2013

Short- and Long-run Goals in Ultimatum Bargaining

Antonio M. Espín

Filippos Exadaktylos

Benedikt Herrmann

Pablo Brañas-Garza

Recommended Citation

Espín, A.M., Exadaktylos, F., Herrmann, B., & Brañas-Garza, P. (2013). Short- and long-run goals in ultimatum bargaining. ESI Working Paper 13-17. Retrieved from http://digitalcommons.chapman.edu/esi_working_papers/41

Short- and Long-run Goals in Ultimatum Bargaining

Comments

Working Paper 13-17

Short- and long-run goals in ultimatum bargaining

Antonio M. Espín [a], Filippos Exadaktylos [b*], Benedikt Herrmann [c] & Pablo Brañas-Garza [d]

Authors' affiliations:
[a] GLOBE, Departamento de Teoría e Historia Económica, Universidad de Granada. Campus de Cartuja s/n, 18071 Granada, Spain.
[b] BELIS, Murat Sertel Center for Advanced Economic Studies, Istanbul Bilgi University. Santral Campus, 34060 Istanbul, Turkey.
[c] Institute for Health and Consumer Protection, Joint Research Centre, European Commission, 21027 Ispra, Italy.
[d] Department of Economics and International Development, Middlesex University Business School. The Burroughs, NW4 4BT London, UK.

*** Corresponding author**: Filippos Exadaktylos. Santral Kampüsü, E5-101, Eski Silahtarağa Elektrik Santralı, Kazım Karabekir Cad. No: 2/13, 34060 Eyüp Istanbul, Turkey Tel: +90 212 311 53 27 (ph.exadaktylos@gmail.com)

ABSTRACT

The ultimatum game (UG) is widely used to study human bargaining behavior and fairness norms. In this game, two players have to agree on how to split a sum of money. The proposer makes an offer, which the responder can accept or reject. If the responder rejects, neither player gets anything. The prevailing view is that, beyond self-interest, the desire to equalize both players' payoffs (i.e., fairness) is the crucial motivation in the UG. Based on this view, previous research suggests that responders follow short-run psychological incentives when imposing fairness through the rejection of low offers. However, competitive spite, which reflects the desire to reduce others' payoffs, can also account for the behavior observed in the UG, and has been linked to short-run, present-oriented aspirations as well. In this paper, we explore the relationship between individuals' inter-temporal preferences and their behavior in a large-scale dual-role UG experiment. We find that impatience (present orientation) predicts the rejection of low, "unfair" offers as responders *and* the proposal of low, "unfair" offers as proposers, which is consistent with spite but inconsistent with fairness motivations. This behavior systematically reduces the payoffs of those who interact with impatient individuals. Thus, impatient individuals appear to be keen on reducing their partners' share of the pie, even at the risk of destroying it. These findings indicate that competitive spite, rather than fairness, is the short-run motivation in ultimatum bargaining.

Keywords: ultimatum game; costly punishment; delay discounting; impatience; fairness; spite; cooperation; competition

Introduction

The ultimatum game (UG) is an economic experimental set-up widely used to study the nature of human bargaining and the enforcement of fairness norms (1-4). In this game, the first player (the proposer) proposes how to split a sum of money with the second player (the responder). The responder can either accept or reject the proposal. If the proposal is accepted, the “pie” is divided accordingly; if rejected, neither player is paid. Economic models based on narrow self-interest predict that the responder should accept any positive offer, at least in non-repeated interactions. By backward induction, the proposer should offer the smallest positive amount to the responder, who will accept the deal. However, experimental evidence has consistently contradicted these predictions as responders very often reject “unfair”, albeit positive offers and most proposers offer “fair”, equal splits (5).

Explaining proposers’ generous offers is straightforward from a strategic viewpoint: since a low offer will likely be rejected, it is in the proposer’s self-interest to make a high offer to avoid coming up empty-handed (6, 7). Strategic reasoning does not apply, however, to responders’ observed behavior if future encounters with the same proposer are unlikely (otherwise, rejections might be used to encourage higher future offers). Most scholars have invoked fairness-based rationales for the existence of rejections in one-shot interactions: people dislike unfairness—defined in either simple forms like mere payoff inequality (8, 9) or more complex ones like intentional unfairness (“unkindness”) (10, 11). In this vein, the rejection of a low offer is considered as an act of costly punishment triggered by the unfairness of the proposal. Therefore, the mainstream view is that the decision making of both proposers and responders in the one-shot UG relies on a combination of (strategic) self-interest and fairness-based considerations. Less attention has been paid, however, to other motivations like (psychological) spite, the “ugly twin” of altruism, as a crucial force underlying observed behavior *in either role* of the UG. For a spiteful individual, other individuals are competitors whose payoffs negatively affect her own utility (e.g., 12, 13; see ref. 14 for a review of other-regarding preferences models).

Recently, delay discounting (DD) is being used to assess the motivations behind social behavior (15-17). DD measures individuals’ preferences for smaller-sooner over larger-later rewards (see reviews in refs. 18-20). If a specific choice involves trading off short-run and long-run incentives, those individuals who discount the future more heavily (i.e., present-oriented, impatient individuals with a high rate of DD) would favor the former over the latter. Outside the field of social behavior, there are many well-studied examples of how DD influences decision making (e.g., 21-23).

With regards to social behavior, Crockett et al. (16) found that higher DD (impatience) predicts higher rejection rates in the specific context of the one-shot UG, thus suggesting that short-run psychological incentives—such as immediate negative emotions (2, 24) or psychological rewards (25)—underlie the decision to punish unfairness at a personal cost. Accordingly, promoting long-run material self-interest would require overriding the immediate impulse to punish violations of fairness norms. Yet other interpretations are possible. Espín et al. (17) found that high DD is characteristic of free-riders who pay a cost to punish other free-riders in a one-shot public goods game. Free-riders' punishment of other free-riders is considered to be motivated by competitive spite because it increases the punisher's relative standing and is hardly reconcilable with the moralistic, norm-based motives which are assumed to be behind cooperators' punishment of free-riders (e.g., 26-28). This finding suggests that competitive, (costly) spiteful behavior might respond to short-run psychological forces. Moreover, the same study also found a negative relationship between cooperators' DD and their willingness to punish free-riders, indicating that long-run incentives might trigger the moralistic punishment of norm-violations. As both patient cooperators and impatient free-riders were found to punish those who free ride, the mere observation of an individual's punishment behavior is not sufficient to disentangle whether it has a competitive or normative basis. In the public goods game, observing the punisher's cooperation level is also required (27).

Something similar may occur in the UG: looking exclusively at the rejection behavior of individuals might provide only a partial picture. Since both fairness (normative) and spiteful (competitive) motives can drive rejections (12, 29, 30), individuals' behavioral patterns in the UG should be more broadly analyzed. In light of the findings of Crockett et al. (16) and Espín et al. (17), a straightforward method is to test whether the "impatient rejecters" comply or not with the fairness norm.

In this paper, we address this issue by analyzing how individuals' DD relates to their behavior in both roles of the UG. If impatient subjects are found to reject low, unfair offers as responders *and* to propose high, fair offers as proposers, it can be argued that fairness goals respond to short-run incentives in the context of the UG. Fair outcomes (either observed or imposed) have been shown to activate different areas in the neural circuitry of reward (25, 31, 32; see ref. 33 for a review). Thus, these psychological incentives associated with fairness might be less delayed or less lasting than the incentives associated with other outcomes (such as, for instance, earning some money through the acceptance of a low offer or dominating the other player by means of offering her a low amount).

On the other hand, it is known that the individuals' payoffs relative to others rather than in absolute terms are associated with activation in reward areas of the brain (striatum) when social interactions take place in competitive frameworks (34-36). If these competition-based hedonic feelings represent short-run incentives in the context of the UG, we would expect that impatient subjects behave spitefully in both roles in order to reduce their partners' payoffs (possibly as an expression of dominance; see ref. 37), that is, they would reject low offers as responders *and* make low offers as proposers. This "fight-seeking" behavior would make them less likely to reach an agreement with their partners.

This same behavior, however, can also be explained by the reduced ability of individuals to make *strategic* self-interested choices. That is, it could be that impatience goes along with a diminished capacity to anticipate that offering a low amount (as a proposer) will potentially lead to a rejection and that setting a high punishment threshold (as a responder) means losing potential earnings. In such a case, impatient subjects would adopt less adaptive strategies, thus earning lower payoffs than the average. Conversely, spiteful behavior is not aimed at achieving a particular payoff for oneself but instead to reduce others' payoffs. Thus, if spite is indeed what underlies the decisions of impatient subjects, we might observe that it is not the impatient subjects themselves but rather their interacting partners who end up with low payoffs.

To test these hypotheses we analyze data from a citywide survey-experiment (see ref. 38 for a detailed description) which contains a dual-role UG and a measurement of participants' inter-temporal preferences. All participants (*N*=713 final observations, 386 females) were inhabitants of Granada (Spain)—a representative sample of the city's adult population—and made their experimental decisions anonymously from their own households in the presence of two monitors. Participants' (mathematical) cognitive abilities, risk preferences and extensive socio-economic information were also gauged (see Supporting Information (SI)).

The participants completed two complementary DD subtasks with six decisions each. The first subtask involved a one-day wait, whereas the second implied a six-month delay. The inter-temporal preferences elicited over these delays will be referred to hereafter as short-run and long-run DD, respectively. This will serve us to check whether DD elicited over different time horizons may result in different associations with behavior (see Methods).

In the UG, participants made decisions as both proposers and responders in random order. We therefore obtained the strategy profile for each subject consisting of an offer as proposer and a minimum acceptable offer (MAO) as responder. By using a UG task in which responders state their punishment threshold before learning the actual proposal (in contrast to the direct-response method; see ref. 39 for a review), we aim to focus on preference-based explanations of behavior (14), therefore avoiding that a negative emotional impulse (2, 24, 31) is what triggers impatient responders' rejections (see Methods).

Results

Delay discounting and behavior in the ultimatum game

Table 1 presents the estimates of the impact of DD on UG behavioral strategies in columns (1)-(3). Each cell contains estimates from one separate regression, with the variable at the top of the column as the dependent variable. In all regressions we control for socio-demographic variables (age, gender, marital status, household income, and educational level), cognitive abilities, risk preferences, and order effects in decisions as possible confounding factors. Robust standard errors are clustered by interviewer. OLS estimates are shown for comparability of coefficients (other regression methods like Tobit or ordered models yield similar main results and are available upon request from the authors). Darker cells denote significant predictors (*p*-values in brackets). The complete regressions can be found in Tables S1-S4.

Different characterizations of DD are presented in rows. The first and second rows show the effect of short-run and long-run DD, respectively, on the dependent variables. To capture short- and long-run DD we use the number of impatient responses the individual made for each delay (from 0 to 6). In the third row "combined DD" refers to the average of the above DD measures ([DDs+DDl]/2). To facilitate interpretation, the three measurements of DD are normalized to the interval [0, 1]. Finally, "highDD vs. lowDD", in the fourth row, is a binary variable taking the value 1 if the individual belongs to the top 33% and 0 if the individual belongs to the bottom 33% of the distribution of "combined DD". Observations falling in the central 33% are missing for the analyses shown in the last row, hence the sample for this last exercise is reduced to 488.

Columns (1), (2), and (3) refer to regressions with the individual's offer, MAO, and their difference as dependent variables, respectively. This last variable (offer-MAO) will serve as a measure of the margin of agreement each individual allows: the larger one's offer and the smaller one's MAO (thus, the larger the difference), the more likely the individual is to agree with others. All these variables are expressed as a fraction of the pie.

dependent vars.:	**offer** (1)	**MAO** (2)	**offer-MAO** (3)	***own payoff*** (4)	***other's payoff*** (5)
short-run DD	-0.0294 (0.157)	0.0428 (0.052)	-0.0722 (0.024)	-0.0115 (0.131)	-0.0252 (0.053)
long-run DD	-0.0324 (0.041)	0.0393 (0.051)	-0.0717 (0.004)	0.0018 (0.785)	-0.0269 (0.009)
combined DD	-0.0437 (0.038)	0.0581 (0.017)	-0.1018 (0.002)	-0.0070 (0.404)	-0.0369 (0.006)
highDD vs. lowDD	-0.0281 (0.052)	0.0431 (0.005)	-0.0711 (0.001)	-0.0069 (0.215)	-0.0231 (0.013)

Table 1. Impact of DD over UG strategies and expected payoffs. The estimated coefficients for different DD characterizations as explanatory variables are shown in rows. Dependent variables are expressed as a fraction of the pie (€20). Each estimate refers to a different OLS regression with robust standard errors clustered by interviewer (108 groups) and controlling for age, gender, married, household income, educational level, mathematical cognitive abilities, risk preferences, and order effects. *N*=713, except for the last row where *n*=488. P-values are shown in brackets. Darker cells display significant estimates (all *Ps*≤0.053). Complete regressions are presented in Tables S1-S4.

The impact of both short-run and long-run DD on offers (column (1)) is negative and quantitatively similar, but only reaches significance in the case of long-run DD. As we discuss in the SI, we cannot disentangle whether this difference is due to the fact that the presence of immediate payoffs in the short-run task reduces the predictive power of short-run DD (which would be in favor of the dual-valuation account of DD) or to the fact that subjects' responses to the task were poorly distributed (Figure S1). A seemingly substitutive effect (when including both variables in a single regression their coefficients are still negative but lose significance; not reported) suggests that we will possibly obtain a better picture by combining both measures. In fact, the variable "combined DD" reports a slightly stronger effect on offers. The "highDD vs. lowDD" variable yields a similar result. Thus, the effect of DD on offers is negative, though rather small (between 2.81% and 4.37% of the pie depending on the DD specification).

On the other hand, all the estimates of DD are positive and significant when the dependent variable is the individual's MAO (column (2)). Hence, we replicate the finding by Crockett et al. (16) to the extent that more impatient responders are more likely to reject low offers. The effect of DD on MAOs is larger than its effect on offers but still quite small (between 3.93% and 5.81% of the pie).

Column (3) shows that the above relationships translate into a relatively strong effect of DD on "offer-MAO". This means that the margin for agreement shrinks as DD increases. It will therefore be easier to shake hands with a patient individual. Specifically, these effects lie between 7.11% and 10.18% of the pie. As in the case of offer and MAO, here we observe as well that short-run and long-run DD are associated with the same patterns, and combining the two measures improves the model's power of fit.

In Figure 1 we show the mean (± robust SEM clustered by interviewer) offer (panel A), MAO (panel B), and offer-MAO (panel C) as a function of DD measures. For visual clarity we categorized individuals in three groups according to their DD and plot offers and MAOs in terms of their deviation from the mean offer (0.462±0.007) and MAO (0.350±0.009). Positive deviations indicate above-average offers or MAOs in each case. From left to right and separated by dashed lines, the short-run, long-run, and combined DDs appear split in terciles ("low", "med", and "high" for the bottom, middle, and top tercile, respectively).

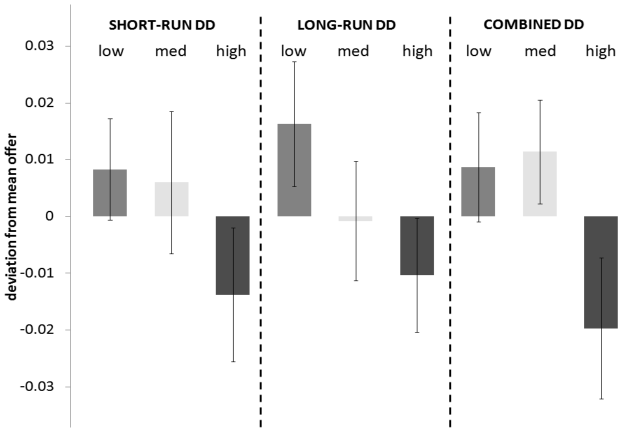
While the estimated effects and statistical significance are properly obtained through regressions (Table 1), Figure 1 provides a more illustrative picture with regards to the effect DD has on bargaining behavior. In particular, from both Table 1 and Figure 1 we obtain the following:

> **Result 1**: present-oriented subjects offer less in the UG;
>
> **Result 2**: present-oriented subjects reject more, that is, their MAO is higher;
>
> **Result 3**: consistently, present-oriented subjects do not facilitate agreements. More precisely, the margin for agreement allowed by the most patient individuals virtually doubles that allowed by the most impatient individuals.[*]

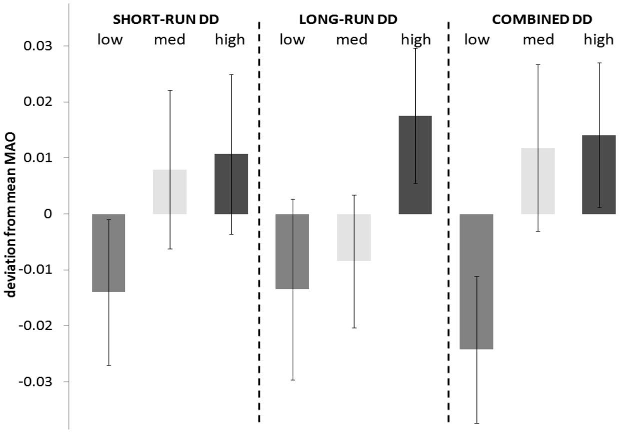
---

[*] Note here that both patient and impatient groups display mean offers well above mean MAOs. Recent evidence from computer simulations indeed indicates that strategies with offer>MAO>0 are evolutionarily stable (40).

A. Offer



B. MAO



C. Offer-MAO

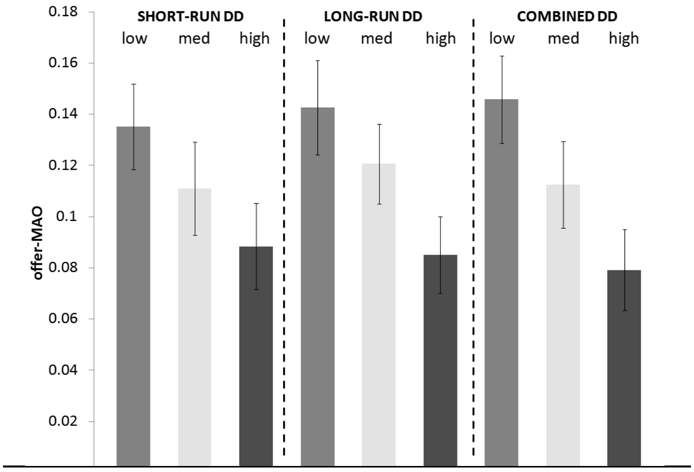


Figure 1. Offer, MAO, and Offer-MAO by DD groups. Mean (±robust SEM clustered by interviewer) offer (panel A), MAO (panel B), and offer-MAO (panel C) by groups of DD. Both offers and MAOs are plotted in terms of their deviation from the mean behavior. From left to right and separated by dashed lines, the short-run, long-run, and combined DD appear split in terciles ("low", "med", and "high" for the 1st, 2nd, and 3rd tercile, respectively).

Taken together, these results lead to a rejection of the hypothesis that high DD is a predictor of individuals' concern for fairness in either role of the UG since the offers made by high-DD proposers are, on average, more unfair. In terms of the Fehr-Schmidt's (8) inequality aversion model, impatient individuals appear to exhibit stronger aversion to disadvantageous inequality and smaller aversion to (possibly even "negative aversion" to, i.e., preference for) advantageous inequality compared to patient individuals. In the context of the UG, this would imply that impatient individuals are keen on equalizing payoffs when they are below but unwilling to do so when they are above, which is consistent with competitive-spiteful preferences.

Does the final outcome relate to individuals' delay discounting?

The above results, however, can also be explained if high DD predicts less strategic rather than more spiteful behavior. To disentangle the two, we now focus on the participants' payoffs. We simulated a perfect random matching between participants (i.e., like a round-robin tournament where everybody plays once against everybody in each role) resulting in 1,424 (712 interacting partners * 2 roles) simulated interactions per subject, and computed their expected (mean) payoffs as a proxy for reproductive fitness. From an evolutionary viewpoint, this method will actually give us an appropriate measure for the adaptiveness of the strategies adopted, since the probability of matching with each of the other participants across the city was identical. We obtained the expected payoff per interaction of each individual ("*own payoff*") and that of the other individuals when interacting with her ("*other's payoff*"), which were calculated from the actual distribution of individual strategies in the sample (see Methods).

In column (4) of Table 1 we display the estimates for regressions with the expected *own payoff*, expressed as fraction of the pie, as the dependent variable. None of the DD specifications results in significant estimates. Thus, based on the simulation analysis we do not find support for the hypothesis that high discounters were simply unable to apply an advantageous (i.e., more adaptive) strategy. Participants with high DD did not earn less (or more) than participants with low DD, as participants' payoffs were not significantly related to their DD.

Interestingly, however, a salient result is that DD impacts negatively and significantly on *other's payoff* according to all DD specifications (column (5)). That is, the higher the DD of an individual's interacting partner, the less she is expected to earn from that interaction. The total effect of DD on *other's payoff* ranges between 2.31% and 3.69% of the pie. Putting these findings into a evolutionary perspective and considering the expected payoffs as a measure of potential reproductive fitness, this effect, although seemingly small, is in fact profound. The 99th and 50th percentiles of the distribution of *own payoff* are 0.482 and 0.451, respectively; hence, a mere 3.1% reduction in the payoff is sufficient to depress an individual's fitness from the top to the median part of the distribution.

Therefore, the strategies adopted by patient and impatient individuals are equally adaptive but the effects these strategies have on others are substantially different: individuals (either patient or impatient) will get lower payoffs from their interactions with impatient individuals than from their interactions with patient individuals. In fact individuals facing impatient partners more often than others will have lower expected payoffs and hence lower survival probabilities as well.

In Figure 2, *own payoff* (panel A) and *other's payoff* (panel B) are plotted in terms of their deviation from the mean payoff (0.430±0.003). The same categorizations of DD of Figure 1 are employed. It is nicely illustrated that the struggle will be fiercer with impatient interacting partners. We therefore conclude:

Result 4: present-oriented subjects do not earn less money;

Result 5: the partners of present-oriented subjects earn less money.

Given these results, it appears that high-DD individuals are not less strategic but indeed more spiteful. In other words, the alternative hypothesis (i.e., that high-DD individuals' decisions reflect a diminished capacity to maximize their own payoffs) fails the test of the individuals' payoffs. Therefore, from Results 1 to 5, only the spite account for the observed behavior of impatient individuals finds support.

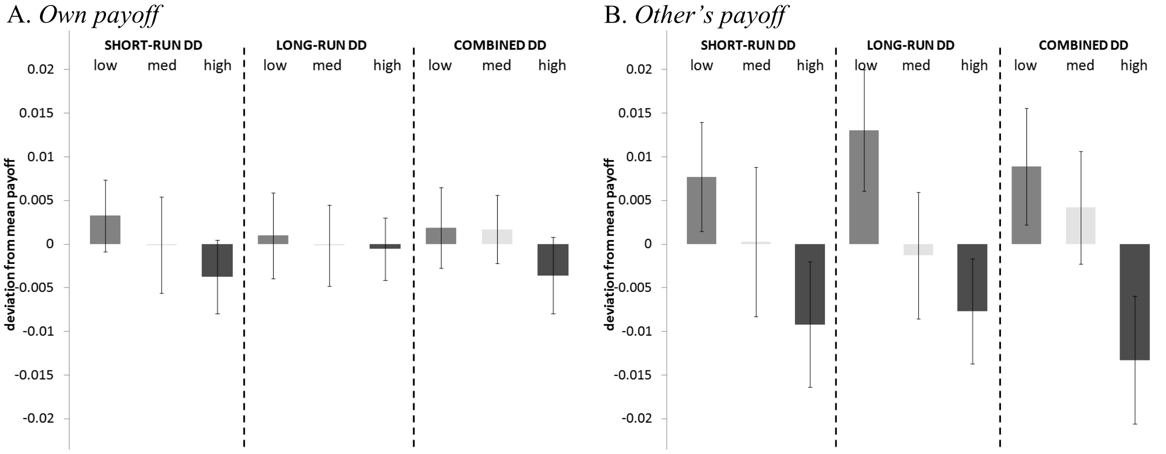


Figure 2. Own and other's payoff by DD groups. Mean (±robust SEM clustered by interviewer) *own payoff* (panel A) and *other's payoff* (panel B) by groups of DD (same groups as in Figure 1). Both own and other's mean payoffs are plotted in terms of their deviation from the mean payoff.

Finally, we look into the role of cognitive abilities in order to shed more light on how behavior and payoffs are linked to each other. Tables S1 to S4 in SI reveal that subjects endowed with higher cognitive abilities achieve a higher *own payoff* (P=0.009 in the regression using "combined DD"; Table S3, column (4)). However, higher cognitive abilities also predict higher MAOs (P=0.029; column (2)), which is at odds with the payoff maximizing behavior, i.e., setting MAO either to zero or to the smallest possible amount. In addition, cognitive abilities do not predict offers being closer to the equal split (P>0.7; column (1)), which in our sample would be the payoff maximizing behavior. That is, subjects with higher cognitive abilities succeed in achieving larger total payoffs, as one would expect, but at the same time they do not manifest payoff maximizing behavior when analyzing each role separately. Such an observation is important insofar as it shows that the relationship between the behavioral predictors (cognitive abilities and DD) and the final payoffs is not so clear-cut.[†] Concretely, in our case, what determines subjects' payoffs is the whole behavioral profile coming from both choices in the UG and the actual distribution of choices in the population. Thus, observing higher DD to predict both lower offers (Result 1) and higher MAOs (Result 2) but not lower payoffs (Result 4) should not be considered a puzzle.

[†] In contrast to previous studies (41, 42), cognitive abilities and DD are unrelated in our sample, regardless of the statistical approach employed (Ps>0.3).

Discussion

Low offers clearly violate fairness norms but, at the same time, they provide the perfect reason for envious or spiteful desires to arise (12, 37). Our design, in which subjects play both roles of the UG, allows exploring whether impatient responders are truly concerned with fairness when rejecting low offers. We find, however, that high DD predicts spiteful rather than fair strategies in both roles. These spiteful strategies involve the rejection of disadvantageous, “unfair” splits, but also the proposal of advantageous, “unfair” splits. Quite importantly, this behavioral pattern by high discounters does not lead them to earn less (i.e., their strategies are not less adaptive), but they result instead in significantly lower payoffs for those who interact with them. This is consistent with the observation of Marlowe et al. (43) that hunter-gatherers of smaller societies, assumed to strongly discount the future (44), show more spiteful behavior in the UG. Present orientation has indeed been related to both aggressive (45) and uncooperative (15) patterns.

We interpret this result as evidence that spiteful behavior responds to short-run psychological incentives. However, it could be argued that living environments favoring local (vs. global) competition for resources could impose social-ecological pressures for the selection of both spiteful and present-oriented preferences (46-48). Thus, both traits might serve as cognitive adaptations to environmental cues of local competition signaling a strong link between individuals’ reproductive success and their short-run relative standing. In fact, it has been found that exposure to harsh social conditions during childhood predicts later seemingly spiteful behavior in a repeated prisoner’s dilemma game (49). This line of argument could raise concerns on whether the way we interpret the relationship between impatience and spiteful behavior is the only possible one, or if instead there exists such an unobserved third variable driving the result. Although we control for a large set of socio-economic characteristics of subjects in the statistical analyses, this possibility cannot be completely ruled out. A more systematic approach to such potentially underlying processes would thus be an interesting endeavor for future research.

Based upon previous research (17), our findings suggest that rejection behavior in the UG might better resemble the spiteful punishment by free-riders in terms of its psychological foundations than the moralistic punishment by cooperators. In effect, the bargaining—intrinsically conflictive—nature of the UG could be generating a competitive environment, where outperforming the other player is a primary goal (34-36). In ultimatum bargaining, both players can make use of their own forces to prevent the other player from achieving her goals, thus offering a natural context for the expression of dominance behavior, which is deeply rooted in early human cognitive development (50, 51). Such an interpretation is supported by recent findings indicating that the rejection of low offers may reflect a tendency to avoid being subjugated to the other player (52).

Along these lines, Crockett et al. (32) found that serotonin-depleted participants were more likely to reject low offers in the UG, but tended to be less likely to punish low offers as third-party observers (which is considered to reflect a clear concern for social fairness, see ref. 53). Moreover, reducing subjects' serotonin levels was found to increase the psychological satisfaction (as measured by striatal activation) of rejecting low offers in the UG, but to decrease the satisfaction associated with receiving fair offers. These results indicate that reduced serotonergic activity predicts retaliatory motives behind the rejection of low offers in the UG rather than an enhanced preference for fairness. Our findings are consistent with those of Crockett et al. (32) insofar as there is an intimate link between low serotonin levels and high DD (16, 54). Thus, responders' retaliatory behavior triggered by serotonin depletion could reflect a present-oriented, spiteful desire to reduce the proposers' payoffs.

Taken together, these studies indicate that, in the UG, not all of rejection decisions are driven by the notion of fairness. Accordingly, they add up to a growing literature on social dilemma games (17, 26, 27, 55-57), giving support for the presence, not only of fairness concerns, but also of competitive spite—a pro-self rather than pro-social sentiment—as a key psychological ingredient behind costly punishment.

In social dilemmas, the punishment of free-riders by cooperators is considered a second-order cooperative behavior as it is beneficial for the group (58, 59) though not for the punisher (60) in the long term. However, both empirical (55) and theoretical (57, 61) evidence suggests that, under specific circumstances, spiteful punishment by free-riders may dramatically challenge the dynamics of cooperation and the long-run social efficiency. Special care has therefore to be taken when using the standard UG (where one cannot know whether or not the punisher wants to enforce fairness or take a spiteful, competitive attitude) as a device to study peer punishment and, on top of that, when building theories on how individuals, institutions or groups enforce the relevant social norms based on results from rejection behavior in this game. Future research should take into account that hyper-competitiveness (37) might be as fundamental to the complexity of human social behavior as ultra-sociality (62).

Methods

The delay-discounting task. In the discounting task, participants had to state their willingness to wait in order to receive a hypothetical monetary payoff. In contrast to the UG, decisions in this task were not incentivized with money for technical and logistical reasons and given that previous studies have shown that real incentives do not change the distribution of individual responses in DD tasks either within or between subjects (63-65; however, see ref. 66). Typically, participants had to choose between sooner-smaller rewards and larger, but more delayed rewards in a series of binary decisions. The larger the delayed amount needed for "convincing" an individual to wait, the higher her DD score.

We used the following protocol: The short-run DD was measured by having participants choose between €5 available "today" and €5+X (X = €0, … , €5) to be received "tomorrow". For the long-run DD, the six choices were between €150 delayed by one month and €150+X (X = €0, … , €100) delayed by seven months (see SI). The average number of impatient responses (out of six) was 2.75±0.127 (robust SEM clustered by interviewer to account for dependency between the observations gathered by the same interviewers, leaving a total of 108 independent groups) in the short-run subtask and 3.16±0.087 in the long-run one (see Figure S1 for the distribution of choices in the DD subtasks).

According to dual-valuation theories of DD (e.g., 67), these two measures would capture different components of the psychological evaluation of delayed rewards because the long-run subtask did not involve trading-off immediate payoffs. In contrast, single-valuation theories (e.g., 68) claim for a unique process underlying the evaluation of delayed and immediate rewards. The Spearman's rank order correlation between the number of impatient responses in short-run and long-run subtasks was 0.302 (*P*=0.000). This far-from-perfect correlation opens a door for the two measures to be actually capturing different psychological constructs and, consequently, having distinct associated behaviors (see SI for a discussion on this issue).

The Ultimatum Game. In the UG, all participants made decisions as both proposers and responders in random order. The pie to split was €20 (≈$27). As proposers, participants were asked to state which share of the €20 (in 10% increments) they wanted to offer to an anonymous partner. As responders, participants were asked to accept or reject each of the following proposals (proposer's payoff, responder's payoff): (€20, €0), (€18, €2), (€16, €4), (€14, €6), (€12, €8), (€10, €10), that is, the strategy method was employed (69). This allowed the elicitation of each participant's minimum acceptable offer (MAO). Apart from the obvious advantage of eliciting the full strategy profile for every participant, employing the strategy instead of the direct-response method allowed for the following crucial features of our design. First, the scope for rejections being guided by emotional reactivity against the proposer's actual behavior is reduced since responders decided in a rather "cold" state. Second, the outcome of the decision a participant made first (either proposer or responder, randomly chosen) could not have influenced her behavior at the second decision. Third, given that the main variable of interest was delay discounting, had we used the direct-response method, different temporal spillovers across roles would have prevented a clear interpretation of the results. That is, as proposers, participants would have to wait for the responder's decision in order to learn the outcome of the game, whereas as responders, the outcome would have been learnt automatically from their own decision.

Hence, through our experimental protocol we obtained the strategy profile for each subject consisting of an offer as proposer and a MAO as responder. After making their decisions, participants were randomly paired in order to calculate the real payoffs according to their chosen strategies and those of their counterparts. Thus, subjects were playing a one-shot, dual-role, simultaneous UG (see Figure S2 for the distribution of choices in the game). One out of every ten participants was randomly selected for real payment (see SI).

Expected payoffs. As described by refs 40 and 70, the average payoff for individual i (with offer=o_i and MAO=m_i) after interacting in both roles with individual j (o_j, m_j) is given by (a) $\frac{1}{2}(1-o_i+o_j)$ if $o_i \geq m_j$ and $o_j \geq m_i$; (b) $\frac{1}{2}(1-o_i)$ if $o_i \geq m_j$ and $o_j < m_i$; (c) $\frac{1}{2}o_j$ if $o_i < m_j$ and $o_j \geq m_i$; and (d) 0 if $o_i < m_j$ and $o_j < m_i$. Hence, the expected "*own payoff*" for individual i is calculated by weighting each of these four possible payoffs by the probability of that specific case occurring within our sample (i.e., its relative frequency). Analogously, the average payoff for individual i's partner (i.e., individual j; the "other") in the same cases is (a) $\frac{1}{2}(1-o_j+o_i)$; (b) $\frac{1}{2}o_i$; (c) $\frac{1}{2}(1-o_j)$; and (d) 0. The expected "*other's payoff*" for individual i is calculated by assigning weights (same as above) to the latter payoffs, and reflects the payoff an individual expects to get when interacting with individual i (see SI).

All participants in the experiments reported in the manuscript were informed about the content of the experiment prior to participating. Moreover, their anonymity was always preserved (in agreement with Spanish Law 15/1999 on Personal Data Protection) by randomly assigning them a numerical code to identify them in the system. No association was ever made between their real names and the results. As is standard in socio-economic experiments, no ethic concerns are involved other than preserving the anonymity of participants. This procedure was checked and approved by the Vice-dean of Research of the School of Economics of the University of Granada; the institution hosting the experiment.

Acknowledgements. This paper has benefitted from the comments and suggestions of Molly J. Crockett, Simon Gächter, David G. Rand, Angel Sánchez and participants at CCC Meeting 2011 (Nottingham), M-WASEB 2012 (Magdeburg), SEET 2012 (Lanzarote) and EC-JRC Summer School 2012 (Ispra). FE acknowledges the post-doctorate fellowship granted by the Scientific and Technological Research Council of Turkey (TUBITAK). Financial support from the Spanish Ministry of Science and Innovation (ECO2010-17049), the Government of Andalusia Project for Excellence in Research (P07.SEJ.02547) and the Ramón Areces Foundation (R + D 2011) is gratefully acknowledged.

REFERENCES

1. Güth W, Schmittberger R, Schwarze B (1982) An experimental analysis of ultimatum bargaining. *J Econ Behav Organ* 3: 367-388.
2. Sanfey AG, Rilling JK, Aronson JA, Nystrom LE, Cohen JD (2003) The neural basis of economic decision-making in the ultimatum game. *Science* 300: 1755-1758.
3. Henrich J et al. (2005) 'Economic man' in cross-cultural perspective: behavioral experiments in 15 small-scale societies. *J Behav Brain Sci* 28: 795-815.
4. Henrich J et al. (2006) Costly punishment across human societies. *Science* 312: 1767-1770.
5. Camerer C (2003) *Behavioral Game Theory: Experiments in Strategic Interaction*.(Princeton University Press, Princeton).
6. Roth AE, Prasnikar V, Okuno-Fujiwara M, Zamir S (1991) Bargaining and market behavior in Jerusalem, Ljubljana, Pittsburgh, and Tokyo: an experimental study. *Am Econ Rev* 81: 1068-1095.
7. Wells J, Rand D (2013) Strategic self-interest can explain seemingly "fair" offers in the ultimatum game. Available at http://ssrn.com/abstract=2136707.
8. Fehr E, Schmidt KM (1999) A theory of fairness, competition, and cooperation. *Q J Econ* 114: 817-868.
9. Bolton GE, Ockenfels A (2000) ERC: a theory of equity, reciprocity, and competition. *Am Econ Rev* 90: 166-193.
10. Rabin M (1993) Incorporating fairness into game theory and economics. *Am Econ Rev* 83: 1281-1302.
11. Charness G, Rabin M (2002) Understanding social preferences with simple tests. *Q J Econ* 117: 817-869.
12. Kirchsteiger G (1994) The role of envy in ultimatum games. *J Econ Behav Organ* 25: 373-389.
13. Levine DK (1998) Modeling altruism and spitefulness in experiments. *Rev Econ Dyn* 1: 593-622.
14. Fehr E, Schmidt KM (2006) in *Handbook of the Economics of Giving, Altruism and Reciprocity, vol. 1,* eds Kolm S-C, Ythier JM (Elsevier, Amsterdam) pp 615-691.
15. Curry OS, Price ME, Price JG (2008) Patience is a virtue: cooperative people have lower discount rates. *Pers Individ Dif* 44: 778-783.

16. Crockett MJ, Clark L, Lieberman MD, Tabibnia G, Robbins TW (2010) Impulsive choice and altruistic punishment are correlated and increase in tandem with serotonin depletion. *Emotion* 10: 855-862.
17. Espín AM, Brañas-Garza P, Herrmann B, Gamella JF (2012) Patient and impatient punishers of free-riders. *Proc Biol Sci* 279: 4923-4928.
18. Frederick S, Loewenstein G, O'Donoghue T (2002) Time discounting and time preference: a critical review. *J Econ Lit* 40: 351-401.
19. Green L, Myerson J (2004) A discounting framework for choice with delayed and probabilistic rewards. *Psychol Bull* 130: 769-792.
20. Luhmann CC (2009) Temporal decision-making: insights from cognitive neuroscience. *Front Behav Neurosci* 3: 39.
21. Kirby KN, Petry NM, Bickel WK (1999) Heroin addicts have higher discount rates for delayed rewards than non-drug-using controls. *J Exp Psychol Gen* 128: 78-87.
22. Chabris CF, Laibson DI, Morris CL, Schuldt JP, Taubinsky D (2008) Individual laboratory-measured discount rates predict field behavior. *J Risk Uncertain* 37: 237-269.
23. Meier S, Sprenger CD (2012) Time discounting predicts creditworthiness. *Psychol Sci* 23: 56-58.
24. Van't Wout M, Kahn RS, Sanfey AG, Aleman A (2006) Affective state and decision-making in the ultimatum game. *Exp Brain Res* 169: 564-568.
25. de Quervain DJ et al. (2004) The neural basis of altruistic punishment. *Science* 305: 1254-1258.
26. Shinada M, Yamagishi T, Ohmura Y (2004) False friends are worse than bitter enemies: 'altruistic' punishment of in-group members. *Evol Hum Behav* 25: 379-393.
27. Falk A, Fehr E, Fischbacher U (2005) Driving forces behind informal sanctions. *Econometrica* 73: 2017-2030.
28. Eldakar OT, Farrell DL, Wilson DS (2007) Selfish punishment: altruism can be maintained by competition among cheaters. *J Theor Biol* 249: 198-205.
29. Carpenter J (2003) Is fairness used instrumentally? Evidence from sequential bargaining. *J Econ Psychol* 24: 467-489.
30. Falk A, Fehr E, Fischbacher U (2003) Reasons for conflict: lessons from bargaining experiments. *J Inst Theor Econ* 159: 171-187.

31. Tabibnia G, Satpute AB, Lieberman MD (2008) The sunny side of fairness: preference for fairness activates reward circuitry (and disregarding unfairness activates self-control circuitry). *Psychol Sci* 19: 339-347.
32. Crockett MJ et al. (2013). Serotonin modulates striatal responses to fairness and retaliation in humans. *J Neurosci* 33: 3505-3513.
33. Tabibnia G, Lieberman MD (2007) Fairness and cooperation are rewarding: evidence from social cognitive neuroscience. *Ann N Y Acad Sci* 1118: 90-101.
34. Fliessbach K et al. (2007) Social comparison affects reward-related brain activity in the human ventral striatum. *Science* 318: 1305-1308.
35. Dvash J, Gilam G, Ben-Ze'ev A, Hendler T, Shamay-Tsoory SG (2010) The envious brain: the neural basis of social comparison. *Hum Brain Mapp* 31: 1741-1750.
36. Bault N, Joffily M, Rustichini A, Coricelli G (2011) Medial prefrontal cortex and striatum mediate the influence of social comparison on the decision process. *Proc Natl Acad Sci USA* 108: 16044-16049.
37. Jensen K (2010) Punishment and spite, the dark side of cooperation. *Philos Trans R Soc Lond B Biol Sci* 365: 2635-2650.
38. Exadaktylos F, Espín AM, Brañas-Garza P (2013) Experimental subjects are not different. *Sci Rep* 3: 1213.
39. Brandts J, Charness G (2011) The strategy versus the direct-response method: a first survey of experimental comparisons. *Exp Econ* 14: 375-398.
40. Iranzo J, Floría LM, Moreno Y, Sánchez A (2012) Empathy emerges spontaneously in the ultimatum game: Small groups and networks. *PloS one,* 7: e43781.
41. Burks SV, Carpenter JP, Goette L, Rustichini A (2009) Cognitive skills affect economic preferences, strategic behavior, and job attachment. *Proc Natl Acad Sci USA* 106: 7745-7750.
42. Dohmen T, Falk A, Huffman D, Sunde U (2010) Are risk aversion and impatience related to cognitive ability? *Am Econ Rev* 100: 1238-1260.
43. Marlowe FW et al. (2011) The 'spiteful' origins of human cooperation. *Proc Biol Sci* 278: 2159-2164.
44. Woodburn J (1980) in *Soviet and Western Anthropology*, ed Gellner E (Duckworth, London), pp 95-117.

45. Nelson RJ, Trainor BC (2007) Neural mechanisms of aggression. *Nat Rev Neurosci* 8: 536-546.
46. Gardner A, West SA (2004) Spite and the scale of competition. *J Evol Biol* 17: 1195-1203.
47. Daly M, Wilson M (2005) Carpe diem: adaptation and devaluing the future. *Q Rev Biol* 80: 55-60.
48. Hill EM, Jenkins J, Farmer L (2008) Family unpredictability, future discounting, and risk taking. *J Socio Econ* 37: 1381-1396.
49. McCullough ME, Pedersen EJ, Schroder JM, Tabak BA, Carver CS (2013) Harsh childhood environmental characteristics predict exploitation and retaliation in humans. *Proc Biol Sci* 280: 20122104.
50. Mascaro O, Csibra G (2012) Representation of stable social dominance relations by human infants. *Proc Natl Acad Sci USA* 109: 6862-6867.
51. Thomsen L, Frankenhuis WE, Ingold-Smith MC, Carey S (2011) Big and mighty: preverbal infants mentally represent social dominance. *Science* 331: 477-480.
52. Yamagishi T et al. (2012) Rejection of unfair offers in the ultimatum game is no evidence of strong reciprocity. *Proc Natl Acad Sci USA* 109: 20364-20368.
53. Fehr E, Fischbacher U (2004) Third-party punishment and social norms. *Evol Hum Behav* 25: 63-87.
54. Schweighofer N et al. (2008) Low-serotonin levels increase delayed reward discounting in humans. *J Neurosci* 28: 4528-4532.
55. Herrmann B, Thöni C, Gächter S (2008) Antisocial punishment across societies. *Science* 319: 1362-1367.
56. Gächter S, Herrmann B (2009) Reciprocity, culture and human cooperation: previous insights and a new cross-cultural experiment. *Philos Trans R Soc Lond B Biol Sci* 364: 791-806.
57. Rand DG, Nowak MA (2011) The evolution of antisocial punishment in optional public goods games. *Nat Commun* 2: 434.
58. Fehr E, Gächter S (2002) Altruistic punishment in humans. *Nature* 415: 137-140.
59. Gächter S, Renner E, Sefton M (2008) The long-run benefits of punishment. *Science* 322: 1510.

60. Dreber A, Rand DG, Fudenberg D, Nowak MA (2008) Winners don't punish. *Nature* 452: 348-351.
61. Rand DG, Armao IV JJ, Nakamaru M, Ohtsuki H (2010) Anti-social punishment can prevent the co-evolution of punishment and cooperation. *J Theor Biol* 265: 624-632.
62. Richerson PJ, Boyd R (1998) in *Ideology, Warfare, and Indoctrinability; Evolutionary Perspectives*, eds Eibl-Eibisfeldt I, Salter F . (Berghahn Books, London), pp 71-95.
63. Johnson MW, Bickel WK (2002) Within-subject comparison of real and hypothetical money rewards in delay discounting. *J Exp Anal Behav* 77: 129-146.
64. Lagorio CH, Madden GJ (2005) Delay discounting of real and hypothetical rewards III: steady-state assessments, forced-choice trials, and all real rewards. *Behav Processes* 69: 173-187.
65. Madden GJ, Raiff BR, Lagorio CH, Begotka AM (2004) Delay discounting of potentially real and hypothetical rewards II: between- and within-subject comparisons. *Exp Clin Psychopharmacol* 12: 251-261.
66. Coller M, Williams MB (1999) Eliciting individual discount rates. *Exp Econ* 2: 107-127.
67. McClure SM, Laibson DI, Loewenstein G, Cohen JD (2004) Separate neural systems value immediate and delayed monetary rewards. *Science* 306: 503-507.
68. Kable JW, Glimcher PW (2007) The neural correlates of subjective value during intertemporal choice. *Nat Neurosci* 10: 1625-1633.
69. Mitzkewitz M, Nagel R (1993) Experimental results on ultimatum games with incomplete information. *Int J Game Theory* 22: 171-198.
70. Rand DG, Tarnita CE, Ohtsuki H, Nowak MA (2013) Evolution of fairness in the one-shot anonymous Ultimatum Game. *Proc Natl Acad Sci USA* 110: 2581-2586.

Supporting Information (SI) for

Short- and long-run goals in ultimatum bargaining

S1. Materials and Methods

The survey-experiment was conducted from November 23rd to December 15th 2010, recruiting a total of 835 individuals from the adult population of the city of Granada, Spain. The sample was representative in terms of the geographical location of households within the city, age and gender of the participants (detailed information regarding sampling procedures as well as experimental protocols and games' instructions can be found in Exadaktylos et al. [S1]). Participants were ex-ante informed that the data would be used for scientific purposes only, that responses would never be linked to the identity of the respondent and that the procedures followed for the study and data acquisition were in accordance to the Spanish law on data protection guarantying full anonymity. Each respondent was interviewed in his/her own house by a pair of interviewers (108 pairs in total). Interviewers were last-course university students from the University of Granada, enrolled in a course on "field experiments", which involved their training on the methodology and conduction of survey-experiments. Their performance was carefully monitored by the main researchers through a web-based system and linked to their final grade in the course.

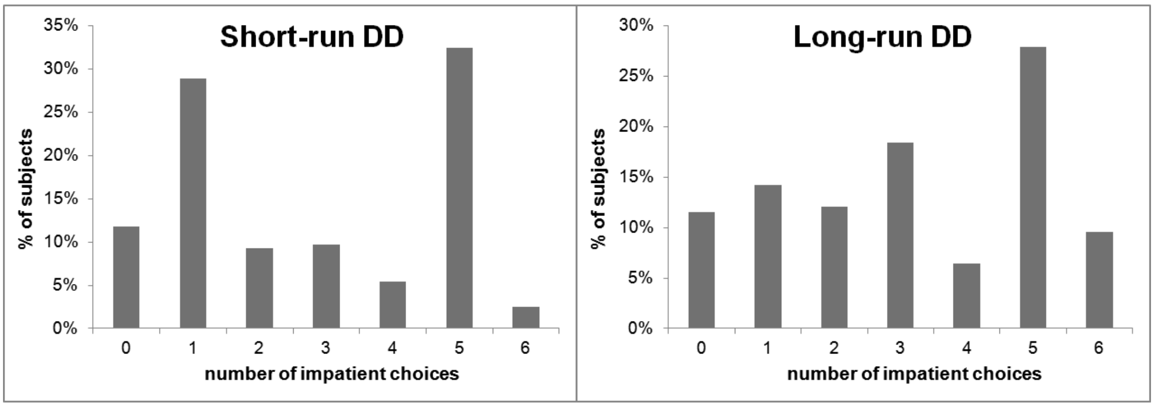
For statistical analysis purposes, we have used only those participants whose responses in both the delay discounting task and the ultimatum game were complete and reliable. This involved excluding those individuals making multiple switching or following non-monotonic patterns in either the delay discounting task or the Ultimatum Game, and those never switching from the sooner to the later reward in any of the two DD tasks (see below). Additionally, only complete observations with regards to control variables were included, which is the usual practice when dealing with field data. The final sample consists of 713 complete observations (average age 36.7±16.6 (SD), 54.14% female).

S1.1. The delay discounting task

Two series of inter-temporal decisions involving hypothetical monetary rewards were presented. One of the interviewers read each of the decisions involved in both subtasks, one at a time, and the interviewee gave his or her responses also by word of mouth. Participants faced a total of six decisions in each task. In the first decision of the short-run DD subtask, participants had to choose between €5 to be received "today" (sooner option) and €5 to be received "tomorrow" (later option). The remaining five decisions kept the sooner reward constant while increasing the later reward, in the following order: €6, €7, €8, €9, €10. In the first decision of the long-run DD subtask, participants had to choose between €150 to be received in one month time (sooner option) and €150 to be received in seven months time (later option). The remaining five decisions kept the sooner reward constant while increasing the later reward, in the following order: €170, €190, €210, €230, €250.

This task was specifically adopted to meet the particular purposes and restrictions of the survey-experiment. The two discounting measures captured by the task were not designed in order to allow for parameterization (i.e., in order to be characterized in a particular functional form) but rather in order to allow a non-parametric characterization, that is, the number of impatient responses. The distribution of subjects' choices in the task is shown in Figure S1. In the case of the short-run DD, two categories concentrate more than 60% of subjects, while choices in the long-run DD are better distributed.

Figure S1. Distribution of subjects' choices in the DD tasks



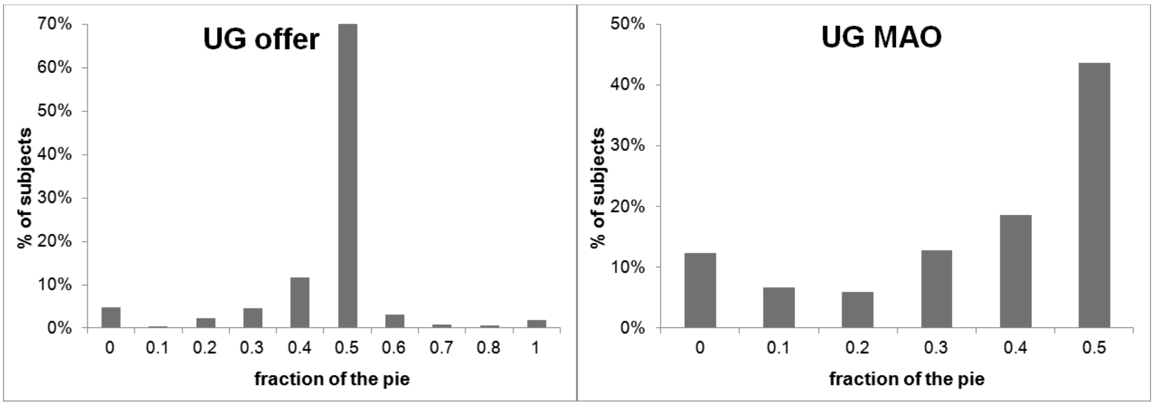
According to dual-valuation theories of DD [S2, S3], decisions involving immediate and delayed rewards are evaluated in the brain differently than those involving only delayed rewards. Concretely, the so-called "beta" and "delta" systems would be at work for valuating delayed rewards [S4]. The impatient beta system is supposed to steeply discount all non-immediate rewards (i.e., there is an immediacy premium or a present bias). The more patient delta system would discount delays in a less-steep, exponential shape. Thus, the subjective value of a delayed reward would result from subtracting the non-immediacy penalization (beta system) from the discounted value of the reward (delta system). It could be therefore that the two DD measures we obtained are in association with different behavioral patterns in the UG since only the short-run subtask involved immediate payoffs—meaning that the beta system would not determine choices in the long-run DD. On the contrary, single-valuation theories [S5, S6] argue in favor of a single psychological process evaluating both immediate and delayed rewards. This process would discount the value of all rewards in function of the delay to their delivery, following an hyperbolic form. According to this view, no behavioral differences should be found for the two DD measures we gathered.

S1.2. The ultimatum game

All participants made decisions in both roles of the game. As proposers, subjects made an offer to a randomly matched participant on how to split a pie of €20 (in €2 increments). The average offer was 46.2% (±0.7; robust SEM clustered by interviewers) of the pie. In the role of responders, subjects had to state their willingness to accept or reject each of the following proposals (proposer's payoff (€), responder's payoff (€)): (20, 0); (18, 2); (16, 4); (14, 6); (12, 8); (10, 10). With this method we obtained the minimum acceptable offer (MAO) of each subject. The average MAO was 35.0% (±0.9) of the pie. These averages are within the range found in previous ultimatum field experiments [S7]. Figure S2 displays the distribution of offers and MAOs (expressed as fraction of the pie) in the sample.

The instructions of the game were read aloud by one of the interviewers. Subsequently, participants were required to privately write down their choices on a decision sheet, which was later introduced in an envelope to ensure a double-blind procedure. The order in which decisions were made was randomized across participants. Matching and payment took place within the next two weeks and the average earnings among winners were €9.60.

Figure S2. Distribution of subjects' choices in the UG



S1.3. Calculation of expected payoffs

To calculate the expected payoffs of participants we simulated a perfect random matching. In particular, the UG offer (o_i) and the MAO (m_i) of every subject was matched with, respectively, the MAO (m_j, j=1…N, $j≠i$) and the offer (o_j, j=1…N, $j≠i$) of every other subject. After interacting with all the other subjects in both roles of the game, each subject's *own payoff* will be simply given by her mean payoff across the 712 encounters. Furthermore, for every subject we have also computed the *other's payoff*, which is given by the mean payoff of the other 712 participants from their interactions with this subject (again, taking both roles into account). That is, the *other's payoff* of participant *i* is a measure of how much one expects to earn when interacting with *i*. This measure is not to be confounded with the mean *own payoff* of the other subjects.

The average payoff for individual *i* after interacting in both roles with individual *j* is given by [S8, S9]:

a) $\frac{1}{2}(1-o_i+o_j)$ if $o_i \geq m_j$ and $o_j \geq m_i$;
b) $\frac{1}{2}(1-o_i)$ if $o_i \geq m_j$ and $o_j < m_i$;
c) $\frac{1}{2}o_j$ if $o_i < m_j$ and $o_j \geq m_i$;
d) 0 if $o_i < m_j$ and $o_j < m_i$.

Then, the expected "*own payoff*" for individual i is calculated by weighting each of these four possible payoffs by the probability of that specific case occurring in the sample (i.e., its relative frequency). Likewise, the average payoff for individual i's partner (i.e., individual j; the "other") is given by:

a) ½$(1-o_j+o_i)$ if if $o_i \geq m_j$ and $o_j \geq m_i$
b) ½o_i if $o_i \geq m_j$ and $o_j < m_i$;
c) ½$(1-o_j)$ if $o_i < m_j$ and $o_j \geq m_i$;
d) 0 if $o_i < m_j$ and $o_j < m_i$.

Again, the expected "*other's payoff*" for individual i is calculated by assigning weights (same as above) to the latter payoffs. Let us illustrate how we calculate both *own payoff* and *other's payoff* with an example.

We use a simple case with only three subjects whose strategies are (o_1, m_1) = (8, 4), (o_2, m_2) = (2, 6) and (o_3, m_3) = (4, 10). We look into the case of subject 1. Performing the random matching, this subject is matched with all other subjects; subjects 2 and 3 in this example. From her interaction with subject 2, subject 1's payoff is given by ½(20-8)=6 since 8≥6 and 2<4 (case b) above). Similarly, interacting with subject 3, subject 1's payoff will be: ½4=2 since 8<10 and 4≥4 (case c) above). To calculate the *own payoff* of subject 1, we attach the appropriate weight to the above payoffs, which in this case is 0.5 for both payoffs (i.e., their relative frequency is 50%; the weight of the remaining possible cases is obviously zero). Thus the *own payoff* is 0.5*6 + 0.5*2 = 4.

Let us now calculate the *other's payoff* corresponding to subject 1. From her interaction with subject 1, subject 2's payoff will be determined as follows: ½8=4 since 8≥6 and 2<4 (case b) above). From her interaction with subject 1, subject 3's payoff will be: ½(20-4)=8 since 8<10 and 4≥4 (case c) above). In order to calculate the *other's payoff* we attach the corresponding weight to each payoff, which again in this particular example is 0.5 in both cases. Thus the *other's payoff* for subject 1 is 0.5*4 + 0.5*8 = 6.

Similarly we can calculate the *own payoff* of subjects 2 and 3, which are 2 and 4 respectively. It is important to note that the *other's payoff* of subject 1 is different than the mean *own payoff* of the other two subjects, which is (2+4)/2= 3.

S2. Supporting analyses

S2.1. Variables description

In the next subsection, we will provide the estimates of the regressions summarized in Table 1 of the main text. "Short-run DD" and "long-run DD" refer to the number of impatient responses the individual made for each delay; "combined DD" is the average of the two (these three categorizations of DD are normalized to the interval [0, 1]); "highDD vs. lowDD" takes the value 1 if the individual belongs to the top 33% and 0 if belongs to the bottom 33% of the distribution of "combined DD" (observations falling in the central 33% are missing in the analyses using this variable).

The control variables employed in the regressions are:

- *Age* ϵ [16, 89].

- *Male*: 1 if male, 0 if female.

- *Married*: 1 if married, 0 otherwise.

- *House inc* ϵ [0, 4500]: average household monthly income in the last year (in €500 increments).

- *Educ level* ϵ [0, 8]: no studies (0), incomplete primary school (1), complete primary school (2), incomplete secondary school (3), complete secondary school (4), incomplete university diploma or technical degree (5), complete university diploma or technical degree (6), incomplete bachelor or postgraduate degree (7), complete bachelor or postgraduate degree (8).

- *Cognit ab* ϵ [0, 5]: number of correct answers to the following five mathematical questions:

> 1. *If the probability of being infected by an illness is 10%, how many persons of a group of 1000 would be infected by that kind of illness?*

2. *If there are 5 persons that own the winning lottery ticket and the prize to be shared is two million euros, how much money would each person receive?*

3. *Suppose that you have 100€ in a savings account and the rate of interest that you earn from the savings is 2% per year. If you keep the money in the account for 5 years, how much money would you have at the end of these 5 years?:*
a. More than 102€
b. 102€ exactly
c. Less than 102€
d. S/he cannot/do not want to answer

4. *Suppose that you have 100€ in a savings account. The account accumulates a 10% rate of interest per year. How much money would you have in your account after two years?*

5. *The total cost of a bat and a ball is 1.10 euros. The bat costs 1 euro more than the ball. How many cents does the ball cost?*

- *Risk 1*: 1 if option b, 0 if option a in the question:

We flip a coin. Choose one of the following options:

a. Take 1.000 Euros no matter if it is heads or tails.

b. Take 2.000 Euros if it is heads and nothing if it is tails.

- *Risk 2*: 1 if option a, 0 if option b in the question:

Choose one of the following options:

a. Take a lottery ticket with 80% chance of winning 45 Euros and 20% chance of winning nothing.

b. Take 30 Euros.

- *Risk 3*: 1 if 'Yes', 0 if 'No' in the question:

Would you accept the following deal? We flip a coin. If it is heads you win 1,500 Euros and if it is tails you lose 1,000 Euros: Yes (Y), No (N)

S2.2. Regression analyses

Tables S1 to S4, present the OLS regressions using “short-run DD”, “long-run DD”, “combined DD”, and “highDD vs. lowDD”, respectively, to characterize delay discounting as explanatory variables. The dependent variables (expressed as a fraction of the pie) in columns (1) to (5) are, respectively: offer, MAO, offer-MAO, *own payoff*, and *other’s payoff*. In all regressions we control also for order effects. Robust standard errors clustered by interviewers are presented in brackets.

From the regression analyses it appears that the effect of DD on behavior and payoffs does not crucially depend on which period-length is used to measure it, though it is more prominent in the case of the longer delay. It might be that the “beta” component of DD (see Text S1.1) has no influence on behavior and it is the “delta” component which drives the results. This would explain why the long-run DD yields better estimates. However, this result can also be due to the higher noise of observations in the short-run DD subtask (see Figure S1). Thus, our results do not provide unequivocal support for single- or dual-valuation theories.[‡]

Among the control variables, only the subjects’ cognitive abilities, marital status and risk preferences yield significant coefficients across models. Cognitive abilities relate positively to MAO and *own payoff*, as reported in the main text. Different risk-taking measures report different relationships with behavior, thus making an interpretation difficult (also, a high level of collinearity between the measures could influence the estimation). Finally, married subjects are found to be less willing to reject low offers (i.e., they have a lower MAO), although weakly.

[‡] Although the task was not designed to allow for parameterization, we have used the data to analyze the separate effects of empirically estimated “beta” and “delta” discount factors (following the methodology employed in Burks et al. [S10]) and, as expected, delta predicts subjects’ behavior slightly better than beta but still both measures are linked to the same patterns (available upon request from the authors).

Table S1. UG behavior and expected payoffs as a function of *short-run DD*

	offer **(1)**	**MAO** **(2)**	**offer-MAO** **(3)**	***own payoff*** **(4)**	***other's payoff*** **(5)**
short-run DD	-0.0294	0.0428*	-0.0722**	-0.0115	-0.0252*
	(0.021)	(0.022)	(0.032)	(0.007)	(0.013)
age	0.0003	0.0008	-0.0005	0.0000	0.0003
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
male	-0.0025	-0.013	0.0104	-0.0043	0.0005
	(0.010)	(0.013)	(0.015)	(0.004)	(0.006)
married	-0.0070	-0.0325*	0.0255	0.0053	-0.0038
	(0.014)	(0.017)	(0.024)	(0.005)	(0.008)
house inc	-0.0000	0.0000	-0.0000	-0.0000	-0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
educ level	0.0021	-0.0041	0.0062	0.0011	0.0027
	(0.004)	(0.003)	(0.005)	(0.001)	(0.002)
cognit ab	0.0014	0.0117**	-0.0102	0.0052***	-0.0014
	(0.005)	(0.005)	(0.007)	(0.002)	(0.003)
risk 1	-0.0110	0.0560***	-0.0670**	-0.0044	-0.0133
	(0.016)	(0.0189)	(0.026)	(0.006)	(0.010)
risk 2	-0.0070	-0.0153	0.0083	-0.0021	-0.0008
	(0.013)	(0.017)	(0.023)	(0.005)	(0.009)
risk 3	0.0422**	-0.0381	0.0803*	0.0001	0.0266*
	(0.020)	(0.031)	(0.041)	(0.009)	(0.014)
R^2	0.0415	0.0655	0.0511	0.0635	0.0523
F	2.42***	2.15***	1.72**	3.78***	1.47*
obs.	713	713	713	713	713

Notes: OLS estimates. Robust standard errors clustered by interviewers in brackets.*, **, *** indicate significance at the 0.10, 0.05 and 0.01 levels, respectively. All regressions control for order effects.

Table S2. UG behavior and expected payoffs as a function of *long-run DD*

	offer **(1)**	**MAO** **(2)**	**offer-MAO** **(3)**	***own payoff*** **(4)**	***other's payoff*** **(5)**
long-run DD	-0.0324**	0.0393*	-0.0717***	0.0018	-0.0269***
	(0.016)	(0.020)	(0.024)	(0.006)	(0.010)
age	0.0002	0.0008	-0.0006	0.0000	0.0003
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
male	-0.0018	-0.0138	0.0120	-0.0041	0.0011
	(0.010)	(0.012)	(0.015)	(0.004)	(0.006)
married	-0.0059	-0.0334*	0.0274	0.0046	-0.0030
	(0.014)	(0.018)	(0.025)	(0.005)	(0.009)
house inc	-0.0000	0.0000	-0.0000	-0.0000	-0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
educ level	0.0023	-0.0044	0.0067	0.0012	0.0029
	(0.004)	(0.003)	(0.005)	(0.001)	(0.002)
cognit ab	0.0012	0.0120**	-0.0108	0.0051***	-0.0016
	(0.005)	(0.005)	(0.007)	(0.002)	(0.003)
risk 1	-0.0120	0.0569***	-0.0688***	-0.0036	-0.0141
	(0.016)	(0.019)	(0.025)	(0.006)	(0.010)
risk 2	-0.0049	-0.0182	0.0133	-0.0015	0.0010
	(0.013)	(0.017)	(0.023)	(0.005)	(0.008)
risk 3	0.0407**	-0.0364	0.0770*	0.0004	0.0254*
	(0.020)	(0.031)	(0.040)	(0.009)	(0.014)
R^2	0.0423	0.0646	0.0509	0.0601	0.0532
F	2.17***	2.14***	1.92**	4.37***	1.57*
obs.	713	713	713	713	713

Notes: OLS estimates. Robust standard errors clustered by interviewers in brackets.*, **, *** indicate significance at the 0.10, 0.05 and 0.01 levels, respectively. All regressions control for order effects.

Table S3. UG behavior and expected payoffs as a function of *combined DD*

	offer **(1)**	**MAO** **(2)**	**offer-MAO** **(3)**	***own payoff*** **(4)**	***other's payoff*** **(5)**
combined DD	-0.0437**	0.0581**	-0.1018***	-0.0070	-0.0369***
	(0.021)	(0.024)	(0.032)	(0.008)	(0.013)
age	0.0002	0.0008	-0.0006	0.0000	0.0003
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
male	-0.0021	-0.0133	0.0112	-0.0041	0.0008
	(0.010)	(0.012)	(0.015)	(0.004)	(0.006)
married	-0.0054	-0.0343*	0.0289	0.0052	-0.0026
	(0.014)	(0.017)	(0.024)	(0.005)	(0.009)
house inc	-0.0000	0.0000	-0.0000	-0.0000	-0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
educ level	0.0022	-0.0042	0.0064	0.0012	0.0027
	(0.004)	(0.003)	(0.005)	(0.001)	(0.002)
cognit ab	0.0014	0.0117**	-0.0103	0.0051***	-0.0014
	(0.005)	(0.005)	(0.007)	(0.002)	(0.003)
risk 1	-0.0126	0.0580***	-0.0707***	-0.0043	-0.0147
	(0.016)	(0.019)	(0.026)	(0.006)	(0.010)
risk 2	-0.0063	-0.0164	0.0101	-0.0016	-0.0002
	(0.013)	(0.017)	(0.023)	(0.005)	(0.008)
risk 3	0.0408**	-0.0363	0.0771*	0.0000	0.0255*
	(0.020)	(0.031)	(0.040)	(0.009)	(0.014)
R^2	0.0443	0.0680	0.0560	0.0610	0.0567
F	2.39***	2.24***	1.97***	4.30***	1.59*
obs.	713	713	713	713	713

Notes: OLS estimates. Robust standard errors clustered by interviewers in brackets.*, **, *** indicate significance at the 0.10, 0.05 and 0.01 levels, respectively. All regressions control for order effects.

Table S4. UG behavior and expected payoffs as a function of *highDD vs. lowDD*

	offer **(1)**	**MAO** **(2)**	**offer-MAO** **(3)**	***own payoff*** **(4)**	***other's payoff*** **(5)**
hDD vs. lDD	-0.0281*	0.0431***	-0.0711***	-0.0069	-0.0231**
	(0.014)	(0.015)	(0.021)	(0.005)	(0.009)
age	-0.0003	0.0007	-0.0011	-0.0002	0.0000
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
male	-0.0016	-0.0118	0.0102	-0.0062	0.0017
	(0.016)	(0.014)	(0.022)	(0.005)	(0.010)
married	0.0022	-0.0401*	0.0423	0.0088	0.0011
	(0.017)	(0.021)	(0.029)	(0.007)	(0.011)
house inc	-0.0000	0.0000	-0.0000	-0.0000	-0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
educ level	0.0056	-0.0086**	0.0143*	0.0009	0.0048
	(0.005)	(0.004)	(0.007)	(0.002)	(0.003)
cognit ab	0.0022	0.0167**	-0.0145	0.0063**	-0.0014
	(0.007)	(0.006)	(0.010)	(0.003)	(0.004)
risk 1	-0.0147	0.0613**	-0.0761**	0.0001	-0.0163
	(0.020)	(0.026)	(0.035)	(0.008)	(0.014)
risk 2	-0.0096	-0.0078	-0.0018	-0.0093	-0.0036
	(0.017)	(0.018)	(0.026)	(0.006)	(0.010)
risk 3	0.0399	-0.0434	0.0833	0.0012	0.0278
	(0.026)	(0.041)	(0.056)	(0.013)	(0.019)
R^2	0.0611	0.0899	0.0774	0.0790	0.0711
F	2.47***	4.06***	2.09***	3.58***	1.71**
obs.	488	488	488	488	488

Notes: OLS estimates. Robust standard errors clustered by interviewers in brackets.*, **, *** indicate significance at the 0.10, 0.05 and 0.01 levels, respectively. All regressions control for order effects.

REFERENCES

S1. Exadaktylos F, Espín AM, Brañas-Garza P (2013) Experimental subjects are not different. *Sci Rep* 3: 1213.

S2. McClure SM, Laibson DI, Loewenstein G, Cohen JD (2004) Separate neural systems value immediate and delayed monetary rewards. *Science* 306: 503-507.

S3. McClure SM, Ericson KM, Laibson DI, Loewenstein G, Cohen JD (2007) Time discounting for primary rewards. *J Neurosci* 27: 5796-5804.

S4. Laibson D (1997) Golden eggs and hyperbolic discounting. *Q J Econ* 112: 443-478.

S5. Kable JW, Glimcher PW (2007) The neural correlates of subjective value during intertemporal choice. *Nat Neurosci* 10: 1625-1633.

S6. Ainslie GW (1992) *Picoeconomics: The Strategic Interaction of Successive Motivational States Within the Person* (Cambridge University Press, Cambridge).

S7. Henrich J et al. (2006) Costly punishment across human societies. *Science* 312: 1767-1770.

S8. Rand DG, Tarnita CE, Ohtsuki H, Nowak MA (2013) Evolution of fairness in the one-shot anonymous Ultimatum Game. *Proc Natl Acad Sci USA* 110: 2581-2586.

S9. Iranzo J, Floría LM, Moreno Y, Sánchez A (2012) Empathy emerges spontaneously in the ultimatum game: Small groups and networks. *PloS one,* 7: e43781.

S10. Burks SV, Carpenter JP, Goette L, Rustichini A (2009) Cognitive skills affect economic preferences, strategic behavior, and job attachment. *Proc Natl Acad Sci USA* 106: 7745-7750.

Economic Science Institute Working Papers

2013

13-16 Schniter, E. and Shields, T. Recalibrational Emotions and the Regulation of Trust-Based Behaviors.

13-15 Corgnet, B., Hernán-Gonzalez, R., and Rassenti, S. Firing Threats and Tenure: Incentive effects and impression management.

13-14 Erik O. Kimbrough, E., and Rubin, J. Sustaining Group Reputation.

13-13 Moore, K., Sun, P., de Vries, C., and Zhou, C. Shape Homogeneity and Scale Heterogeneity of Downside Tail Risk.

13-12 Chowdhury, S., Lee, D., and Sheremeta, R. Top Guns May Not Fire: Best-Shot Group Contests with Group-Specific Public Good Prizes.

13-11 Kimbrough, E., Rubin, J., Sheremeta, R., Shields, T. Commitment Problems in Conflict Resolution.

13-10 Klose, B. and Kovenock, D. The All-Pay Auction with Complete Information and Identity-Dependent Externalities.

13-09 Branas-Garza, P., Kovarik, J., and Neyse, L. Second-to-Fourth Digit Ratio has a Non-Monotonic Impact on Altruism.

13-08 McCarter, M., Samak, A., and Sheremeta, R. Divided Loyalties or Conditional Cooperation? An experimental study of contributions to multiple public goods.

13-07 Gabaix, X., Laibson, D., Li, D., Li, H., Resnick, S., and de Vries, C. The Impact of Competition on Prices with Numerous Firms.

13-06 Sheremeta, R. Overbidding and Heterogeneous Behavior in Contest Experiments.

13-05 Deck, C. and Porter, D. Prediction Markets in the Laboratory.

13-04 Corgnet, B., Hernán-Gonzalez, R., Kujal, P., and Porter, D. The Effect of Earned vs. House Money on Price Bubble Formation in Experimental Asset Markets.

13-03 Sheremeta, R. and Zhang, J. Three-Player Trust Game with Insider Communication.

13-02 McCarter, M. and Sheremeta, R. You Can't Put Old Wine in New Bottles: The Effect of Newcomers on Coordination in Groups.

13-01 Corgnet, B., Hernan-Gonzalez, R., and Rassenti, S. Peer Pressure and Moral Hazard in Teams: Experimental Evidence.

2012

12-31 Thomas, C. An Alternating-Offers Model of Multilateral Negotiations.

12-30 Mago, S., Sheremeta, R. and Yates, A. Best-of-Three Contest Experiments: Strategic versus psychological momentum.

12-29 Bigoni, M., Camera, G. and Casari, M. Strategies of Cooperation and Punishment among Students and Clerical Workers.

12-28 Camera, G. and Kim, J. Buyer's Equilibrium with Capacity Constraints and Restricted Mobility: A recursive approach.

12-27 Camera, G., Casari, M., and Bigoni, M. Binding Promises and Cooperation Among Strangers.

12-26 Schniter, E., Shields, T. and Dickhaut, J. Ageism & Cooperation.

12-25 Gjerstad, S. and Smith, V. Balance Sheet Crises: Causes, Consequences and Responses.

12-24 Gómez-Miñambres, J., Corgnet, B. and Hernán-Gonzalez, R. Goal Setting and Monetary Incentives: When Large Stakes Are Not Enough.

12-23 Clots-Figueras, I., Hernán González, R., and Kujal, P. Asymmetry and Deception in the Investment Game.

12-22 Dechenaux, E., Kovenock, D. and Sheremeta, R. A Survey of Experimental Research on Contests, All-Pay Auctions and Tournaments.

12-21 Rubin, J. and Sheremeta, R. Principal-Agent Settings with Random Shocks.

12-20 Gómez-Miñambres, J. and Schniter, E. Menu-Dependent Emotions and Self-Control.

12-19 Schniter, E., Sheremeta, R., and Sznycer, D. Building and Rebuilding Trust with Promises and Apologies.

12-18 Shields, T. and Xin, B. Higher-order Beliefs in Simple Trading Models.

12-17 Pfeiffer, G. and Shields, T. Performance-Based Compensation and Firm Value: Experimental evidence.

12-16 Kimbrough, E. and Sheremeta, R. Why Can’t We Be Friends? Entitlements, bargaining, and conflict.

12-15 Mago, S., Savikhin, A., and Sheremeta, R. Facing Your Opponents: Social identification and information feedback in contests.

12-14 McCarter, M., Kopelman, S., Turk, T. and Ybarra, C. Too Many Cooks Spoil the Broth: How the tragedy of the anticommons emerges in organizations.

12-13 Chowdhury, S., Sheremeta, R. and Turocy, T. Overdissipation and Convergence in Rent-seeking Experiments: Cost structure and prize allocation rules.

12-12 Bodsky, R., Donato, D., James, K. and Porter, D. Experimental Evidence on the Properties of the California's Cap and Trade Price Containment Reserve.

12-11 Branas-Garza, P., Espin, A. and Exadaktylos, F. Students, Volunteers and Subjects: Experiments on social preferences.

12-10 Klose, B. and Kovenock, D. Extremism Drives Out Moderation.

12-09 Buchanan, J. and Wilson, B. An Experiment on Protecting Intellectual Property.

12-08 Buchanan, J., Gjerstad, S. and Porter, D. Information Effects in Multi-Unit Dutch Auctions.

12-07 Price, C. and Sheremeta, R. Endowment Origin, Demographic Effects and Individual Preferences in Contests.

12-06 Magoa, S. and Sheremeta, R. Multi-Battle Contests: An experimental study.

12-05 Sheremeta, R. and Shields, T. Do Liars Believe? Beliefs and Other-Regarding Preferences in Sender-Receiver Games.

12-04 Sheremeta, R., Masters, W. and Cason. T. Winner-Take-All and Proportional-Prize Contests: Theory and experimental results.

12-03 Buchanan, J., Gjerstad, S. and Smith, V. There's No Place Like Home.

12-02 Corgnet, B. and Rodriguez-Lara, I. Are you a Good Employee or Simply a Good Guy? Influence Costs and Contract Design.

12-01 Kimbrough, E. and Sheremeta, R. Side-Payments and the Costs of Conflict.

2011

11-20 Cason, T., Savikhin, A. and Sheremeta, R. Behavioral Spillovers in Coordination Games.

11-19 Munro, D. and Rassenti, S. Combinatorial Clock Auctions: Price direction and performance.

11-18 Schniter, E., Sheremeta, R., and Sznycer, D. Restoring Damaged Trust with Promises, Atonement and Apology.

11-17 Brañas-Garza, P., and Proestakis, A. Self-discrimination: A field experiment on obesity.

11-16 Brañas-Garza, P., Bucheli, M., Paz Espinosa, M., and García-Muñoz, T. Moral Cleansing and Moral Licenses: Experimental evidence.

11-15 Caginalp, G., Porter, D., and Hao, L. Asset Market Reactions to News: An experimental study.

11-14 Benito, J., Branas-Garz, P., Penelope Hernandez, P., and Sanchis Llopis, J. Strategic Behavior in Schelling Dynamics: A new result and experimental evidence.

11-13 Chui, M., Porter, D., Rassenti, S. and Smith, V. The Effect of Bidding Information in Ascending Auctions.

11-12 Schniter, E., Sheremeta, R. and Shields, T. Conflicted Minds: Recalibrational emotions following trust-based interaction.

11-11 Pedro Rey-Biel, P., Sheremeta, R. and Uler, N. (Bad) Luck or (Lack of) Effort?: Comparing social sharing norms between US and Europe.

11-10 Deck, C., Porter, D., and Smith, V. Double Bubbles in Assets Markets with Multiple Generations.

11-09 Kimbrough, E., Sheremeta, R., and Shields, T. Resolving Conflicts by a Random Device.

11-08 Brañas-Garza, P., García-Muñoz, T., and Hernan, R. Cognitive effort in the Beauty Contest Game.

11-07 Grether, D., Porter, D., and Shum, M. Intimidation or Impatience? Jump Bidding in On-line Ascending Automobile Auctions.

11-06 Rietz, T., Schniter, E., Sheremeta, R., and Shields, T. Trust, Reciprocity and Rules.

11-05 Corgnet, B., Hernan-Gonzalez, R., and Rassenti, S. Real Effort, Real Leisure and Real-time Supervision: Incentives and peer pressure in virtual organizations.

11-04 Corgnet, B. and Hernán-González R. Don't Ask Me If You Will Not Listen: The dilemma of participative decision making.

11-03 Rietz, T., Sheremeta, R., Shields, T., and Smith, V. Transparency, Efficiency and the Distribution of Economic Welfare in Pass-Through Investment Trust Games.

11-02 Corgnet, B., Kujal, P. and Porter, D. The Effect of Reliability, Content and Timing of Public Announcements on Asset Trading Behavior.

11-01 Corgnet, B., Kujal, P. and Porter, D. Reaction to Public Information in Markets: How much does ambiguity matter?

2010

10-23 Sheremeta, R. Perfect-Substitutes, Best-Shot, and Weakest-Link Contests between Groups.

10-22 Mago, S., Sheremeta, R., and Yates, A. Best-of-Three Contests: Experimental evidence.

10-21 Kimbrough, E. and Sheremeta, R. Make Him an Offer He Can't Refuse: Avoiding conflicts through side payments.

10-20 Savikhim, A. and Sheremeta, R. Visibility of Contributions and Cost of Inflation: An experiment on public goods.

10-19 Sheremeta, R. and Shields, T. Do Investors Trust or Simply Gamble?

10-18 Deck, C. and Sheremeta, R. Fight or Flight? Defending Against Sequential Attacks in the Game of Siege.

10-17 Deck, C., Lin, S. and Porter, D. Affecting Policy by Manipulating Prediction Markets: Experimental evidence.

10-16 Deck, C. and Kimbrough, E. Can Markets Save Lives? An Experimental Investigation of a Market for Organ Donations.

10-15 Deck, C., Lee, J. and Reyes, J. Personality and the Consistency of Risk Taking Behavior: Experimental evidence.

10-14 Deck, C. and Nikiforakis, N. Perfect and Imperfect Real-Time Monitoring in a Minimum-Effort Game.

10-13 Deck, C. and Gu, J. Price Increasing Competition? Experimental Evidence.

10-12 Kovenock, D., Roberson, B., and Sheremeta, R. The Attack and Defense of Weakest-Link Networks.

10-11 Wilson, B., Jaworski, T., Schurter, K. and Smyth, A. An Experimental Economic History of Whalers' Rules of Capture.

10-10 DeScioli, P. and Wilson, B. Mine and Thine: The territorial foundations of human property.

10-09 Cason, T., Masters, W. and Sheremeta, R. Entry into Winner-Take-All and Proportional-Prize Contests: An experimental study.

10-08 Savikhin, A. and Sheremeta, R. Simultaneous Decision-Making in Competitive and Cooperative Environments.

10-07 Chowdhury, S. and Sheremeta, R. A generalized Tullock contest.

10-06 Chowdhury, S. and Sheremeta, R. The Equivalence of Contests.

10-05 Shields, T. Do Analysts Tell the Truth? Do Shareholders Listen? An Experimental Study of Analysts' Forecasts and Shareholder Reaction.

10-04 Lin, S. and Rassenti, S. Are Under- and Over-reaction the Same Matter? A Price Inertia based Account.

10-03 Lin, S. Gradual Information Diffusion and Asset Price Momentum.

10-02 Gjerstad, S. and Smith, V. Household Expenditure Cycles and Economic Cycles, 1920 – 2010.

10-01 Dickhaut, J., Lin, S., Porter, D. and Smith, V. Durability, Re-trading and Market Performance.

2009

09-11 Hazlett, T., Porter, D., and Smith, V. Radio Spectrum and the Disruptive Clarity OF Ronald Coase.

09-10 Sheremeta, R. Expenditures and Information Disclosure in Two-Stage Political Contests.

09-09 Sheremeta, R. and Zhang, J. Can Groups Solve the Problem of Over-Bidding in Contests?

09-08 Sheremeta, R. and Zhang, J. Multi-Level Trust Game with "Insider" Communication.

09-07 Price, C. and Sheremeta, R. Endowment Effects in Contests.

09-06 Cason, T., Savikhin, A. and Sheremeta, R. Cooperation Spillovers in Coordination Games.

09-05 Sheremeta, R. Contest Design: An experimental investigation.

09-04 Sheremeta, R. Experimental Comparison of Multi-Stage and One-Stage Contests.

09-03 Smith, A., Skarbek, D., and Wilson, B. Anarchy, Groups, and Conflict: An experiment on the emergence of protective associations.

09-02 Jaworski, T. and Wilson, B. Go West Young Man: Self-selection and endogenous property rights.

09-01 Gjerstad, S. Housing Market Price Tier Movements in an Expansion and Collapse.

2008

08-09 Dickhaut, J., Houser, D., Aimone, J., Tila, D. and Johnson, C. High Stakes Behavior with Low Payoffs: Inducing preferences with Holt-Laury gambles.

08-08 Stecher, J., Shields, T. and Dickhaut, J. Generating Ambiguity in the Laboratory.

08-07 Stecher, J., Lunawat, R., Pronin, K. and Dickhaut, J. Decision Making and Trade without Probabilities.

08-06 Dickhaut, J., Lungu, O., Smith, V., Xin, B. and Rustichini, A. A Neuronal Mechanism of Choice.

08-05 Anctil, R., Dickhaut, J., Johnson, K., and Kanodia, C. Does Information Transparency Decrease Coordination Failure?

08-04 Tila, D. and Porter, D. Group Prediction in Information Markets With and Without Trading Information and Price Manipulation Incentives.

08-03 Thomas, C. and Wilson, B. Horizontal Product Differentiation in Auctions and Multilateral Negotiations.

08-02 Oprea, R., Wilson, B. and Zillante, A. War of Attrition: Evidence from a laboratory experiment on market exit.

08-01 Oprea, R., Porter, D., Hibbert, C., Hanson, R. and Tila, D. Can Manipulators Mislead Prediction Market Observers?