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A Simple Risk-Sharing Experiment

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Abstract

This paper reports on an experiment designed to test whether pairs of individuals are able to exploit efficiency gains in the sharing of a risky financial prospect. Observations from a previous experiment had suggested a general rejection of efficiency in favour of *ex post* equality. The present experiment explores some possible explanations for this. The results indicate that fairness is not a significant consideration, but rather that having to choose between prospects diverts partners from allocating the chosen prospect efficiently.

Keywords Risk-sharing, experiments, bargaining, fairness

JEL classification D81, C91, C92

1 Introduction

Where several individuals have joint ownership of some uncertain financial prospect, such as a business venture, the issue of efficient risk-sharing arises. Partners will, in principle, find it mutually advantageous to agree an advance allocation of the prospect, i.e., a contingent division of its proceeds, and to do so in a way which reflects their respective degrees of risk-aversion. In particular, unless the partners happen to be identically risk-averse an unconditionally equal allocation is *ex ante* inefficient. It is Pareto-dominated by some unequal allocation which, roughly, gives the less risk-averse partner(s) a greater share of the risk but also of the expected value.

In 1997 we conducted an experiment that generated some puzzling data in this respect. We asked pairs of subjects to agree choices from among various uncertain financial prospects, our purpose being to investigate the incidence of Common-Ratio (C-R) inconsistencies in the pattern of their agreed choices.[1] In the process, however, we also asked pairs to register an agreed allocation of their chosen prospect. We had 23 pairs, and all but one agreed an unconditionally equal allocation of each of their twelve chosen prospects.

Evidently, equal division has some distinguishing property which, for these subjects, generally prevailed over any consideration of *ex ante* efficiency. But this raises several interesting questions. Are partners attracted by *ex ante* efficiency at all? Do they recognise opportunities for achieving it? What is the counterattraction of the equal allocation and, in particular, is it related to fairness? In our C-R experiment the primary task for partners was to agree choices from among alternative prospects, the allocation of which was only secondary. Did this somehow divert them from considering *ex ante* efficiency, and thereby increase the relative salience of equal allocation?

The present paper reports on a new experiment designed to address these questions. In section 2 we sketch the theory of risk-sharing. Section 3 describes the experimental design. The results are discussed in sections 4 and 5.

2 *Ex ante* efficiency: the 2×2 case

Consider a pair of individuals {1,2} with joint entitlement to an uncertain financial prospect of the form:

$$\boldsymbol{L} = [x, y; p]$$

That is, they will jointly receive £*x* with probability *p*, and £*y* otherwise. A contingent *allocation* of this prospect is a vector of *dividends* (x_1, y_1, x_2, y_2) such that $x_1 + x_2 = x$ and $y_1 + y_2 = y$. We assume that each individual *i* cares only about his (read his/her throughout) own dividends, and that his *ex ante* preferences over various allocations of ***L*** are representable by a utility function:

$$u_i(x_i, y_i, p)$$

which, for a risk-averse individual is quasiconcave in (x_i, y_i). Given this, the allocation problem can be represented in a 2×2 Edgeworth Box (Figure 1).

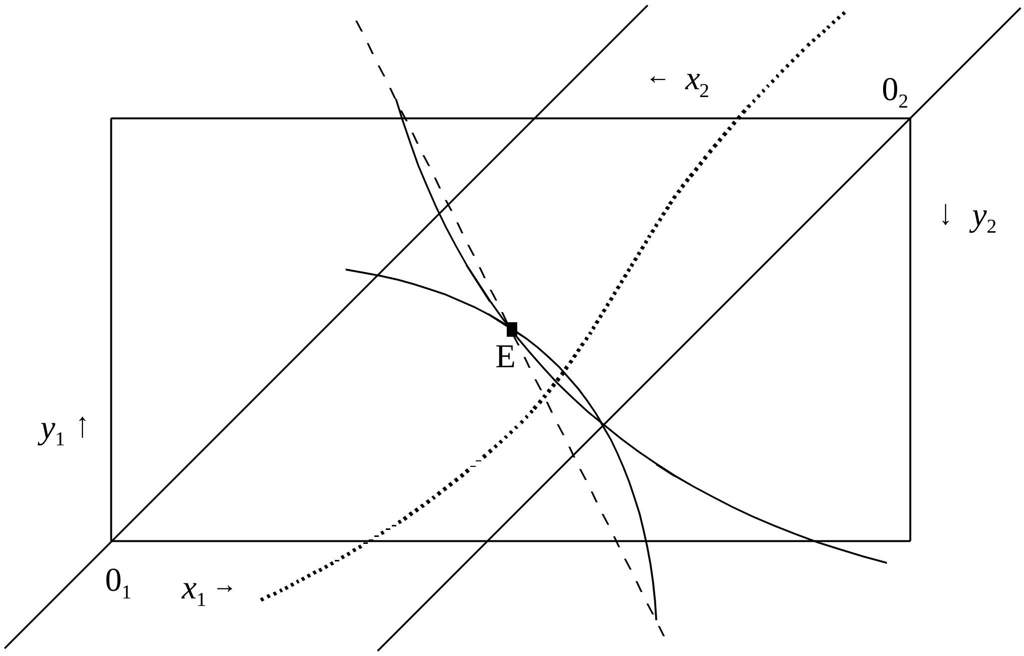

Figure 1: *ex ante* efficiency

Efficient allocations of ***L*** are represented by the dotted contract curve, characterised by the mutual tangency of the individuals' indifference curves. Efficiency requires, roughly, that whichever of the two individuals is the more risk-averse bears less of the risk. In Figure 1 this is individual 2. The contract curve lies relatively close to his *certainty line*, i.e., the 45° line defined by $x_2 = y_2$. Thus, for example, the equal allocation E is Pareto-dominated by allocations in which individual 2 receives a less-than-equal dividend of the larger prize (£*x*), and a more-than-equal dividend of the smaller prize (£*y*).

The dashed diagonal line passing through E has a gradient of $-p/(1-p)$, and represents allocations of equal expected monetary value to each individual. Given that individual 1 is risk-averse, any allocation which Pareto-dominates E must lie above this line, giving him a greater expected monetary value than does E, in order to compensate for the extra risk. In effect, this involves a Pareto-improving exchange of expected value for certainty, with individual 1 substituting the former for the latter.

Although generally inefficient, only E gives partners equal dividends in any given event, i.e., after uncertainty has been resolved. In this sense, therefore, *ex ante* efficiency conflicts with *ex post* fairness. Whether or not there is also a conflict with *ex ante* fairness depends on how this is defined. For example, an allocation is *envy-free* if, before the uncertainty is resolved, no individual strictly prefers another's dividends to his own. In the 2×2 case, this means simply that each individual weakly prefers the allocation in question to its corresponding 'swap' allocation obtained by a 180° rotation around E. Trivially, E itself is envy-free. But, given quasiconcavity, so too is any allocation which Pareto-dominates it. Defined as envy-freeness, therefore, *ex ante* fairness is compatible with efficiency.

3 The experiment

The main design problem was to present each subject-pair with a joint prospect of which we could be confident that the equal allocation was inefficient. Consider the class of prospects typified by:

$$\boldsymbol{M} = [g, c-g; p]$$

where $p > ½$ and $c > 0$ are given, and $g \in [0, c]$ is a variable. Given sole ownership of such a prospect, individual *i* will have a most preferred value $\hat{g}_i \geq c/2$. An infinitely risk-averse individual will most prefer the certainty of $\hat{g}_i = c/2$. A risk-neutral or risk-loving individual will most prefer the constrained $\hat{g}_i = c$, since both the expected value and the risk of the prospect are positively related to *g*. A mildly risk-averse individual may also be thus constrained. In general we assume that $\hat{g}_i \in [c/2, c]$ is unique for any individual i.

Now consider two individuals {1,2}, for whom $\hat{g}_1 > \hat{g}_2$, and the joint prospect:

$$\boldsymbol{L} \;=\; [(\hat{g}_1+\hat{g}_2), 2c-(\hat{g}_1+\hat{g}_2)\,;p]$$

The equal allocation E here gives each individual, in effect, a prospect of type ***M*** where $g=(\hat{g}_1+\hat{g}_2)/2$. But the unequal allocation $\mathrm{P}=(\hat{g}_1, c-\hat{g}_1, \hat{g}_2, c-\hat{g}_2)$ instead gives each his most-preferred prospect of type ***M***. So E is inefficient, being Pareto-dominated by P.

Our experiment was based on this reasoning. Each session seated a group of (on average) twelve new subjects at individual computer terminals in a single room. Apart from some oral instructions, pre-recorded and played back to the whole group, the session was carried out in silence, subjects communicating only with, and via, the computer. The principal instructions, both oral and onscreen, are reproduced as Appendix A.

The session comprised two stages. In Stage 1 each individual subject was asked to divide, in units of £1, a total payment of £20 between two events, Green and Red, to be realised at the end of the session by the subject's own drawing of a coloured ball from an opaque bag. There were three balls, two green and one red, which the group was shown at the start of the session. Thus for each individual we elicited $\hat{g}_i$, given $p = \mathbf{b}$, $c=20$, and incremental units of £1.[2]

We chose the £1 increment for the sake of clarity and simplicity. But the necessity to restrict g (and thus $\hat{g}_i$) to discrete units, however small, creates potential ambiguity. For any given pair, if $\hat{g}_1 - \hat{g}_2$ is odd then the equal allocation of ***L*** requires half-unit divisions, over which we have no direct preference information. In particular, if $\hat{g}_1 - \hat{g}_2 = 1$ then either partner might actually prefer E to P.

On completion of Stage 1, therefore, the computer paired-up the subjects, according to a simple algorithm intended to maximise the number of pairs for whom $\hat{g}_1 - \hat{g}_2 > 1$. Stage 2 then followed, in which each pair was asked to agree an allocation of ***L***, in units of £0.5. The prospective payments in ***L*** were defined with reference to an identical Green/Red lottery. They were the sum of the two partners' respective Stage 1 choices, and thus differed between pairs. But the subjects were not told this, and indeed were not told the $\hat{g}_i$ of their partners. The two stages were presented as unconnected decision problems. In order to eliminate wealth effects, on completion of the session one of the two stages was randomly selected for playing out and payment, the subjects having been told this in advance.

Each pair was given one of three treatments of Stage 2. These were designed to recreate, in graded steps, a decision problem similar in structure to that of our previous C-R experiment. In treatment 1 we presented each pair with a choice between E and P. Given a clear and simple choice between two allocations, the first being wholly equal but Pareto-dominated by the second, which would the pair choose? In treatment 2 we did not pre-select or highlight allocation P. Instead, the pair could agree any allocation of $\boldsymbol{L}$, subject to a default of E. Assuming that they were interested in doing so, would partners be able to achieve efficiency gains without external guidance?

Treatment 3 was identical to treatment 2 except that the pair was offered the choice of an alternative prospect $\boldsymbol{K}$, also to be allocated by mutual agreement. As already noted, consistent with the data from our C-R experiment is the hypothesis that this will divert partners from considering unequal allocations. It would be desirable, of course, to have a theoretical basis for this "diversion hypothesis". One such might be in terms of bounded rationality. In general, the choice between two prospects cannot be separated from the choice of allocation, since a partner's preference will depend on how each is to be allocated. Indeed, for each prospect there may be efficient allocations which are Pareto-dominated by allocations of the other. So agreement over the choice of prospect is potentially very complex for partners.[3] A great deal of simplification, both of computation and negotiation, can be obtained by taking the allocation of each prospect as given. Insofar as equal allocation has any attraction, it may therefore increase under such circumstances.

The alternative prospect $\boldsymbol{K}$ was £20 for certain. This specification had two related advantages. Firstly, it preserved our own informational base. For any two risk-averse partners, we know that equal division (£10 each for certain) is efficient among allocations of $\boldsymbol{K}$. But we know also that in general it is Pareto-dominated by P. In addition, at least one partner (viz., the less risk-averse partner 1) prefers the default E. So, secondly, the availability of this particular $\boldsymbol{K}$ should have provided only a mild diversion from the matter of allocating $\boldsymbol{L}$. and in this sense a strong test of the diversion hypothesis. There was a downside to this, however, as noted in Section 5 below.

In all treatments, Stage 2 negotiations were conducted anonymously, via the computer. Partner 1 made the first proposal. Partner 2 could then either accept this or return a counter-proposal, and so on. A brief message could be sent with each proposal. Acceptance at any stage would end the process. In treatments 2 and 3 the number of proposals was limited to eight (four per partner). In treatment 1 we felt that such a limit was unnecessary, as there was no distributional conflict of interest between the partners. This turned out to be unwise, although not fatally so.

Subjects were undergraduate and graduate students at York University, being largely but not exclusively economists. There were 120 individual subjects, and thus 60 pairs. Treatment 1 used 13 pairs over two sessions. Treatment 2 used 24 pairs, and treatment 3 used 23, each over four sessions. In treatment 2 there was a bug in our computer program which led to a crash for two pairs. These two pairs are excluded from the transcript (Appendix B), which otherwise presents a full record Stage 2 negotiations and agreements, the latter categorised in terms of preferences as revealed by Stage 1 decisions.

4 Agreed allocations

Treatment 1 isolated for each pair a simple binary choice between the equal allocation and *ex ante* efficiency. The results were striking. Of the thirteen pairs, eleven (1:1-1:11) agreed to choose the efficient, but unequal, allocation P. Eight of these did so immediately, i.e., with no counter-proposal. Pair 1:12 had a protracted dispute based, apparently, on some misunderstanding by partner 2. This eventually had to be terminated by the experimenter, with partner 1 still holding out for P. So only one pair (1:13) explicitly agreed to choose E.

Treatment 2 gave pairs a free and unguided choice over the allocation of $\boldsymbol{L}$, subject to an increment of £0.5 and a default of E. Figure 2 shows the resulting agreements. This is an Edgeworth Box in which the axes are normalised so that E and P are common points, showing each pair's agreed allocation relative to the E-P interval. The figure therefore excludes pair 2:13, for whom $\hat{g}_1 = \hat{g}_2$ and thus E=P. (This was the only such pair in treatment 2; there were none in treatment 1 and three in treatment 3.) Each data point is randomly nudged so that coincident observations appear separately. Agreements of all pairs other than on the line connecting E and P are individually identified by that pair's number.

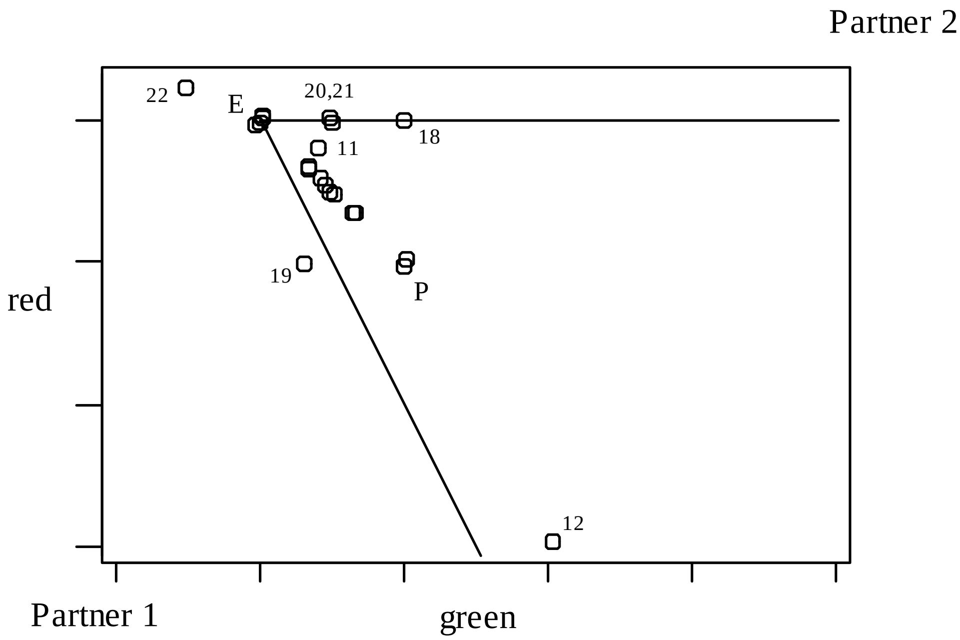

Figure 2: treatment 2 agreements normalised on the E-P interval

As in treatment 1, the attractions of the equal allocation do not seem to weigh heavily here. Other than 2:13, only four pairs agreed E. Twelve pairs agreed allocations Pareto-superior to E, or possibly so. The first two (2:1 and 2:2) agreed P itself. The last of these (2:12) is the only pair over all three treatments for whom $\hat{g}_1 - \hat{g}_2 = 1$; the tickmarks therefore represent the £0.5 increment for this pair.

Four of the remaining five pairs reached agreements inferior to E for one partner. The diagonal line with gradient -2 comprises allocations which, for either partner, have the same expected monetary value as E (cf. Figure 1). So the agreement of 2:19 is inferior to E for partner 1, who is risk-averse, since it involves both more risk and less expected value. But for partner 2 it is superior not only to E but also to P. Conversely, the agreement of 2:18 is inferior to E for partner 2, but superior to P for partner 1, while the agreements of 2:20 and 2:21 are superior at least to E for partner 1. The final agreement (2:22) is ambiguous. Quasiconcavity would imply that partner 1 prefers E to the agreed allocation, but since $\hat{g}_1 = 20$ it may be that he is a risk-lover and thus has non-quasiconcave preferences. Nevertheless it seems plausible to assume that this agreement is inferior to E for him at least.

Treatment 3 added another dimension to the joint decision problem, in that pairs had to select a prospect as well as its allocation. Table 1 compares the principal categories of agreement across all three treatments. In the first column is shown the proportion (and absolute number) of pairs reaching an agreement Pareto-superior to E, or possibly so. The third column records pairs agreeing E itself. This includes 1:12 but excludes 2:13, each of which has already been noted. The latter's agreement of E(=P) is recorded in the second column as "trivial", along with two similar pairs in treatment 3. The final column records those agreements inferior to E for at least one of the two partners.

	superior		trivial		E		inferior	
treatment 1 (n=13)	.85	(11)	.00	(0)	.15	(2)	-	-
treatment 2 (n=22)	.55	(12)	.05	(1)	.18	(4)	.23	(5)
treatment 3 (n=23)	.17	(4)	.09	(2)	.43	(10)	.30	(7)

Table 1: Principal categories of agreement by treatment

In line with the diversion hypothesis, the proportion of nontrivial E-agreements increased to 43% in treatment 3, while the proportion of Pareto-superior agreements diminished to 17%, comprising four pairs (three of whom, remarkably, agreed P itself). But the seven agreements recorded as "inferior" are importantly different in character from their five counterparts in treatment 2. They all take the form of an equal division of the alternative prospect ***K***, i.e., £10 each for certain. This includes 3:23, for whom $\hat{g}_1 = \hat{g}_2 = 15$, yet who somehow managed to avoid the trivial E=P agreement.

Overall, therefore, 81% (17/21) of the nontrivial agreements in treatment 3 were for an equal allocation, compared with only 19% (4/21) in treatment 2. Of course it is somewhat disconcerting that 41% (7/17) of these equal allocations were of the alternative prospect ***K***, which for at least one partner in each pair was inferior to the default.

5 Proposals and messages

In examining the pre-agreement proposals and messages, our principal interest is in discovering what, if any, are the attractions for partners of the equal allocation. Following the discussion in Section 2, we might look for explicit appeals to fairness (or some related idea) in the messages. In treatment 1 these occur only in 1:10 and 1:12. The former is almost paradigmatic. Here, partner 1 is initially prepared to concede E, evidently assuming that partner 2 prefers it to P. Eventual agreement on P simply requires partner 2 to make it clear that this is not so. So fairness, as invoked here by partner 1, is *ex ante* rather than *ex post*, and provides no barrier to efficiency. Pair 1:12 is more difficult to interpret, due to partner 2's apparent confusion of his partner's dividends with his own. But even if this is an oblique attempt by partner 2 to be fair (which seems unlikely), the discussion clearly concerns *ex ante* preferences, so could at best be interpreted as an inarticulate version of 1:10.

In treatment 3 fairness is mentioned explicitly only in 3:18 and 3:19. The former comprises an unresolved argument about what constitutes *ex ante* fairness. The latter is more ambiguous, and here the message (from partner 2) accompanies a proposal of equal allocation. But note that this is in response to two successive proposals which for him are not only inferior to E but also *ex ante* unfair, on any plausible definition.

Across all three treatments, the only two messages invoking fairness in a clearly *ex post* sense are in 3:7 and 2:17, each accompanying a proposal of equal allocation. In the latter, the proposer elaborates by outlining an equivalent arrangement involving side-payments. But even here it is not obvious how he would have responded to a slightly less aggressive proposal (such as P) from his partner.

So overall there is little support for the hypothesis that partners value the equal allocation for its *ex post* fairness. Indeed, there is no clear indication that it has any substantive property of interest to partners. Other than those already noted, proposals of equal allocation are generally accompanied either by no (informative) message at all, or by some expression of *ex ante* preference, as in 1:11, 2:16, 3:2, 3:4 and 3:22. Perhaps the most plausible conclusion is that the focal-point features of equal allocation, such as its simplicity or symmetry, are more significant than any substantive property such as fairness. By their nature, we might expect these features to be tacitly understood, rather than explicitly discussed, by partners.

Our second interest is in understanding why (more) partners are diverted from efficiency when prospect choice is at issue, as in treatment 3. According to the bounded-rationality theory sketched in Section 3, pairs take allocations as given because this simplifies the problem of prospect selection. It follows that if the attraction of equal allocation just is its simplicity, as suggested above, then it will tend to be the given allocation for each prospect. It is difficult to find any direct evidence of this in the messages, however, with two possible exceptions. In 3:8, partner 1 could be interpreted as arguing for ***L***, as opposed to ***K***, taking an equal allocation as given. Likewise, partner 2 in 3:17 is willing to discuss the choice of prospect, but only taking "equal benefits" as given.

The bounded-rationality theory would also be supported by negotiations where partners argue the choice of prospect, while proposing only equal allocations of either. Unfortunately, no such evidence exists here. The only pairs repeatedly to dispute the choice of prospect were 3:18 and 3:19, interestingly also the only pairs in treatment 3 explicitly to discuss fairness. But in each case there was at least one proposal of unequal allocation, accompanied by an expression of *ex ante* preferences. There were only four other pairs (3:1, 3:2, 3:4 and 3:17) in which partners differed over prospects at any stage in negotiations, and in three of these an unequal allocation was eventually agreed, following some remarkably cogent expressions of *ex ante* preference.

Of course, as noted in Section 3, our specification of ***K*** militated against disputes over prospects. While providing a strong test of the diversion hypothesis, this perhaps makes the data less informative on its underlying explanation. In this respect it might have been useful to present each pair with alternative prospects between which (given equal allocation) the two partners had opposing preferences, although to be meaningful this would also have required a different default. But we had insufficient information to do this. In any case, the fact that four of the undisputed agreements (3:20-3:23) were for prospect ***K***, equally distributed, makes this idea appear rather speculative.

6 Concluding remarks

We might summarise as follows. The pattern of agreements suggests that, where allocation is the sole issue, partners largely favour *ex ante* efficiency over *ex post* equality. Not only are they willing to exploit efficiency gains where these are plainly available (as in treatment 1), but they are substantially able to locate them without external prompting (as in treatment 2). However, where allocation is not the sole issue (as in treatment 3), the relative counterattractions of equal allocation are evidently stronger. From the transcripts there is little indication that *ex post* fairness is a significant consideration in this. A more plausible explanation is that equal allocation is attractive mainly for its simplicity, that this is tacitly understood by partners, and that this feature is at a premium when prospect choice is an issue. But perhaps the best that can be said of the transcript evidence is only that it is not inconsistent with this.

Even in treatment 3 we are some way from reproducing the results of the C-R experiment, where equal allocation was virtually universal. Of course our aim was not to do this, but rather to isolate some specific aspects of the joint decision problem. But it is worth noting some of the differences between the conditions of two experiments.

Firstly, subject pairs here had to make one choice of prospect, compared with twelve (i.e., one prospect from each of twelve pairs) in the C-R experiment. In the latter case, the simplification gained by taking the (equal) allocation as given would be even more valuable and, to that extent, we might expect more such agreements.

Secondly, in the C-R experiment partners negotiated face-to-face, in private and without an imposed bargaining protocol. It might be conjectured that the formality and anonymity of the present experiment would have induced a strategic pursuit of self-advantage by individual subjects, excluding norms of fairness which apply in less formal (and thus perhaps more realistic) bargaining environments.[4] But, as we have seen, *ex ante* fairness is not entirely absent from our subjects' messages, and certainly not from their agreements, of which all but a handful (2:18-2:21) were envy-free or possibly so. It may be that a less formal environment would have eliminated even this small pocket of unfairness, but there is no reason to suppose that, *ceteris paribus*, it would have generated a greater incidence of equal allocation.

Finally, we prompted individuals to consider carefully their *ex ante* preferences in Stage 1, and thus perhaps primed them to do likewise in Stage 2. Such cues were absent from the C-R experiment, as presumably in real life. Had we somehow been able to present the same partners with the same Stage 2 options, but without the preceding Stage 1 decision, it is plausible to suppose that equal allocations would have been more prevalent in all three treatments. It is also possible that such agreements would have been supported by messages invoking *ex post* fairness, and even that the differences between treatments 2 and 3 would have disappeared. All of this is, unfortunately, untestable.

But this raises the question of how successful we were in eliciting the true, considered risk-preferences of individual subjects. In particular, we restricted the subject's choice to increments of £1, mainly for simplicity and clarity, but also to obscure the option of dividing the total payment in proportion to the relative probabilities, i.e., **b** on Green, which Loomes (1998) has suggested to be a focal-point solution here. Figure 3 compares the distribution of our subjects' Stage 1 responses (3Johns) with the equivalent responses reported by Loomes.

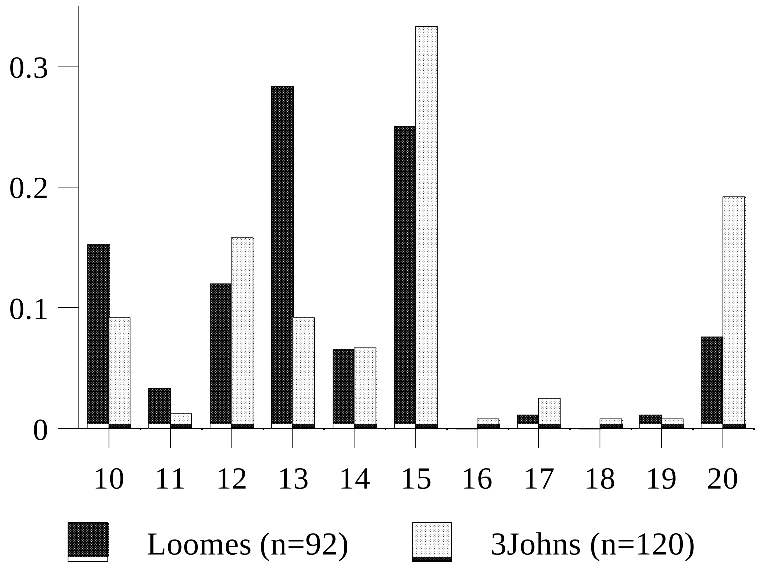

Figure 3: distribution of $\hat{g}_i$

The two distributions have some common features, most notably the virtual absence of choices within the £15-£20 interval, relative to the peaks at either end of it. This may reflect a focal-point effect or perhaps an inability to discriminate more finely over this region. Another possibility is that the peak at £20 is really a compressed tail, and that many of these subjects would gamble further if negative Red payments were allowed.

However, there are sufficient differences between the two samples to reject statistically (Mann-Whitney $p = .002$) the hypothesis that they are drawn from identical populations. The most obvious of these is in respect of the £13 response which is (to the nearest £) the Loomes focal point. This dominates his sample as both mode and median, whereas in our sample £15 does likewise. It therefore appears that we were successful in suppressing this focal point, albeit while possibly promoting another. But this cannot be attributed directly to our choice of increment. Loomes's subjects were permitted increments of £0.1, but almost all of them (82/92) responded in whole £1 units (the rest being so rounded in Figure 3). So the differences are probably due instead to our presentation and description of the decision problem, although of course the choice of increment has a bearing on this.

Acknowledgements

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Notes

1. Reported in Bone, Hey and Suckling (1999).
2. This is similar to a procedure used by Loomes (1998) as part of a quite different experiment.
3. See Bone (1998) for an analysis of prospect choice under these conditions.
4. This is a controversial topic, as reviewed and discussed by Roth (1995). In particular, there is some evidence (notably Guth *et al*, 1982) that fairness can prevail even over the stark logic of a complete-information, single-good ultimatum game. Strategically, the bargaining game embedded in the present experiment is considerably more complex than this, if not unsolvable. For an analysis of strategic bargaining games under various informational assumptions, see Osborne and Rubinstein (1990).

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APPENDIX A

Oral instructions prior to reading Screen 1

This experiment is in two parts. In each part of the experiment you have to make one simple decision, which will affect the amount you are paid when the experiment has ended.

However, your decisions will not determine that payment completely. There is also a random factor. Before being paid, you will be asked to draw a ball from this bag.* The bag contains two green balls and one red ball. The amount you are then paid will depend not only on the decisions you have made, but also on which colour ball you draw. This is, of course, twice as likely to be green as to be red.

Your decision in Part 1 of the experiment will be yours alone. In Part 2, however, your decision will be made jointly with a partner.

Only one of these two decisions will actually count. At the end of the experiment, you will toss a coin to determine which of your decisions (Part 1 or Part 2) is to count. Then you will draw a ball from the bag, to determine your final payment according to that decision.

During the experiment you will communicate with, and through, the computer. It will give you further instructions. You will have the opportunity to ask us questions, if these instructions are not clear to you. Otherwise, however, you must remain silent throughout the experiment. Please take as much time as you need to reflect on your decisions. At some stages in the experiment you may have to wait for others to reflect on their decisions. Please be patient.

* at this point the bag and its contents were displayed

THIS IS PART 1 OF THE EXPERIMENT

You have to make a choice from eleven options, as shown in the table. Each option specifies the payment you will receive, depending on whether the drawn ball is Green or Red. In each case, the two payments total £20.

The safest option, at the top of the table, gives you £10 for certain, whether the drawn ball is Green or Red.

However, the option at the bottom of the table gives you £20 should the drawn ball be Green. Here, of course, you risk receiving nothing, should the drawn ball be Red. But note that Green is twice as likely as Red, so the average payment here is £13.33.

Alternatively, you may choose one of the intermediate options. Generally, as you move down the table, the average payment increases. But so too does the risk.

There is no correct choice here. It is purely a matter of your own preference.

	GREEN ❍ ❍	RED ❍
→	£10	£10
	£11	£9
	£12	£8
	£13	£7
	£14	£6
	£15	£5
	£16	£4
	£17	£3
	£18	£2
	£19	£1
	£20	£0

Screen 1: instructions for Stage 1

THIS IS PART 2 OF THE EXPERIMENT

The computer has selected another person in this room to be your partner.

You and your partner now have to agree on a choice between two options, A and B, represented by the two tables on the right of the screen. Each table shows the payment which you and your partner will receive, depending on whether the drawn ball is Green or Red.

Your task is to agree, with your partner, which of these two options to select.

You may communicate only via the computer, which will allow you to exchange proposals.

A	GREEN ❍ ❍	RED ❍
You	£14.50	£5.50
partner	£14.50	£5.50

B	GREEN ❍ ❍	RED ❍
You	£17.00	£3.00
partner	£12.00	£8.00

Screen 2(1): initial instructions for Stage 2 under treatment 1
(specimen example: money prizes are dependent on Stage 1 responses)

THIS IS PART 2 OF THE EXPERIMENT

The computer has selected another person in this room to be your partner.

As in Part 1, the value of your payment will depend on whether the drawn ball is Green or Red, and you are given some degree of choice over this.

In this case, however, you will have to negotiate with your partner. The two of you may choose any payments you like (in increments of 50p), except that your respective Green payments must together total £29 and, similarly, your Red payments must total £11.

You may communicate only via the computer, which will allow you to exchange proposals. If you cannot reach agreement, then by default you and your partner will be allocated equal payments, as shown in the table on the right of the screen.

Default

	GREEN ❍ ❍	RED ❍
You	£14.50	£5.50
partner	£14.50	£5.50

Screen 2(2): initial instructions for Stage 2 under treatment 2
(specimen example: money prizes are dependent on Stage 1 responses)

THIS IS PART 2 OF THE EXPERIMENT

The computer has selected another person in this room to be your partner. You and your partner have to agree a choice from two options, A and B, as shown in the upper table. These are similar to the Part 1 options, except that here the payments are to be SHARED by you and your partner.

Option A gives you, for certain, £20 to share. Option B is riskier, but has a higher average payment of £23.00. For each option, the two possible payments (Green and Red) total £40.

In addition to agreeing a choice between A and B, you must also agree how to divide each of its two possible payments (Green and Red).

You may communicate only via the computer, which will allow you to exchange proposals. If you cannot reach agreement, then by default you will be given option B, equally divided, as shown in the lower table.

	GREEN ❍ ❍	RED ❍
A	£20.00	£20.00
B	£29.00	£11.00

B	GREEN ❍ ❍	RED ❍
You	£14.50	£5.50
partner	£14.50	£5.50

Screen 2(3): initial instructions for Stage 2 under treatment 3
(specimen example: money prizes are dependent on Stage 1 responses)

APPENDIX B **Session Transcripts**

Within each treatment, pairs are ordered and grouped according to the type of agreement they reached. Each is identified as "Pair *t*:*r*", where *t* denotes the treatment number. Partner 1's Stage 1 choices and Stage 2 proposals are shown on the left, with partner 2's on the right. Each proposal is represented by a 2×2 table in which partner 1's proposed (Green/Red) shares appear on the top row, and partner 2's on the bottom. In each case the proposer's own shares are in bold type. The final proposal is that which is agreed. Any accompanying messages are reproduced verbatim, except that "A" and "B" were used in treatment 1 to denote E and P respectively, and in treatment 3 to denote ***K*** and ***L*** respectively.

Treatment 1 13 Pairs

Pairs 1-11: Agreement on P

20.0	**0.0**	**Partner 1**	**15.0**	**5.0**	**Partner 2**	**Pair 1:1**

20.0	**0.0**
15.0	5.0

17.0	**3.0**	**Partner 1**	**15.0**	**5.0**	**Partner 2**	**Pair 1:2**

17.0	**3.0**
15.0	5.0

17.0	**3.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 1:3**

17.0	**3.0**
12.0	8.0

15.0	**5.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 1:4**

15.0	**5.0**
12.0	8.0

15.0	**5.0**	**Partner 1**	**10.0**	**10.0**	**Partner 2**	**Pair 1:5**
15.0 10.0	**5.0** 10.0	I like a bit of more risk and the minimum value for this time is 5				

15.0	**5.0**	**Partner 1**	**13.0**	**7.0**	**Partner 2**	**Pair 1:6**
15.0 13.0	**5.0** 7.0	are you ok?				

16.0	**4.0**	**Partner 1**	**14.0**	**6.0**	**Partner 2**	**Pair 1:7**
16.0 14.0	**4.0** 6.0	cool?				

17.0	**3.0**	**Partner 1**	**15.0**	**5.0**	**Partner 2**	**Pair 1:8**
17.0 15.0	**3.0** 5.0	not that bothered...				

15.0	**5.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 1:9**
13.5 13.5	**6.5** 6.5		15.0 **12.0**	5.0 **8.0**		

20.0	**0.0**	**Partner 1**	**15.0**	**5.0**	**Partner 2**	**Pair 1:10**
17.5 17.5	**2.5** 2.5	E is more in your favour but not by much, so fair is fair	20.0 **15.0**	0.0 **5.0**	P is better	
17.5 17.5	**2.5** 2.5	maths should tell you that E is better	20.0 **15.0**	0.0 **5.0**	maths is not always right and i want a guaranteed 5 quid	

20.0	**0.0**	**Partner 1**	**15.0**	**5.0**	**Partner 2**	**Pair 1:11**
20.0 15.0	**0.0** 5.0	I do not mind the gamble	17.5 **17.5**	2.5 **2.5**	E has a better average payment	

20.0 | **0.0** 15.0 | 5.0	not really...only a little difference	17.5 | 2.5 **17.5** | **2.5**	the difference is small, but E is still a higher average
20.0 | **0.0** 15.0 | 5.0	the acerage is higher on mine but slightly lower on your		

Pair 12: Unresolved disagreement - terminated by the experimenter

20.0 | **0.0**	**Partner 1**	**15.0** | **5.0**	**Partner 2** **Pair 1:12**
20.0 | **0.0** 15.0 | 5.0	just do what i say. we will win	17.5 | 2.5 **17.5** | **2.5**	Im certainly not going to do what you say, E is much fairer for both of us
20.0 | **0.0** 15.0 | 5.0	no way i will choose E, its P, go for high risk high return strategy	17.5 | 2.5 **17.5** | **2.5**	I don't want a high risk option,one of us will lose out
20.0 | **0.0** 15.0 | 5.0	no	17.5 | 2.5 **17.5** | **2.5**	Why not? Don't be so stubborn. We will be guranteed some money rather than the risk of nothing
20.0 | **0.0** 15.0 | 5.0	i will not give in, choose P now	17.5 | 2.5 **17.5** | **2.5**	No. Why dont you give in? It makes sense. Think about it
20.0 | **0.0** 15.0 | 5.0	show me the money...choose P now chicken	17.5 | 2.5 **17.5** | **2.5**	You will see the money if youu choose E as I want to. Im not a chicken,I just want to walk away with more than nothing
20.0 | **0.0** 15.0 | 5.0	rule no 1, never argue with me. rule no 2 i am always right. rule no 3 give in now or else	17.5 | 2.5 **17.5** | **2.5**	Or else what? Dont you try to threaten me. I know Im right and youre wrong so well stick it out until you change your mind
20.0 | **0.0** 15.0 | 5.0	ok lets make a compromise, if i win you give me all the takings and if i lose	17.5 | 2.5 **17.5** | **2.5**	YOu didnt finish your sentence...Im not going to give you anything,look E is fair,,we will both get a reasonable prize
20.0 | **0.0** 15.0 | 5.0	just agree with me...	17.5 | 2.5 **17.5** | **2.5**	no,agree with me
20.0 | **0.0** 15.0 | 5.0	no	17.5 | 2.5 **17.5** | **2.5**	tough luck

Pair 13: Agreement on E

18.0 | **2.0**	**Partner 1**	**15.0** | **5.0**	**Partner 2** **Pair 1:13**
16.5 | **3.5** 16.5 | 3.5	better on average		

Treatment 2 22 usable pairs (2 unusable due to computer failure)

Pairs 1-5: Agreement (possibly) Pareto-superior to E

20.0	**0.0**	**Partner 1**	**15.0**	**5.0**	**Partner 2**	**Pair 2:1**
20.0 15.0	**0.0** 5.0		20.0 **15.0**	0.0 **5.0**		

20.0	**0.0**	**Partner 1**	**13.0**	**7.0**	**Partner 2**	**Pair 2:2**
25.0 8.0	**0.0** 7.0		18.0 **15.0**	2.0 **5.0**		
21.0 12.0	**0.0** 7.0		19.0 **14.0**	1.0 **6.0**	There is no way I am going to accept an unbalanced bid like yours. I am quite happy if necessary to take the default	
20.0 13.0	**0.0** 7.0					

15.0	**5.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 2:3**
14.5 12.5	**5.5** 7.5					

20.0	**0.0**	**Partner 1**	**13.0**	**7.0**	**Partner 2**	**Pair 2:4**
18.0 15.0	**2.0** 5.0					

15.0	**5.0**	**Partner 1**	**13.0**	**7.0**	**Partner 2**	**Pair 2:5**
14.5 13.5	5.5 6.5	hello...				

20.0	**0.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 2:6**
18.0 14.0	**2.0** 6.0		18.0 **14.0**	2.0 **6.0**	Confusion reigns	

20.0	**0.0**	**Partner 1**	**14.0**	**6.0**	**Partner 2**	**Pair 2:7**
17.0 17.0	**3.0** 3.0	hello there i think we should keep it as it is. we are more likely to get a green one and either way we make money	18.0 **16.0**	2.0 **4.0**	I think it is a lot of risk with ur choice. we should think of getting red and then we will end up with inly three pounds soo	
17.0 17.0	**3.0** 3.0	think about it there is a 50 50 chance of this being played out anyway. have a laugh lifes too short to take these thngs seriously	18.0 **16.0**	2.0 **4.0**	it is only forgoing one pound to get one if you get red. then if you lose you get 4 and not three and still get a big amount if you win. so?	

14.0	**6.0**	**Partner 1**	**11.0**	**9.0**	**Partner 2**	**Pair 2:8**
13.5 11.5	**6.5** 8.5		12.5 **12.5**	7.5 **7.5**		
14.0 11.0	**6.0** 9.0	Why syick to the default numbers, live a little.	13.0 **12.0**	7.0 **8.0**		

20.0	**0.0**	**Partner 1**	**15.0**	**5.0**	**Partner 2**	**Pair 2:9**
20.0 15.0	0.0 5.0	hi there, I think my proposal is cool	18.0 17.0	2.0 3.0	I think mine is cooler. What do you think about it?	
19.0 16.0	1.0 4.0	Lets make it like that partner. I am bored, so please accept my excellent proposal	18.5 16.5	1.5 3.5	I think we cant do more than that. Dont forget, the red ball could also be the one in the end...	

20.0	**0.0**	**Partner 1**	**14.0**	**6.0**	**Partner 2**	**Pair 2:10**
20.0 14.0	**0.0** 6.0	is your payoff the one you chose in part 1, I chose mine the way like in part 1	19.0 **15.0**	1.0 **5.0**	risk it this way its better for me	
19.5 14.5	**0.5** 5.5	I feel like I am in a turkish bazar, how is this one for you?	**18.5** 15.5	**1.5** 4.5	it’s the best you can get	
19.0 15.0	**1.0** 5.0	lets stick with your first proposal then Cheers				

15.0	**5.0**	**Partner 1**	**10.0**	**10.0**	**Partner 2**	**Pair 2:11**
15.0 10.0	**6.5** 8.5	A good balance no matter the outcome for you, an imbalance for me	15.0 **10.0**	5.0 **10.0**		
14.0 11.0	**6.5** 8.5	It is not the chance of winning that counts. I need some extra for the risk I take.	13.0 **12.0**	7.0 **8.0**		
14.5 10.5	**6.5** 8.5	One green is worth 2 reds with probabilities	13.5 **11.5**	7.0 **8.0**		

15.0	**5.0**	**Partner 1**	**14.0**	**6.0**	**Partner 2**	**Pair 2:12**
15.0 14.0	**5.0** 6.0		16.0 **13.0**	1.0 **10.0**		
16.0 13.0	**4.0** 7.0		15.5 **13.5**	3.0 **8.0**		
15.5 13.5	**4.0** 7.0					

Pair 13: Trivial

20.0	**0.0**	**Partner 1**	**20.0**	**0.0**	**Partner 2**	**Pair 2:13**
27.0 13.0	**0.0** 5.0		10.0 **30.0**	0.0 **0.0**		
25.0 15.0	**0.0** 0.0		11.5 **28.5**	0.0 **0.0**	R u wanting a 20 20 split?	
20.0 20.0	**0.0** 0.0					

Pairs 14-17: (Nontrivial) agreement on E

15.0	**5.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 2:14**
13.5 13.5	**6.5** 6.5	I am happy with these values				

20.0	**0.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 2:15**
16.0 16.0	**4.0** 4.0					

15.0	**5.0**	**Partner 1**	**10.0**	**10.0**	**Partner 2**	**Pair 2:16**
13.5 11.5	**6.5** 8.5	Is this acceptable to you?	12.0 **13.0**	7.0 **8.0**	How is this.	
14.0 11.0	**6.5** 8.5	Well, this seems better to me. What do you reckon?	12.5 **12.5**	7.5 **7.5**	Let us just leave it as it is eh, you are making some silly decisions. O.k.	
12.5 12.5	**7.5** 7.5	Well it depends on if you are feeling lucky. One more chance to change your mind.				

20.0	**0.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 2:17**
24.0 8.0	**0.0** 8.0		16.0 **16.0**	4.0 **4.0**	The default position is fairest. The alternative would be 32 in green and 8 in red on either one of us. We then agree to split the proceeds later.	

Pairs 18-22: Agreement inferior to E for at least one partner

15.0	**5.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 2:18**
15.0 12.0	**6.5** 6.5					

13.0	**7.0**	**Partner 1**	**10.0**	**10.0**	**Partner 2**	**Pair 2:19**
12.5 10.5	**8.5** 8.5	what do you think???	11.0 **12.0**	9.0 **8.0**	this is convenient for you	
12.0 11.0	**7.5** 9.5	im not too sure err..but what about this?	12.0 **11.0**	7.0 **10.0**	all right. I accept your green part. Now you go on with my red, OK?	

14.0	**6.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 2:20**
15.0 11.0	**5.0** 9.0		13.5 **12.5**	6.0 **8.0**		
14.0 12.0	**6.0** 8.0		13.5 **12.5**	6.5 **7.5**		
14.0 12.0	**6.5** 7.5		13.5 **12.5**	7.0 **7.0**		

20.0	**0.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 2:21**
22.0 10.0	**5.0** 3.0		18.0 **14.0**	4.0 **4.0**		
20.0 12.0	**4.0** 4.0		18.0 **14.0**	4.0 **4.0**		

20.0	**0.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 2:22**
16.0 16.0	**4.0** 4.0	?	12.0 **20.0**	6.0 **2.0**	If we stick to this, and get red, youre happy, if we get green were both happy	
15.0 17.0	**5.0** 3.0		14.0 **18.0**	5.0 **3.0**	come on, this way i only get one more pound than you, but youre playing safer. ps are you a boy or a girl	
14.0 18.0	**5.0** 3.0	Okay, but dont insult me...				

Treatment 3 23 Pairs

Pairs 1-4: Agreement (possibly) Pareto-superior to E

15.0	**5.0**	**Partner 1**	**10.0**	**10.0**	**Partner 2**	**Pair 3:1**
12.5 12.5	**7.5** 7.5		10.0 **10.0**	10.0 **10.0**		
15.0 10.0	**5.0** 10.0	Imhappy to get 5 quid for half an hours work If you want to have 10 quid, how is this?				

15.0	**5.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 3:2**
14.0 13.0	**6.5** 6.5	If you accept now, we can get the money and go...	10.0 **10.0**	10.0 **10.0**	I prefer a guaranteed tenner...	
12.0 8.0	**10.0** 10.0	I really prefer the risk, so need some compensation to play safe...sorry	15.0 **12.0**	5.0 **8.0**	How about this?	

15.0	**5.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 3:3**
10.0 17.0	**13.0** 0.0	could be getting a full 17...?	15.5 **11.5**	4.5 **8.5**	or maybe i could not get a full 17, if you like a risk, could do this	
15.0 12.0	**5.0** 8.0	just a little safer...				

20.0	**0.0**	**Partner 1**	**13.0**	**7.0**	**Partner 2**	**Pair 3:4**
15.0 18.0	**5.0** 2.0		10.0 **10.0**	10.0 **10.0**	I would prefer less risk than your propsal offered for me, but would accept a bit more risk than this	
16.5 16.5	**3.5** 3.5		17.5 **15.5**	2.5 **4.5**		

Pairs 5-6: Trivial

15.0	**5.0**	**Partner 1**	**15.0**	**5.0**	**Partner 2**	**Pair 3:5**

15.0 15.0	**5.0** 5.0	***L***, 50,50,ok?

15.0	**5.0**	**Partner 1**	**15.0**	**5.0**	**Partner 2**	**Pair 3:6**

15.0 15.0	**5.0** 5.0	Let us be equal.

Pairs 7-16: (Nontrivial) agreement on E

15.0	**5.0**	**Partner 1**	**10.0**	**10.0**	**Partner 2**	**Pair 3:7**

12.5 12.5	**7.5** 7.5	Don't mind ***K*** or ***L*** but lets be fluffy and share

15.0	**5.0**	**Partner 1**	**10.0**	**10.0**	**Partner 2**	**Pair 3:8**

12.5 12.5	**7.5** 7.5	Seems to me that this is the best way to maximize payment in a joint sharing of the proceeds of the experiment.

15.0	**5.0**	**Partner 1**	**10.0**	**10.0**	**Partner 2**	**Pair 3:9**

12.5 12.5	**7.5** 7.5	proposal ***L*** equally divided. Agree?

14.0	**6.0**	**Partner 1**	**11.0**	**9.0**	**Partner 2**	**Pair 3:10**

12.5 12.5	**7.5** 7.5	

13.0	**7.0**	**Partner 1**	**10.0**	**10.0**	**Partner 2**	**Pair 3:11**
11.5 11.5	**8.5** 8.5					

20.0	**0.0**	**Partner 1**	**13.0**	**7.0**	**Partner 2**	**Pair 3:12**
16.5 16.5	**3.5** 3.5					

19.0	**1.0**	**Partner 1**	**15.0**	**5.0**	**Partner 2**	**Pair 3:13**
17.0 17.0	**3.0** 3.0					

20.0	**0.0**	**Partner 1**	**13.0**	**7.0**	**Partner 2**	**Pair 3:14**
16.5 16.5	**3.5** 3.5		18.5 **14.5**	2.5 **4.5**		
16.5 16.5	**2.5** 4.5	Why do you put me at a higher scale. Is it not better to have it 50 50?	16.5 **16.5**	3.5 **3.5**	Equal split sounds ok...	

15.0	**5.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 3:15**
16.5 10.5	**0.0** 13.0	***L***. If green, I make 6 pounds more, if red, you make 13 pounds more. This favours you. Comply or else.	13.5 **13.5**	6.5 **6.5**		
10.5 16.5	**13.0** 0.0	Theres no point going 50 50, thats the default option. heres the same proposal the other way round. green gives you 6 pounds more, red gives me 13 more. OK?	13.5 **13.5**	6.5 **6.5**	The default option is still the one involing the smallest risk of the ***L*** options.	
10.5 16.5	**13.0** 0.0	the whole point of negotiating is to try to gain an advantage and make off with more loot than me. Taking risks is what makes life worth living. COMPLY NOW.	13.5 **13.5**	6.5 **6.5**	Sorry, some loot for everyone...	
27.0 0.0	**13.0** 0.0	Then why not take ***K*** if you dont like risks? This is my final offer, a bit ludicrous but I can see you are not going to budge an inch so what the hell.	13.5 **13.5**	6.5 **6.5**		

15.0	**5.0**	**Partner 1**	**10.0**	**10.0**	**Partner 2**	**Pair 3:16**
13.5	**6.0**		0.0	0.0	The default option seems entirely reasonable to me. So, I send you this proposal in the hope that you will accidentally hit the wrong button	
11.5	9.0		**25.0**	**15.0**		
25.0	**15.0**		12.5	7.5	Enough of this.	
0.0	0.0		**12.5**	**7.5**		

Pairs 17-23: Agreement (£10 each) inferior to E for at least one partner

14.0	**6.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 3:17**
13.0	**7.5**	Is this proposal suitable for you	10.0	10.0	It is pretty sure. If you want to risk please offer equal benefits.	
13.0	6.5		**10.0**	**10.0**		

15.0	**5.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**	**Pair 3:18**
11.0	**8.0**	How about this?	11.5	6.5	that was not fair,, was it? What about this you get the same if green	
9.0	12.0		**15.5**	**6.5**		
13.0	**7.5**	It was fair multiply the green one by two, and add it to the red one and theyre equal. yours was completely unfair	13.0	7.0	what about this then?	
14.0	5.5		**14.0**	**6.0**		
10.0	**10.0**	That was unfair again. I cant be bothered with this lets just have a guaranteed 10 ok?				
10.0	10.0					

15.0	**5.0**	**Partner 1**	**13.0**	**7.0**	**Partner 2**	**Pair 3:19**
10.0	**10.0**	OK	14.0	6.0	Take a chance?	
10.0	10.0		**14.0**	**6.0**		
16.0	**7.0**	Is this OK? I think if you want to take risk you have to pay for this.	10.0	10.0	Oh, In which case I think splitting even might be best after all.	
12.0	5.0		**10.0**	**10.0**		
11.0	**10.5**	I change my prefferences now. But not too much. Think that it could be worst the next time...	10.0	10.0	Your last offfer was not at all fair. Lets split even?	
9.0	9.5		**10.0**	**10.0**		

20.0	**0.0**	**Partner 1**	**15.0**	**5.0**	**Partner 2**		**Pair 3:20**

10.0 10.0	**10.0** 10.0	hello, I think keeping it all even is best. What about you? What did you put for the first part?

15.0	**5.0**	**Partner 1**	**12.0**	**8.0**	**Partner 2**		**Pair 3:21**

10.0 10.0	**10.0** 10.0	Is it ok?

15.0	**5.0**	**Partner 1**	**13.0**	**7.0**	**Partner 2**		**Pair 3:22**

10.0 10.0	**10.0** 10.0	Sorry to be boring, but Id rather not risk anything

15.0	**5.0**	**Partner 1**	**15.0**	**5.0**	**Partner 2**		**Pair 3:23**

10.0 10.0	**10.0** 10.0