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New insights on empirical conflicting claims problems

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Abstract

The present paper analyses the between-context uniformity in conflicting claims problems (O'Neill, 1982) by means of a questionnaire study that has been expressly designed with the aim of combining the strengths and avoid the weaknesses of those found in the related literature (Gaertner and Schokkaert, 2012). Furthermore, we include the following main features that, to the best of our knowledge, have not been jointly considered previously. Firstly, the sample is not restricted to degree students looking for improving its representativeness. Secondly, the contexts are accurately defined with the aim of providing all the needed information without leaving room to personal interpretation. Thirdly, a general explanation of each proposed fairness criterion is accompanied by its application to two different problems in order to encourage respondents to focus not just on one outcome but on the general principle underlying it. Fourthly, we do not only ask about the fairest criterion but also about the perception of each one being fair. Finally, the agents' wealth status quo is considered in order to obtain some evidence about both the role of solidarity as a basis of distributive justice and the support for the existence of a universal basic income.

Keywords: Conflicting claims problems; fair allocation; social questionnaires
JEL classification: D63

1. Introduction

A conflicting claims problem is a distribution problem in which the available amount to be shared, the *endowment*, is not enough to cover the agents' acquired rights on it, their *claims*. This model describes a great variety of situations being the distribution of the net worth of a bankrupt firm among its creditors so representative that has led to refer also to them as "bankruptcy problems".

An illustrative example is the fishing quotas reduction, in which the agents' claims can be understood as the previous captures, and the endowment is the new (lower) level of joint captures (Gallastegui et al., 2003; Iñarra and Skonhof, 2008). Similarly, the establishment of milk quotas among the EU members, introduced in 1984, led to a conflict on claims. Each member state was given a reference quantity which was then allocated

to individual producers. The initial quotas were not sufficiently restrictive to remedy the surplus production and they had to be cut twice more, in the late 1980s and early 1990s.[1] In both examples, *proportionality* was the main principle applied. Another very different situation is the 9/11 Victim Compensation Fund, where the income each victim would have earned in a full lifetime was estimated to establish the legal right to be compensated, that is, the individual claim.[2]

Other relevant practical cases involving more complex rationing situations are water distribution in drought periods or resource allocation procedures in the public health care sector (see, for instance, Hougaard et al., 2012 and Moreno-Ternero and Roemer, 2012); the design of efficient radio resource management policies that provide the highest possible quality of service levels while guaranteeing user fairness and protocols for the reduction of pollution have also been modelled as problems with conflicting claims (see Lucas-Estañ et al., 2012 and Giménez-Gómez et al., 2016, respectively).

The formal analysis of such problems, following a seminal paper by O'Neill (1982), has provided a vast number of well-behaved solutions.[3] Among them, the prominent solutions are the *Proportional*, the *Constrained Equal Awards*, the *Constrained Equal Losses* and the *Talmud* rules. The *Proportional* rule states that the endowment should be shared in proportion to the claims. The *Constrained Equal Awards* and the *Constrained Equal Losses* rules are based on equal division as the principle of distributive justice. Specifically, the former shares the endowment equally among claimants, subject to no-one being able to receive more than their claim. On the contrary, the latter recommends equal division of the incurred losses (the amount of the claim not honoured), establishing that no claimant can end up with a negative amount. Finally, the *Talmud* rule combines the two latter rules, taking as the reference point the half of the aggregate claims (the midpoint). When the endowment is less than the midpoint, equal distribution of resources prevails; otherwise, each agent receives half of their claim and the equal losses criterion is applied to share the remaining endowment.

The purpose of the present paper is to contribute to the analysis of the perception of distributive justice in conflicting claims problems by means of questionnaire studies (see Gaertner and Schokkaert, 2012 for a survey about empirical social choice, specifically where Chapter 4 summarises the works related to fairness in conflicting claims problems). Therefore, respondents have to give their opinions about the acceptance of different allocations from the point of view of fairness, as external observers or arbitrators (see, for instance, Amiel et al., 2008). Following the denomination due to Bosmans and Schokkaert (2009), we focus on the so-called between-context uniformity, that is, given a fixed mathematical formulation of a problem with conflicting claims, we study the influence of differences in the economic context. Other previous works that are partially close to ours are Schokkaert and Overlaet (1989), Gächter and Riedl (2006) and Herrero et al. (2010).

[1] Quotas ended on 1st April 2015.

[2] See the "Final Report of the Special Master for the September 11th Victim Compensation Fund of 2001".

[3] The reader is referred to Moulin (2002) and Thomson (2015) as surveys of this literature.

Specifically, we design eight different economic contexts by means of all combinations of the next pairs of specifications referring to the general background story, origin of claims and agents' economic position:

(i) General background stories: a company that cannot honour the committed salaries of the workers of its advertising department versus a mutual benefit society that cannot fully pay the entitled retirement pensions of its members;

(ii) Origin of claims: rights that come from differences in effort (hours worked for the firm and monetary contribution to the mutual benefit society) versus rights that represent differences in some agents' characteristics that are outside their control (publicists' creative abilities or retirees' family situation); and

(iii) Agents' economic position: claimants that have other sources of income, in addition to salary or pension, that allows them to cover their basic needs versus claimants that have only their salaries or pensions.

To the best of our knowledge, the influence of agents' economic position when solving conflicting claims problems has not been analysed previously. Additionally, we aim at providing enough information about each specific context with the aim of avoiding the respondents' personal interpretations of undefined aspects.

Our contribution to the analysis of the specific causes, if any, of the differences among the response patterns of a society is twofold. On the one hand, we try to isolate the "pure" background story from both the nature of the claims and the agents' economic positions. In some manner, economic position is an attempt at providing new insights, from an empirical point of view, into both the role of solidarity as a basis of distributive fairness and the support of the existence of a universal basic income (Widerquist et al., 2013).

On the other hand, we aim to find if there are some significant differences in people's moral intuitions, in terms of their personal characteristics: gender, age, education level, labour situation and economic position. Therefore, we do not restrict our sample to a particular population such as students, as usual in empirical social choice. On the contrary, our questionnaires are aimed at a heterogeneous set of participants, pursuing a global representativeness of all the social strata (see, for instance, Schokkaert and Capeau, 1991).

This paper is organised as follows. Section 2 introduces the theoretical model. Section 3 provides the set-up of our questionnaires. Section 4 presents and discusses the between-context uniformity results and the influence of personal characteristics on the application of distributive justice principles. Finally, Section 5 concludes. The questionnaires and some statistical computations are provided in the Appendices.

2. The theoretical model

Next we present the mathematical formulation of the conflicting claims problems and the rules that are used throughout the present paper.

Consider a set of agents $N = \{1, 2, ..., n\}$ and an amount $E \in \mathbb{R}_+$ of a perfectly divisible resource, the **endowment**, that has to be allocated among them. Each agent has a **claim**, $c_i \in \mathbb{R}_+$ on it. Let $c \equiv (c_i)_{i \in N}$ be the claims vector and $C = \sum_{i=1}^{n} c_i$.

A **conflicting claims problem** is a pair (E, c) with $C > E$. Without loss of generality, we will increasingly order the agents according to their claims, $c_1 \leq c_2 \leq \ldots \leq c_n$, and we will denote by $\mathcal{B}$ the set of all conflicting claims problems.

Given a conflicting claims problem, a rule associates within each problem a distribution of the endowment among the agents.

A **rule** is a single valued function $\varphi : \mathcal{B} \to \mathbb{R}^n_+$ such that for all $i \in N$, $\sum_{i=1}^{n} \varphi_i(E, c) = E$ (**efficiency**); and $0 \leq \varphi_i(E, c) \leq c_i$, (**non-negativity** and **claim-boundedness**).

The **Proportional** (P) rule (see Thomson, 2015) recommends a distribution of the endowment which is proportional to the claims: for each $(E, c) \in \mathcal{B}$ and each $i \in N$, $P_i(E, c) \equiv \lambda c_i$, where $\lambda = \dfrac{E}{\sum_{i \in N} c_i}$.

The **Constrained equal awards** (CEA) rule (Maimonides, 12^{th} century), proposes equal awards to all agents, subject to no-one receiving more than their claim: for each $(E, c) \in \mathcal{B}$ and each $i \in N$, $CEA_i(E, c) \equiv \min\{c_i, \mu\}$, where μ is such that $\sum_{i \in N} \min\{c_i, \mu\} = E$.

The **Constrained equal losses** (CEL) rule (Maimonides, 12^{th} century, Aumann and Maschler, 1985), chooses the awards vector at which all agents incur equal losses, subject to no-one receiving a negative amount: for each $(E, c) \in \mathcal{B}$ and each $i \in N$, $CEL_i(E, c) \equiv \max\{0, c_i - \mu\}$, where μ is such that $\sum_{i \in N} \max\{0, c_i - \mu\} = E$.

The **Talmud** (T) rule (Aumann and Maschler, 1985) proposes to apply the CEA rule, if the endowment is not enough to satisfy the half-sum of the claims. Otherwise, each agent receives half of their claim and the CEL rule is applied to distribute the remaining endowment: for each $(E, c) \in \mathcal{B}$, and each $i \in N$, $T_i(E, c) \equiv \mathrm{CEA}_i(E, c/2)$ if $E \leq C/2$; and $T_i(E, c) \equiv c_i/2 + \mathrm{CEL}_i(E - C/2, c/2)$, otherwise.

3. The questionnaires

3.1. Collecting data

Since we aim to identify the justice principles of the society when it has to distribute some resources which are not enough to honour all the claims, we introduce heterogeneity into our sample since we do not restrict it to a particular population. In doing so, we can analyse if there is some significant differences in people's choices in terms of the following characteristics (extensively shown in Appendix 1): age, gender, level of education achieved, level of household income, employment status, city and country of habitual residence, and being a supportive person.

Accordingly, the data had to be collected using an Online survey because it is the best way to get answers from different regions and countries. There are several sites for this purpose, such as Free Online Surveys, SurveyMonkey, SurveyPlanet and the particular that we selected for our study, Google Drive. In order to give a different random questionnaire to each person who accessed the surveys, a programming language

was needed for ensuring a similar number of answers for all the different questionnaires. The selected language was PHP, and in using it we were able to collect the answer itself, the code for the questionnaire, its URL, the date and time in which it was answered and then send all these data by email. Using this information, we know that there were 1,067 accesses to the questionnaires, and we received 575 responses.

3.2. Defining contexts

The questionnaires have been designed with the aim of checking the between-contexts uniformity in conflicting claims problems. That is, we want to find out the answer to the following question: does people's perception of distributive justice depend on the economic context?

Firstly, two background stories are introduced, as in the study by Bosmans and Schokkaert (2009): an **advertising department of a private company** and a **mutual benefit society**. In each of them, three agents are involved, being employees and retirees, respectively.

F Employees who are working in an advertising department and the salaries which the firm was committed to pay them cannot be honoured.

M Retirees who are members of a mutual benefit society that cannot face up to the committed retirement pensions.

Secondly, following the study of Schokkaert and Overlaet (1989), we consider different origins of the claims: **the agents' effort,** materialised in hours worked or monetary contributions, depending on the background story, and **some agents' characteristics outside their control**.

E The committed payments are related to the number of hours worked, in the case of employees, and to the retirees' monetary contributions to the mutual benefit society.

S The committed payments are related to the employees' creative ability and to the retirees' family situation.

Finally, we contemplate two different status quo distributions of wealth of the agents: one that allows them to **have their basic needs covered** and another in which they **have nothing**, that is, their income is just what they receive when solving the conflicting claims problem.

Y The agents can cover their basic needs by alternative sources of income, other than what they receive when facing the conflicting claim problem.

N The agents have no other extra sources of income, different from what they receive when facing the conflicting claim problem.

By combining different background stories, origin of the claims and wealth status quo, we obtain eight different contexts, as Figure 1 summarises.

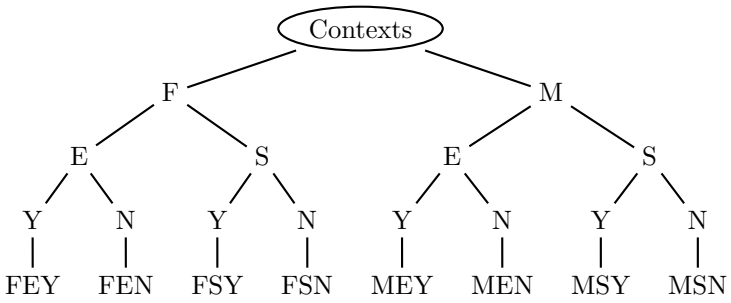

Figure 1: **The eight different contexts.** F=firm, M=mutual benefit society, E=effort, S=skill/family situation, Y=extra income, N=no extra income.

Remark 1 *Three characteristics about the agents' rights should be highlighted:*

1. *In all the contexts the rights are payment commitments.*
2. *The rights are either a result of the agents' active involvement (in the FE and ME contexts they come from the agents' exerted efforts and from their monetary contributions, respectively), or a result from some features outside the agents' control (in the FS and MS contexts they come from the agents' creative ability and from their family situation, respectively).*
3. *The rights represent hours worked (FE context), or creative ability (FS context), or monetary contribution (ME context) or basic needs (MS context).*

It is noteworthy, that among all the considered contexts, only in the MSN context do the rights represent basic needs that cannot be covered in any way.

3.3. Designing the questionnaires

The respondents act like an external arbitrator who faces randomly one of the eight possible contexts. Then, they have to evaluate if each of the four proposed rules is fair or not, and which one is the fairest.

Concretely, each of the respondents faces one of the two economic background stories, where the origin of the acquired rights is explained. Next, we gather one of the questionnaires (see Appendix 1 for a full description of all questionnaires).

> *The **advertising department of a private company** placed in Spain consists of three people with the following characteristics: same qualification level, similar family situation, same creative ability, none of them has another source of income, and all of them live in Spain.*
>
> *The **company** committed to pay them €120,000 per year, an amount that it was decided to distribute according to the number of hours worked by each of them as follows: (30,000; 39,000; 51,000). That is: publicist 1: €30,000, publicist 2: €39,000, and publicist 3: €51,000.*
>
> *However, due to causes beyond the control of the **workers**, the amount of money the **company** can spend this year on their **salaries** is lower, and this is the reason why the acquired rights cannot be met fully.*

One of our main contributions is that we ask about fair criteria combining different strengths of previous related works while providing new features, as detailed below.

Firstly, all of the respondents face an identical **pair of problems** in which they have to analyse fairness:

> *Consider the following two situations:*
>
> ***A*** *The* ***company*** *has only €75,000.*
>
> ***B*** *The* ***company*** *has only €45,000.*

Secondly, as in Gächter and Riedl (2006) and Herrero et al. (2010), we provide different possible divisions of the resources according to the CEA, CEL and P rules in each of the conflicting claims problems, but we also consider the T rule. The explanation of each rule is given. Each respondent has to answer whether they consider the recommendation of each rule **fair** for both situations or not, taking into account that fairness of one rule does not exclude fairness of the others.

> *Next, different distributions for situations A and B are proposed. We want to know if you consider them fair or not. Note that you can select more than one option as fair. Moreover, if you select a pair of distributions as fair, it means that you think that the distributions proposed for both situations, A and B, are fair simultaneously.*
>
> *Distribution 1: The available amount of money is equally divided among the three publicists.*
>
> *- In situation A the distribution would be (25,000; 25,000; 25,000).*
>
> *- In situation B the distribution would be (15,000; 15,000; 15,000).*
>
> *Do you think this pair of distributions is fair? Yes / No.*
>
> *Distribution 2: The three publicists lose the same amount of money.*
>
> *- In situation A the distribution would be (15,000; 24,000; 36,000), because everyone loses €15,000.*
>
> *- In situation B the distribution would be (5,000; 14,000; 26,000), because everyone loses €25,000.*
>
> *Do you think this pair of distributions is fair? Yes / No.*
>
> *Distribution 3: If the available amount of money is greater than half of the originally committed amount (greater than €60,000), then the money is distributed so that each publicist loses the same amount (Distribution 2). If the available amount of money is less than half of the originally committed amount (less than €60,000), then the money is equally divided among publicists (Distribution 1).*
>
> *- In situation A the distribution would be (15,000; 24,000; 36,000), because everyone loses €15,000.*
>
> *- In situation B the distribution would be (15,000; 15,000; 15,000).*
>
> *Do you think this pair of distributions is fair? Yes / No.*
>
> *Distribution 4: The percentages of money that correspond to each publicist according to the original commitment are 25%, 32.5% and 42.5%, respectively. The final available amount is distributed using these percentages.*

- In situation A the distribution would be (18,750; 24,375; 31,875).
- In situation B the distribution would be (11,250; 14,625; 19,125).
Do you think this pair of distributions is fair? Yes / No.

Remark 2 *The specific data of the mathematical problems have been carefully determined in order to impose some constraints:*

1. *The respondents' final decision is not affected by the perverse effects that an agent's zero payoff may cause (see, for instance, Bosmans and Schokkaert, 2009).*
2. *The application of the principles of equal gains and equal losses is not affected by non-negativity and claim boundedness conditions.*
3. *The application of the T rule contemplates the two different criteria, equal gains and equal losses, that it gathers implicitly.*
4. *The application of the T rule is affected by neither the upper bound nor by the lower bound conditions related to the half-sum of the claims.*
5. *Provide an allocation that recommends an agent's payoff as considerably lower than the current legal annual minimum wage in Spain, which currently amounts to €9, 182.80).*

Thirdly, it is also permissible to propose a different pair of divisions as fair through **an open question** (Gächter and Riedl, 2006). This proposal should be explained.

Would you propose as fair a distribution that is different from those presented previously? If so, please answer the following questions:
- How would you distribute the €75,000 available in situation A?
- How would you distribute the €45,000 available in situation B?
- If you have proposed a new distribution, what criterion have you used?

Fourthly, among all the fair proposals, the respondent must select which is the **fairest proposal**.

Considering all the previous pairs of distributions that you think are fair, which one do you think is the "fairest"?

Finally, the questionnaire concludes by asking a battery of personal and socio-economic questions.

4. Results

All the mentioned tables in the following paragraphs are placed in Appendix 2.

For Tables 2 to 20 the p-values correspond to the null hypothesis that the percentages are equal for all the contexts.[4]

[4]The null hypothesis is rejected if the p-value is less than the significance level, that we have chosen to be equal to 0.05. The smaller the p-value, the more strongly the test rejects the null hypothesis being tested.

4.1. Influence of contexts

The total sample consists of 575 respondents, corresponding to 290 for the firm versions and to 285 for the mutual benefit society versions. Table 1 reports the sample sizes of each of the different contexts.

Code	Background story	Origin of the claims	Additional income	Number
FEN	Publicists	Worked hours	No	73
FEY	Publicists	Worked hours	Yes	80
FSN	Publicists	Creative abilities	No	67
FSY	Publicists	Creative abilities	Yes	70
MEN	Society members	Monetary contributions	No	70
MEY	Society members	Monetary contributions	Yes	75
MSN	Society members	Family situation	No	76
MSY	Society members	Family situation	Yes	64

Table 1: Sample sizes.

At a first global sight, among all the proposed rules, the P rule is considered fair by 87.06% of the respondents and 65.32% of them indicate that it is the fairest rule, as shown in Figures 2 and 3.

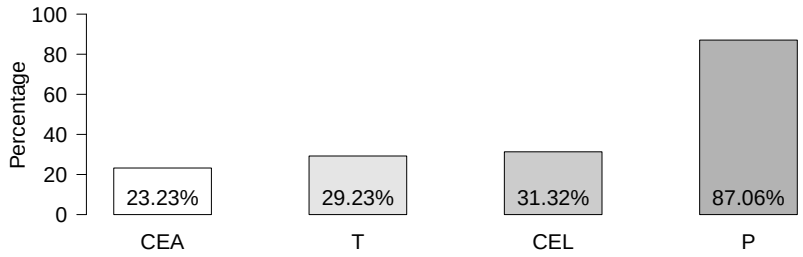

Figure 2: Do you think this pair of rules is fair? Percentage of positive answers

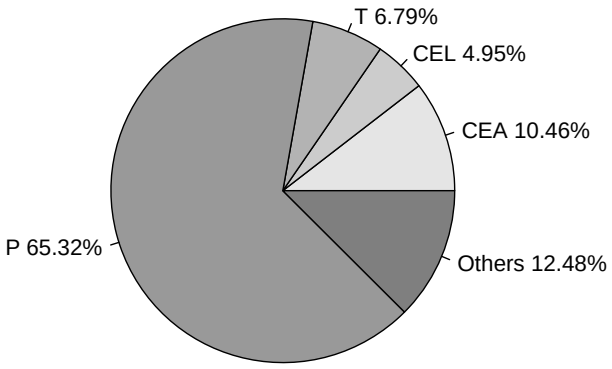

Figure 3: Which one do you think is the "fairest"?

When analysing each version of the questionnaires, the previous results remain valid, as the χ^2 tests in Tables 2 and 3 show. That is, the P rule is considered to be fair with percentages between 80.26% and 92.00%, and it is recognised as the fairest rule with

values between 52.70% and 71.64%. Regarding the other rules, we observe significant differences for the T rule when asking about the fairness of the proposal, and for the CEL rule when considering the fairest proposal.

Next, we study differences among the answers of the questionnaires that refer to firms and mutual benefit societies, as well as those answers that differ in the origin of the claims and in the level of wealth, which is measured by the existence of other sources of income.

Firstly, we analyse the influence of the background story on the answers, firm versus mutual benefit society. In accordance with Table 4, there are differences between these two contexts for the CEA rule when the origin of the claims is related to the claimants' effort (hours worked and monetary contributions) and the agents have another source of income, FEY and MEY contexts. Accordingly, the percentage of respondents that think that the CEA rule is fair in the FEY context (29.1%) is almost double that which corresponds to the corresponding to the MEY context (15.5%). This difference may be related to the idea that more hours worked does not necessarily mean more productivity, whereas there is no doubt about the role the monetary contributions play.

Similarly, there are big differences for the T rule when the origin of the claims is outside the agents' control (creative abilities and family situation) and the agents have no other source of income, the FSN and MSN contexts. In this case, the T rule is considered fair in the first context by the 25.4% of the respondents, whereas this percentage increases up to 45.3% in the second context. This difference may come from the fact that people are supportive and in favour of everyone having an income level to meet their basic needs. In this regard, let us note two features. On the one hand, in the FSN context, the claims represent abilities, meanwhile in the MSN context, they represent needs, as pointed out in Remark 1. On the other hand, the T rule represents a balance between solidarity and guarantee since when the amount to be shared is large this rule equalises losses, the sacrifice to which agents have to face, but it guarantees a minimal income to each claimant when the amount to allocate is small.

If we consider which rule is the fairest in pairs of contexts with different background stories (Table 5), we discover that more people think that the CEL rule is fair in the MSN context than in the FSN context (13.5% in contrast to 3.1%, respectively). However, the opposite happens with the P rule, 52.7% of the respondents consider that it is fair in the MSN context against the 70.3% that select it as fair in the FSN scenario. This could be supported by the idea that when claims represent needs and and there are no other sources of income, the MSN context, respondents tend to focus on losses rather than on gains and the CEL equalises losses, but the P rule implies greater losses for greater needs.

Secondly, we compare answers depending on the origin of the claims, effort versus something outside the agents' control. In this case, only with the T rule, different results are obtained in the context of society members with no additional sources of income, MEN versus MSN contexts. As shown in Table 6, the percentages go from 20% in the first context to 45.33% in the second context. This difference may be due to the same facts that were commented previously in relation to solidarity and coverage of basic needs. With the same focus, the origin of the claims, we also observe different results for the fairest rule (Table 7) just in the same pair of contexts, MEN versus MSN, where the percentage of respondents that think that the P rule is the fairest, 71.6%, is greater when the claims represent needs, the MEN context, than when their origin are monetary contributions,

52.7%, in the MSN context. Recall that, as aforementioned, the proportionality principle implies that losses are proportional to needs, hence agents with more needs will lose more.

Finally, when we pay attention to agents' level of wealth (Table 8), we only obtain a difference for the T rule in the mutual benefit society context when the claims are due to the family situation, so that they represent needs, MSN versus MSY contexts. In this case, the percentages go from 45.3% in the first context to 25.4% in the second context. Again, the different result could be explained by that nowadays people are very sensitive to the fact of having difficulties for covering the basic needs, and the T rule is able to guarantee a minimum level of income.

Summing up the answers to the open question "Others" (distribution number 5), 87 respondents propose an allocation criterion that is different from the provided rules, and approximately one third of them indicate that a minimum amount should be given to everyone, allocating the remainder amount by using a known criterion such as the P, CEA, CEL or T rules. This response does not correspond to a particular context, rather the contrary, it is proposed for all the eight contexts presented. This fact could reflect that these people support the existence of a universal basic income, independently of the personal circumstances.

Additionally, it is noteworthy that 64 respondents, 11.13% of the sample, do not consider themselves as supportive people. Most of the respondents (76.6%) are men, 25% of whom were born between 1971 and 1980. These percentages should be treated with caution because they must be compared with the proportions of these people in the whole sample, where they are 59% and 19.7%, respectively, with no significant differences related to the education level or employment status.

4.2. Influence of personal characteristics

Among all the personal characteristics asked of respondents, we have focused on checking if there are different answers according to employment, education level, year of birth and gender.

When we classify respondents using the employment status and compute the p-values for the whole sample (Table 10), there are significant differences for all the rules except for the T rule. These differences are only significant for the CEL rule in the firm contexts, whereas in the mutual benefit society contexts the CEL rule is the only one with no significant differences (Tables 11 and 12). We can observe that in the firm scenarios, a few self-employed people consider it fair to lose the same amount of money (18.75%), while quite a number of retirees accept this justice principle (55.56%). In the pension questionnaires, the CEA and P rules are less accepted as fair by retirees (11.11% and 70.00%, respectively) and the T rule is less accepted as fair by employees (17.76%). The greatest acceptance is found in students for the CEA rule (36.67%), in retirees for the CEL rule (44.44%) and in the "Other employment status" category for the T and P rules (50.00% and 90.91%, respectively).

Taking into account the education level, the higher the level, the less there is acceptance of the CEA, CEL and T rules as fair (Table 13). This is particularly true in the firm questionnaires (Table 14) for the CEA and CEL rules and in the mutual benefit society contexts (Table 15) for the T rule.

By considering the year of birth, with the whole sample there are very significant differences for the CEL and T rules, since the acceptance of these criteria as fair increases

with respect to the advance in year of birth (Table 16). In the firm questionnaires there are no significant differences (Table 17) while in the mutual benefit society questionnaires there are significant differences for the CEL, T and P rules with the same tendency as there is over the whole sample (Table 18).

In relation to gender, the CEL rule is considered to be fair for a greater percentage of women (38.25%) than men (27.08%), being this difference significant (Table 19). Analogously, the CEL rule is considered to be the fairest rule by by 7.24% of women and just by 3.42% of men (Table 20).

4.3. Probit models

In order to find a relation between the personal characteristics and the probability of the responses to the different rules, a probit model has been run. Specifically, we use as dependent variable the probability of considering fair each criterion, and we include the personal characteristics as long as dummy variables to differentiate between contexts (firms vs. mutual benefit societies, efforts vs. skills, and extra income vs. no extra income). The results for this model, corresponding to each one of the criteria, are summarised in Table 21. In relation to this group of probit models, we find out that the effort dummy has a negative effect on the CEA rule, similarly to that of the "worker" factor (employment3). Regarding the CEL rule, the fact that agents have extra income has a clear influence on considering this rule as fair, being the men who are less likely to find it so. The T rule is more accepted as fair as the year of birth increases (i.e., by younger people) and less accepted if the claims come from an active involvement of the agents (i.e., hours worked or monetary contributions).

Finally, another group of probit models has been run using the same independent variables to find the probability that each respondent answers whichever proposal is the fairest (Table 22). In these probit models, the education level has a negative effect on considering the CEA and CEL rules the fairest ones. On the other hand, the "other employment" factor (employment5) has a positive effect on the choice of the CEL rule as the fairest. The year of birth has a positive effect on considering the CEL rule as the fairest and a negative effect on considering the P rule as the fairest.

5. Conclusions

We focus on empirical social choice, by means of questionnaire studies on conflicting claims problems, to analyse if the response patterns of the society, when facing these situations, depend on the economic context or not. Next, we present the main conclusions that can be obtained from our study.

Firstly, most respondents select more than an allocation as fair, as shown by the percentages of responses, which means that distributive justice, as superbly expressed by Young (1994), does not boil down to a single formula, but represents a balance between different competing principles.

Secondly, similarly to all the previous studies, our analysis confirms that the proportional rule is the most popular, 87.06% of the respondents think that it is fair. However, this prevalence decreases considerably, by up to 65.32%, when respondents have to choose just one allocation, the fairest.

Thirdly, surprisingly enough and contrary to as shown in previous studies, when focusing on fair allocations there are no significant differences related to the proportional, constrained equal awards and constrained equal losses rules.

Fourthly, the response pattern of the Talmud rule as fair presents significant changes, depending on the economic context. Specifically, this rule is considered fair in the MSN context by the 45.3% of the respondents, whereas this percentage decreases to 25.4% in the FSN and MSY contexts and to 20% in the MEN context. This result could be interpreted, given the nature of the Talmud rule, as a more protective attitude of the society towards: (i) retirees rather than workers when both have no responsibility for the origin of their rights and lack of additional income, (ii) rights that represent needs than those ones that represent monetary contributions, for the retiree collective with no additional sources of income and (iii) retiree collective with rights that represent needs when they have no other source of income than when they have enough wealth to cover their basic needs.

This protective attitude of the society in the previous cases (i) and (ii), it is also observed when asking about the fairest rule by means of the different responses related to the proportional and constrained equal losses rules. The first rule is considered to be the fairest by less people in the MSN context than in the FSN and MEN contexts, and the second rule is chosen as the fairest by more people in the MSN context than in the FSN context.

Fifthly, there are significant differences in the response pattern related to the personal characteristics of the respondents: employment, education level, year of birth and gender. Therefore, the student opinions would not have had an appropriate representativeness of social choice.

Finally, the respondents' choices give some insights about the concept of solidarity, guarantee of the coverage of basic needs and support of a universal basic income. Concretely, the data show a tendency to focus on the sacrifice of people when rights represent needs. Moreover, from them, it can also be deduced an important concern about ensuring that people meet their basic needs, but not in all economic contexts in which agents have not enough resources. It is also noteworthy, that the responses of a few people reflect that they support the existence of a universal basic income, independently of the personal circumstances. Nonetheless, we have not arrived at any clear conclusion concerning these three aspects. A deep analysis of these aspects constitutes one of our lines for further research.

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Appendix 1: Questionnaires

As commented, we have 8 different types of questionnaires. In this section we provide the questionnaires. Due to the fact that the body of each questionnaire is similar, only changing in context, next we introduce the first class of them, and we establish the differences in each context (see also Table 1).

Questionnaire FEN

Context

The advertising department of a private company placed in Spain consists of three people with the following characteristics:

- Same qualification level
- Similar family situation
- Same creative ability
- None of them has another source of income
- All of them live in Spain

The company committed to pay them €120,000 per year, an amount that it was decided to distribute according to the number of hours worked by each of them as follows: (30,000; 39,000; 51,000). That is:

- Publicist 1: €30,000
- Publicist 2: €39,000
- Publicist 3: €51,000

However, due to causes beyond the control of the workers, the amount of money the company can spend this year on their salaries is lower, and this is the reason why the acquired rights cannot be met fully.

Consider the following two situations:

A) The company has only €75,000.
B) The company has only €45,000.

Distributions

Next, different distributions for situations A and B are proposed.

We want to know if you consider them fair or not. Note that you can select more than one option as fair.

Moreover, if you select a pair of distributions as fair, it means that you think that the distributions proposed for both situations, A and B, are fair simultaneously.

Distribution 1

The available amount of money is equally divided among the three publicists.

- In situation A the distribution would be (25,000; 25,000; 25,000).
- In situation B the distribution would be (15,000; 15,000; 15,000).

Do you think this pair of distributions is fair?

☐ Yes
☐ No

Distribution 2

The three publicists lose the same amount of money.

- In situation A the distribution would be (15,000; 24,000; 36,000), because everyone loses €15,000.
- In situation B the distribution would be (5,000; 14,000; 26,000), because everyone loses €25,000.

Do you think this pair of distributions is fair?

☐ Yes
☐ No

Distribution 3

If the available amount of money is greater than half of the originally committed amount (greater than €60,000), then the money is distributed so that each publicist loses the same amount (Distribution 2). If the available amount of money is less than half of the originally committed amount (less than €60,000), then the money is equally divided among publicists (Distribution 1).

- In situation A the distribution would be (15,000; 24,000; 36,000), because everyone loses €15,000.
- In situation B the distribution would be (15,000; 15,000; 15,000).

Do you think this pair of distributions is fair?

☐ Yes
☐ No

Distribution 4

The percentages of money that correspond to each publicist according to the original commitment are 25%, 32.5% and 42.5%, respectively. The final available amount is distributed using these percentages.

- In situation A the distribution would be (18,750; 24,375; 31,875).
- In situation B the distribution would be (11,250; 14,625; 19,125).

Do you think this pair of distributions is fair?

☐ Yes
☐ No

Distribution 5

Would you propose as fair a distribution that is different from those presented previously? If so, please answer the following questions:

- How would you distribute the €75,000 available in situation A?

- How would you distribute the €45,000 available in situation B?

- If you have proposed a new distribution, what criterion have you used?

The "fairest" distribution

Considering all the previous pair of distributions that you think are fair, which one do you think is the "fairest"?

☐ Distribution 1
☐ Distribution 2
☐ Distribution 3
☐ Distribution 4
☐ Distribution 5

Personal characteristics

Please, answer the following questions:

Gender

☐ Male
☐ Female

Year of birthday

Highest level of education completed

- ☐ Uneducated
- ☐ Primary or compulsory education
- ☐ Secondary or bachelor's degree
- ☐ Graduate
- ☐ Postgraduate (Master or Doctorate)

Approximate level of household income (yearly)

- ☐ Below €15,000 (about $19,500)
- ☐ Between €15,000 and €35,000 (about, between $19,500 and $45,500)
- ☐ Between €35,000 and €50,000 (about, between $45,500 and $65,000)
- ☐ Above €50,000 (about $65,000)

What is the number of people in your family (including yourself)?

[ ]

Employment status

- ☐ Student
- ☐ Retiree
- ☐ Worker
- ☐ Self-employed
- ☐ Other

If you have selected "Other" in previous question, write it down

[ ]

Occupation

[ ]

City and country of birth

[ ]

City and country of habitual residence

[ ]

Do you consider yourself a supportive person?

- ☐ Yes
- ☐ No

Thank you very much for your collaboration
If you want, you can next make any comments about this questionnaire.

Comments

[ ]

Questionnaire FEY

Context

The advertising department of a private company placed in Spain consists of three people with the following characteristics:

- Same qualification level
- Similar family situation
- Same creative ability
- All of them have, in addition to the salary, other sources of income that allow them to cover their basic needs
- All of them live in Spain

The company committed to pay them €120,000 a year, an amount that it was decided to distribute according to the number of hours worked by each of them...

Questionnaire FSN

Context

The advertising department of a private company placed in Spain consists of three people with the following characteristics:

- Same qualification level
- Similar family situation
- All of them work the same number of hours
- None of them has another source of income
- All of them live in Spain

The company committed to pay them €120,000 a year, an amount that it was decided to distribute according to their creative abilities...

Questionnaire FSY

Context

The advertising department of a private company placed in Spain consists of three people with the following characteristics:

- Same qualification level
- Similar family situation
- All of them work the same number of hours
- All of them have, in addition to the salary, other sources of income that allow them to cover their basic needs
- All of them live in Spain

The company committed to pay them €120,000 a year, an amount that it was decided to distribute according to their creative abilities...

Questionnaire MEN

Context

Three people are members of a mutual benefit society that operates in Spain. They have paid to such a society in order to receive a retirement pension. When retiring, they have the following characteristics:

- Similar family situation
- None of them has another source of income
- All of them live in Spain

All together, are entitled to receive €120,000 a year, an amount that it was decided to distribute according to the payments made by each of them...

Questionnaire MEY

Context

Three people are members of a mutual benefit society that operates in Spain. They have paid to such a society in order to receive a retirement pension. When retiring, they have the following characteristics:

- Similar family situation
- All of them have, in addition to the retirement pension, other sources of income that allow them to cover their basic needs
- All of them live in Spain

All together, are entitled to receive €120,000 a year, an amount that it was decided to distribute according to the payments made by each of them...

Questionnaire MSN

Context

Three people are members of a mutual benefit society that operates in Spain. They have paid such a society in order to receive a retirement pension. When retiring, they have the following characteristics:

- All of them have paid to the society the same amount of money
- None of them has another source of income
- All of them live in Spain

All together, are entitled to receive €120,000 a year, an amount that it was decided to distribute according to the family situation of each of them...

Questionnaire MSY

Context

Three people are members of a mutual benefit society that operates in Spain. They have paid to such a society in order to receive a retirement pension. When retiring, they have the following characteristics:

- All of them have paid to the society the same amount of money
- All of them have, in addition to the retirement pension, other sources of income that allow them to cover their basic needs
- All of them live in Spain

All together, are entitled to receive €120,000 a year, an amount that it was decided to distribute according to the family situation of each of them...

Appendix 2: Statistics

	CEA	CEL	T	P
FEN	15.714	21.739	20.290	87.324
FEY	29.114	32.468	30.769	88.312
FSN	23.810	33.333	25.397	89.062
FSY	28.125	31.746	41.270	89.855
MEN	19.118	26.866	20.000	82.857
MEY	15.493	37.500	23.611	92.000
MSN	27.632	30.667	45.333	80.263
MSY	26.667	36.667	25.424	87.097
All	23.230	31.319	29.228	87.057
p-value	0.262	0.560	0.003**	0.466

Signif. codes: 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 2: Percentages: Do you think this pair of distributions is fair?

	CEA	CEL	T	P	Others
FEN	9.091	0.000	4.545	68.182	18.182
FEY	12.987	3.896	5.195	61.039	16.883
FSN	10.938	3.125	7.812	70.312	7.812
FSY	4.478	4.478	10.448	64.179	16.418
MEN	10.448	4.478	1.493	71.642	11.940
MEY	7.042	2.817	8.451	69.014	12.676
MSN	14.865	13.514	9.459	52.703	9.459
MSY	13.559	6.780	6.780	67.797	5.085
All	10.459	4.954	6.789	65.321	12.477
p-value	0.510	0.031*	0.423	0.285	0.242

Signif. codes: 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 3: Percentages: Which one do you think is the “fairest”?

	CEA	CEL	T	P
FEN vs MEN	0.598	0.486	0.967	0.456
FEY vs. MEY	0.047*	0.520	0.326	0.446
FSN vs. MSN	0.609	0.738	0.015*	0.154
FSY vs. MSY	0.856	0.565	0.064 .	0.621

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 4: p-values: Do you think this pair of distributions is fair? Comparisons: Publicists vs. Society members

	CEA	CEL	T	P	Others
FEN vs. MEN	0.792	0.244	0.365	0.664	0.314
FEY vs. MEY	0.231	1.000	0.521	0.310	0.472
FSN vs. MSN	0.495	0.031*	0.732	0.035*	0.732
FSY vs. MSY	0.072 .	0.705	0.467	0.669	0.043*

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 5: p-values: Which one do you think is the “fairest”? Comparisons: Publicists vs. Society members

	CEA	CEL	T	P
FEN vs. FSN	0.240	0.135	0.484	0.755
FEY vs. FSY	0.897	0.928	0.195	0.766
MEN vs. MSN	0.230	0.618	0.002**	0.687
MEY vs. MSY	0.115	0.921	0.810	0.346

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 6: p-values: Do you think this pair of distributions is fair? Comparisons: Origin of the claims

	CEA	CEL	T	P	Others
FEN vs. FSN	0.726	0.240	0.489	0.792	0.080 .
FEY vs. FSY	0.076 .	1.000	0.237	0.698	0.940
MEN vs. MSN	0.433	0.064 .	0.065 .	0.021*	0.633
MEY vs. MSY	0.218	0.410	1.000	0.882	0.137

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 7: p-values: Which one do you think is the “fairest”? Comparisons: Origin of the claims

	CEA	CEL	T	P
FEN vs. FEY	0.052 .	0.147	0.148	0.854
FSN vs. FSY	0.579	0.849	0.059 .	0.882
MEN vs. MEY	0.572	0.181	0.610	0.095 .
MSN vs. MSY	0.900	0.462	0.018*	0.284

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 8: p-values: Do you think this pair of distributions is fair? Comparisons: Basic needs covered

	CEA	CEL	T	P	Others
FEN vs. FEY	0.461	0.249	1.000	0.374	0.838
FSN vs. FSY	0.200	1.000	0.601	0.455	0.133
MEN vs. MEY	0.478	0.674	0.117	0.736	0.895
MSN vs. MSY	0.831	0.209	0.754	0.078 .	0.511

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 9: p-values: Which one do you think is the “fairest”? Comparisons: Basic needs covered

	CEA	CEL	T	P
Student	37.500	42.045	38.636	80.682
Retiree	22.222	50.000	29.412	73.684
Worker	19.520	27.134	24.012	89.971
Self-employed	22.034	30.000	33.898	81.967
Other	18.605	37.209	33.333	91.489
p-value	0.014*	0.027*	0.055 .	0.024*

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 10: Percentages: Do you think this pair of distributions is fair? (All)

	CEA	CEL	T	P
Student	39.286	42.857	32.143	89.286
Retired	33.333	55.556	37.500	77.778
Worker	22.905	26.286	29.379	89.560
Self-employed	15.625	18.750	25.000	81.250
Other	20.833	45.833	20.833	92.000
p-value	0.240	0.026*	0.826	0.443

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 11: Percentages: Do you think this pair of distributions is fair? (Publicists)

	CEA	CEL	T	P
Student	36.667	41.667	41.667	76.667
Retired	11.111	44.444	22.222	70.000
Worker	15.584	28.105	17.763	90.446
Self-employed	29.630	42.857	44.444	82.759
Other	15.789	26.316	50.000	90.909
p-value	0.011*	0.198	0.000***	0.036*

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 12: Percentages: Do you think this pair of distributions is fair? (Society members)

	CEA	CEL	T	P
Primary	57.143	28.571	57.143	75.000
Secondary	25.424	41.880	31.624	83.193
Graduate	25.434	31.792	27.907	87.845
Postgraduate	18.143	26.068	26.609	89.167
p-value	0.006**	0.028*	0.102	0.171

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 13: Percentages: Do you think this pair of distributions is fair? (All)

	CEA	CEL	T	P
Primary	66.667	22.222	44.444	72.727
Secondary	31.915	43.478	29.787	85.106
Graduate	24.242	32.653	27.551	88.119
Postgraduate	17.797	22.414	29.310	91.597
p-value	0.007**	0.048*	0.752	0.178

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 14: Percentages: Do you think this pair of distributions is fair? (Publicists)

	CEA	CEL	T	P
Primary	40.000	40.000	80.000	80.000
Secondary	21.127	40.845	32.857	81.944
Graduate	27.027	30.667	28.378	87.500
Postgraduate	18.487	29.661	23.932	86.777
p-value	0.332	0.387	0.048*	0.586

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 15: Percentages: Do you think this pair of distributions is fair? (Society members)

	CEA	CEL	T	P
1940	28.571	65.000	33.333	85.714
1950	14.865	19.178	17.333	88.462
1960	19.632	25.926	22.360	88.095
1970	21.622	32.727	30.909	87.500
1980	27.941	35.294	35.294	88.571
1990	31.579	40.351	43.860	82.456
p-value	0.168	0.001**	0.006**	0.893

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 16: Percentages: Do you think this pair of distributions is fair? (All)

	CEA	CEL	T	P
1940	30.000	55.556	25.000	90.000
1950	17.949	23.684	23.077	95.238
1960	20.755	27.619	21.698	86.111
1970	25.862	29.825	36.207	86.207
1980	23.077	23.077	38.462	96.154
1990	40.000	46.667	26.667	86.667
p-value	0.552	0.286	0.296	0.464

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 17: Percentages: Do you think this pair of distributions is fair? (Publicists)

	CEA	CEL	T	P
1940	27.273	72.727	40.000	81.818
1950	11.429	14.286	11.111	80.556
1960	17.544	22.807	23.636	91.667
1970	16.981	35.849	25.000	88.889
1980	30.952	42.857	33.333	84.091
1990	28.571	38.095	50.000	80.952
p-value	0.210	0.000***	0.000***	0.000***

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 18: Percentages: Do you think this pair of distributions is fair? (Society members)

	CEA	CEL	T	P
Female	25.676	38.249	31.050	87.773
Male	21.231	27.077	28.037	86.707
p-value	0.225	0.006**	0.450	0.711

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 19: Percentages: Do you think this pair of distributions is fair? (All)

	CEA	CEL	T	P	Other
Female	11.312	7.240	6.787	64.253	10.407
Male	9.938	3.416	6.832	65.839	13.975
p-value	0.608	0.044*	0.984	0.703	0.217

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 20: Percentages: Which one do you think is the “fairest”? (All)

	CEA	CEL	T	P
(Intercept)	4.075	-1.002	-32.293*	3.529
d_publicist	0.119	-0.096	0.051	0.093
d_effort	-0.298*	-0.151	-0.280*	0.003
d_income	0.084	0.242*	0.031	0.180
education	-0.139 .	-0.108	-0.043	0.104
employment2	-0.443	0.531	0.473	-0.302
employment3	-0.524*	-0.279	-0.124	0.187
employment4	-0.456	-0.215	0.270	-0.124
employment5	-0.509	-0.067	0.139	0.433
yearofbirth	-0.002	0.001	0.016*	-0.002
gender	-0.167	-0.345**	-0.172	-0.006

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

d_publicist = dummy firms vs. mutual benefit societies

d_effort = dummy efforts vs. skills

d_income = dummy extra income vs. no extra income

education = level of education

employment2 = retiree vs. student

employment3 = worker vs. student

employment4 = self-employed vs. student

employment5 = other vs. student

gender = 0 female, 1 male

Table 21: Probit: Do you think this pair of distributions is fair?

	CEA	CEL	T	P
(Intercept)	-0.558	-81.328**	-15.050	36.093*
d_publicist	-0.142	-0.296	0.072	-0.076
d_effort	-0.064	-0.355	-0.292	0.109
d_income	-0.112	0.089	0.042	0.021
education	-0.264**	-0.300*	0.132	0.119
employment2	0.687	1.573 .	-3.715	-0.639
employment3	-0.186	0.780 .	0.042	-0.146
employment4	-0.149	0.668	0.120	0.071
employment5	-0.342	0.962*	-0.136	0.166
yearofbirth	0.000	0.041**	0.007	-0.018**
gender	-0.139	-0.294	-0.072	0.026

Signif. : 0 “***” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

Table 22: Probit: Which one do you think is the “fairest”?