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Abstract

We study the problem faced by a decision maker who must set a deadline for an offer to be accepted. There are two sources of uncertainty. First, he must estimate the probability of his offer being accepted under various deadlines. Second, he must estimate whether the recipient of an offer that is accepted will reward or punish him as a function of the deadline he set. We model the decision maker’s dilemma by embedding his decision problem in a game against another player, the responder. The responder is waiting for a better alternative, but an exploding offer must be accepted or rejected before discovering whether the better alternative will arrive. An extended offer allows the responder to first learn about the outcome of the better alternative. The responder, upon accepting the proposer’s offer, can reciprocate by altering the proposer’s payoff. In four experiments, we observe that many proposers issue exploding offers, even though this results in substantially lower payoffs. Differences in payoffs are primarily due to negative reciprocation towards exploding offers, which we term the reciprocation curse. Our analyses suggest that proposers giving exploding offers fall prey to projection bias – i.e., they issue exploding offers if they themselves would accept exploding offers. The main prescriptive conclusion for proposers is to consider explicitly the potential reciprocation curse when setting deadlines.

Key words Exploding Offers; Deadlines; Ultimatums; Job Search; Firm Employment Decisions; Behavioral Economics.

JEL Classification J64 · M51 · D03 · D8
1 Introduction

In many labor markets, job offers come with attached deadlines. Often, deadlines are used strategically – to pre-empt competition – in order to secure high-quality applicants (see Roth & Xing, 1994, and references therein). Consulting firms, banks, hedge funds, and industry firms all make strategic use of deadlines when hiring newly minted MBAs. Consulting firms, for example, tend to interview the same set of applicants, and the competition for top talent is stiff. We have observed that the most prestigious consulting firms, whose positions are the most sought after by candidates, tend to be more flexible in their deadlines. While their deadlines are not entirely open-ended, these firms are quite agreeable in giving people time to consider the offer. In contrast, less prestigious firms tend to employ stricter, shorter deadlines. (Roth (2008) describes a similar relationship in the academic market for young economists.)

The applicant who must decide whether to accept a position prior to knowing what other offers might yet come faces a very difficult decision. For an MBA graduate who has accumulated significant debt to finance her education, the decision can feel like one of the most important ones in her life. Accepting an offer and then reneging on it is unethical and can be costly, since many business schools impose sanctions for such behavior. At Wharton, for example, students can be fined up to $20,000 for reneging on an accepted offer, and can lose access to the school’s career management services.\(^1\) Hence, the decision to accept or reject an exploding offer is often binding.

By accepting an exploding offer that involves some period of lock-in or commitment, the responder is exposed to the opportunity costs of forgone future offers. On the other hand, rejecting the offer also imposes a cost on the responder if no better offers materialize in the future. The proposer faces different trade-offs. An extended offer may end up being rejected because the extra time it provided allowed the responder to successfully secure a better outside option. An exploding offer may be rejected because

\(^1\) [http://employer.wharton.upenn.edu/recruiting/interview_policies.cfm](http://employer.wharton.upenn.edu/recruiting/interview_policies.cfm)
the responder feels the opportunity costs of forgoing further search are too high. These tradeoffs were studied in Tang, Bearden, and Tsetlin (2009). Here, we focus on another potentially important strategic consideration: can the choice of offer deadline affect an employee’s behavior beyond the negotiation stage? In other words, might employees hired via exploding offers behave systematically differently from those hired through extended offers? More importantly, should these potential differences affect a proposer’s choice between issuing an extended or exploding offer?

Consider a mid-tier consulting firm that gives an early, exploding offer to a very good applicant (i.e., one who is likely to do well on the job market), which the applicant accepts prior to learning whether better offers will yet come. The applicant is then obliged to work for the firm, for at least a reasonable period of time. Upon the acceptance of the offer, the firm and the new employee engage in another game-like interaction, wherein the employee faces a reciprocation decision. The employee can choose to work more or less hard, and in a more general sense can choose to be more or less committed to the firm. At an extreme, the new employee could choose a commitment level so low that the firm would have preferred not to have hired him at all. These considerations are potentially important for any firm when making interviewing and staffing decisions. In addition, they might be important for job market institutions (such as career services departments in business schools), especially when making policy decisions.

The current paper studies whether the deadline attached to an offer (i.e., an exploding or an extended deadline) can affect an employee’s behavior after its acceptance. We model this as a deadline game with reciprocation opportunities, which §3 describes in detail. (A detailed theoretical analysis of the game is presented in the Appendix.) Results from four behavioral experiments, and analyses of our findings, are presented in §4. The concluding section discusses some limitations and implications of the current research.
2 Background

The game we introduce and study in the current paper shares some features with the Ultimatum Game (Güth, Schmittberger, & Schwarze, 1982), which has received considerable attention in behavioral economics, as well as the Ultimatum Deadline Game introduced by Tang et al. (2009). Whereas the standard Ultimatum Game and Ultimatum Deadline Game include only a single bargaining stage, the game examined in this paper consists of a bargaining stage followed by a second stage in which a responder who accepts an offer has an opportunity to reciprocate, by rewarding or punishing the deadline setter. Next, we review the literature that forms the foundation for the current paper.

In the conventional Ultimatum Game, a proposer is allocated a fixed amount of money, say $10 (see, e.g., Güth et al., 1982). The proposer then has to suggest an allocation of the $10 between herself and another player, the responder. If the responder accepts, the money is allocated according to the offer. But if the responder rejects the offer, both players earn nothing. The sub-game perfect solution, assuming self-interested income-maximizing agents, is for the proposer to offer the smallest permissible amount (e.g., $0.01), and for the responder to accept this offer. The responder accepts this offer because rejection would leave the responder with nothing, which is worse than $0.01. Clearly, a self-interested responder would accept any non-zero allocation, but a self-interested proposer should only offer the responder his smallest acceptable allocation (so as to leave the largest possible payoff for the proposer). Empirically, however, the modal offer tends to be close to 50% of the total amount, and small offers (e.g., $1 out of a $10 pie) are almost always rejected (for reviews, see Bearden, 2001; Camerer & Thaler, 1995). The standard account of this pattern of results is that people are concerned about fairness, and that this sometimes trumps pure pecuniary self-interest. Small offers are
seen as unfair, and are consequently rejected; proposers anticipate this, and therefore give larger offers.\textsuperscript{2}

The outside options for both players (i.e., the payoffs when no agreement is reached) in the standard Ultimatum Game are zero. In many natural settings, however, the participants in exchanges that are reasonably modeled as Ultimatum Games have distinctly non-zero outside options. For example, a job candidate who is currently employed (but considering changing employers), if offered a particular take-it-or-leave-it pay package, will have the option to remain in his current position. There is evidence that the presence of non-zero outside options significantly impacts the outcome of ultimatum offers. For instance, Knez and Camerer (1995) ran a series of Ultimatum Game experiments in which proposers and responders each had non-zero payoffs in the event that offers were rejected. They found that rejection rates were significantly higher when players had outside options, and concluded that previous studies using zero payoffs for disagreement may have vastly underestimated disagreement rates in more natural settings. Most importantly, when responders had a non-zero outside option (e.g., $2 in a setting where proposers were dividing a $10 pie), proposers tended to offer too little, resulting in a high proportion of rejections. Schmitt (2004) also found that offers of a given proportion were rejected more often when responders had an outside option.

Tang et al. (2009) studied a related game – that of Ultimatum Deadlines. Their paper is perhaps the first to rigorously consider the choice of deadlines in ultimatum settings with a single proposer and responder. On day 0, the proposer offers to form a partnership with the responder, and gives the responder a deadline (from day 1 to 10) by which to reply. If the partnership deal is accepted on the day of the deadline, the proposer and the responder each get a payoff of $10. Meanwhile, the responder is waiting to learn whether he will receive a better offer that pays $40. The better offer’s arrival is uncertain

\textsuperscript{2} Pillutla and Murnighan (1996) present empirical work suggesting that the mechanism of respondents’ rejections is more emotional – the feelings of anger that small offers may engender can be a better explanation of rejections that mere perceptions that offers were unfair.
– it may or may not come. In addition, the timing of its arrival (conditional on it coming) is stochastic. If the better offer arrives prior to the deadline, the responder earns $40 and the proposer gets nothing. If the better offer does not arrive prior to the deadline, then the responder must accept or reject the proposer’s offer on the day of the deadline. If accepted, the players each earn $10. If rejected, the proposer earns nothing, and the responder faces a lottery: he earns $40 if the better offer comes and nothing otherwise. Crucially, the probability of the better offer arriving (conditional on it not yet having arrived) is decreasing in time. That is, if the responder rejects a proposer’s offer, the resulting lottery he engages in is more favorable when the deadline is short than when it is long. Conversely, if the responder accepts a proposer’s offer, he sacrifices a more favorable lottery when the deadline is short than when it is long. Tang et al. (2009) found that subjects in the role of proposers tended to set deadlines that were too short – their offers were rejected quite often.

Note that the better offer in the game studied by Tang et al. (2009) is effectively a stochastic outside option – a probabilistic BATNA (best alternative to negotiated agreement) for the responder. The responder has an outside option, and the proposer can influence the (expected) value of that outside option via her choice of proposed deadline. A shorter deadline, if accepted, would require that the responder forgo a higher expected value outside option than a longer deadline would. But, at the same time, a longer deadline exposes the proposer to greater risk of the responder being lost to the better alternative prior to the deadline, which would leave the proposer with nothing. Importantly, the game ends once an agreement is reached; there is no opportunity for the responder to reciprocate towards the proposer in response to the offer of a longer or shorter deadline (which gave him more or less opportunity to explore his outside options). We conjecture that deadlines are likely to affect a responder’s behavior after an agreement has been reached. Our intuition is that the responder will evaluate the proposer’s offer relative to the outside option. When the offer is perceived as positive relative to the outside option, the responder will be more likely to reciprocate positively.
(i.e., to be generous). When the offer is perceived as negative relative to the outside option, he will be more likely to reciprocate negatively (e.g., to be punitive) towards the proposer.

Indeed, there is evidence that players will reciprocate in ultimatum-related games if given the opportunity. For example, Andreoni, Harbaugh, and Vesterlund (2003) examined a game in which a proposer first chose how to divide a pie ($2.40) between herself and another player (who had no say in the matter).\(^3\) The second player could then choose to increase or decrease the proposer’s payoff at some cost to himself – he could increase or decrease the proposer’s payoff by $0.05 for every $0.01 he paid. There was a relationship between proposer allocations and the second players’ reward-punish decisions: higher allocations were rewarded more often and punished less. In related work, Ben-Ner, Putterman, Kong, and Magan (2004) examined a two round Dictator Game in which subjects alternated the dictator role. They found that when subjects were paired with the same person from one round to the next, dictator allocations were highly correlated: players who received little in the first round tended to give little in the second round, while those who had received generous allocations also tended to give generous allocations. However, when players were paired with a different, randomly selected player in the second round, the correlation between first and second round allocations dropped significantly.

To summarize, studies of Ultimatum Games with outside options have shown that the outside options tend to foster higher levels of disagreement (relative to cases where the outside option is 0, as in the standard game). Most important, when responders have non-zero outside options, it seems that proposers fail to appreciate the effects these outside options will have on the allocations responders will find acceptable – proposers seem to underestimate what responders will view as fair allocations when they have

\(^3\) Games in which a proposer chooses an allocation and the responder has no say have been dubbed Dictator Games (see, e.g., Katok and Zwick, 1998). Structurally, Dictator Games are identical to Ultimatum Games except that the responder has no say in the matter.
outside options. The results from Tang et al.’s (2009) Ultimatum Deadline Game (proposers tended to set deadlines that were too short) suggest that proposers may have underestimated the impact of responders’ (stochastic) outside option on their acceptable deadlines. Finally, the studies of Dictator Games permitting reciprocation show that players respond in kind: that is, they reward players who are generous to them and punish those whom they perceive as less than generous.

In each of the studies we have cited here, as in most experimental studies, there was reasonably significant heterogeneity in how people played the games – i.e., not everyone played the same. Of course, there can be – and most surely are – any number of reasons for the individual differences. Players may have different attitudes toward fairness, different risk profiles, different beliefs about the nature of the games, and so on. This observed variability often results in significant disagreements and inefficient payoffs. For example, Andrade and Ariely (2009) reported that participants who rejected small offers in Ultimatum Games were more likely to make larger offers than participants who themselves accepted small offers. Going further, recent work by Artinger, Exadaktylos, Koppel, and Saaksvuori (2010) suggests that participants in Ultimatum Games tend to believe that other players are more similar to themselves than is in fact the case. They found a positive correlation between proposer allocations and beliefs about what other proposers would offer; there was also a positive correlation between the subjects’ smallest acceptable allocation and their estimates of others’ smallest acceptable allocations. In other words, their subjects believed that the other subjects would behave much like themselves. This belief can lead to inefficient decision-making when, for example, a player who would accept a small allocation thus decides to offer a small allocation to another player who in actuality finds it disagreeable, leading to rejection. In a similar vein, Malhotra (2004) found that players in a two-person trust game were not very sensitive to the factors affecting their counterparts’ decisions. Most importantly, first-movers underestimated the extent to which their choices affected the second-movers’ decision to reciprocate. Loewenstein, O’Donoghue, and Rabin (2003) review a range of
settings (e.g., market games, individual decision tasks, etc.), and show that there is a generalized tendency for people to anticipate that others will behave in ways similar to themselves. People tend to project their preferences onto others – they believe that others will like what they like and dislike what they dislike. This general behavioral tendency – which they refer to as a projection bias – will play an important role in our understanding of the games we study here. (Also note that the projection bias is closely related to the well-documented false consensus effect (Ross, Greene, & House, 1977).) We will present evidence that the disagreements that arise in our games are the result of players mistakenly projecting their own preferences onto other players.

3 The Deadline Game

We will refer to the game we study as the Deadline Game. In effect, it is an Ultimatum Deadline game that permits reciprocation by the responder. The game is composed of two stages. First, the proposer gives the responder an ultimatum deadline. Second, if the responder accepts the proposer’s offer, then the responder makes a reciprocation decision, which we model in two different ways. In the first variant of the game, the responder makes a binary decision to either reward or punish the proposer, at no cost to himself. In the other, the responder plays a Dictator Game with the proposer. The stages are described in detail below.

Ultimatum Deadline Stage Here, the proposer must choose to give the responder either a short or a long deadline by which to accept an offer that pays both players X. At the same time, the responder is waiting to learn whether he will receive a preferred (better) outside option that pays Y > X. The outside option will arrive with probability 0.5. Importantly, whether it will come will only be learned after the expiry of the short deadline but prior to the expiry of the long deadline. If the proposer offers the short deadline and the responder accepts it, then each earns X and the game moves to the reciprocation stage. If the proposer gives the short deadline and the responder rejects it,
then the proposer earns 0 and the responder receives a lottery that pays Y with probability 0.5 and nothing otherwise. If the proposer chooses the long deadline instead, then the responder learns whether the better option arrives before deciding whether to accept the proposer’s offer. The better offer arrives with probability 0.5, and when it does the responder earns Y, while the proposer earns nothing. If the better offer does not arrive, then the responder accepts the proposer’s offer, each of them earn X, and the game moves to the reciprocation stage.

**Reciprocation Stage** The reciprocation stage only occurs when the responder has accepted the proposer’s offer, whether it is a short deadline offer or a long deadline offer. We model reciprocation in two ways: allowing the responder to reward or punish the proposer by adding or subtracting an amount Z from the proposer’s payoffs from the deadline stage; or by allowing the responder to play a dictator game with the proposer over an additional endowment provided in the second stage (i.e., not with the deadline stage earnings).

The ultimatum deadline stage of the game is similar to the game studied by Tang et al. (2009), while the reciprocation stage shares features with, for example, the game used by Andreoni et al. (2003). Combined, these elements allow us to examine the impact of reciprocation on deadline setting decisions such as those faced by the firms we discussed in the introduction.

In the next section, we report results from four experiments in which we examine behavior in the games we just described. Performing multiple experiments allowed us to vary reciprocation mechanisms (reward-punish, dictator), subject populations (MBAs, general public), payoffs, currencies (USD, SGD, EUR), and response elicitation protocols (strategy method, sequential method). Our over-arching hypothesis is that short, exploding offer deadlines encourage negative reciprocation, and hurt the payoffs of players issuing them. The hypothesis receives unambiguous support.
4 Behavioral Studies of Deadline Games

In this section we report results from four experiments in which we examined behavior in the Deadline Game. We used standard experimental economics protocols (Hertwig & Ortmann, 2001) in each study: deception was avoided and incentive-compatible payoffs were used. We employed the strategy method to elicit decisions in Studies 1, 2, and 3 (Selten, 1967; for other uses of this protocol, consult Brandts & Charness, 2000; Cason & Mui, 1997; Tang et al., 2009): each subject specified what she would do under all feasible contingencies, in both the proposer and responder roles. The strategy method allows us to get a richer set of data from each subject, thereby allowing us to answer questions that could not be addressed using a sequential method. However, in Study 4, we do employ the sequential elicitation protocol in order to assess whether our findings, conclusions, and inferences are contingent upon the response elicitation format.

In this section, we describe each experiment and its main findings. We will provide a unified account – or explanation – of the results from all studies taken together in subsection §4.3. A detailed analysis of the game and its underlying model is presented in the Appendix.

4.1 Studies 1 and 2: Deadline Games with Reward-Punish Allocations

In Studies 1 and 2, we examine a Deadline Game in which reciprocation is modeled with a costless reward-punish decision: the responder can choose to increase or decrease the proposer’s payoff at no cost to himself. Costless reciprocation provides a relatively pure measure of the effects that proposers’ deadline setting decisions have on responders’ feelings towards the proposer’s decision. By allowing the responders to freely reward or punish the proposers we can factor out the impact of the responders’ own self-interested concerns. For instance, if reciprocation were very costly, then the impact of the proposers’ deadline decisions on the feelings of the responders (towards the proposers) might be concealed, as their revelation could potentially be viewed as prohibitively expensive. Study 1 was run with an MBA sample. Study 2 was then run as a replication.
of Study 1 with a general population sample in order to verify the robustness of our findings.

**Method**

**Study 1 Participants** Participants were 102 MBA students at INSEAD. They were told that they would play an experimental job-search game, and that two randomly selected pairs (4 people) would be selected for actual cash payments. They were informed that the payoffs to the selected players could range from €0 to €200, depending on the decisions of the players’ as well as a bit of chance.

**Study 2 Participants** After running Study 1, we ran a replication study using a different population, Amazon Mechanical Turk (AMT) workers, to establish the generality of our findings. One-hundred and ninety-two AMT workers completed the game. Each was paid a small participation fee of $0.25. In addition, two pairs were selected at random and paid bonuses based on their decisions in the game.

The AMT population is quite diverse, and includes a number of real-life job seekers. See Paolacci, Chandler, and Ipeirotis (2010) for a recent discussion of the utility of AMT for experimental research. Horton, Rand, and Zeckhauser (2010) show that experiments on AMT produce results in line with those obtained in standard brick-and-mortar experimental laboratories, and argue that the platform should be used in experiments more frequently, as it is itself a true labor market.

**Study 1 Protocol** The game was described as a hiring problem, where the proposer was a firm and the responder was a job candidate. The subjects were given full information about the payoffs to players in both roles under all contingencies of the game. They were told that the firm was attempting to hire a candidate, who had a 50% chance of later receiving a better offer from another firm that would pay €200 to the candidate, while the firm’s own offer paid the candidate €80. The firm had to choose between giving the candidate a “long” or “short” deadline. Under the long deadline the candidate would first learn whether he had received the better offer before deciding to accept the firm’s
offer, while under the short deadline the candidate would not get the chance to learn whether the better offer would come before deciding whether to accept or reject the firm’s offer.

Again, if the firm chose to give an exploding (short) offer, the candidate would have to decide whether to accept or reject this offer prior to discovering whether the better offer arrives. If the exploding offer was accepted, a partnership was formed, and both the firm and the candidate earned €80. Next, conditional on forming a partnership, the candidate would make a decision on whether to reward or punish the firm, which would add or subtract €40 from the firm’s payoff. This decision would not alter the candidate’s payoffs in any way. If the exploding offer was rejected, the firm would receive €0, and the candidate would receive €200 if the better offer arrived and €0 otherwise. In this case, the candidate would not have the opportunity to reward or punish the firm (with the ±€40).

If the firm selected the extended (long) offer, then the candidate would first discover whether the better offer arrived before deciding whether to accept the firm’s offer. Should the better offer arrive, the candidate would receive €200 and the firm would receive €0. On the other hand, if the better offer did not arrive, the candidate would automatically accept the firm’s offer, and both the candidate and the firm would receive €80. Conditional on the candidate accepting the firm’s offer (i.e., when the better offer did not arrive), the candidate would then decide whether to reward or punish the firm, which would increase or reduce the firm’s payoff by €40.

The relative values of the payoffs are meant to capture the class of deadline setting decisions that we find the most difficult and also the most interesting: those where the responder’s potential outside option is considerably better than the proposer’s offer, but in which the difference is not so stark that the problem becomes trivial (e.g., when the expected value of the outside option is worth many times the value of the proposer’s offer).
In addition, after making their decisions, subjects were asked to provide estimates of the percentage of the population they thought would give an exploding offer, accept an exploding offer, punish an exploding offer, and punish an extended offer. Collecting these estimates allowed us to assess the possible motivations behind participant’s choices. As it is clearer to analyze these results across all our studies simultaneously, we present our findings regarding subjects’ motivations in §4.3.

**Study 2 Protocol** The relative payoffs were the same as in Study 1: the Euro amounts used in Study 1 were divided by 10, and paid out in US Dollars. In other words, selected proposers and responders received $8 for forming a partnership, the reward-punish amount was $4, and the better outside offer was worth $20 to the responder. In the context of AMT, these are substantial (potential) sums for a relatively brief task. As in Study 1, after making their decisions, subjects were asked to provide estimates of the percentage of the population that would make specific choices. (Again, see §4.3 for an analysis of these results.)

**Results**

**Study 1** Thirty-nine percent of the subjects chose to give exploding offers. The exploding offers were accepted by only 32% of the subjects, which is significantly less than the 50% probability of securing the candidate by giving a long deadline ($z = -3.56, p < 0.001$). Further, exploding offers were punished 55% of the time, while extended offers were punished only 10% of the time, a highly significant difference ($z = 5.96, p < 0.001$). Exploding offers had both a lower capture rate and a higher punishment rate than extended offers. Hence, the associated payoffs for extended offers first-order stochastically dominated those for exploding offers. Table 1 presents a summary of these results.

Using the observed acceptance and punishment proportions, we can compute the (ex-post) empirical expected payoffs to proposers for short and long deadline offers.
Doing so, we find that short deadlines had an expected payoff of €24.71, while long deadline offers had an expected payoff more than twice that, €56.08.

**Study 2** Fifty-five percent of the subjects gave exploding offers. Exploding offers were acceptable to 55% of the subjects, which is *not* significantly different from the 50% probability of securing the candidate by giving an extended deadline (p = 0.13, by a proportion test). Exploding offers were punished by 39% of the subjects, while extended offers were only punished by 6% of the subjects, a highly significant difference ($z = 7.35, p < 0.001$). In short, exploding offers had a capture rate no better than the extended offers, but they were punished at a significantly higher rate. Hence, again, the payoffs for extended offers dominated those for exploding offer. See Table 1 for a summary. The ex-post empirical expected payoffs were $4.72 for exploding offers and $5.74 for extended offers.

**Discussion**

Both Study 1, which used an MBA sample, and Study 2, which used a (more) general population sample (Amazon Mechanical Turk Workers), lead to the same conclusion: exploding offers have lower expected payoffs than extended offers in these games. More striking is that exploding offers have payoffs that are stochastically dominated by those for extended offers: they are no more likely to capture the responder (compared to the 0.5 probability under an extended offer), and they are more likely to be punished when accepted. Yet, exploding offers were given between 39% (Study 1) and 55% (Study 2) of the time. Once we have presented the results from the next two studies, we will offer an explanation for this apparent anomaly.

**4.2 Studies 3 and 4: Deadline Games with Dictator Allocations**

Studies 1 and 2 allowed responders to reward or punish proposers at no cost to themselves. This is arguably unrealistic, since reciprocation in many natural settings – for instance, working harder at one’s job – requires a costly expenditure (of time, effort, etc.). As such, we modified the game to impose costs on responders when reciprocating to
proposers. All the elements of the interaction were as before, except that in Studies 3 and 4, whenever responders accepted the proposer’s offer, they proceeded to play a Dictator Game, dividing a bonus pool of money between themselves and the proposers (see, e.g., Forsythe, Horowitz, Savin, & Sefton, 1994).

As mentioned above, Studies 1, 2, and 3 all made use of the strategy method. But one might worry whether the results from these studies are in some way an artifact of the strategy method protocol (see, e.g., Brosig, Weimann, & Yang, 2003; Oxoby & McLeish, 2004; or see Abele, Bless, & Ehrhart, 2004, who investigate differences arising when decision-makers are merely led to perceive that they are playing a simultaneous-move game sequentially). To address this, in Study 4, we had subjects play the same game as in Study 3, but under a sequential protocol. Each subject played the role of either the proposer or the responder, but not both. Further, to increase realism, the game was played over the course of one week. Our primary objective in running Study 4 was to assess whether our previous results showing that large proportions of subjects tend to give offers with dominated payoffs would replicate in a more natural setting. We tried to keep the protocol as clean and as natural as possible, given the constraint that we were indeed conducting an experiment. In sum, Study 4 is a straightforward test of whether subjects are likely to err in giving exploding offers under a more natural (sequential) protocol.

Method

**Study 3 Participants** Fifty-three INSEAD MBA participants took part for the chance to earn cash prizes linked to performance. Two randomly selected pairs of participants were paid bonuses corresponding to their outcomes in the game.

**Study 4 Participants** One hundred INSEAD MBA students participated in Study 4. They were recruited via e-mail announcements. Those who took part were informed that two randomly selected pairs of participants would be compensated based on their decisions in the game. Subjects who signed up to participate were directed to an online survey website where they received a description of the set-up, detailing the rules
of the game. Shortly afterwards, they received an email notification of their assigned role. To be clear, each subject was assigned to only one role: to be either a proposer or a responder. (This is in contrast to the other studies, where every subject played both roles.)

**Study 3 Protocol** The game was described as a hiring scenario, where the proposer was a firm and the responder was a candidate. Participants were told that the firm was attempting to hire a candidate, who had a 50% chance of receiving a better offer from an outside firm. This offer would be worth SGD 300 to the candidate. Again, the firm faced a choice between giving an exploding offer or an extended offer.

Given an exploding offer, the candidate would have to decide whether to accept or reject this offer prior to discovering whether the better offer would arrive. If the exploding offer was accepted, a partnership was formed, and both the firm and the candidate earned SGD 100. In addition, the candidate would play a Dictator Game with an additional SGD 75. That is, in the cases where a partnership was formed, the candidate would have sole discretion about how much of the SGD 75 to keep for himself and how much to give to the proposer. If the exploding offer was rejected, the firm would receive SGD 0, while the candidate would receive SGD 300 if the better offer arrived and SGD 0 if it did not.

If the firm gave an extended offer, then the candidate would discover whether the better offer arrived before having to make a decision regarding the firm’s offer. Should the better offer arrive, then the candidate would receive SGD 300 and the firm would receive SGD 0. On the other hand, if the better offer did not arrive, the candidate would automatically accept the firm’s offer and both the candidate and the firm would receive SGD 100. In addition, in case of acceptance, the candidate would decide how to allocate SGD 75 between himself and the proposer.

In Study 3, we again asked candidates for their estimates of population proportions – this time we asked for the percentage that would give an exploding offer, the percentage that would reject an exploding offer, the average allocation of those accepting an exploding offer, and the average allocation of those accepting an extended
offer. This time, we asked for these estimates before asking for participants’ decisions in the game. Altering the sequence in which we asked for subjects’ estimates and their decisions allows us to rule out order effects as an explanation for any of our findings. (See §4.3 for the analyses of these results.)

**Study 4 Protocol** Proposers first specified their deadlines, and these were then communicated to the respective candidate players with whom they had been randomly paired. Candidate players who received exploding offers had to decide whether to accept or reject the offer before learning whether they would receive the better, outside offer. Those who accepted the exploding offer had to then make their dictator allocation decision.

Candidates who received extended offers were notified that they had received extended offers, and that they would later learn whether they would receive the outside offer. Those who did receive the outside offer were notified of this, which then meant that their game had concluded — they did not have to make any further decisions. Those who did not receive the outside offer were notified of this, and were then asked to make their dictator allocation decision. All notifications were via email through the experimenter; there was no communication between the subjects. At each stage of the experiment, the subjects received a personalized email with a unique link to an online page where they input their actions.

One goal of Study 4 was to enhance the realism of the hiring situation being modeled in the experimental game. As such, we chose not to ask subjects for their estimates of population percentages (unlike in Studies 1, 2, and 3). Omitting these questions in this study serves as a test of whether our results are influenced by the act of asking subjects for percentage estimates.

**Results**

**Study 3** The summary statistics for participants’ responses are shown in Table 2. Sixty-four percent of the subjects, a significant majority, chose to give exploding offers (z
= 2.06, p = 0.04). But, only 47% of subjects accepted exploding offers. Importantly, the percentage who would accept exploding offers was no higher than the capture rate under extended offers (p > 0.05). That is, giving extended offers did not improve the proposers’ chances of successfully capturing the responder (i.e., of forming a partnership).

Figure 1 (top panel) shows the cumulative distributions of dictator allocations for exploding and extended offers. It is easy to see that allocations when accepting extended offers first-order stochastically dominate allocations when accepting exploding offers. The distributions are statistically different, as established with a Wilcoxon signed-rank test (z = -3.16, p = 0.002). The dictator allocations were significantly better for the proposers who issued extended offers.

The expected payoff to the proposer for an exploding offer (SGD 52.66) was less than that for an extended offer (SGD 62.84). This payoff difference comes from two sources – the lack of a significant difference in the rate with which proposers captured the responders under exploding deadlines, and the significantly lower dictator allocations after exploding offers. Again, extended offers dominated exploding offers.

**Study 4** The summary statistics for participants’ responses are shown in Table 2. Fifty-six percent of the subjects chose to give an exploding offer, and these were accepted only 46% of the time (not significantly different from the capture rate under the extended offer of 0.50, p > 0.05). Thus, by choosing the exploding offer, proposers did not improve their chances of securing the responder. From Figure 1 (bottom panel), it is clear that the extended offer allocation distribution (first-order) stochastically dominates the exploding offer distribution (further, a Mann-Whitney test rejects the null that the exploding and extended allocation distributions are equivalent, z = -3.59, p < 0.001).4 The median allocation in response to exploding offers was SGD 0, whereas the median allocation in

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4 The Wilcoxon signed-rank test is appropriate in Study 3 as the strategy method yields a within-subject comparison; the Mann-Whitney test is appropriate in Study 4 as the sequential method yields a between-subject comparison.
response to extended offers was SGD 37 (half the total pie of SGD 75). The (ex-post) expected payoff was SGD 65.32 for an extended deadline and only SGD 48.25 for an exploding deadline.

**Comparison of Study 3 and 4 Results** The proportions of subjects who gave and accepted exploding offers in Study 4 were not significantly different from those from Study 3 (all ps > 0.05, by proportion tests). Further, comparing the dictator allocations for exploding and extended offers from Study 3 with those from Study 4 by Mann-Whitney tests, we find no significant differences (exploding offers: z = 1.68, p = 0.09; extended offers: z = -1.03, p = 0.30). In sum, we have no strong evidence that behavior in the game was substantially different under the sequential and strategy elicitation methods.

**Discussion**

Even when reciprocation was costly, we found that the subjects were more likely to reward extended offers than exploding offers. Again, we found that the exploding offer payoffs were stochastically dominated by extended offer payoffs, and yet they were still given with significant frequency. The effect – that exploding offers are often given and that they have inferior payoffs – seems to be quite robust. It held under both the strategy and sequential elicitation protocols, which did not generate significantly different behavioral patterns. In the next subsection, we propose an explanation for this effect.

**4.3 Evidence for Projection**

The Appendix provides a thorough analysis of the game and its underlying model. In sum, these analyses show that the solution to the proposer’s decision problem might depend on her risk preferences, unless the payoffs resulting from exploding and extended offers can be ordered by first-order stochastic dominance. In that case, her decision is easy: simply choose the non-dominated alternative. But, this begs the question: why did we observe such a high percentage of subjects giving exploding offers even though their payoffs were dominated? Risk preferences cannot account for these
experimental findings. Instead, as we show below, the results seem to be driven by heterogeneity in beliefs.

Recall that the subjects in the experiments had to decide which deadline to set without knowing, for example, the precise probability of short offers being accepted. Instead, they had to use their own judgment to estimate the probabilities. In addition to their decisions in the game, in Studies 1-3, we elicited subjects’ (explicit) estimates of the probability of exploding offers being accepted; the punishment rates for exploding and extended offers (Studies 1 and 2); and the average dictator allocations for exploding and extended offers (Study 3). (Study 4 was run under a sequential protocol in which we tried to keep the nature of the task relatively natural. Hence, we only asked the subjects for their decisions – we did not elicit their beliefs about the actions of other subjects.)

From a normative standpoint, a proposer’s decision to give an exploding or extended deadline is driven by her beliefs about how the responders will respond to those deadlines – i.e., whether they are likely to accept exploding offers and how they will reciprocate. Hence, normatively, we should find a relationship between proposers’ beliefs and their actions in the game; more specifically, we should find that beliefs guide actions: that they serve as the basis for actions. But a fundamental question is: how do players’ beliefs arise? Our conjecture is that players project their own preferences onto other players: those players who find that short offers are acceptable to themselves are more apt to believe that other players will find them acceptable. Next, we will examine the relationship between players’ actions and their stated beliefs.

First, we looked at the relationship between the deadlines subjects chose to give and those that they chose to accept. Table 3 displays these contingencies for Studies 1-3. There is a significant relationship between the two decisions in all three studies (Study 1: $\chi^2(1) = 19.01$, $p < 0.001$, Kendall’s Tau-b = 0.43; Study 2: $\chi^2(1) = 17.67$, $p < 0.001$, Kendall’s Tau-b = 0.29; Study 3: $\chi^2(1) = 5.17$, $p = 0.02$, Kendall’s Tau-b = 0.31). Put differently, the subjects’ own deadline setting and acceptance decisions are correlated. The nature of the relationships is clearer when we look at the data conditionally. The
percentage of subjects who accepted or rejected exploding offers conditional on whether they themselves gave exploding or extended offers is shown in Table 4. Notice that the values on the major diagonal tend to be higher than those on the minor diagonal. That is, those subjects who gave exploding offers tended to accept them, while those who gave extended offers tended to reject exploding offers. Table 5 shows the percentages of subjects who gave exploding and extended offers conditional on whether they themselves accepted exploding offers. Again, we see the same general pattern: Subjects who accepted exploding offers were considerably more likely to give exploding offers than were the subjects who rejected exploding offers.

Recall that we asked each subject in Studies 1-3 to estimate the probability that other players in the experiment would accept exploding offers. Here, we examine whether there is a relationship between these estimates and the subjects’ deadline decisions. Our main interest is this: Are the subjects' estimates more strongly related to the deadlines they set or to the ones they would accept? We address this question using ANOVAs with Type I (Sequential) sums of squares. Doing so allows us to look at the influence of variables as they are introduced sequentially into the model. This procedure accounts for the fact that the independent variables in the analyses (i.e., give exploding or extended offer, and accept or reject exploding offer) are highly correlated (i.e., not orthogonal). See Applebaum and Cramer (1974) for a discussion of the utility of employing Type I SSQ when the independent variables in ANOVA are correlated.

For each study, we ran ANOVAs with Type I sums of squares with give-exploding (first variable), accept-exploding (second variable), and their interaction (third variable) as independent variables, and estimated probability of an exploding offer being accepted as the dependent variable. The main effect of give-exploding was marginally significant in Study 1 (F(1, 98) = 3.37, p = 0.07), and significant in Study 2 (F(1, 201) = 7.14, p = 0.001) and Study 3 (F(1, 49) = 10.86, p = 0.002). More interestingly, after controlling for give-exploding, there is a highly significant main effect of accept-exploding in each of the studies (Study 1: F(1, 98) = 20.62, p < 0.001; Study 2: F(1, 201)
The interaction was non-significant in each study (all ps > 0.40). Hence, subjects’ deadline decisions were related to their subjective estimates of whether exploding offers would be accepted: subjects who gave higher estimates of acceptance were more likely to give exploding offers. But, importantly, their estimates were also highly related to whether they themselves would accept exploding offers. The average estimates for each of the four subject types (give-exploding and accept exploding; give-exploding and reject exploding; etc.) are displayed in Table 6. Analogous tests using the subjects’ estimates of punishment rates (Studies 1 and 2) and estimates of dictator allocations (Study 3) produced no significant main effects or interactions (all ps > 0.15). The average estimates are themselves shown in Table 7 for each subject type.

Rerunning the sequential ANOVAs but introducing accept-exploding as the first variable and give-exploding as the second variable we find highly significant main effects of accept-exploding (Study 1: F(1, 98) = 23.89, p < 0.001; Study 2: F(1, 201) = 82.81, p < 0.001; Study 3: F(1, 49) = 24.82, p < 0.001). Importantly, the main effect of give-exploding is non-significant when introduced after accept-exploding in Study 1 (F(1, 98) = 0.09, p = 0.76) and Study 2 (F(1, 201) = 0.00, p = 0.97), and marginally significant in Study 3 (F(1, 49) = 3.35, p = 0.07). None of the interaction terms are significant (all ps > 0.40).

We ran the same sets of ANOVAs using the estimated probabilities of extended and exploding offers being punished (Studies 1 and 2) and of the dictator allocations after extended and exploding offers (Study 3). There were no significant effects. The average estimates are displayed in Table 7. It is quite apparent that the beliefs about reciprocation were not systematically related to the subjects’ decisions in the games. Overall, the subjects anticipated that extended offers would lead to more positive reciprocation.

In conjunction, the sequential ANOVAs reveal that beliefs about the probability of exploding offers being accepted are linked to deadline setting decisions and also to deadline acceptance decisions. However, once we control for the effects of deadline
acceptance decisions – i.e., remove the variance explained by them – we find no further relationship between beliefs about acceptance probabilities for exploding offers and deadline setting decisions (Studies 1 and 2) or only weak evidence (Study 3). The greatest influence on the probability estimates seems to come from which deadlines they themselves would accept. Further, there is no evidence that there are any differences in beliefs about punishment rates, only in beliefs about acceptance rates.

Taken together, a sensible inference is that subjects project what they themselves find acceptable onto the other players, and use this as the basis for forming their beliefs and consequently their deadline decisions. The subjects who gave exploding offers may have selected a dominated alternative (ex ante), but they themselves (wrongly) tended to believe that the offers would be accepted with higher than actual probability. A reasonable inference is that they projected their own preferences onto the other subjects: they assumed people would act as they themselves would.

As a final note, the similarity of our findings on the projection bias across Studies 1, 2, and 3 strongly suggest that the order of asking for population estimates and game decisions had no significant impact on the results. Asking participants to first give their decisions and then provide their estimates (Studies 1 and 2) or to first provide their estimates and then give their decisions (Study 3) did not change the evidence for the projection bias. In addition, the similarity of the main results in Studies 3 and 4 (i.e., the payoffs from giving an exploding versus an extended offer) provide evidence that the act of asking for participants’ population estimates did not significantly influence their decisions in the game.

5 Conclusions

We introduced the Deadline Game where the proposer chooses between an exploding and an extended offer. The responder, whenever accepting the offer, can reciprocate by altering the proposer’s payoff. We conducted four experimental studies
employing different versions of this game. In all four studies, issuing an exploding offer resulted in much lower payoffs to the proposers. Nevertheless, a substantial fraction of subjects in the proposer’s role did issue an exploding offer.

In the Deadline Game, the proposer’s payoff depends on two factors: the probability that the responder accepts the offer (for an extended offer this probability is fixed at 50%; for an exploding offer this probability equals the proportion of responders that would accept an exploding offer), and the responder’s allocation decision at the reciprocation stage. The main factor that resulted in exploding offers being inferior to extended offers (from the proposer’s standpoint) was the variation in responders’ reciprocation across these offer types. The proportion of the responders that would accept an exploding offer was close to 50% in three out of four studies (and never significantly higher than 50%), but responders reciprocated much less positively to the proposer after accepting an exploding offer, than an extended offer. In other words, the proposers issuing an exploding offer suffered from what we call the reciprocation curse.

From a normative standpoint, a proposer should issue an exploding offer if she believes that the probability that the responder will accept it is high enough to compensate for the reciprocation curse. In §4.3 we get some insights into the drivers of proposers’ decisions. The subjects anticipated the reciprocation curse, regardless of whether they issued exploding or extended offers – that is, regardless of their deadline decision, they estimated that exploding offers would be more likely to generate negative reciprocation. In other words, even though subjects did anticipate the reciprocation curse, they essentially ignored it when deciding which offer to issue. The main predictor of whether a proposer would issue an exploding or extended offer was whether the proposer himself found an exploding offer acceptable. This is akin to projection bias as reviewed in §2.

Of course, there are still many open questions regarding the effects of ultimatum deadlines. Our four experiments all made use of one-shot games. These games reasonably capture the problem faced by firms that hire relatively infrequently and therefore have little opportunity to learn from their actions. Hence, it also might be fruitful in the future
to examine whether the effects we observed persist in settings where participants receive regular feedback, as might be the case in some (typically large) firms that hire more frequently.

The impact of exploding deadlines on overall market efficiency is also worth exploring. In an experimental market with multiple firms and multiple candidates, each having heterogeneous preferences over potential matches, Sondak and Bazerman (1991) provide some evidence that the use of exploding offers lowers the aggregate quality of matching outcomes. In their study, the candidates had no opportunity to reciprocate towards firms; thus, it is unclear what effects exploding offers would have on market efficiency when this element of realism is introduced.

One important takeaway from our research is that the reciprocation curse that results from exploding offers, despite being anticipated by subjects, tends to be ignored when weighing the pros and cons of an exploding offer versus an extended offer. Though we cannot be sure, we would expect that the same effect is likely to occur in real-life settings as well. If so, our results have important practical implications. Note, however, that in some situations there may be reasons for a proposer to prefer an exploding offer. For instance, when interviewing many candidates, exploding offers may give the proposer time to hire other candidates; with a single candidate, an exploding offer may be attractive to the proposer because it allows for the early resolution of uncertainty (about whether the candidate will accept the offer). Also, although our experiments do not demonstrate this, it remains possible that issuing an exploding offer might in some cases result in a higher probability of acceptance because the responder will have less time to explore other options. However, on top of all these factors, and running contrary to them, the proposer must keep in mind the reciprocation curse – a newly hired employee might reciprocate in many ways, for example, by being more or less committed to the firm, working more or less hard, and by being more or less helpful to colleagues.

Prescriptively, we would urge managers who are deciding between issuing an exploding or an extended offer to seriously consider the possibility of the reciprocation
curse. Additionally, to avoid the dangers of the projection bias, one simple strategy might be to harness the wisdom of crowds – to ask others whether they think an exploding offer is a good idea. Getting input from new hires, for example, may help one to better calibrate one’s hiring practices.

Wharton’s Career Services website gives the following advice to students who are faced with exploding offers:

“Our belief is that this undue pressure increases the chances of reneging, and turns off the very students - those willing to take a risk - that the companies are most anxious to recruit. But this is how some firms operate. Ask yourself: do I want to work for such an organization?”

Similarly, we would encourage organizations considering giving such offers to sincerely contemplate whether they want someone who has felt forced into accepting an exploding offer working for them. We would urge these organizations to keep in mind the *reciprocation curse*.

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[^5]: [http://www.vpul.upenn.edu/careerservices/wharton/offerdecision.html#policy](http://www.vpul.upenn.edu/careerservices/wharton/offerdecision.html#policy)
Appendix: Analysis of Game and Underlying Model

Game Analysis

In our Deadline Game, just as in the Ultimatum Game and Dictator Game, it is not particularly informative to analyze the Nash Equilibrium strategies based on the players’ payoffs, as there are many (non-pecuniary) reasons for the responders to deviate from the income-maximizing prescription. In the Deadline Games examined in Studies 1-4, the responder makes up to two decisions: whether to accept or reject an exploding offer (if an exploding offer was received); and then, whenever an offer is accepted, whether to reward or punish the proposer (Studies 1 and 2), or to decide on a dictator allocation (Studies 3 and 4).

Whether a responder accepts an exploding offer depends on the responder’s preference for the sure-thing payoff resulting from accepting the offer or the risky lottery resulting from waiting for the better alternative. Of course, the responder’s decision might be influenced by his risk preferences, anticipated regret, and so on. In Studies 1 and 2, the responder’s reciprocation action does not affect his own financial outcome; hence, assuming he is exclusively self-interested and focuses only on income, he should be indifferent between rewarding and punishing the proposers regardless of the deadline he was given. Therefore, reward-punish decisions that systematically deviate from indifference reveal non-financial motivations such as concerns for fairness, emotional reactions, and the like. In contrast, in Studies 3 and 4, where the responder chooses the allocation amounts in a Dictator Game, exclusive concerns for financial self-interest will lead to zero allocations regardless of deadline, while concerns for fairness and other non-monetary considerations could result in non-zero allocations.

Proposer’s Perspective

The proposer’s (one) decision is seemingly simple: to give an exploding offer or not. But besides her own preferences regarding risk and other factors, her decision
depends on her beliefs or expectations about the responder’s behavior. The proposer should consider: a) the probability that an exploding offer will be accepted; and b) the distribution of her payoffs conditional on her offer being accepted (which result from her beliefs about how the responder is likely to reciprocate). Based on her preferences and beliefs she must choose between an exploding and an extended offer. Here, we adopt a decision-theoretic approach to model the proposer’s decision. Our rationale is similar to the one proposed by Rothkopf (2007) for analyzing auctions: given the complexity of the proposer’s problem – resulting from the tremendous uncertainty about how the responder will act – a decision-theoretic approach provides a more transparent, pragmatic framework for understanding the problem than does a game-theoretic one.

To model the proposer’s problem, let us denote the subjective (to the proposer) probability that an exploding offer will be accepted by \( a_s \). One important question for the proposer is whether \( a_s \) is greater or smaller than 0.5, the probability that an extended offer will be accepted. She also needs to compare her (subjective) distributions of her payoffs, conditional on the responder accepting exploding and extended offers. Let \( F_s \) (\( F_l \)) denote the cumulative distribution function (hereafter, distribution) of her payoff conditional on the responder accepting an exploding (extended) offer.

In general, the proposer’s choice between exploding and extended offers depends on her estimates of \( a_s \), \( F_s \), \( F_l \), and her risk preferences. However, Observation 1 below shows that sometimes this choice is independent of the proposer’s risk attitude.

**Observation 1** Suppose that \( F_l \) dominates \( F_s \) in the sense of first-order stochastic dominance, and \( a_s \leq 0.5 \). Then issuing an extended offer results in a distribution of payoffs that first-order dominates the distribution of payoffs resulting from an exploding offer. Similarly, if \( F_s \) first-order dominates \( F_l \) and \( a_s \geq 0.5 \), the proposer is better off issuing an exploding offer, as its resulting payoff distribution first-order stochastically dominates the extended offer payoff distribution.

Therefore, if the proposer believes that the responder will be more generous (in terms of first-order dominance) after accepting an extended offer, compared to after
accepting an exploding one, and she believes the chances of responder accepting an exploding offer are less than 0.5, then she should issue an extended offer. This holds regardless of her risk preferences, as long as the proposer wants to be consistent with the first-order stochastic dominance criterion.

Of course, sometimes the conditions required for Observation 1 to provide the basis for a clear-cut decision will not be satisfied. For example, this would be the case if \( F_l \) first-order dominates \( F_s \) and \( a_s > 0.5 \). In this case, the choice between extended and exploding offers would also depend on the responder’s risk preferences. We explore this in the setting corresponding to Studies 1 and 2, because there \( F_l \) and \( F_s \) can be characterized by a single parameter – the probability that the responder rewards the proposer. Denote the (subjective) probability that the exploding (extended) offer will be rewarded by \( r_s \) (\( r_l \)). If rewarded, the proposer’s payoff is \( H \) (\( H = €120 \) in Study 1 and \( H = $12 \) in Study 2), and if punished, the proposer’s payoff is \( L \) (\( L = €40 \) in Study 1 and \( L = $4 \) in Study 2).

**Proposition 1** Consider a proposer with utility function \( u(\cdot) \). Denote \( u_L = [u(L)-u(0)]/[u(H)-u(0)] \). The proposer prefers an exploding (extended) offer if \( a_s > (<) 0.5 \) \([r_l+(1-r_l)u_L]/[r_s+(1-r_s)u_L]\).

**Proof** If issuing an exploding offer, the proposer’s expected utility is \( a_s[r_l u(H)+(1-r_l)u(L)]+(1-a_s)u(0) \). Under an extended offer, the expected utility is 0.5 \([r_l u(H)+(1-r_l)u(L)+u(0)]\). An exploding offer yields greater expected utility if \( a_s[r_l u(H)+(1-r_s)u(L)]+(1-a_s)u(0) > 0.5 \[r_l u(H)+(1-r_l)u(L)+u(0)] \iff a_s > 0.5 \[r_l+(1-r_l)u_L]/[r_s+(1-r_s)u_L] \). □

Suppose that \( r_s < r_l \). If \( a_s \leq 0.5 \), by Observation 1 an extended offer is better in the first-order stochastic dominance sense. If \( a_s > 0.5 \), the proposer faces a tradeoff: an exploding offer has higher chances of acceptance but lower chances of reward. In this case, the proposer’s choice would depend on her degree of risk aversion. Intuitively, a risk-averse proposer wants to maximize the chances of getting “at least something”, and thus prefers a poorer lottery (with probability of reward being \( r_s \) with higher chances \( a_s \),
rather than a better lottery with probability of reward being \( r_i \) but with lower chances (0.5). The corollary below confirms this intuition.

**Corollary** Suppose \( r_s < r_l \). Consider Proposer 1 with utility function for wealth \( v_1(w) \) and Proposer 2 with utility function for wealth \( v_2(w) \), where Proposer 2 is more risk averse than Proposer 1 (i.e., \( v_2(w) = \phi(v_1(w)) \), where \( \phi(.) \) is increasing and concave). If Proposer 1 prefers the exploding offer, then Proposer 2 also prefers the exploding offer.

**Proof** Let \( u_{L,i} = \frac{v_i(L) - v_i(0)}{v_i(H) - v_i(0)} \), \( i = 1, 2 \). Without loss of generality, assume that \( v_1(.) \) and \( v_2(.) \) are such that \( v_1(0) = v_2(0) = 0 \) and \( v_1(H) = v_2(H) = 1 \), and therefore \( \phi(0) = 0 \) and \( \phi(1) = 1 \). Then \( u_{L,i} = v_i(L) \). Note that \( u_{L,2} \geq u_{L,1} \) because \( v_2(L) = \phi(v_1(L)) \geq (1 - v_1(L)) \phi(0) + v_1(L) \phi(1) \). If Proposer 1 prefers to issue an exploding offer, then by Proposition 1, \( a_s \geq 0.5 \frac{r_l + (1 - r_l)u_{L,1}}{r_s + (1 - r_s)u_{L,2}} \). From \( u_{L,2} \geq u_{L,1} \) and \( r_s < r_l \), \( a_s \geq 0.5 \frac{r_l + (1 - r_l)u_{L,1}}{r_s + (1 - r_s)u_{L,2}} \). \( \square \)
References


Figures

Figure 1. Cumulative distributions of dictator allocations (to proposer) by offer type for Studies 3 and 4.
## Tables

### Table 1. Summary statistics for Studies 1 and 2. (Standard errors in parentheses.)

<table>
<thead>
<tr>
<th>Decision</th>
<th>Study 1</th>
<th>Study 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion Giving Exploding Offer</td>
<td>0.39 (0.05)</td>
<td>0.55 (0.04)</td>
</tr>
<tr>
<td>Proportion Accepting Exploding Offer</td>
<td>0.32 (0.05)</td>
<td>0.55 (0.04)</td>
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<tr>
<td>Proportion Punishing Exploding Offer</td>
<td>0.55 (0.09)</td>
<td>0.39 (0.05)</td>
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<tr>
<td>Proportion Punishing Extended Offer</td>
<td>0.10 (0.03)</td>
<td>0.06 (0.02)</td>
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<td>Expectation of Exploding Offer</td>
<td>€24.71</td>
<td>USD 4.72</td>
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<tr>
<td>Expectation of Extended Offer</td>
<td>€56.08</td>
<td>USD 5.74</td>
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### Table 2. Summary statistics for Studies 3 and 4. (Standard errors in parentheses.)

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<thead>
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<th>Study 3</th>
<th>Study 4</th>
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<tr>
<td>Proportion Giving Exploding Offer</td>
<td>0.64 (0.07)</td>
<td>0.56 (0.07)</td>
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<tr>
<td>Proportion Accepting Exploding Offer</td>
<td>0.47 (0.07)</td>
<td>0.46 (0.10)</td>
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<td>Average Dictator Allocation After Exploding Offer</td>
<td>$11.64 (3.10)</td>
<td>$3.92 (2.71)</td>
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<td>Median Dictator Allocation After Exploding Offer</td>
<td>$5.00</td>
<td>$0.00</td>
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<tr>
<td>Average Dictator Allocation After Extended Offer</td>
<td>$25.69 (2.89)</td>
<td>$30.63 (3.59)</td>
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<td>Median Dictator Allocation After Extended Offer</td>
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<td>$37.00</td>
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<td>Expectation of Exploding Offer</td>
<td>SGD 52.66</td>
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</tr>
<tr>
<td>Expectation of Extended Offer</td>
<td>SGD 62.84</td>
<td>SGD 65.32</td>
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### Table 3. Contingency table for deadline offer (exploding or extended) and whether subjects would accept or reject exploding offers. Cell entries represent the percentage of subjects in the experiment whose decisions fall into that respective cell.

<table>
<thead>
<tr>
<th>Study 1</th>
<th>Accept Exploding</th>
<th>Reject Exploding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Give Exploding</td>
<td>22.55%</td>
<td>16.67%</td>
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<tr>
<td>Give Extended</td>
<td>9.80%</td>
<td>50.98%</td>
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<td>N = 102</td>
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<td></td>
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<table>
<thead>
<tr>
<th>Study 2</th>
<th>Accept Exploding</th>
<th>Reject Exploding</th>
</tr>
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<tbody>
<tr>
<td>Give Exploding</td>
<td>37.86%</td>
<td>17.48%</td>
</tr>
<tr>
<td>Give Extended</td>
<td>17.48%</td>
<td>27.18%</td>
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<tr>
<td>N = 206</td>
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<thead>
<tr>
<th>Study 3</th>
<th>Accept Exploding</th>
<th>Reject Exploding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Give Exploding</td>
<td>37.74%</td>
<td>26.42%</td>
</tr>
<tr>
<td>Give Extended</td>
<td>9.43%</td>
<td>26.42%</td>
</tr>
<tr>
<td>N = 53</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4. Percentage of subjects who accepted and rejected exploding offers conditional on whether they themselves gave exploding or extended offers.

<table>
<thead>
<tr>
<th>Study</th>
<th>Accept Exploding</th>
<th>Reject Exploding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Give Exploding</td>
<td>57.5% 42.50%</td>
<td>16.13% 83.87%</td>
</tr>
<tr>
<td>Give Extended</td>
<td>68.42% 31.58%</td>
<td>39.13% 60.87%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study</th>
<th>Accept Exploding</th>
<th>Reject Exploding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Give Exploding</td>
<td>58.52% 41.18%</td>
<td>26.43% 73.68%</td>
</tr>
<tr>
<td>Give Extended</td>
<td>68.70% 30.30%</td>
<td>24.64% 75.36%</td>
</tr>
</tbody>
</table>

Table 5. Percentage of subjects who gave exploding and extended offers conditional on whether they themselves accepted or rejected exploding offers.

<table>
<thead>
<tr>
<th>Study</th>
<th>Give Exploding</th>
<th>Give Extended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accept Exploding</td>
<td>68.70% 30.30%</td>
<td>24.64% 75.36%</td>
</tr>
<tr>
<td>Reject Exploding</td>
<td>39.13% 60.87%</td>
<td>39.13% 60.87%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study</th>
<th>Accept Exploding</th>
<th>Reject Exploding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Give Exploding</td>
<td>80.00% 20.00%</td>
<td>50.00% 50.00%</td>
</tr>
<tr>
<td>Give Extended</td>
<td>68.42% 31.58%</td>
<td>68.42% 31.58%</td>
</tr>
</tbody>
</table>

Table 6. Average estimated probability of exploding offers being accepted. (Values in parentheses represent one standard error of mean.)

<table>
<thead>
<tr>
<th>Study</th>
<th>Reject Exploding</th>
<th>Accept Exploding</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Give Extended</td>
<td>38 (3) 60 (7)</td>
<td>36 (5) 60 (4)</td>
<td>42 (3)</td>
</tr>
<tr>
<td>Give Exploding</td>
<td>38 (3) 60 (3)</td>
<td>38 (3) 60 (3)</td>
<td>50 (4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study</th>
<th>Reject Exploding</th>
<th>Accept Exploding</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Give Extended</td>
<td>35 (3) 59 (4)</td>
<td>33 (3) 61 (2)</td>
<td>45 (3)</td>
</tr>
<tr>
<td>Give Exploding</td>
<td>34 (2) 60 (2)</td>
<td>34 (2) 60 (2)</td>
<td>52 (2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study</th>
<th>Reject Exploding</th>
<th>Accept Exploding</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Give Extended</td>
<td>35 (5) 60 (4)</td>
<td>47 (4) 63 (3)</td>
<td>42 (5)</td>
</tr>
<tr>
<td>Give Exploding</td>
<td>41 (3) 62 (3)</td>
<td>41 (3) 62 (3)</td>
<td>51 (3)</td>
</tr>
</tbody>
</table>
Table 7. Average estimated probability of punishing exploding and extended offers (Studies 1 and 2), and average estimated dictator allocation to self after exploding and extended offers (Study 3). The estimates are broken down by whether subjects gave exploding offers (rows), and whether they accepted exploding offers (columns). (Values in parentheses represent one standard error of mean.)

<table>
<thead>
<tr>
<th>Study</th>
<th>Mean Estimates Conditional on Receiving Exploding Offer</th>
<th>Mean Estimates Conditional on Receiving Extended Offer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reject Exploding</td>
<td>Accept Exploding</td>
</tr>
<tr>
<td>Study 1</td>
<td>Give Extended</td>
<td>71 (4)</td>
</tr>
<tr>
<td></td>
<td>Give Exploding</td>
<td>67 (6)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>70 (3)</td>
</tr>
<tr>
<td>Study 2</td>
<td>Give Extended</td>
<td>67 (4)</td>
</tr>
<tr>
<td></td>
<td>Give Exploding</td>
<td>59 (4)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>64 (3)</td>
</tr>
<tr>
<td>Study 3</td>
<td>Give Extended</td>
<td>54 (3)</td>
</tr>
<tr>
<td></td>
<td>Give Exploding</td>
<td>49 (5)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>51 (3)</td>
</tr>
</tbody>
</table>