

Fairness in bankruptcy situations: an experimental study

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Abstract

The pari passu principle is the most prominent principle in the law of insolvency. We report from a lab experiment designed to study whether people find this principle a fair solution to the bankruptcy problem. The experimental design generates situations where participants work and accumulate claims in firms, some of which subsequently go bankrupt. Third-party arbitrators are randomly assigned to determine how the liquidation value of the bankrupt firms should be distributed between claimants. Our main finding is that there is a striking support for the pari passu principle of awarding claimants proportionally to their pre-insolvency claims. We estimate a random utility model that allows for the arbitrators to differ in what they consider a fair solution to the bankruptcy problem and find that about 85 percent of the participants endorse the proportional rule. We also find that a non-negligible fraction of the arbitrators follow the constrained equal losses rule, while there is almost no support in our experiment for the constrained equal awards rule or other fairness rules suggested in the normative literature. Finally, we show that the estimated random utility model nicely captures the observed arbitrator behavior, in terms of both the overall distribution of awards and the relationship between awards and claims.

1 Introduction

Bankruptcy law is concerned with situations where a debtor is unable to pay its debts and it constitutes an essential element in any well-functioning market economy (Hotchkiss, John, Moordadian, and Thorburn, 2008). Bankruptcy situations

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bring about distributive conflicts between claimants, and a fundamental issue in bankruptcy law is how the liquidation value of a bankrupt firm should be distributed among the claimants. There is much variation in how national bankruptcy laws distribute assets between different classes of claimants, defined by their security interest, but within the class of typically unsecured claimants, assets are normally distributed in proportion to the pre-insolvency claims. This rule is known as the *pari passu principle* and it is arguably “the foremost principle in the law of insolvency around the world” (Keay and Walton, 1999).

An important argument for a proportional distribution of assets among claimants is that it guarantees non-manipulability (de Frutos, 1999; Ju, Miyagawa, and Sakai, 2007), i.e., claimants do not have an incentive to merge or split their claims. Non-manipulability is, however, not the only relevant consideration in distributive situations. Many experimental studies have demonstrated that fairness considerations are essential for how people handle distributional conflicts (Cappelen, Konow, Sørensen, and Tungodden, 2013; Cappelen, Sørensen, and Tungodden, 2010; Cappelen, Drange Hole, Sørensen, and Tungodden, 2007; Cherry, Frykblom, and Shogren, 2002; Gächter and Riedl, 2005; Frohlich, Oppenheimer, and Kurki, 2004; Hoffman, McCabe, Shachat, and Smith, 1994; Jakiela, forthcoming; Konow, 2000, 1996; Rodriguez-Lara, 2015; Oxoby and Spraggon, 2008), and it is therefore of great importance to understand whether the prominent *pari passu* approach to the bankruptcy problem also is considered a fair way of distributing the liquidation value among claimants.

Following the seminal contributions of O’Neill (1982) and Aumann and Maschler (1985), there is an extensive literature using axiomatic analysis to study the normative appeal of different fairness rules, including the proportional rule, in conflicting claims problems in general and in bankruptcy situations in particular. Two prominent alternatives considered in this literature are the *constrained equal awards rule*, which divides available funds equally among claimants constrained by the requirement that no claimant receives more than his or her claim, and the *constrained equal losses rule*, which distributes losses equally among claimants constrained by the requirement that no claimant loses more than his or her claim. A common feature of these alternatives to the proportional rule is that they aim to capture an egalitarian intuition, but in different ways.¹ The constrained equal awards rule can be seen as applying the egalitarian intuition when dividing “what is still available”, while the constrained equal losses rule is egalitarian when dividing “what is missing”. The main contribution of the present paper is to study whether these alternative egalitarian solutions to the bankruptcy problem are regarded more attractive on fairness grounds than the proportional rule.²

¹Among the many other rules proposed in the axiomatic literature, the most famous one is arguably the Talmud rule, a hybrid of the constrained equal awards rule and the constrained equal losses rule (Aumann and Maschler, 1985; Moreno-Ternero and Villar, 2006). In our initial analysis, not reported in the paper, we did not find any evidence of participants following the Talmud rule and thus we do not focus on it in the following discussion.

²There are also theoretical noncooperative studies of the bankruptcy problem, which look at how

Previous empirical work provides mixed evidence on the normative appeal of these different fairness rules in claims problems. Empirical studies using a questionnaire approach suggest that the proportional rule is considered most attractive (Gächter and Riedl, 2006; Bosmans and Schokkaert, 2009; Herrero, Moreno-Terner, and Ponti, 2010), while the evidence from laboratory experiments is more mixed. Gächter and Riedl (2005) find that actual bargaining agreements are closest to the constrained equal awards solution, while Herrero et al. (2010) find support for the proportional rule in negotiations where unanimous coordination on the same rule is required to solve the claims problem.

The present paper differs from earlier contributions in two important respects. First, our paper studies behavior in real bankruptcy situations in a lab experimental setting and does not rely on framing to create hypothetical bankruptcy situations. In particular, the experiment generates bankruptcy situations where participants work and earn money in firms, some of which subsequently go bankrupt and do not have sufficient funds to pay the sum of claims of the workers. Second, our paper is the first to study how people behave when they are assigned the role of a third-party arbitrator and have to decide how to distribute the liquidation value among the claimants in a bankrupt firm. The arbitrators are not restricted by any legal rules and can therefore freely distribute assets. Our design also removes any manipulability concerns and other incentive problems and therefore provides a clean identification of what the arbitrators consider a fair division of the liquidation value among claimants.

Our main finding is that there is a striking support for the *pari passu* approach. A large majority of arbitrators are motivated by the proportional solution when awarding claimants in bankruptcy situations. We estimate a random utility model that allows for the arbitrators to differ in what they consider a fair solution to the bankruptcy problem and find that 85.4 percent of the participants endorse the proportional rule. This clearly demonstrates that the proportional or *pari passu* rule is not only attractive because it guarantees non-manipulability, it is also considered by most individuals as the fair way of distributing the liquidation value. We find that a non-negligible fraction of the arbitrators follow the constrained equal losses rule, while there is almost no support for the constrained equal awards rule in our experiment. Finally, we show that the estimated random utility model captures the observed arbitrator behavior, in terms of both the overall distribution of awards and the relationship between awards and claims.

The paper is organized as follows. Section 2 provides a further discussion of the different fairness rules that can be used in a bankruptcy situation. Section 3 presents the sample and the experimental design. Section 4 provides descriptive statistics on the production phase and the arbitrator decisions, while we introduce and estimate

the different rules affect investments and social welfare when claims are endogenous. Kibris and Kibris (2013) find that with risk-averse agents, the proportional rule in most cases induces higher utilitarian welfare than the constrained equal awards rule and the constrained equal losses rule, while the highest investments are induced by the constrained equal losses rule. If the agents are risk neutral, however, there is strong non-cooperative support for the proportional rule (Karagözoğlu, 2014).

a random utility model for the arbitrator behavior in Section 5. Section 6 concludes.

2 Fair solutions to the bankruptcy problem

The bankruptcy problem occurs in a situation where there is more than one claimant and the liquidation value to be divided among the claimants is less than the sum of the claims. A general solution to the bankruptcy problem would be a rule that for any specific bankruptcy situation specifies the award to be given to each claimant. It is typically assumed that a normatively attractive rule should fulfill the following three minimal requirements (Thomson, 2003):

- **No waste of resources:** The sum of awards to the claimants should be equal to the liquidation value.
- **Claims boundedness:** No claimant should receive an award smaller than zero or larger than his or her claim.
- **Weak order preservation:** If the claim of one claimant is at least as large as that of another claimant, then the award given to the claimant with the larger claim should be at least as large as the award given to the claimant with the smaller claim.

Many rules satisfy these basic conditions, but in the present analysis we focus on the three most prominent rules in the literature; the *pari passu* or *proportional rule* (P), the *constrained equal awards rule* (CEA), and the *constrained equal losses rule* (CEL). The *proportional rule* states that all claimants should be treated on an equal footing (hence *pari passu*) in the sense that they should obtain awards pro rata according to their pre-insolvency claims. The key intuition underlying the proportional rule is an idea of “neutrality” with respect to the size of the claim; neither large nor small claimants should be favored in the distribution of the liquidation value. The proportional rule clearly satisfies the three basic conditions.

There are two prominent egalitarian approaches that provide interesting alternative solutions to the bankruptcy problem and also satisfy the three minimal conditions: the constrained equal awards rule and the constrained equal losses rule.³ The constrained equal awards rule is the most immediate adoption of the egalitarian idea with regard to the bankruptcy problem. It divides total assets equally between

³Outcome egalitarianism has been the focus of many important studies in behavioral economics (Bellemare, Kröger, and van Soest, 2008; Bolton and Ockenfels, 2000; Charness and Rabin, 2002; Engelmann and Strobel, 2004; Fehr, Glätzle-Rützler, and Sutter, 2013; Fehr, Naef, and Schmidt, 2006; Fehr and Schmidt, 1999), but appears extremely unattractive in a bankruptcy situation. In particular, dividing the liquidation value equally among claimants would violate **Claims boundedness**, since some claimants might receive more than their pre-solvency claim. In fact, this would happen in any bankruptcy situations where the claimants differ in their claims.

claimants, constrained by the requirement that no claimant may receive more than his or her claim. The constrained equal awards rule can be seen as dividing “what is still available”, and an appealing feature of the rule is that it to some extent protects small claimants; the small claimants are always assured to receive a share of the liquidation value.

Another way of approaching the bankruptcy problem, however, is to consider it as a problem of dividing “what is missing”. The constrained equal losses rule captures this intuition and equalizes losses relative to the claim, under the constraint that no claimant should lose more than his or her claim. The constrained equal losses rule can be seen to protect large claimants to some extent; the large claimants will never lose a larger share of their claim than will the small claimants.

Since our experimental design studies bankruptcy situations with two claimants, i and j , we provide formal definitions of the three rules in the two-claimant case.⁴ We denote the liquidation value as E and the claims as $c = (c_i, c_j)$, where, without loss of generality, we assume that $c_i \leq c_j$. Further, let F_i^k and F_j^k denote what the rule k states as the fair award to the claimants i and j , respectively. By the **No waste of resources** condition, it follows that $F_j^k = E - F_i^k$.

The three fairness rules can now be stated in terms of how much is awarded to the claimant with the lowest claim:

$$F_i^P(c, E) = \frac{c_i}{c_i + c_j} E, \quad (1)$$

$$F_i^{CEA}(c, E) = \begin{cases} \frac{E}{2} & \text{when } 0 \leq E \leq 2c_i, \\ c_i & \text{when } 2c_i \leq E \leq c_i + c_j, \end{cases}$$

$$F_i^{CEL}(c, E) = \begin{cases} 0 & \text{when } 0 \leq E \leq c_j - c_i, \\ \frac{E + c_i - c_j}{2} & \text{when } c_j - c_i \leq E \leq c_i + c_j. \end{cases}$$

Figure 1 provides a graphical representation of the three fairness rules by means of their *path of awards* for a fixed claims vector, but for different amounts of the liquidation value E . Each point on the path of awards illustrates how the rule would distribute the available amount between the two claimants.

[Figure 1 about here.]

From Figure 1 we observe that the liquidation value E plays a very different role under the CEA-rule and the CEL-rule than under the P-rule. In particular, the liquidation share given to the claimant with the smallest claim under the P-rule depends only on the pre-solvency claims, while it critically depends on the

⁴For a more general analysis, we refer to Thomson (2003). The fact that we focus on the two-claimant case also rules out any manipulability concerns.

liquidation value under the CEA-rule and the CEL-rule. When the liquidation value is very small ($2c_1 \geq E$), the CEA-rule divides the liquidation value equally between the two claimants, while the claimant with the lowest claim receives slightly more than a proportional share when the liquidation value is very large. In contrast, under the CEL-rule, the claimant with the lowest claim receives nothing when the liquidation value is very small ($c_2 - c_1 \geq E$), while he or she receives slightly less than a proportional share when the liquidation value is very large.

3 Sample and experimental design

We first provide an overview of the sample and the general structure of the experiment, before we turn to a more detailed discussion of each of the three main stages.⁵

3.1 Sample and setting

The participants were students at NHH Norwegian School of Economics. A total of 109 subjects participated, 78 males and 31 females. We organized four sessions that all took place on the same day. Each session lasted about 90 minutes and was conducted in a computer lab using a web-based interface. The experiment was double-blind, i.e., neither subjects nor experimenters could associate decisions with particular participants.

3.2 Experimental design: General structure

The experimental set-up captures the bankruptcy problem and has three phases. In the production phase, the participants acquired claims in five different firms; in the bankruptcy phase, a random procedure determined which firms went bankrupt as well as the liquidation value of each bankrupt firm; in the liquidation phase, third-party arbitrators determined how the liquidation value of the bankrupt firms was to be distributed between the claimants. At the end of the experiment, the participants answered a short background survey after which we implemented the payment procedure. The sequence of events in the experiment is summarized in Table 1.

[Table 1 about here.]

For each bankrupt firm, the participants were paid the award assigned to them by a third-party arbitrator; for the other firms, the participants were paid the claims in full. Including a show up fee of 100 Norwegian Kroner (NOK), participants earned, on average, 431 NOK (about 73 USD).⁶ The computer assigned a payment

⁵Complete instructions and screenshots are provided in Appendix B.

⁶If more than one third-party arbitrator had made a decision in the relevant bankruptcy situation for a participant, we randomly selected and implemented one of the arbitrator decisions.

code to each participant, and an assistant, who was not present in the lab during the experiment, then prepared envelopes containing the payments for each payment code. After bringing the envelopes to the lab, the assistant immediately left and the envelopes were handed out in accordance with the payment codes.

3.3 Production phase

The production phase consisted of 31 production rounds. Before each production round the participants had 30 seconds to decide in which firm they wanted to work in that round. They could choose between five different firms, A-E, but could only work in one firm in a production round, each lasting for 90 seconds.⁷

The different firms had different production technologies, which were introduced to the participants before the first round. In firm A, the task was to count the number of black squares in a sequence of boards; in firm B to add numbers; in firm C to find a specific number in a large table of numbers; in firm D to reproduce a given text; and in firm E to identify the scrambled version of a given word from a list of scrambled words. The participants were informed initially that the earnings potential was the same in all firms; participants would earn a claim of 15 NOK in a firm in a production round if they reached the target level of production. On the screen, the participant could see the time left of the production round, the amount produced so far, and the target level of production.

At the end of the production phase, each participant had accumulated claims in each firm ranging from 0 NOK (if the participant did not work or did not satisfy the production requirement in this firm in any of the rounds) to a maximum of 465 NOK (if the participant worked in the same firm in all rounds and satisfied the production requirement in each round).

3.4 Bankruptcy phase

In the bankruptcy phase, the computer randomly selected for each participant three firms that went bankrupt as well as the liquidation value of each of the three firms (35, 50, and 65 percent of the total claims in the bankrupt firm, respectively). We then constructed the distributive situations by randomly matching participants in pairs. To illustrate, if firm A went bankrupt with a liquidation value of 50 percent for participant 1, then he or she would be randomly matched with another participant 2 for whom firm A also had gone bankrupt with a liquidation value of 50 percent. The matched pair of participants 1 and 2 being claimants in the bankrupt firm A with a liquidation value of 50 percent would then represent a bankruptcy situation for which a third-party arbitrator would have to make a decision. In total, the matching created 299 bankruptcy situations.

⁷If a participant did not make a decision within 30 seconds, the computer randomly and with equal probability selected a firm, but this only happened in one percent of the situations.

3.5 Liquidation phase

In the liquidation phase, each participant made decisions as a third-party arbitrator in four bankruptcy situations.⁸ For each of the four bankruptcy decisions, the arbitrator was informed about the claims of each of the two claimants in the firm and the firm's liquidation value. The arbitrator then had to decide how to divide the liquidation value between the two claimants, where, by design, the arbitrator had to fulfill the **No waste of resources** condition. At the end of this phase, the arbitrators received an overview of the four decisions they had made and were given the opportunity to revise them before making a final confirmation of their arbitrator decisions.

This was a one-shot experiment and incentive considerations could therefore not influence the decisions of the arbitrators. Further, since the arbitrators were not stakeholders in the bankruptcy situations, we can also rule out that self-interest played a role. The design therefore provides a clean identification of what the participants considered a fair solution to the bankruptcy problem.

We introduced different liquidation values to be able to identify which fairness rule guided the arbitrator's decisions. In the planning of the experiment, we simulated the correlation between the different fairness rules given assumptions about the expected variation in claims in the different firms. Based on these simulations, we decided that the chosen liquidation values would provide sufficient variation in the data without creating bankruptcy situations where the liquidation value would be very small or close to the total claims in the firm. In Figure 2, we show that our design does indeed create bankruptcy situations in the experiment where the three fairness rules have very different implications. In the left panel, we provide a comparison of the CEA-rule and the CEL-rule, where we observe that there are many bankruptcy situations in which one of the rules assigns (almost) nothing to the claimant with the smallest claim and the other rule assigns a significant amount to this claimant. In the two other panels, we observe that the P-rule differs significantly from the CEL-rule and the CEA-rule in how much it assigns to the claimant with the smallest claim in the bankruptcy situations in the experiment. In line with Figure 1, we observe in all three panels that the fairness rules only assign the same amount to the two claimants (which are plots on the 45 degree line) when they have the same claim in the firm.

⁸The procedure of assigning bankruptcy situations to arbitrators ensured that (i) the arbitrator was not a claimant in any of the bankruptcy situations for which he or she made a decision, (ii) each arbitrator faced all three possible liquidation shares, and (iii) all bankruptcy situations were covered by at least one arbitrator decision. We aimed for each participant to make four arbitrator decisions (in order to have sufficient data for the analysis), but the assignment procedure could only ensure this if the number of participants in a session was divisible by both three and four. One participant therefore made three arbitrator decisions and two participants made two arbitrator decisions, the rest made four arbitrator decisions. Further, in five bankruptcy situations, the two matched claimants had no claims in the firm and the decision of the arbitrator was therefore trivial. In total, we therefore have 426 real arbitrator decisions in the data set. The participants made their arbitrator decisions before knowing anything about which of their own firms had gone bankrupt or about the arbitrator decisions made by others in the situations involving them as claimants.

[Figure 2 about here.]

4 Descriptive statistics

We here provide descriptive statistics for the production phase and the liquidation phase.

4.1 Production phase

Figure 3 provides an overview of the accumulation of claims across firms.

[Figure 3 about here.]

Most participants produced close to or the maximum of 31 points and the average accumulated claim was largest in Firm A (8.4) and smallest in Firm C (4.8). Very few participants chose to specialize and only work in one firm (2.8 percent). A larger share chose to spread the production evenly (to the extent possible) across all the firms (21.1 percent), which may have been motivated by a desire to avoid risk.⁹

Overall, we observe that there was a significant spread in the accumulated claims in all firms, which enabled us to create bankruptcy situations for which the three fairness rules differed significantly (see also Figure 2). The claimant with the smallest claim in a bankruptcy situation had on average 29.6 percent of the total claims.

4.2 Distributive choices

Figure 4 presents an overview of the arbitrator decisions. The upper part of the figure provides histograms of the liquidation share awarded to the claimant with the smallest claim, for all arbitrator decisions and by liquidation value. Correspondingly, the lower part provides scatter plots of the relationship between the liquidation share awarded to the claimant with the smallest claim and his or her share of the total claims in the firm.

[Figure 4 about here.]

The claimant with the smallest claim was awarded on average 33.1 percent of the liquidation value, but we observe from the upper part of Figure 4 that there is huge variation in how much the claimant with the lowest claim received: nothing in 16.0 percent of the situations, an equal share in 21.6 percent of the situations,

⁹The extent to which a participant concentrated the production can be measured by the Herfindahl index, using the share of the participant's production in each firm. In Figure A1 in Appendix A, we show the distribution of the Herfindahl index for the participants in the experiment.

and everything in 3.5 percent of the situations.¹⁰ There are some differences in the distributions of the allocations across liquidation values, but these differences are not statistically significant ($p = 0.45$).¹¹

We observe from the bottom part of Figure 4 that there is a strong positive relationship between the liquidation share awarded to the claimant with the lowest claim and his or her share of the total claims in the firm. Many of the observations are close to the proportional solution, but we also observe a number of observations that deviate significantly and the linear fit is statistically significantly less than one ($p < 0.001$).¹² The linear fit differs across liquidation values, but these differences are not statistically significant (Wald-test, $p = 0.73$).¹³

Finally, we can look at the extent to which the arbitrators' decisions satisfy the basic conditions. By design, they had to satisfy the **No waste of resources** condition, but we do observe violations of the **Claims boundedness** condition and the **Weak order preservation** condition. Overall, one or both of these conditions were violated in 14.8 percent of the arbitrator decisions. Claimants received strictly more than their claim in 11.3 percent of the arbitrator decisions, and the claimant with the smallest claim received strictly more than the claimant with the largest claim in 9.4 percent of the arbitrator decisions.

5 Analysis

In order to study further the arbitrator decisions, we estimate a random utility model. The model assumes that arbitrators dislike to deviate from what they view as a fair distribution of the liquidation value, but allows for arbitrators to differ in what they consider fair (Cappelen et al., 2013).

Formally, each arbitrator makes decisions in a number of bankruptcy situations, indexed by s , and in each situation the arbitrator has to decide how to divide the liquidation value E_s between the two claimants. Let y_s denote the amount awarded to the claimant with the smallest claim in situation s ; by design, the

¹⁰The fact that some arbitrators gave everything to the claimant with the lowest claim suggests that there is some noise in the data. In the background survey, some of the arbitrators motivated this behavior by expressing sympathy for the claimant with the lowest claim.

¹¹We test the equality of the distributions by using a K -way generalization of the Epps and Singleton (1986) test.

¹²In Table A1 in Appendix A, we report the detailed regressions, both with and without background variables. We observe that the only background variable that is statistically significant is familiarity with bankruptcy law, where participants who are more familiar with bankruptcy law award a lower liquidation share to the claimant with the smallest claim; 3.7 percent of the participants reported that they were very familiar with bankruptcy law, 54.1 percent that they were somewhat familiar, and 42.2 percent that they were not at all familiar with bankruptcy law.

¹³In Figure A2 in Appendix A, we show the relationship between the liquidation share awarded to the claimant with the weakly smallest claim and the share of the total claims for the claimant with the smallest claim for the three fairness rules at the data points of the experiment. It illustrates that this relationship is somewhat sensitive to liquidation value for the CEA-rule and the CEL-rule, but, trivially, not for the P-rule.

other claimant receives $E_s - y_s$. The choice set for the arbitrator is given by $y_s \in \mathcal{Y}_s = \{0, 5, 10, \dots, E_s\}$. We assume that an arbitrator, indexed by i , is motivated by a fairness rule $k(i) \in \{P, \text{CEL}, \text{CEA}\}$ when deciding how to distribute the liquidation value, where we denote $m^{k(i)}$ as what is stated by fairness rule $k(i)$ as a fair award to the claimant with the smallest claim. More specifically, we introduce the utility loss function:

$$V(y; k(i); \cdot) = -\frac{1}{2} \frac{(y - m^{k(i)})^2}{E_s}.$$

Clearly, the utility loss is minimized by the arbitrator implementing what he or she considers the fair division of the liquidation value, i.e. $y = m^{k(i)}$. However, we allow for noise in the arbitrator choices, which accommodates the fact that the **Claim boundedness** and **Weak order preservation** conditions were sometimes violated. We introduce a random utility element which is specific to each bankruptcy situation and to each of the alternatives in the choice set. Taken together, we therefore assume that the arbitrators are maximizing the following random utility model,

$$U_i(y; \cdot) = V(y; k(i); \cdot) + \varepsilon_{sy} / \gamma_i, \quad \text{for } y \in \mathcal{Y}_s, \quad (2)$$

where the random element ε_{sy} is extreme value iid and γ_i captures the importance of the random element for individual i .

The random utility model provides a conditional logit model of the arbitrator choice in each bankruptcy situation. For estimation, we assume that $\log \gamma$ is distributed $N(\mu, \sigma^2)$, which means that we can write the likelihood function for an individual as

$$L_i = \sum_k \lambda_k \int_0^\infty \prod_s \left[\frac{e^{\mathcal{V}(y_s; \cdot)}}{\sum_{y_j \in \mathcal{Y}_s} e^{\mathcal{V}(y_j; \cdot)}} \right] \frac{1}{\gamma \sigma \sqrt{2\pi}} e^{-\frac{1}{2} \left(\frac{\log \gamma - \mu}{\sigma} \right)^2} d\gamma, \quad (3)$$

where the λ_k parameters are the population shares of the different fairness types among the participants in the experiment.

5.1 Estimates of the model

Column A in Table 2 reports estimates of the random utility model. It provides three main insights. First, we observe that the P-rule is by far the most prevalent fairness type in the experiment, in fact 85.4 percent of the arbitrators appear to be motivated by proportionality considerations. Second, we find that a non-negligible fraction of the arbitrators, 11.5 percent, view it as fair to equalize losses among claimants, in line with the CEL-rule. Third, we observe that the share of participants who follow the CEA-rule is negligible.¹⁴ The last two findings suggest that

¹⁴The population estimates are very much in line with the motivations provided by the participants in the background survey. The large majority state that they applied proportionality considerations in their arbitrator choices, while a small minority make references to egalitarian considerations.

participants motivated by an egalitarian ideal tend to view the bankruptcy problem as a question of how to divide what is missing rather than a question of how to divide what is available, which means that they are more concerned with protecting the large claimant than the small claimant.

[Table 2 about here.]

In columns B-D in Table 2, we report estimates for the random utility model when we drop one of the fairness types. We observe from column B that the log-likelihood value falls dramatically if we drop the P-rule. The estimated values of both μ and $\log(\sigma)$ are reduced, which means that the random utility term becomes more important in explaining behavior. From columns C and D, we observe that the log-likelihood value and the estimated values of μ and $\log(\sigma)$ only change marginally when we remove the CEA-rule or the CEL-rule, which means that these rules are of much less importance in explaining the observed behavior.

5.2 Fit of the random utility model

We provide two tests to evaluate the fit of the estimated random utility model. First, in Figure 5, we show the actual and the simulated empirical distributions function of the share given to the claimant with the smallest claim, for all arbitrator decisions and by liquidation value. We notice that although the two distributions differ slightly at the ends, there is overall a close fit in all panels.

[Figure 5 about here.]

Second, we test whether the estimated random utility model can predict the relationship between the liquidation share awarded to the claimant with the lowest claim and his or her share of the total claims in the firm. Table 3 compares regressions on the actual data and on the simulated data. We observe that the model replicates this relationship nicely, in all comparisons the estimated coefficient of the share of the total claims in the actual data is relatively close to the estimated coefficient in the actual data.

[Table 3 about here.]

Overall, the estimated random utility therefore seems to closely capture the underlying motivation of the arbitrators.

6 Conclusion

Our experiment provides strong support for the use of the pari passu rule in bankruptcy law. We find that a large majority of the participants in our experiment follow the proportional rule when they act as third-party arbitrators in real bankruptcy situations where people have different pre-insolvency claims. The

present experimental design rules out that manipulability concerns or other incentive concerns should influence the arbitrator decisions, and thus the experimental results provide clean evidence of the participants considering the pari passu principle a fair solution to the bankruptcy problem.

The support for this approach is not entirely universal, however. A non-negligible share of the participants perceive it as fair to equalize the losses of the claimants, constrained by the requirement that no one should lose more than his or her claim. We do not, however, find much evidence of participants being motivated by the idea that one should equalize what is available, constrained by the requirement that no one should receive more than their claim, or any of the other fairness rules considered in the normative literature.

Many distributional conflicts have a similar structure as the bankruptcy problem (Gaertner and Schwettmann, 2015). To illustrate, consider employer-employee negotiations about the profile of a wage cut across employees when a firm needs to reduce wage costs. The perceived fairness of the wage cut may critically affect how the workers respond in terms of effort provision, and it is therefore of great importance to understand whether the proportionality approach is considered an equally attractive solution to this and other conflicting claims problems as we find is the case in bankruptcy situations.

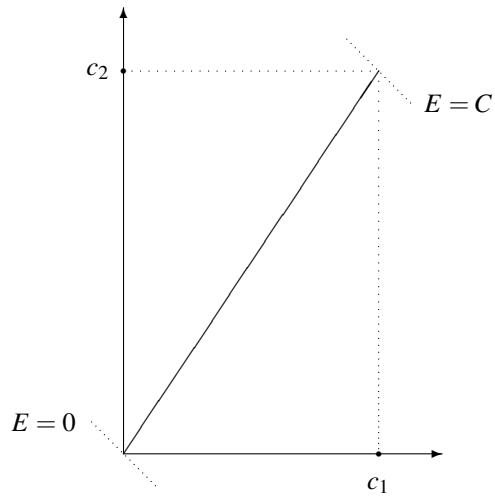
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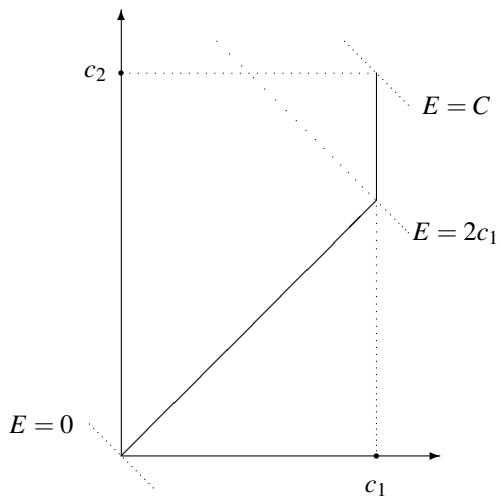
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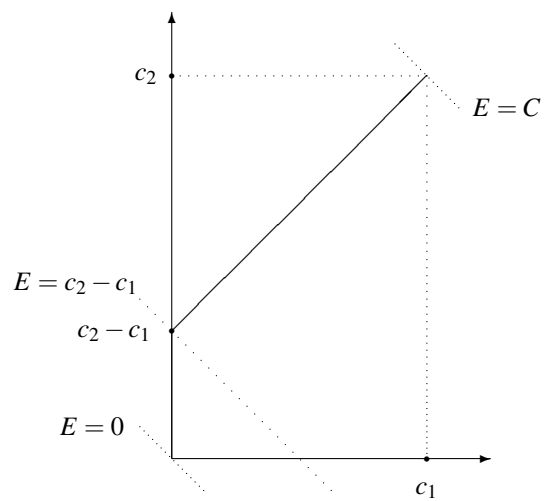
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(a) *Proportional rule*



(b) *Constrained Equal Awards*



(c) *Constrained Equal Losses*

Figure 1: Paths of awards

Note: The figure illustrates the paths of awards for each of the three fairness rules. For a pair of claims, c_1 and c_2 , the panels (a), (b) and (c) give the distribution of the liquidation value E for all values of E between 0 and $C = c_1 + c_2$, for each of the three fairness rules respectively.

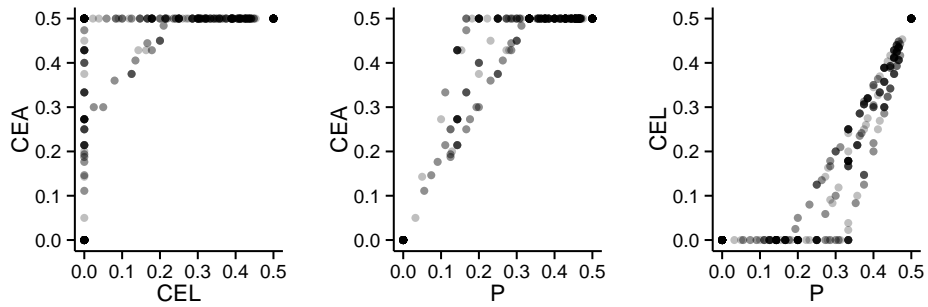


Figure 2: **Pairwise scatter plots of the fairness rules**

Note: The figure provides pairwise comparisons of what the fairness rules imply in each of the bankruptcy situations in the experiment. A point in the left panel shows for one bankruptcy situation in the experiment the liquidation share awarded to the claimant with the smallest claim according to CEA and CEL, respectively. Correspondingly, the two other panels provide the comparison of CEA and P and CEL and P.

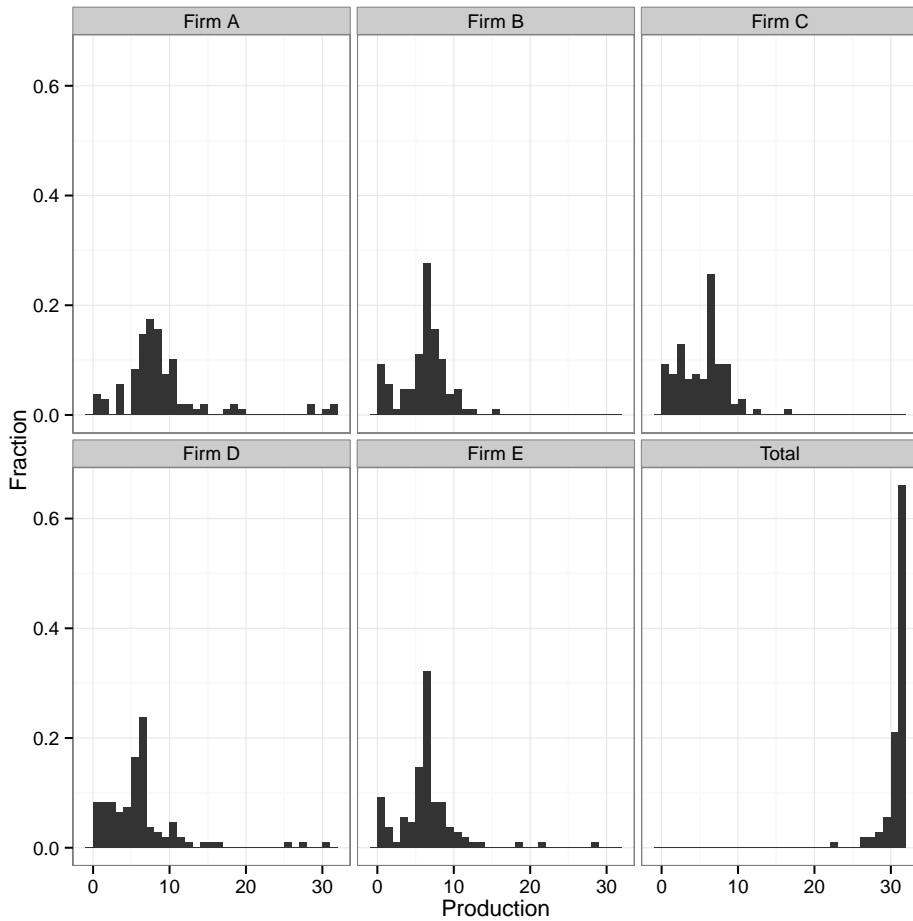


Figure 3: Production in each of the firms

Note: The figure shows the distribution of production in all firms. In each panel, we show the share of participants who had reached the production threshold a given number of times in this firm (0-31). The distribution of total production is given in the lower right panel.

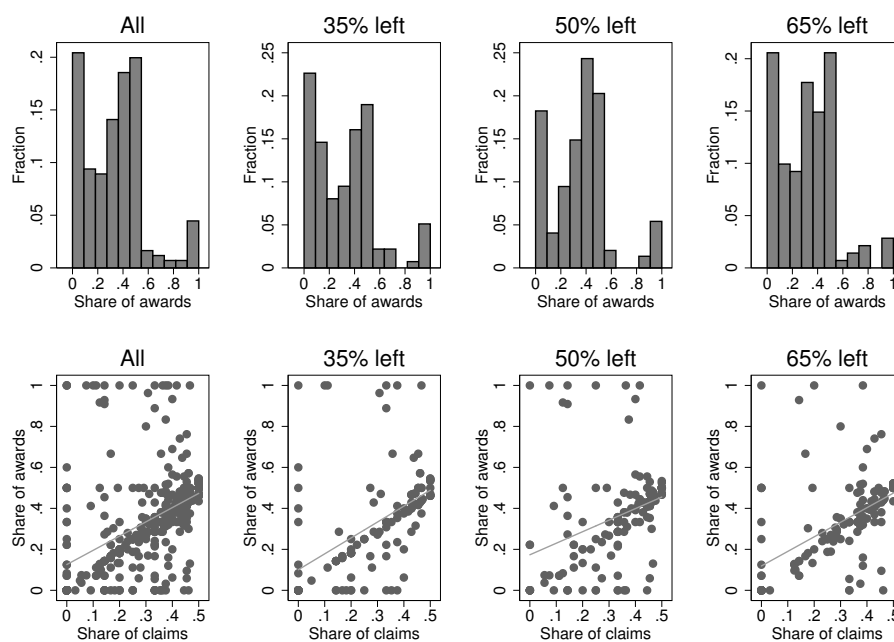


Figure 4: **The liquidation share awarded to the claimant with the smallest claim**

Note: The upper part of the figure shows the distribution of “Share of awards” (the liquidation share awarded to the claimant with the weakly smallest claim), for all situations and by liquidation value. The lower part of the figure shows scatter plots of “Share of awards” (the liquidation share awarded to the claimant with the weakly smallest claim) and ‘Share of claims” (the share of the total claims for the claimant with the weakly smallest claim), for all situations and by liquidation value. We also report the linear fit in each of the panels, the full regressions are reported in Table A1.

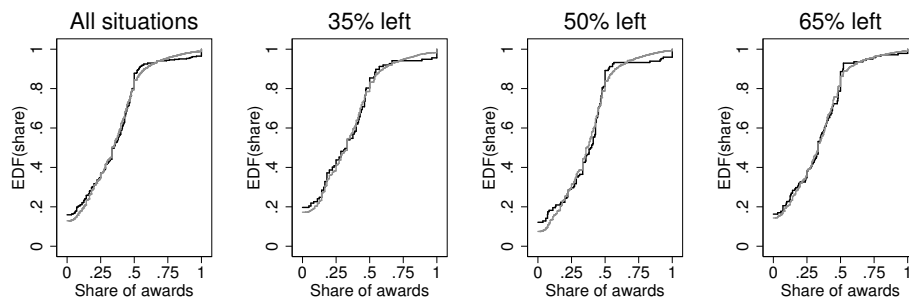


Figure 5: Empirical distribution function: Actual and simulated

Note: The figure compares the actual (in black) and simulated (in grey) empirical distribution functions for the “Share of awards” (the liquidation share awarded to the claimant with the weakly smallest claim), for all situations and by liquidation value. The simulated data are based on 10000 random draws for each situation in the dataset, using (2) and the estimates in column A of Table 2.

Table 1: **Sequence of events in the experiment**

1. Production phase:	Participants acquire claims in the different firms
2. Bankruptcy phase:	Random draws determine which firms go bankrupt and their liquidation value
3. Liquidation phase:	Arbitrators distribute the liquidation value between claimants
4. Background survey:	Gender, years of study, familiarity with bankruptcy law, and motivation for arbitrator decisions
5. Payment:	Participants are paid their awards from the bankrupt firms and the claims in full from the other firms

Table 2: Estimates of the random utility model

	A	B	C	D
λ^P , share proportional	0.854 (0.056)		0.970 (0.026)	0.887 (0.049)
λ^{CEL} , share constrained equal losses	0.115 (0.049)	0.780 (0.067)		0.113 (0.049)
λ^{CEA} , share constrained equal awards	0.031 (0.026)	0.220 (0.067)	0.030 (0.026)	
μ , mean of $\log(\gamma)$	0.646 (0.339)	-0.763 (0.178)	0.422 (0.285)	0.628 (0.327)
σ , standard deviation of $\log(\gamma)$	2.964 (0.343)	1.486 (0.171)	3.052 (0.314)	2.938 (0.342)
$\log L$	-745.9	-932.3	-751.6	-748.7

Note: The table reports the estimates of the random utility model (2), where λ^P , λ^{CEL} , and λ^{CEA} are the share of participants with the proportional, constrained equal losses, and constrained equal awards fairness view. Column A reports estimates from the full model, whereas we in turn drop one of the fairness ideals in column B-D. One population share and its standard error are calculated residually. For estimation, we use the “stats4” library (R Core Team, 2015). Standard errors (in parentheses) are calculated using the delta method where it is appropriate.

Table 3: Conditional fit of the random utility model

	All observations		35% left		50% left		65% left	
	data	simulations	data	simulations	data	simulations	data	simulations
Share of claims	0.69 (0.074)	0.74	0.78 (0.11)	0.72	0.56 (0.14)	0.77	0.71 (0.11)	0.77
constant	0.13 (0.033)	0.11	0.10 (0.044)	0.12	0.17 (0.062)	0.10	0.12 (0.039)	0.10
N	426	4260000	137	1370000	148	1480000	141	1480000
R^2	0.234	0.313	0.279	0.273	0.127	0.310	0.295	0.310

Note: The table reports regressions of the independent variable “Share of awards” (the liquidation share awarded to the claimant with the weakly smallest claim) on “Share of claims” (the share of the total claims for the claimant with the weakly smallest claim), for all observations and by liquidation value. In each case, the left column reports from a regression on actual data, with standard errors in parentheses, and the right column from a regression on simulated data from the random utility model. The simulated data are the same as in Figure 5.