage of respondents who answered "yes" on the first question, i.e. who basically think that an increase in the total amount of food to be distributed

is a “good thing”, even if it is only to the benefit of one person. About 50% of the Belgian respondents and 42% of the Burkinese students have chosen this answer. The corresponding figure for the Indonesian sample is 85%. The difference persists when we also bring the second question into the analysis. Note that only the respondents who answered “yes” on both questions accept the Pareto-principle as it is usually interpreted in economic theory. The principle is now very decisively rejected by our Belgian and Burkinese samples. This is a confirmation of previous empirical results, an early example of which is McClelland and Rohrbaugh (1978). More surprising in the light of this previous work - but more in line with economic theory - is the acceptance of the Pareto principle by a majority of our Indonesian sample. Of those who answered “no” on the first question, the vast majority in Belgium and Burkina Faso changes his mind when it is made explicit that the advantage goes to the poorest. This is not the case in Indonesia, however.<sup>10</sup> The conclusion that our Indonesian sample cares less about redistribution seems to rest on very firm ground.<sup>11</sup> Of course, the qualification added in the previous section about interpreting these results as an indication of intercultural differences remains relevant.

**Table 6. Direct testing of axioms**

	<b>Burkina Faso</b>	<b>Belgium</b>	<b>Indonesia</b>
<b>SAUB</b>	<b>31.1</b>	<b>24.7</b>	<b>44.1</b>
<b>NE</b>	<b>43.5</b>	<b>36.2</b>	<b>63.4</b>
<b>PE: YY</b>	<b>18.2</b>	<b>20.9</b>	<b>62.6</b>
<b>PE: YN</b>	23.8	29.4	21.7
<b>PE: NN</b>	43.8	38.4	4.2
<b>PE: NY</b>	14.2	11.3	11.5

YY = acceptance of the Pareto-criterion

## 6 Conclusion

Normative economic theory attempts to structure and to formalize different concepts of distributive justice and of allocative fairness, and to check their logical coherency and their ethical attractiveness. One potentially important component of such an analysis is the link between these formal approaches and the opinions prevailing in society. While there is a very long tradition of empirical analysis of justice opinions in psychology and sociology, the link between this analysis on the one hand and economic theory and philosophical

<sup>10</sup>The hypothesis that there are no differences between Burkina Faso and Belgium with respect to the acceptance of the Pareto-principle in its YY-form cannot be rejected with a  $\chi^2(1)$ -test ( $p = 0.52$ ). However, there are highly significant differences between Indonesia and Belgium ( $p = 3.85E-19$ ) and between Indonesia and Burkina Faso ( $p = 1.65E-21$ ).

<sup>11</sup>This is also consistent with our earlier finding that the Indonesian sample gives a larger weight to differences in *actual* production.



thinking on the other hand is often weak. It is therefore useful to complement this empirical work with theory-driven survey studies.

Such theory-driven studies should focus on a specific problem that is theoretically well understood and that can be translated into a socially relevant question. We analyzed the problem of how to allocate an indivisible good in the setting of a production economy. To test for intercultural differences, we organized a questionnaire study in three countries: Belgium, Burkina Faso and Indonesia. Most respondents prefer allocations following from applying the distributional rules that are proposed in theory. Moreover, interindividual differences in response patterns can be interpreted in a meaningful way, because the formal axioms fit rather well basic intuitions about desert, efficiency and compensation. In the same way, differences between the samples in different countries display a meaningful pattern. Belgian students are most resource-egalitarian, Burkinese students attach a large weight to innate capacities, Indonesian students focus on actual production. The crucial no-envy criterion is supported by a majority of respondents, but this majority becomes small if there is an unavoidable conflict between no-envy and the "responsibility" requirement of the stand-alone upper bound. All in all, our results tend to confirm the social relevancy of the theoretical analysis of distributional problems in specific economic environments.

While the theory is definitely relevant, our results also suggest some neglected aspects. The specific concern for the poorest individual and the reluctance to give zero to anybody are not strongly present in the axiomatic approaches, but they seem relevant for a fraction of our respondents.<sup>12</sup> We also confirmed the finding of many previous studies that the acceptance of specific axioms may depend on the overall context in which the distributional problem is set. This raises a general question concerning social choice theory. There is need for a kind of "metatheory" that can rationalize how the choice of distributional rule (and hence the acceptance of axioms) depends on the general context of the distributional problem.

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<sup>12</sup>As a matter of fact, Elster (1992) includes the introduction of a "minimum floor" as one of the main ingredients of what he calls the common sense conception of justice.

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