On the First Offer Dilemma in Bargaining and Negotiations

António Osório

Universität Rovira i Virgili (Dept. Economics) and CREIP
(antonio.osoriodacosta@urv.cat)

Abstract

In bargaining and negotiations, should one make the first offer or wait for the opponent to do so? Practitioners support the idea that moving first in bargaining is a mistake, while researchers find strong evidence that first-movers benefit from an anchoring effect. This paper addresses these issues from a theoretical perspective for the first time in the literature. It is found that first-movers benefit from a strategic advantage, while second-movers benefit from an information advantage. Therefore, the existence of first and second-mover advantages depends crucially on the relative strength of these two effects. In line with the experimental literature, first-mover advantages are more prevalent, but second-mover advantages appear in very reasonable and realistic bargaining situations. Among other results, it is found that second-mover advantages require the existence of high-types (patient individuals) and differences in individuals' preferences. The results also suggest a systematic first-mover advantage in contexts of great ambiguity, in which the anchoring effect of the first offer becomes the driving force.

Keywords: Bargaining and negotiation; First offer dilemma; Anchoring effects; Information gains; Second-mover advantage.
JEL classification: C78, C91, D03, D74.

1. Introduction

The first offer dilemma in bargaining and negotiation is a central and debated question among academics and practitioners—should one make the first offer or wait for the opponent to do so? Interestingly, practitioners and researchers tend to disagree on this issue. Loschelder et al., 2014 call it the practitioner-researcher paradox.

There is a conventional wisdom among practitioners that moving first in bargaining is a mistake. Some practical and business oriented literature supports the idea that it is wise to let the opponent make the first offer (Dell and Boswell, 2009; McCormack, 1989; among others). The argument is that first offers provide crucial information to the second-mover and may give away some bargaining zone.

However, the majority of the experimental and empirical research, coming mostly from psychology and business, shows that first offers benefit from an anchoring effect (Chertkoff and Conley, 1967; Galinsky et al., 2009; Galinsky and Mussweiler, 2001; Kristensen and Gärling, 1997; Liebert et al., 1968; Yukl, 1974).[1] The argument is that the first offer drives the cognitive process towards the search for information and attributes that are consistent with this offer (Mussweiler and Strack, 1999, 2000). Orr and Guthrie (2006) have found that around 25% of the variance in the final outcome is explained by first offer effects. Galinsky et al. (2009) and Van Poucke and Buelens (2002) have found even stronger first offer effects. Gunia et al. (2013) show that the first offer effect is remarkably robust across cultures, bargaining powers, and types of negotiations, but some authors argue that first-movers fail to exploit the potential of the anchoring effect (Galinsky and Mussweiler, 2001; Liebert et al., 1968). First offers have an even stronger anchor effect when the subjects have little or no information about the value of the object under negotiation (Gunia et al., 2013; Orr and Guthrie, 2006; Strack and Mussweiler, 1997).

However, the strength of the first offer anchoring effect can be mitigated if we consider information issues, experience, framing, perception and aspirations. For instance, Liebert et al. (1968) have found that less well-informed bargainers are more influenced by extreme first offers than informed bargainers (Orr and Guthrie, 2006). Orr and Guthrie (2006) conclude that experts are more immune to anchoring effects, but not completely so (Neale and Bazerman, 1983; Ritov, 1996). For instance, Northcraft and Neale (1987) have found anchoring effects in real estate professionals (Mussweiler et al., 2000), and Englich et al. (2006) and Orr and Guthrie (2006) have found anchoring effects in professional judges. The first offer anchoring effect can also be mitigated by inconsistent or contradictory information that does not support the proposed value (Chapman and Johnson, 1999; Kristensen and Gärling, 2000; Lord et al., 1984; Mussweiler et al., 2000).

The theoretical literature, coming mostly from economics, also agrees with the ex-

[1] Empirical studies supporting the existence of a second-mover advantages are usually the exception (Gunia et al., 2013; Galinsky et al., 2009; Neale and Lys, 2015). For instance, Cotter and Henley Jr (2008) show that first-mover advantages exist only if negotiators are inexperienced. Loschelder et al. (2016) found second-mover advantages in multi-issue zero-sum (integrative) negotiations when first offers reveal the first-mover preferences, but not in single issue zero-sum (distributive) negotiations (see also Loschelder et al., 2014; Ritov and Moran, 2008).

istence of first-mover advantages in non-cooperative bargaining situations (Ausubel et al., 2002; Binmore et al., 1992; Fudenberg et al., 1985; Kennan and Wilson, 1993; Rubinstein, 1982, 1985; Sobel and Takahashi, 1983). The existence of first-mover advantages are implicit in most studies (Muthoo, 1999; Osborne and Rubinstein, 1990). However, this issue has never been addressed explicitly. As opposed to other economic issues, in which first- and second-mover advantages are well-understood (Lieberman and Montgomery, 1988), the existence of first- or second-mover advantages in bargaining and negotiations remains far from our understanding. The present paper is the first theoretical approach aimed at addressing these issues.

The objective of this paper is to study the circumstances under which the second-mover holds an advantage in bargaining. In this context, we want to understand why—despite so much evidence in favor of the first-mover position—professional bargainers seem to prefer the second-mover position.

For instance, at some moment in our lives, when buying or selling an object, we have been invited to make the first offer. This invitation is very common among professional bargainers. For instance, in China and in most Eastern cultures (in some Western countries also, but to a much lesser extent), some goods do not have a price tag. In this context, when buyers demand information about the selling price, they are invited to make an offer. In other words, sellers refrain from making the first offer in order to become second-movers. In fact, professional bargainers seem to compete for this position. In this context, the following question arises: what are the strategic reasons behind such behavior?

In order to address these issues, we consider the Rubinstein (1982) infinite horizon alternating offers model with incomplete information about the time preferences (i.e., the discount factor). In this model, two fully rational individuals bargain over the division of a pie with a unit value. For simplicity, we consider that individuals can be of two different types. *High-type* individuals, who have a higher discount factor and are consequently less likely to accept a smaller share of the pie (*patient-types*), and *low-type* individuals, who have a lower discount factor and are consequently more likely to accept a smaller share of the pie (*impatient-types*).

We consider a one-sided incomplete information structure (Ausubel et al., 2002; Binmore et al., 1992; Fudenberg et al., 1985; Kennan and Wilson, 1993; Rubinstein, 1985), in which the first-mover has no knowledge about the second-mover's type, but the second-mover has complete information about the first-mover's type. The information structure leads to a simpler and more tractable model, and is motivated by the fact that offers provide information about the individuals' types.

Under perfect information conditions, first-movers hold a *strategic advantage*

(Muthoo, 1999; Osborne and Rubinstein, 1990; Rubinstein, 1982), which is explained by the fact that first-movers have an early chance to impose their preferences on second-movers. In a context with costly delay due to discounting, the second-mover is in a weaker position, because rejection implies an undesired loss of value. The first-mover advantage explores this fact.

The introduction of incomplete information returns an *information advantage* to the second-mover. The first-mover faces a dilemma: either she proposes an *aggressive offer* (i.e., an offer that is relatively more favorable to herself), but that may be rejected, which leads to a *cost of delay*, or she proposes a *soft offer* (i.e., an offer that is relatively less favorable to herself, which has associated an *information cost*), but is sure to be accepted. Consequently, the second-mover may benefit from offers that are higher than required for acceptance, which has associated an *information gain.* Therefore, the existence of first- or second-mover advantages depends crucially on the strength of the strategic and information advantage.

We find two different first-mover strategic behaviors. (i) If there is a strong belief that the second-mover is of the high-type, the first-mover proposes *soft offers.* In this case, there is *no delay* and no destruction of value, but the first-mover may incur an *information cost* and the second-mover benefit from an *information gain.* Consequently, second-mover advantages exist if the information advantage is sufficiently strong, which increases with the difference between the types. (ii) Otherwise, if there is no strong belief that the second-mover is of the high-type, the first-mover proposes *aggressive offers.* However, these offers can be rejected by the high-type second-movers, and consequently lead to a *cost of delay.* In this case, the second-mover position is preferred if the first-mover *cost of delay* is sufficiently important.

We also find other regularities. First, second-mover advantages always require the existence of differences in individuals' types. Second, second-mover advantages always require sufficiently strong beliefs that the opponent is of the high-type, i.e., the type that rejects aggressive offers. These beliefs discipline first-movers to propose soft offers, which are the offers that can potentially benefit second-movers. Third, first-mover advantages tend to be more prevalent, in line with the experimental and empirical literature, but second-mover advantages tend to appear under very reasonable and realistic situations. Fourth, first-mover advantages are particularly robust in contexts of great ambiguity, which may provide a rationale for why it is so difficult to find second-mover advantages in the experimental literature.

This paper is organized as follows: Section 2 describes the theoretical framework, Section 3 characterizes the bargaining equilibrium, Section 4 studies the existence of first- and second-mover advantages in bargaining, and Section 5 concludes.

2. The incomplete information model

We consider two individuals ($i \in \{1, 2\}$) who take turns making offers about how to divide a pie of size one. We do not fix a buyer and a seller role to each individual. Instead, individual $i = 1$ denotes the first-mover and individual $i = 2$ denotes the second-mover.

Individuals dislike delay. In this context, individuals' discount the future according to the discount factor $\delta_i^{\omega_i} \in (0, 1)$ where $\omega_i \in \{l, h\}$ denotes the individual i type. For the sake of simplicity, individuals can be of two types. *High-types* or *patient-types* (denoted as $\omega_i = h$), who have a higher discount factor $\delta_i^h \in (0, 1)$, and are consequently less likely to accept a lower share of the pie. *Low-types* or *impatient-types* (denoted as $\omega_i = l$), which have a lower discount factor $\delta_i^l \leqslant \delta_i^h$, and consequently more likely to accept a lower share of the pie. High- and low-types have probabilities $p \in [0, 1]$ and $1 - p$, respectively.

The bargaining protocol is similar to the one in Rubinstein (1982), but with one-sided incomplete information (Ausubel et al., 2002; Binmore et al., 1992; Fudenberg et al., 1985; Kennan and Wilson, 1993; Rubinstein, 1985), in which the first-mover has no information about the second-mover's type, but the second-mover learns the first-mover's type after observing their offer. However, ex-ante, i.e., before bargaining begins, the second-mover does not know the first-mover type.[2] Let $x_i^{\omega_1\omega_2}$ and $1-x_i^{\omega_1\omega_2}$ denote the first and second-mover share of the pie proposed by mover $i \in \{1, 2\}$ in Stage $i \in \{1, 2\}$ (in our context, since agreement is reached either in Stage 1 or 2, we remove the reference to time). The superscripts $\omega_1, \omega_2 \in \{l, h\}$ associate the offers with the first and second-mover types, respectively.[3]

The equilibrium offers and payoffs are obtained as in the Rubinstein (1982) model. In equilibrium, individuals must be indifferent between accepting and rejecting the first and second-mover offers made in Stage 1 and 2, respectively. In Stage 1, the first-mover offer $x_1^{\omega_1\omega_2}$ must be such that the second-mover must be indifferent between

[2]Often in reality, information revelation occurs more slowly. Consequently, in every period individuals alternate positions, which makes it difficult to separate the strategic and information effects. For that reason, a simple and tractable information structure is strictly necessary to separate these two effects. Nonetheless, in aggregate terms, the first-mover is always ahead in strategic terms, while the second-mover is always ahead in information terms.

[3]Note that under incomplete information, the individual true type may not coincide with the superscripts attached to a particular offer, because individuals may strategically propose something different. For instance, a low type first-mover may propose x_1^{hh} or x_1^{hl} to a high- or low-type second-mover, respectively, which is different from her optimal perfect information offer x_1^{lh} or x_1^{ll}, respectively.

accepting it in Stage 1, with payoff $1-x_1^{\omega_1\omega_2}$, and rejecting it, with Stage 2 discounted payoff $\delta_2^{\omega_2}(1-x_2^{\omega_1\omega_2})$, i.e., $1-x_1^{\omega_1\omega_2} = \delta_2^{\omega_2}(1-x_2^{\omega_1\omega_2})$. In Stage 2, the second-mover offer $x_2^{\omega_1\omega_2}$ must be such that the first-mover must be indifferent between accepting it in Stage 2, with payoff $x_2^{\omega_1\omega_2}$, and rejecting it, with Stage 3 discounted payoff $\delta_1^{\omega_1}x_1^{\omega_1\omega_2}$, i.e., $x_2^{\omega_1\omega_2} = \delta_1^{\omega_1}x_1^{\omega_1\omega_2}$. The solution to the system made up of these two equilibrium conditions returns the following first and second-mover offers:

$$(x_1^{\omega_1\omega_2}, x_2^{\omega_1\omega_2}) = \left(\frac{1-\delta_2^{\omega_2}}{1-\delta_1^{\omega_1}\delta_2^{\omega_2}}, \frac{\delta_1^{\omega_1}(1-\delta_2^{\omega_2})}{1-\delta_1^{\omega_1}\delta_2^{\omega_2}}\right), \tag{1}$$

for $\omega_1, \omega_2 \in \{l, h\}$.

In our context, the first-movers (the uninformed side) can make two different kinds of offers: *soft offers* and *aggressive offers.* A *soft offer* is a first-mover offer that is accepted by any second-mover type (i.e., x_1^{lh} or x_1^{hh}, depending on whether the first-mover is of the low or high-type, respectively), while an *aggressive offer* is a first-mover offer that is accepted by low-type second-movers but rejected by high-type second-movers (i.e., x_1^{ll} or x_1^{hl}, depending on whether the first-mover is of the low or high-type, respectively). Clearly, soft offers entail lower shares of the pie for the first-mover than aggressive offers (i.e., $x_1^{lh} \leqslant x_1^{ll}$ or $x_1^{hh} \leqslant x_1^{hl}$, depending on whether the first-mover is of the low or high-type, respectively).

Hence, if an agreement is reached in Stage 1, the first- and second-mover payoffs are:

$$(v_1^{\omega_1\omega_2}, v_2^{\omega_1\omega_2}) = (x_1^{\omega_1\omega_2}, 1-x_1^{\omega_1\omega_2}) = \left(\frac{1-\delta_2^{\omega_2}}{1-\delta_1^{\omega_1}\delta_2^{\omega_2}}, \frac{\delta_2^{\omega_2}(1-\delta_1^{\omega_1})}{1-\delta_1^{\omega_1}\delta_2^{\omega_2}}\right), \tag{2}$$

for $\omega_1, \omega_2 \in \{l, h\}$, while if agreement is reached in Stage 2, the first and second-mover discounted payoffs are:

$$(\widehat{v}_1^{\omega_1\omega_2}, \widehat{v}_2^{\omega_1\omega_2}) = (\delta_1^{\omega_1}x_2^{\omega_1\omega_2}, \delta_2^{\omega_2}(1-x_2^{\omega_1\omega_2})) = \left(\frac{\delta_1^{\omega_1}\delta_1^{\omega_1}(1-\delta_2^{\omega_2})}{1-\delta_1^{\omega_1}\delta_2^{\omega_2}}, \frac{\delta_2^{\omega_2}(1-\delta_1^{\omega_1})}{1-\delta_1^{\omega_1}\delta_2^{\omega_2}}\right), \tag{3}$$

for $\omega_1, \omega_2 \in \{l, h\}$. The decoration "$\widehat{\ }$" denotes Stage 2 payoffs discounted to Stage 1.

Note that the second-mover discounted payoff is the same regardless of whether there is an early or a late agreement, i.e., $v_2^{\omega_1\omega_2} = \widehat{v}_2^{\omega_1\omega_2}$ for all $\omega_1, \omega_2 \in \{l, h\}$, which is an implication of the fact that agreement is reached either in Stage 1 or 2.

In order to make specific predictions regarding the existence of first and second-mover advantages, we assume that types are symmetric. Otherwise, the existence of second-mover advantages could be explained by asymmetries between the individuals in terms of discounting, as in the perfect information model.

Assumption (symmetry): $\delta_1^l = \delta_2^l = \delta^l$ *and* $\delta_1^h = \delta_2^h = \delta^h$.

The four combinations of first and second-mover types differ in terms of $\omega_1 \in \{l, h\}$ and $\omega_2 \in \{l, h\}$, respectively, i.e., $\{ll, lh, hl, hh\}$. The following result ranks the first and second-mover discounted payoffs in expressions (2) and (3) in terms of value.

Lemma 1. *The following relation between payoffs holds true:*

$$v_1^{hl} \geqslant v_1^{ll} \geqslant v_1^{hh} \geqslant v_1^{lh} \text{ and } v_2^{hl} \leqslant v_2^{ll} \leqslant v_2^{hh} \leqslant v_2^{lh}, \tag{4}$$

for $\delta^l \leqslant \delta^h \leqslant 1$, *with strict inequality if* $\delta^l < \delta^h < 1$, *where* $v_2^{\omega_1\omega_2} = \widehat{v}_2^{\omega_1\omega_2}$ *for all* $\omega_1, \omega_2 \in \{l, h\}$.

The proof of Lemma 1 can be found in the Appendix. These inequalities are important for understanding our results.

3. The bargaining equilibrium characterization

In our context, the starting point is understanding that first-movers will have a *strategic advantage*, while second-movers will have an *information advantage*. The first-mover strategic advantage is based on the fact that the first-mover has an early chance to impose its interests on the second-mover. Consequently, the second-mover is in a weaker position because rejection implies an undesired loss of value due to delay, which becomes more severe with discounting. The first-mover strategic advantage explores this fact. The second-mover information advantage is due to the fact that the second-mover may benefit from first-mover offers that are higher than required for acceptance (soft offers), which materializes into *information gains* to the second-mover and *information costs* to the first-mover, while not losing the chance to reject unfavorable offers (aggressive offers), which materializes into *costs of delay* to the first-mover. The strength of these two effects determines who has advantage in bargaining.

In this context, we distinguish between the low- and high-type first-movers behavior because they may lead to different equilibrium offers.

Low-type first-mover case - The low-type first-mover soft offer x_1^{lh} does not risk rejection, but has an implicit information cost. In this case, the low-type first-mover payoff is given by:

$$v_1^{lh} = E(v_1^l) - (1 - p)Ic_1^l, \tag{5}$$

where $Ic_1^l = v_1^{ll} - v_1^{lh}$ denotes the low-type first-mover information cost, and $E(v_1^l) = pv_1^{lh} + (1 - p)v_1^{ll}$ is the low-type ex-ante expected payoff, i.e., the payoff that the low-type first-mover would obtain if he/she could propose the offer suited to each possible second-mover type.

On the other hand, the low-type first-mover aggressive offer x_1^{ll} risks rejection, and has an implicit cost of delay. In this case, the low-type first-mover payoff is given by:

$$\overline{v}_1^{ll} = E(v_1^l) - pCd_1^l, \tag{6}$$

where $Cd_1^l = v_1^{lh}(1 - \delta^l \delta^l)$ denotes the low-type first-mover cost of delay.

In this context, the following result characterizes the low-type first-mover equilibrium behavior in our incomplete information setting.

Proposition 1 (equilibrium characterization - low-type). *If*

$$p > \overline{p}^l = \frac{Ic_1^l}{Ic_1^l + Cd_1^l} = \frac{v_1^{ll} - v_1^{lh}}{v_1^{ll} - \delta^l \delta^l v_1^{lh}}, \tag{7}$$

where $\overline{p}^l \in [0,1]$, *the low-type first-mover proposes a soft offer* x_1^{lh}, *which is accepted by any type of second-mover. Otherwise, i.e., if* $p \leqslant \overline{p}^l$, *the low-type first-mover proposes an aggressive offer* x_1^{ll} *(*$\geqslant x_1^{lh}$*), which is accepted by the low-type second-mover, but not by the high-type second-mover, who counter offers with* x_2^{lh}.

The proof of Proposition 1 and the derivation of the above expected payoffs can be found in the Appendix.

High-type first-mover case - Similarly, the high-type first-mover soft offer x_1^{hh} does not risk rejection, but has an implicit information cost. In this case, the high-type first-mover payoff is given by:

$$v_1^{hh} = E(v_1^h) - (1-p)Ic_1^h, \tag{8}$$

where $Ic_1^h = v_1^{hl} - v_1^{hh}$ denotes the high-type first-mover information cost, and $E(v_1^h) = pv_1^{hh} + (1-p)v_1^{hl}$ is the high-type ex-ante expected payoff, i.e., the payoff that the high-type first-mover would obtain if he/she could propose the offer suited to each possible second-mover type.

The high-type first-mover aggressive offer x_1^{hl} risks rejection and has an implicit cost of delay. In this case, the high-type first-mover payoff is given by:

$$\overline{v}_1^{hl} = E(v_1^h) - pCd_1^h, \tag{9}$$

where $Cd_1^h = v_1^{hh}(1 - \delta^h \delta^h)$ denotes the high-type first-mover cost of delay.

In this context, the following result characterizes the high-type first-mover equilibrium behavior in our incomplete information setting.

Proposition 2 (equilibrium characterization - high-type). *If*

$$p > \overline{p}^h = \frac{Ic_1^h}{Ic_1^h + Cd_1^h} = \frac{v_1^{hl} - v_1^{hh}}{v_1^{hl} - \delta^h \delta^h v_1^{hh}}, \tag{10}$$

where $\overline{p}^h \in [0, 1]$, *the high-type first-mover proposes a soft offer* x_1^{hh}, *which is accepted by any type of second-mover. Otherwise, i.e., if* $p \leqslant \overline{p}^h$, *the high-type first-mover proposes an aggressive offer* x_1^{hl} *(*$\geqslant x_1^{hh}$*), which is accepted by the low-type second-mover, but not by the high-type second-mover, who counter offers with* x_2^{hh}.

The proof of Proposition 2 and the derivation of the above expected payoffs can be found in the Appendix.

Equilibrium analysis and considerations - The cutoffs $\overline{p}^l$ and $\overline{p}^h$ found in Propositions 1 and 2, respectively, define the transition point between soft and aggressive offers for the low- and high-types, respectively. The likelihood of aggressive offers increases if the cutoffs $\overline{p}^l$ and $\overline{p}^h$ increase, i.e., the respective ratios Cd_1^l/Ic_1^l and Cd_1^h/Ic_1^h decrease, and the opposite otherwise.

Corollary 1 (cutoffs - comparative statics). $\overline{p}^l$ *and* $\overline{p}^h$ *increase with the first-mover information cost and decrease with the first-mover cost of delay.*[4]

Under incomplete information, if the population of high-types (p) is sufficiently large, i.e., there is a strong belief that the second-mover is patient. In this context, the threat of rejection and costly delay forces the first-mover to make a soft offer (i.e., x_1^{lh} or x_1^{hh}, depending on whether the first-mover is of the low or high type, respectively), which is accepted by any type of second-mover. However, this offer is unfavorable for the first-mover if the second-mover is of the low-type (and favorable to the low-type second-mover), because this second-mover type would have accepted a more aggressive offer. The potential loss for the first-mover is an *information cost*, while the potential benefit for the second-mover is an *information gain*.

[4] In this context, note that $\overline{p}^l$ and $\overline{p}^h$ increase with δ^h and decrease with δ^l. Intuitively, from the first-movers perspective, an increase in δ^h or a decrease in δ^l reduces the cost of delay, i.e., the cost associated with aggressive offers, see expressions (6) and (9). Thereby, increasing the incentives to make aggressive offers. On the other hand, an increase in δ^h or a decrease in δ^l increases the first-mover information cost, i.e., the cost associated with soft offers, see Expressions (5) and (8). Thereby, reducing the incentives to make soft offers.

Corollary 2 (soft offers - implications). *If the first-mover makes a soft offer there is* ***no cost of delay****, but the first-mover has an* ***information cost*** *if matched with a low-type second-mover, and the low-type second-mover obtains an* ***information gain****. Consequently, the second-mover benefits from an (expected)* ***information advantage****.*

However, as stated in Propositions 1 and 2, if there is no strong belief that the second-mover is patient, it is optimal for the first-mover to make an aggressive offer (i.e., x_1^{ll} or x_1^{hl}, depending on whether the first-mover is of the low- or high-type, respectively). This strategy risks rejection by high-type second-movers, which causes a loss of value for the first-mover due to discounting, i.e., a *cost of delay*. However, the second-mover is not affected by delay, consequently, the second-mover improves in relative terms because the first-mover obtains a lower payoff.

Corollary 3 (aggressive offers - implications). *If the first-mover makes an aggressive offer, the first-mover suffers a* ***cost of delay*** *if matched with a high-type second-mover because high-type second-movers reject aggressive offers. Consequently, the second-mover benefits from an (expected)* ***information advantage****.*

Altogether, Corollaries 2 and 3 imply that the second-mover information advantage can have three distinct sources: 1) first-mover information costs, 2) second-mover information gains, 3) first-mover costs of delay.

Another implication of Corollaries 2 and 3 are upper and lower bounds/limits in the first and second-mover payoffs, respectively. In other words, the introduction of incomplete information benefits the second-mover position.

Corollary 4 (payoff bounds). *Under incomplete information the first-mover obtains* ***at most*** *the perfect information payoff, while the second-mover obtains* ***at least*** *the perfect information payoff.*

4. First and second-mover advantages in bargaining

In this section, we study under which circumstances the magnitude of the second-mover information advantages identified in Corollaries 2 and 3 are strong enough to lead to a second-mover advantage in bargaining.

In order to reduce the number of cases to be considered, while preserving the most realistic ones and without affecting the generality of the results, we assume that high-types are more likely to make aggressive offers than low-types.

Assumption: $\overline{p}^l \leqslant \overline{p}^h$.

This assumption reduces to inequality,

$$(1 + \delta^l + \delta^h)\delta^l \geqslant 1, \tag{11}$$

which is not restrictive, because it includes the vast majority of interesting cases. For instance, $1/2 \leqslant \delta^l \leqslant \delta^h$ is enough to guarantee that inequality (11) is always satisfied.[5]

Low-type optimal bargaining position - In order to consider the low-type optimal strategic position, we must present the low-type second-mover expected payoffs, which depends on the likelihood of each first-mover type and their offers.

If both first-mover types are making soft offers, i.e. in the interval $p \in [\overline{p}^h, 1]$, the low-type second-mover obtains information gains from both first-mover types. In this case, the low-type second-mover expected payoff is given by:

$$pv_2^{hh} + (1-p)v_2^{lh} = E(v_2^l) + pIG_2^{hl} + (1-p)Ig_2^{ll}, \tag{12}$$

where $Ig_2^{hl} = v_2^{hh} - v_2^{hl}$ and $Ig_2^{ll} = v_2^{lh} - v_2^{ll}$ denote the low-type second-mover information gains derived from the high-type and low-type first-mover soft offers, respectively, and $E(v_2^l) = pv_2^{hl} + (1-p)v_2^{ll}$ is the low-type second-mover ex-ante expected payoff, i.e., the payoff that the low-type second-mover would obtain before learning the first-mover type.

Consequently, since in the interval $p \in [\overline{p}^h, 1]$ the low-type first-mover is proposing a soft offer, the low-type second-mover has an advantage in bargaining if the expected payoff in Expression (12) is larger than the expected payoff of being low-type first-mover in Expression (5), which can be rewritten as follows:

$$\underbrace{pIg_2^{hl} + (1-p)Ig_2^{ll} + (1-p)Ic_1^l}_{\text{2nd-mover information advantage}} > \underbrace{E(v_1^l) - E(v_2^l)}_{\text{1st-mover strategic advantage}}, \tag{13}$$

where the second-mover *information advantage* is composed by the second-mover expected information gains and the first-mover information costs. The first-mover

[5]This assumption avoids the consideration of cases with excessive low discounting. Nonetheless, we note that such extreme cases tend to support a trivial first-mover advantage because the associated high impatience induces a strong first-mover strategic advantage.

strategic advantage is determined by the difference between the first-mover and second-mover ex-ante expected payoffs.

However, in the interval $p \in [\overline{p}^l, \overline{p}^h]$, only the low-type first-movers are proposing soft offers. Therefore, the low-type second-mover obtains information gains from the low-type first-movers only. In this case, the low-type second-mover expected payoff is given by:

$$pv_2^{hl} + (1-p)v_2^{lh} = E(v_2^l) + (1-p)Ig_2^{ll}. \tag{14}$$

Consequently, since in the interval $p \in [\overline{p}^l, \overline{p}^h]$ the low-type first-mover is still proposing a soft offer, the low-type second-mover has an advantage in bargaining if the expected payoff in Expression (14) is larger than the expected payoff of being low-type first-mover in Expression (5), which can be rewritten as follows:

$$\underbrace{(1-p)Ig_2^{ll} + (1-p)Ic_1^l}_{\text{2nd-mover information advantage}} \quad > \quad \underbrace{E(v_1^l) - E(v_2^l)}_{\text{1st-mover strategic advantage}} \quad . \tag{15}$$

Now, the second-mover *information advantage* only consider information gains from the low-types, because the high-types are proposing aggressive offers.

Otherwise, when both first-mover types are making aggressive offers, i.e., in the interval $p \in [0, \overline{p}^l]$, the low-type second-mover payoff is simply the ex-ante expected payoff, i.e., $E(v_2^l)$. However, since in this interval the low-type first-mover is proposing an aggressive offer, the low-type second-mover has an advantage in bargaining if the ex-ante expected payoff $E(v_2^l)$ is larger than the expected payoff of being low-type first-mover in Expression (6), which can be rewritten as follows:

$$\underbrace{pCd_1^l}_{\text{2nd-mover information advantage}} \quad > \quad \underbrace{E(v_1^l) - E(v_2^l)}_{\text{1st-mover strategic advantage}} \quad . \tag{16}$$

Now, the second-mover *information advantage* is supported exclusively by the first-mover cost of delay from the potential match with an high-type second-mover.

Given the previous inequalities, the following result establishes the conditions in terms of p, δ^l, and δ^h in which the second-mover position in bargaining is preferred for the low-type individuals.

Proposition 3 (low-type optimal position). *Suppose that* $\overline{p}^l \leqslant \overline{p}^h$:

(a) For $p \in [\max\{1/(1+\delta^h), \overline{p}^l\}, 1]$, *low-types prefer the second-mover position providing that* δ^h *is sufficiently large and* δ^l *sufficiently small, and the opposite otherwise.*

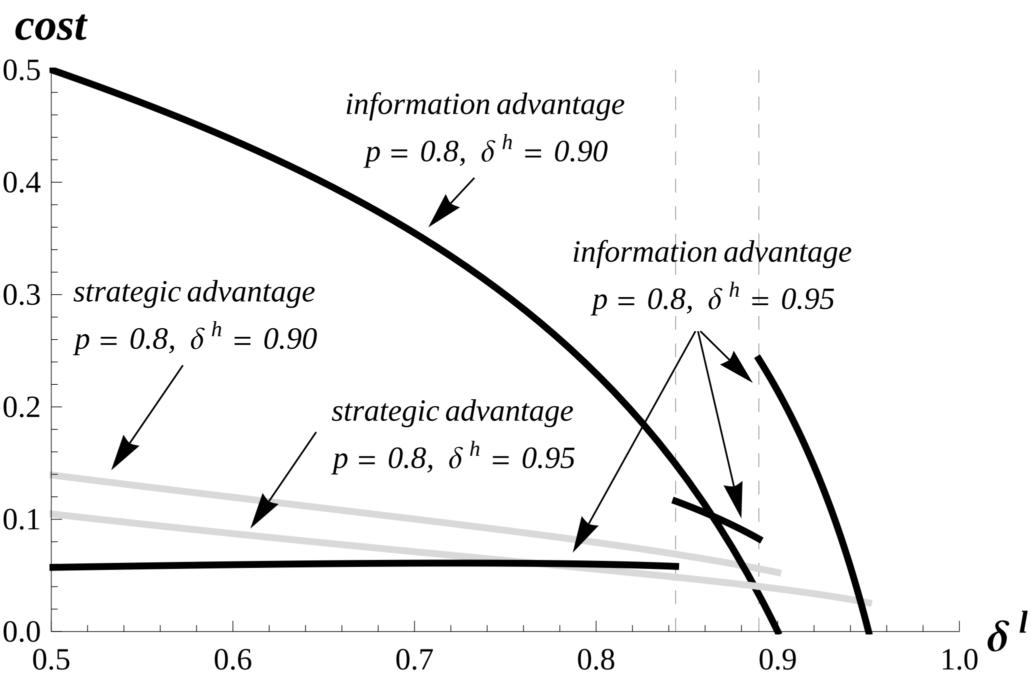

Figure 1: Low-type first-mover strategic advantage (gray solid lines) and second-mover information advantage (black solid lines) for varying low-type discount factor $\delta^l \in [0.5, \delta^h]$. The population of high-types is fixed at $p = 0.8$. The high-type discount factor is either $\delta^h = 0.95$ or $\delta^h = 0.90$.

(b) For $p \in (1/(1+\delta^h), \max\{1/(1+\delta^h), \overline{p}^l\})$, *low-types prefer the second-mover position providing that* δ^h *is sufficiently small and* δ^l *sufficiently large, and the opposite otherwise.*

(c) For $p \in [0, 1/(1+\delta^h)]$, *the second-mover position is never preferred by low-types.*

The proof of Proposition 3 and a more detailed derivation of the above expected payoffs can be found in the Appendix.

(a) There is a high likelihood that the second-mover is of the high-type. Consequently, low-type first-movers make a soft offer. Therefore, according to Part *(a)* of Proposition 3, if the second-mover information advantage is strong enough to overcome the first-mover strategic advantage, it is better for the low-types to be second-movers, which is true if δ^h is large and/or δ^l low enough.

(b) When $p \in [0, \overline{p}^l)$, the intuition changes. It is more difficult for the low-type to obtain a second-mover advantage because both first-mover types are making

aggressive offers. In this case, the low-type first-mover may incur a loss due to delay, which becomes increasingly likely with the difference $\delta^h - \delta^l$. Consequently, the low-type second-mover advantage exists only if this difference is not too large, otherwise, the first-mover strategic advantage dominates.

(c) Consequently, since the first-mover position is only threatened by the existence of high-types, as $p \in [0, \overline{p}^l)$ decreases, it becomes more difficult for the low-type individuals to benefit from the second-mover position. Part (c) of Proposition 3 formalizes this intuition by stating that there is a cutoff value $1/(1+\delta^h)$ below which the first-mover position is always preferred. This region includes the interval $p \in [0, 1/2]$ as a particular case.

Figure 1 provides an illustration of Proposition 3, for varying $\delta^l \in [0.5, \delta^h]$ with $p = 0.8$ and δ^h fix at 0.90 and 0.95. The dark solid line represents the second-mover information advantage. The gray line represents the first-mover strategic advantage. The vertical dashed lines represent the cutoffs $\overline{p}^l$ and $\overline{p}^h$ written in terms of δ^l for given δ^h and p. The discontinuities are due to the transition between inequalities conditions (13), (15) and (16) for decreasing δ^l.

(i) If $\delta^h = 0.9$, we have the cutoff $\overline{\delta}^l(\overline{p}^h) = 0.443$, meaning that for $\delta^l \geqslant 0.5$ both first-mover types are making soft offers. In this case, for $\delta^l \in [0.5, 0.881]$ there is a robust and dominant second-mover advantage of the type stated in Part (a) of Proposition 3, that disappears when both types become similar (for δ^l above 0.881).

(ii) If $\delta^h = 0.95$, we have the cutoff $\overline{\delta}^l(\overline{p}^l) = 0.844$ (and $\overline{\delta}^l(\overline{p}^h) = 0.890$). In this case, for $\delta^l \in [0.844, 0.946]$ there is a second-mover advantage of the type stated in Part (a) of Proposition 3, which benefits from low δ^l (and high δ^h), while for $\delta^l \in [0.767, 0.844]$ there is a second-mover advantage of the type stated in Part (b) of Proposition 3, which benefits from high δ^l (and low δ^h). The second-mover advantage disappears when both types are either very similar (for δ^l above 0.946) or very different (for δ^l bellow 0.767).

High-type optimal bargaining position - In order to consider the high-type optimal strategic position, we must present the high-type second-mover expected payoffs, which depends on the likelihood of each first-mover type and their offers.

The high-type second-movers expected payoff is the same as the ex-ante expected payoff, which is simply $E(v_2^h) = pv_2^{hh} + (1-p)v_2^{lh}$ (see the Appendix for more details), because these high-types will always reject aggressive offers, and the soft offers are exactly design to be accepted by the high-types. Therefore, the high-type second-mover does not benefit from information gains.

Consequently, since in the interval $p \in [\overline{p}^h, 1]$ the high-type first-mover is proposing a soft offer, the high-type second-mover has an advantage in bargaining if the ex-ante expected payoff $E(v_2^h)$ is larger than the expected payoff of being high-type first-mover in Expression (8), which can be rewritten as follows:

$$\underbrace{(1-p)Ic_1^h}_{\text{2nd-mover information advantage}} > \underbrace{E(v_1^h) - E(v_2^h)}_{\text{1st-mover strategic advantage}} , \tag{17}$$

where the second-mover *information advantage* is supported exclusively by the first-mover information cost form the potential match with a low-type second-mover that would have accepted a more aggressive offer. The first-mover *strategic advantage* is determined by the difference between the first-mover and second-mover ex-ante expected payoffs.

Similarly, since in the intervals $p \in [0, \overline{p}^l]$ and $p \in [\overline{p}^l, \overline{p}^h]$ the high-type first-mover is proposing an aggressive offer, the high-type second-mover has an advantage in bargaining if the ex-ante expected payoff $E(v_2^h)$ is larger than the expected payoff of being high-type first-mover in Expression (9), which can be rewritten as follows:

$$\underbrace{pCd_1^h}_{\text{2nd-mover information advantage}} > \underbrace{E(v_1^h) - E(v_2^h)}_{\text{1st-mover strategic advantage}} , \tag{18}$$

where the second-mover *information advantage* is supported exclusively by the first-mover cost of delay from the potential match with an high-type second-mover that rejects the aggressive offer.

Given the previous inequalities, the following result establishes the conditions in terms of p, δ^l, and δ^h in which the second-mover position in bargaining is preferred for the high-type individuals.

Proposition 4 (high-type optimal position). *Suppose that* $\overline{p}^l \leqslant \overline{p}^h$:

(a) For $p \in [\max\{1-(1-\delta^h)/(\delta^h\delta^h), \overline{p}^h\}, 1]$, *the second-mover position is never preferred by high-types.*

(b) For $p \in [\overline{p}^h, \max\{1-(1-\delta^h)/(\delta^h\delta^h), \overline{p}^h\})$, *high-types prefer the second-mover position providing that* δ^h *is sufficiently large and* δ^l *sufficiently small, and the opposite otherwise.*

(c) For $p \in [\min\{(1+\delta^h)/(1+\delta^h+\delta^h\delta^h), \overline{p}^h\}, \overline{p}^h)$, *the second-mover position is always preferred by high-types.*

(d) For $p \in (1/(1+\delta^h), \min\{(1+\delta^h)/(1+\delta^h+\delta^h\delta^h), \overline{p}^h\}]$, *high-types prefer the second-mover position providing that* δ^h *is sufficiently small and* δ^l *sufficiently large, and the opposite otherwise.*

(e) For $p \in [0, 1/(1+\delta^h)]$, *the second-mover position is never preferred by high-types.*

The proof of Proposition 4 and a more detailed derivation of the above expected payoffs can be found in the Appendix.

Most of the intuition that is valid for Proposition 3 is also valid for Proposition 4. However, there are some important differences. First, Part (a) of Proposition 4 establishes an interval in which it is always better to be first-mover, i.e., for all parameter values. Second, Part (c) of Proposition 4 establishes an interval in which it is always better to be second-mover, i.e., for all parameter values.

The high-type second-mover advantage stated in Proposition 3 depends on two sub-intervals: $p \in [\overline{p}^h, 1]$ and $p \in [0, \overline{p}^h]$. Inside each sub-interval, we have different cases.

Inside the sub-interval $p \in [\overline{p}^h, 1]$, we have two cases:

(a) The strong belief that the second-mover is patient causes both first-mover types to propose soft offers. This situation has an associated information cost for the high-type first-mover, but only when matched with low-type second-movers. Part (a) of Proposition 4 establishes that when this event has a low probability (i.e., for large p), the expected information cost is low, and it is better to be first-mover.

(b) However, this statement is not true has p becomes smaller inside this interval. Part (b) of Proposition 4 states that a second-mover advantage may exist if the first-mover information cost is sufficiently large, which occurs when δ^h is sufficiently large or δ^l sufficient low.

Inside the sub-interval $p \in [0, \overline{p}^h]$, we have three cases:

(d) The high-type aggressive offers are accepted by the low-type second-movers, but rejected by the high-type second-movers. The first-mover losses due to delay decrease with δ^h. Consequently, the high-type first-mover advantage depends on the strategic advantage, which improves with δ^h and decreases with δ^l. This is the statement in Part (d) of Proposition 4.

(c) However, it may happen that the high-type first-mover strategic advantage is not enough for compensate the losses due to delay. In this case, the second-mover position is preferred as stated in Part (c) of Proposition 4. However, this interval is not always guaranteed to exist.

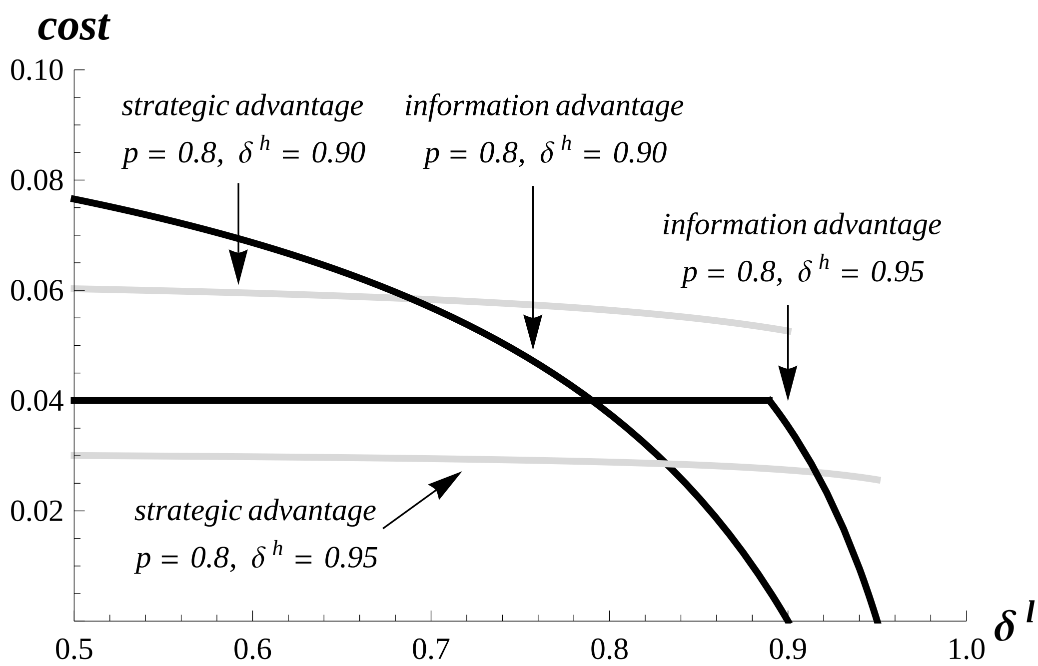

Figure 2: High-type first-mover strategic advantage (gray solid lines) and second-mover information advantage (black solid lines) for varying low-type discount factor $\delta^l \in [0.5,\delta^h]$. The population of high-types is fixed at $p = 0.8$. The high-type discount factor is either $\delta^h = 0.95$ or $\delta^h = 0.90$.

(e) Finally, in Part (e) of Proposition 4, as in Part (c) of Proposition 3, there is a cutoff value $1/(1+\delta^h) \geqslant 1/2$ below which the first-mover position is always preferred.

Note that the intervals in Parts (b)-(d) of Proposition 4 may vanish, but not the intervals in Part (a) and (e), which are always guaranteed to exist. For instance, if $\delta^h \leqslant 0.76$ the intervals in Parts (b)-(d) of Proposition 4 vanish and high-type first-movers have always an advantage in bargaining.

Figure 2 provides an illustration of Proposition 4, for varying $\delta^l \in [0.5, \delta^h]$ with $p = 0.8$ and δ^h fixed at 0.90 or 0.95. The dark solid line represents the second-mover information advantage. The gray line represents the first-mover strategic advantage. The kink is due to the transition between inequalities (17) and (18) for varying δ^l.

(i) If $\delta^h = 0.9$, for $\delta^l \in [0.5, 0.689]$ there is a second-mover advantage of the type stated in Part (b) of Proposition 4 (where $1 - (1 - \delta^h)/(\delta^h\delta^h) = 0.877$ and

$p = 0.8 \geqslant \overline{p}^h$). In comparison with Proposition 3, the second-mover advantage is less robust.

(ii) If $\delta^h = 0.95$, for $\delta^l \in [0.5, 0.890]$ there is a second-mover advantage of the type stated in Part (c) of Proposition 4, while for $\delta^l \in [0.890, 0.916]$ there is a second-mover advantage of the type stated in Part (b) of Proposition 4 (where $1-(1-\delta^h)/(\delta^h\delta^h) = 0.945$ and $(1+\delta^h)/(1+\delta^h+\delta^h\delta^h) = 0.684$, with $p = 0.8 \leqslant \overline{p}^h$ for $\delta^l \leqslant 0.890$ and the opposite otherwise). The second-mover advantage is extremely robust, except when both types are similar. Patient high-types have an advantage in being second-movers in bargaining if low-types are sufficiently impatient.

General observations and discussion - The second-mover information advantage is manifested by (i) soft offers that penalize the first-mover and benefit the second-mover who would otherwise have accepted lower offers, or/and (ii) a delay in bargaining, which penalizes the first-mover relatively to the second-mover. In this context, the value of p and the difference between types $(\delta^h - \delta^l)$ generate trade-offs between the *strength* and *existence* of second-mover advantages.

Consequently, the existence of second-mover advantages require a sufficiently large population of high-types, because these types discipline first-movers to propose soft offers and make the strategic advantage weaker.

Corollary 5 (second-mover advantage and high-types). *Under incomplete information the existence of second-mover advantage requires a sufficiently large number of high-types, i.e.,* $p > 1/(1+\delta^h)$.

This result is worth mentioning in connection with the experimental results. Most of these studies involve subjects bargaining in contexts of great ambiguity. In some cases, individuals may not even know their own type or there is not even visual contact between the participants, whereas in other studies, there is no product identification—subjects bargain and negotiate over abstract objects, which they are not familiar with. Despite the scientific correctness of these procedures, they create enormous ambiguity. Consequently, a reasonable guess for dealing with such ambiguity is to behave as if $p = 1/2$ and/or $\delta^h - \delta^l = 0$, which according to our results lead to systematic first-mover advantages. In this context, our results are in line with the experimental literature.

$$0\,\underbrace{\text{- - - - - - - - - - - - - - - -}}_{1st-mover}\,1/(1+\delta^h)\,\underbrace{\text{- - - - - - - -}}_{2nd-mover}\,\underbrace{\text{- - - - -}}_{1st-mover}\,1 \quad p$$

Scheme: In general, second-mover advantages may exist for intermediate/high values of p.

The idea that ambiguity favors the first-mover position is not new. Gunia et al. (2013) acknowledge that in contexts of great ambiguity the first offer becomes the relevant indicator of the value of the object under negotiation, Liebert et al. (1968) show that less informed bargainers are more influenced by extreme first offers than more informed bargainers, while Orr and Guthrie (2006) point out that first-mover advantages in negotiations can be reduced if additional information is provided to the subjects.

Similarly, a necessary condition for a second-mover advantage is the existence of differences between types, which translates into differences in value for the object under negotiation. The existence of second-mover advantages requires heterogeneity between individuals.

Corollary 6 (second-mover advantage and discounting). *Under incomplete information the existence of second-mover advantage requires differences in the individuals' types, i.e.,* $\delta^h - \delta^l > 0$.

5. Conclusion

The first offer dilemma in bargaining and negotiation is an ancient and intriguing question, which seems to fascinate everybody, but is one for which we do not have a clear answer. The present paper attempts to understand under what circumstances, it is better to be in the first or the second-mover position in bargaining and negotiations.

First-movers have a strategic advantage that explores the second-mover fear of costly delay. This advantage is similar to an "anchoring effect". Incomplete information creates a second-mover information advantage, because the second-mover may benefit from offers higher than required for acceptance, and first-mover may suffer losses due to costs of delay. Therefore, the existence of first and second-mover advantages depends crucially on the relative strength of these effects.

We found that second-mover advantages in bargaining exist when there are differences between individuals, and these differences are neither too high nor too low. Second-mover advantages also require a sufficiently large population of high-types because these types discipline first-movers to make soft offers, which favors the existence of second-mover information advantages. We have focused on the conditions that sustain the existence of second-mover advantages in bargaining because these are the most surprising and interesting in the context of the existing literature. Nonetheless, we also found—in line with the existing empirical literature—that first-mover advantages are more prevalent, but second-mover advantages exist under very reasonable and realistic conditions.

Despite the frequency with which it is encountered in reality, the first offer dilemma in bargaining and negotiations has been overlooked by the theoretical literature. This paper is the first that formally addresses this issue. These observations call for a research agenda. In this context, the possibility of no agreement, the breakdown of negotiations and outside options are interesting extensions and are likely to provide further support in favor of the existence of second-mover advantages. For convenience, we have introduced incomplete information about time preferences, but uncertainty about other aspects of the bargaining process are also possible. Moreover, in situations in which there is a clear second-mover advantage, it is natural to expect that both parties will play a waiting game in order to gain this position (factual observation shows that professionals actually do this). This possibility could be an interesting extension. Similarly, in contexts in which the existence of first-mover advantages is clear, it is natural to expect some sort of competition for this position.

The research agenda also needs new experimental studies. For instance, it would be interesting to consider situation in which subjects have clear preferences and beliefs about the value of the object under negotiation. Experiments between individuals with different levels of expertise and cultural backgrounds are also likely to improve our knowledge about the first offer dilemma in bargaining and negotiations.

Finally, we expect that our research will contribute to the literature by expanding our understanding about the strategic and information roles of offers in bargaining and negotiations. In particular, our results may help researchers and practitioners when it comes to designing optimal bargaining strategies, help decision-makers implementing mechanisms that can protect buyers and sellers, and benefit society as a whole.

Acknowledgments: Financial support from the GRODE Universitat Rovira i Virgili and Generalitat de Catalunya under Projects 2018PFR-URV-B2-53 and 2017SGR770, and the Spanish Ministry of Science and Innovation Projects ECO2016-75410-P and RTI2018-094733-B-100 (AEI/FEDER, UE) is gratefully acknowledged. I would like to thank Brian Gunia, Margaret Neale and Juan Pablo Rincón-Zapatero, as well as several seminars and congress participants for helpful comments and discussions. The usual caveat applies.

Appendix: Proofs of the Results

Proof of Lemma 1. In order to show the inequality chain $v_1^{hl} \geqslant v_1^{ll} \geqslant v_1^{hh} \geqslant v_1^{lh}$, we must verify each inequality. For instance, Expression (2) implies that $v_1^{hl} = (1-\delta^l)/(1-\delta^h\delta^l)$ and $v_1^{ll} = (1-\delta^l)/(1-\delta^l\delta^l)$. After some algebra, we obtain that $v_1^{hl} \geqslant v_1^{ll}$ for $\delta^l \leqslant \delta^h$. The inequality $v_1^{hh} \geqslant v_1^{lh}$ follows the same argument. In order to verify the inequality $v_1^{ll} \geqslant v_1^{hh}$, since $v_1^{ll} = (1-\delta^l)/(1-\delta^l\delta^l)$ and $v_1^{hh} = (1-\delta^h)/(1-\delta^h\delta^h)$, simply note that the derivative $\partial((1-x)/(1-x^2))/\partial x = -1/(1+x)^2 < 0$. Therefore, since $\delta^l \leqslant \delta^h$, we must have $v_1^{ll} \geqslant v_1^{hh}$. In order to show the inequality chain $\widehat{v}_2^{hl} = v_2^{hl} \leqslant \widehat{v}_2^{ll} = v_2^{ll} \leqslant \widehat{v}_2^{hh} = v_2^{hh} \leqslant \widehat{v}_2^{lh} = v_2^{lh}$, simply note that in both inequalities (2) and (3), the second-mover payoff is the same regardless of whether there is an early or a late agreement, i.e., $v_2^{\omega_1\omega_2} = \widehat{v}_2^{\omega_1\omega_2}$ for all $\omega_1, \omega_2 \in \{l, h\}$. Consequently, since $v_1^{\omega_1\omega_2} + v_2^{\omega_1\omega_2} = 1$ for all $\omega_1, \omega_2 \in \{l, h\}$, if $v_1^{hl} \geqslant v_1^{ll} \geqslant v_1^{hh} \geqslant v_1^{lh}$, then we must have $v_2^{hl} \leqslant v_2^{ll} \leqslant v_2^{hh} \leqslant v_2^{lh}$. ■

Proof of Propositions 1 and 2. The equilibrium behavior is obtained by backward induction. Bargaining reaches Stage 2 if the second-mover rejects the offer made by the first-mover in Stage 1. In Stage 2, both parties are perfectly informed and obtain the perfect information payoffs of the continuation game. Therefore, in Stage 2, individuals obtain the payoffs given by Expression (3), which are discounted to Stage 1. In Stage 1, the first-mover is uncertain about the second-mover type.

(Stage 1 - the low-type first-mover) If the first-mover makes a soft offer x_1^{lh}, which is accepted by both second-mover types, with first period payoffs $\left(v_1^{lh}, v_2^{lh}\right) = \left(x_1^{lh}, 1-x_1^{lh}\right)$, see Expression (2) for $\omega_1\omega_2 = lh$. If the first-mover proposes an aggressive offer x_1^{ll}, which is accepted by the low-type second-mover only, with first period payoffs $\left(v_1^{ll}, v_2^{ll}\right) = \left(x_1^{ll}, 1-x_1^{ll}\right)$, see Expression (2) for $\omega_1\omega_2 = ll$, but rejected by the high-type second-mover, which proposes the perfect information offer $x_2^{lh} = \delta^l(1-\delta^h)/(1-\delta^l\delta^h)$, with payoff $\widehat{v}_2^{lh} = \delta^h(1-\delta^l)/(1-\delta^l\delta^h) = v_2^{lh} \geqslant v_2^{ll}$ for $\delta^l \leqslant \delta^h$, by Lemma 1. The soft offer returns the payoff v_1^{lh}, which can be rewritten in terms of information costs as in expression (5), while the aggressive offer returns the expected payoff $\overline{v}_1^{ll} = p\widehat{v}_1^{lh} + (1-p)v_1^{ll}$, which can be rewritten in terms of cost of delay as in Expression (6). Therefore, the low-type first-mover makes a soft offer if Condition (7) is satisfied, which can be written as:

$$p > \overline{p}^l = \frac{\delta^h - \delta^l}{1-\delta^l + \delta^l(1-\delta^h)(1-\delta^l-\delta^l\delta^l)},$$

i.e., if $v_1^{lh} > \overline{v}_1^{ll}$. Otherwise, if $p \leqslant \overline{p}^l$, i.e., $v_1^{lh} \leqslant \overline{v}_1^{ll}$, the low-type first-mover proposes an aggressive offer. Note that since $v_1^{ll} \geqslant v_1^{lh} \geqslant \widehat{v}_1^{lh}$ for $\delta^l \leqslant \delta^h \leqslant 1$ (by Lemma 1), we must have $\overline{p}^l \in [0,1]$. Therefore, as p increases, v_1^{lh} remains constant, but $\overline{v}_1^{ll}$ decreases, and the opposite otherwise. Finally, it is easy to show that the cutoff value $\overline{p}^l \in [0,1]$ increases δ^h and decreases with δ^l for $0 \leqslant \delta^l \leqslant \delta^h$. Therefore, it takes the minimum value $\overline{p}^l = 0$ in δ^l if $\delta^l = \delta^h$ and the maximum value $\overline{p}^l = \delta^h$ if $\delta^l = 0$.

It takes the minimum value $\overline{p}^l = 0$ in δ^h if $\delta^h = 0$ because $\delta^l \leqslant \delta^h$ and the maximum value $\overline{p}^l = 1$ if $\delta^h = 1$ for any $0 \leqslant \delta^l \leqslant \delta^h$.

(Stage 1 - the high-type first-mover case) A similar argument holds for the high-type first-mover. Briefly, the first-mover makes an aggressive offer (x_1^{hl}), which is accepted by the low-type second-mover only, with Stage 1 payoffs $\left(v_1^{hl}, v_2^{hl}\right) = \left(x_1^{hl}, 1 - x_1^{hl}\right)$, see Expression (2) for $\omega_1\omega_2 = hl$. The high-type first-mover makes a soft offer (x_1^{hh}), which is accepted by both second-mover type, the associated Stage 1 payoffs are $\left(v_1^{hh}, v_2^{hh}\right) = \left(x_1^{hh}, 1 - x_1^{hh}\right)$, see Expression (2) for $\omega_1\omega_2 = hh$.

Therefore, the high-type first-mover either proposes an aggressive offer x_1^{hl} with expected payoff $\overline{v}_1^{hl} = p\widehat{v}_1^{hh} + (1-p)v_1^{hl}$, which can be rewritten in terms of cost of delay as in Expression (9), or proposes a soft offer x_1^{hh}, with payoff v_1^{hh}, which can be rewritten in terms of information costs as in Expression (8). Therefore, the high-type first-mover makes a soft offer if Condition (10) is satisfied, which after some algebra can be written as:

$$p > \overline{p}^h = \frac{\delta^h - \delta^l}{1 - \delta^l + \delta^h(1-\delta^h)(1-\delta^l-\delta^h\delta^l)},$$

i.e., $v_1^{hh} > \overline{v}_1^{hl}$. Otherwise, if $p \leqslant \overline{p}^h$, i.e., $v_1^{hh} \leqslant \overline{v}_1^{hl}$, the high-type first-mover proposes an aggressive offer. Note that since $v_1^{hl} > v_1^{hh} > \widehat{v}_1^{hh}$ for $\delta^l < \delta^h < 1$ by Lemma 1, it implies that $\overline{p}^h \in [0,1]$. Therefore, as p increases, v_1^{hh} remains constant, but $\overline{v}_1^{hl}$ decreases, and the opposite otherwise. Finally, it is easy to show that the cutoff value $\overline{p}^h \in [0,1]$ increases δ^h and decreases with δ^l for $0 \leqslant \delta^l \leqslant \delta^h$. Therefore, it takes the minimum value $\overline{p}^h = 0$ in δ^l if $\delta^l = \delta^h$ and the maximum value $\overline{p}^h = \delta^h/(1+\delta^h(1-\delta^h))$ if $\delta^l = 0$. It takes the minimum value $\overline{p}^h = 0$ in δ^h if $\delta^h = 0$ because $\delta^l \leqslant \delta^h$ and the maximum value $\overline{p}^h = 1$ if $\delta^h = 1$ for any $0 \leqslant \delta^l \leqslant \delta^h$. Finally, the equilibrium obtained is unique as shown in Rubinstein (1985). ■

Proof of Proposition 3. The offers in this proof are shown to correspond to optimal strategic behavior in Propositions 1 and 2. The payoff relations are shown in Lemma 1.

Part (a): Since $\overline{p}^l \leqslant \overline{p}^h$, we start by considering the interval $p \in [\overline{p}^h, 1]$. The low-type first-mover offers x_1^{lh} with payoff v_1^{lh}, see Expression (5). If the low-type first-mover were to become a second-mover then: (i) with probability p they would meet a high-type first-mover who would offer x_1^{hh}, which would be accepted by the low-type second-mover, and (ii) with probability $1-p$ would meet a low-type first-mover who would offer x_1^{lh}, which would be accepted by the low-type second-mover. The low-type second-mover expected payoff is $pv_2^{hh} + (1-p)v_2^{lh}$, which can be rewritten in terms of information costs as in Expression (12).

Therefore, it is better to be second-mover if $v_1^{lh} < pv_2^{hh} + (1-p)v_2^{lh}$, i.e., if inequality (13) is satisfied, which after some algebra is equivalent to the inequality:

$$\delta^h(1+\delta^h - p)(\delta^h - \delta^l) > (1-\delta^h)^2(1+\delta^h). \tag{19}$$

Since $v_2^{lh} \geqslant v_2^{hh}$ by Lemma 1, the second-mover position improves monotonically when p decreases. Moreover, we can find parameter values such that in the extremes of the interval, i.e., at $p = \overline{p}^h$ and at $p = 1$, we have either first- or second-mover advantages. Therefore, for $p \in [\overline{p}^h, 1]$ there is no interval with an exclusive first- or second-mover advantage. Moreover, the second-mover advantage implicit in (19) increases with δ^h and decreases with δ^l.

If $p \in [\overline{p}^l, \overline{p}^h]$, the low-type first-mover offers x_1^{lh} with payoff v_1^{lh}, see Expression (5). If the low-type first-mover would become second-mover then: (i) with probability p they would meet a high-type first-mover who would offer x_1^{hl}, which would be accepted by the low type second-mover, and (ii) with probability $1-p$ they would meet a low-type first-mover who would offer x_1^{lh}, which would be accepted by the low-type second-mover. The low-type second-mover expected payoff is $pv_2^{hl} + (1-p)v_2^{lh}$, which can be rewritten in terms of information costs as in Expression (14). Therefore, it is better to be second-mover if $v_1^{lh} < pv_2^{hl} + (1-p)v_2^{lh}$, i.e., if inequality (15) is satisfied, which after some algebra is equivalent to inequality:

$$(\delta^h - p)(\delta^h - \delta^l) > (1-\delta^h)^2. \tag{20}$$

Since $v_2^{lh} \geqslant v_2^{hl}$ by Lemma 1, the second-mover position improves monotonically when p decreases. Moreover, we can find parameter values such that in the extremes of the interval, i.e., at $p = \overline{p}^l$ and at $p = \overline{p}^h$, we have either first- or second-mover advantages. Note also that inequality (20) fails if $p \geqslant \delta^h$, but since for $p \in [\overline{p}^l, \overline{p}^h]$, we always have $p \leqslant \delta^h$ because $\overline{p}^h \leqslant \delta^h$. In order to see it, since $\overline{p}^h$ is strictly decreasing in δ^l, just evaluate $\overline{p}^h$ at $\delta^l = 0$ to find that even at the maximum, we have $\overline{p}^h \leqslant \delta^h$ because $\delta^h \leqslant 1$. Therefore, for $p \in [\overline{p}^l, \overline{p}^h]$ there is no region with an exclusive first- or second-mover advantage. Moreover, the second-mover advantage implicit in (20) increases with δ^h and decreases with δ^l. Inequalities (19) and (20) are different, but since they lead to similar conclusions, they are aggregated in the statement of Part (a) of Proposition 3.

Part (b): If $p \in [0, \overline{p}^l]$, the low-type first-mover offers x_1^{ll} with payoff $p\widehat{v}_1^{lh} + (1-p)v_1^{ll}$, see Expression (6). If the low-type first-mover were to become second-mover then: (i) with probability p they would meet a high-type first-mover who would offer x_1^{hl}, which would be accepted by the low-type second-mover, and (ii) with probability $1-p$ they would meet a low-type first-mover who would offer x_1^{ll}, which would be accepted by the low-type second-mover. The low-type second-mover expected payoff is $pv_2^{hl} + (1-p)v_2^{ll}$, which is simply $E(v_2^l)$. Therefore, it is better to be second-mover if $p\widehat{v}_1^{lh} + (1-p)v_1^{ll} < pv_2^{hl} + (1-p)v_2^{ll}$, i.e., if inequality (16) is satisfied, which after some algebra is equivalent to inequality:

$$\delta^l(p(1-(\delta^h-\delta^l)(1-\delta^h)) + \delta^h(1-p(1+\delta^h))) > (1-p). \tag{21}$$

Since $v_1^{ll} \geqslant v_2^{ll}$ and $\widehat{v}_1^{lh} \leqslant v_2^{hl}$ by Lemma 1, the second-mover position improves monotonically when p increases. We can find parameter values such that in the extreme of the interval, i.e., at $p = \overline{p}^l$, we have either a first- or a second-mover advantage. Moreover, the second-mover advantage implicit in (21) decreases with δ^h, but the effect of δ^l is less clear cut. Therefore, if $1-p(1+\delta^h) \geqslant 0$, the effect of δ^l, in the left-hand side of inequality (21) is positive. Otherwise, if $1-p(1+\delta^h) < 0$, we can split the left-hand side in two terms: $\delta^l p(1-(\delta^h-\delta^l)(1-\delta^h)) > 0$ and $\delta^l\delta^h(1-p(1+\delta^h)) < 0$. The former term increases with δ^l because it is positive, while the latter decreases with δ^l because it is negative. The positive effect on the first term always dominates for $p < p^o = \delta^h/(2\delta^h\delta^h + (\delta^h-\delta^l)(1-\delta^h)-1)$, and the opposite otherwise. Simultaneously, a second-mover advantage requires inequality (21) to be satisfied which occurs for:

$$p > p^t = \frac{1-\delta^h\delta^l}{(1-\delta^h)(1+\delta^h)^2 - (\delta^h-\delta^l)(1-2\delta^h\delta^h) + (1-\delta^h)(\delta^h-\delta^l)^2}.$$

The denominator is positive for any $\delta^h \geqslant \delta^l$. In order to see it note that the denominator reaches a minimum at $\delta^h - \delta^l = (1-2\delta^h\delta^h)/(2(1-\delta^h))$ if $\delta^h < \sqrt{1/2}$, otherwise, the minimum is obtained at $\delta^h = \delta^l$. In both cases, the denominator is positive. Since, the numerator is non-negative and because $\delta^h \in [0,1]$ and $0 \leqslant \delta^l$, we must have $p^t \in [0,1]$. This transition point can be below or above $\overline{p}^l$. The question is whether there is a second-mover advantage supported by a decrease in δ^l for $p \in [0, \overline{p}^l]$. In such a case, we need $p^o < p^t$ in order for there to be a non-empty region with these characteristics, i.e., we must have $\delta^h - \delta^l > (1+\delta^h-\delta^h\delta^h)/(1-\delta^h)$, which is impossible because $\delta^h - \delta^l \in [0, \delta^h]$ cannot take values larger than 1. Therefore, we always have $p^t \leqslant p^o$ and any low-type second-mover advantage for $p \in [0, \overline{p}^l]$ must be supported by an increase in δ^l.

Part (c): Consequently, in the best case scenario for the second-mover, i.e., the case in which $\delta^l = \delta^h$ in inequality (21), we find that a second-mover advantage is impossible if $p \leqslant 1/(1+\delta^h)$, where $1/(1+\delta^h)$ can be smaller or larger than $\overline{p}^l$. The latter statement justifies the cutoff notation $\max\{1/(1+\delta^h), \overline{p}^l\}$ in Part (a) and (b). ■

Proof of Proposition 4. The offers in this proof are shown to correspond to optimal strategic behavior in Propositions 1 and 2. The payoff relationships are shown in Lemma 1.

Parts (a)-(b): Since $\overline{p}^l \leqslant \overline{p}^h$, we start by considering the interval $p \in [\overline{p}^h, 1]$. The high-type first-mover offers x_1^{hh} with payoff v_1^{hh}, see Expression (8). If the high-type first mover were to become second-mover then: (i) with probability p they would meet a high-type first-mover who would offer x_1^{hh}, which would be accepted by the high-type second-mover, and (ii) with probability $1-p$ they would meet a low-type first-mover who would offer x_1^{lh} which would be accepted by the high-type second-mover. Therefore, the high-type second-mover expected payoff is $pv_2^{hh} + (1-p)v_2^{lh}$, which is simply $E(v_2^h)$. Therefore, a second-mover advantage exist if $v_1^{hh} < pv_2^{hh} + (1-p)v_2^{lh}$, which happens if inequality (17) is satisfied, which after some algebra is equivalent to inequality:

$$\delta^h(\delta^h - p)(\delta^h - \delta^l) > (1-\delta^h)^2(1+\delta^h). \tag{22}$$

Note that this inequality fails if $p \geqslant \delta^h$, where $\delta^h \geqslant \overline{p}^h$ (see the proof of Proposition 3), which guarantee that for $p \in [\overline{p}^h, 1]$ there exists an interval in which the high-type first-mover always has an advantage. Moreover, if we consider the best case scenario for the second-mover, i.e., the case in which $\delta^l = 0$, then inequality (22) fails if $p \geqslant 1-(1-\delta^h)/(\delta^h\delta^h)$. The result is general and does not depend on the assumption $\overline{p}^l \leqslant \overline{p}^h$. Since $1-(1-\delta^h)/(\delta^h\delta^h) \leqslant \delta^h$, the condition $p \geqslant 1-(1-\delta^h)/(\delta^h\delta^h)$ is the one that establishes the existence of a first-mover advantage for the high-type individual. Moreover, we can find parameter values such that at the extremes of the interval, i.e., at $p = \overline{p}^h$, we have either a first- or a second-mover advantage depending on those values, then the condition for a high-type first-mover advantage becomes $p \geqslant \max\{1-(1-\delta^h)/(\delta^h\delta^h), \overline{p}^h\}$. Therefore, if $p \in [\overline{p}^h, \max\{1-(1-\delta^h)/(\delta^h\delta^h), \overline{p}^h\})$, an high-type second-mover advantage may exists for $(\delta^h - \delta^l) > 0$ that is sufficiently large if inequality (22) is satisfied. Since $v_1^{hh} \geqslant v_2^{hh}$ and $v_2^{hh} \leqslant v_2^{lh}$ by Lemma 1, the high-type second-mover payoff improves when p decreases. Note also that in the interval $p \in [\overline{p}^h, 1]$, the second-mover advantage is more difficult for the high-types than for the low-types because inequality (22) is more difficult to satisfy than inequality (19).

Parts (c)-(e): If $p \in [\overline{p}^l, \overline{p}^h)$, the high-type first-mover offers x_1^{hl} with payoff $p\widehat{v}_1^{hh} + (1-p)v_1^{hl}$, see Expression (9). If the high-type first-mover were to become a second-mover then: (i) with probability p they would meet a high-type first-mover who would offer x_1^{hl}, which would be rejected by the high-type second-mover who proposes x_2^{hh}, and (ii) with probability $1-p$ they would meet a low-type first-mover who would offer x_1^{lh}, which would be accepted by the high-type second-mover. Therefore, the high-type second-mover expected payoff is $p\widehat{v}_2^{hh} + (1-p)v_2^{lh}$, where $\widehat{v}_2^{hh} = v_2^{hh}$, which is simply $E(v_2^h)$. However, note that the same expected payoffs are obtained if $p \in [0, \overline{p}^l)$. In order to see it, note that the high-type first-mover makes the same offers x_1^{hl}. If the high-type first-mover were to become a second-mover then: (i) with probability p they would meet an high-type first-mover who would offer x_1^{hl}, which would be rejected by the high-type second-mover that proposes x_2^{hh}, and (ii) with probability $1-p$ they would meet a low-type first-mover who would offer x_1^{ll}, which would be rejected by the high-type second-mover who proposes x_2^{lh}. Therefore, the high-type second-mover expected payoff is $p\widehat{v}_2^{hh} + (1-p)\widehat{v}_2^{lh}$, where $\widehat{v}_2^{hh} = v_2^{hh}$ and $\widehat{v}_2^{lh} = v_2^{lh}$, which is simply $E(v_2^h)$. Consequently, a high-type second-mover advantage exists if $p\widehat{v}_1^{hh} + (1-p)v_1^{hl} < pv_2^{hh} + (1-p)v_2^{lh}$, which corresponds to the same inequality condition as in the interval $p \in [\overline{p}^l, \overline{p}^h)$. Therefore, for $p \in [0, \overline{p}^h)$ we have a unique high-type second-mover advantage if inequality (18) is satisfied, which after some algebra is equivalent to inequality:

$$((1-p) - \delta^h(p(1+\delta^h)-1))(\delta^h - \delta^l) < (1-(\delta^h)^2)(p(1+\delta^h)-1). \qquad (23)$$

Since $\widehat{v}_2^{hh} = v_2^{hh} \geqslant \widehat{v}_1^{hh}$ and $\widehat{v}_2^{lh} = v_2^{lh}$, the second-mover information advantage increases monotonically with p. If $p \leqslant 1/(1+\delta^h)$, the left-hand side is non-negative, while the right-hand side is non-positive. Consequently, there is never a second-mover advantage for any $\delta^h \geqslant \delta^l \geqslant 0$. Otherwise, if $p > 1/(1+\delta^h)$, the right-hand side becomes strictly positive. If in simultaneous $p > (1+\delta^h)/(1+\delta^h+\delta^h\delta^h)$, the second-mover always has an advantage for any $\delta^l \in [0, \delta^h]$ because the left-hand side becomes strictly negative. In this case, there is always a second-mover advantage for any $\delta^h \geqslant \delta^l \geqslant 0$. If $p \in (1/(1+\delta^h), (1+\delta^h)/(1+\delta^h+\delta^h\delta^h)]$, both sides in inequality (23) are non-negative. Consequently, the second-mover advantage exist if δ^l is sufficiently large. Moreover, we can find parameter values such that $\overline{p}^h$ can appear below or above $1/(1+\delta^h)$ and/or $(1+\delta^h)/(1+\delta^h+\delta^h\delta^h)$. Therefore, in the extreme of the interval, i.e., at $p = \overline{p}^h$, we can have either a first- or a second-mover advantage depending on the parameter values. Consequently, we write this cutoff as $\min\{(1+\delta^h)/(1+\delta^h+\delta^h\delta^h), \overline{p}^h\}$. ■

References

Ausubel, L. M., Cramton, P., Deneckere, R. J., 2002. Chapter 50 - bargaining with incomplete information. Vol. 3 of Handbook of Game Theory with Economic Applications. Elsevier, pp. 1897 – 1945.

Binmore, K., Osborne, M. J., Rubinstein, A., 1992. Chapter 7 - noncooperative models of bargaining. Vol. 1 of Handbook of Game Theory with Economic Applications. Elsevier, pp. 179 – 225.

Chapman, G. B., Johnson, E. J., 1999. Anchoring, activation, and the construction of values. Organizational Behavior and Human Decision Processes 79 (2), 115–153.

Chertkoff, J. M., Conley, M., 1967. Opening offer and frequency of concession as bargaining strategies. Journal of Personality and Social Psychology 7 (2), 181–185.

Cotter, M. J., Henley Jr, J. A., 2008. First-offer disadvantage in zero-sum game negotiation outcomes. Journal of Business-to-Business Marketing 15 (1), 25–44.

Dell, D., Boswell, J., 2009. Never Make the First Offer:(except when You Should) Wisdom from a Master Dealmaker. Penguin.

Englich, B., Mussweiler, T., Strack, F., 2006. Playing dice with criminal sentences: The influence of irrelevant anchors on experts judicial decision making. Personality and Social Psychology Bulletin 32 (2), 188–200.

Fudenberg, D., Levine, D. K., Tirole, J., 1985. Infinite-Horizon Models of Bargaining with One-Sided Incomplete Information. Cambridge University Press, Cambridge, UK and New York, pp. 73–98.

Galinsky, A., Mussweiler, T., 2001. First offers as anchors: the role of perspective-taking and negotiator focus. Journal of Personality and Social Psychology 81 (4), 657–669.

Galinsky, A. D., Ku, G., Mussweiler, T., 2009. To start low or to start high? the case of auctions versus negotiations. Current Directions in Psychological Science 18 (6), 357–361.

Gunia, B. C., Swaab, R. I., Sivanathan, N., Galinsky, A. D., 2013. The remarkable robustness of the first-offer effect: Across culture, power, and issues. Personality and Social Psychology Bulletin 39 (12), 1547–1558.

Kennan, J., Wilson, R., 1993. Bargaining with private information. Journal of Economic Literature 31 (1), 45–104.

Kristensen, H., Gärling, T., 1997. The effects of anchor points and reference points on negotiation process and outcome. Organizational Behavior and Human Decision Processes 71 (1), 85–94.

Kristensen, H., Gärling, T., 2000. Anchoring induced biases in consumer price negotiations. Journal of Consumer Policy 23 (4), 445–460.

Lieberman, M. B., Montgomery, D. B., 1988. First-mover advantages. Strategic Management Journal 9 (S1), 41–58.

Liebert, R. M., Smith, W. P., Hill, J., Keiffer, M., 1968. The effects of information and magnitude of initial offer on interpersonal negotiation. Journal of Experimental Social Psychology 4 (4), 431–441.

Lord, C., Lepper, M., Preston, E., 1984. Considering the opposite: a corrective strategy for social judgment. Journal of Personality and Social Psychology 47 (6), 1231–1243.

Loschelder, D., Swaab, R., Trötschel, R., Galinsky, A., 2014. The first-mover disadvantage: the folly of revealing compatible preferences. Psychological Science 25 (4), 954–962.

Loschelder, D., Trötschel, R., Swaab, R., Friese, M., Galinsky, A., 2016. The information-anchoring model of first offers: When moving first helps versus hurts negotiators. The Journal of Applied Psychology 101 (7), 995–1012.

McCormack, M. H., 1989. What they still don't teach you at Harvard Business School. Bantam.

Mussweiler, T., Strack, F., 1999. Hypothesis-consistent testing and semantic priming in the anchoring paradigm: A selective accessibility model. Journal of Experimental Social Psychology 35 (2), 136–164.

Mussweiler, T., Strack, F., 2000. The use of category and exemplar knowledge in the solution of anchoring tasks. Journal of Personality and Social Psychology 78 (6), 1038–1052.

Mussweiler, T., Strack, F., Pfeiffer, T., 2000. Overcoming the inevitable anchoring effect: Considering the opposite compensates for selective accessibility. Personality and Social Psychology Bulletin 26 (9), 1142–1150.

Muthoo, A., 1999. Bargaining theory with applications. Cambridge University Press.

Neale, M., Lys, T., 2015. Getting (more of) what You Want: How the Secrets of Economics and Psychology Can Help You Negotiate Anything, in Business and in Life. Basic Books.

Neale, M. A., Bazerman, M. H., 1983. The role of perspective-taking ability in negotiating under different forms of arbitration. Industrial & Labor Relations Review 36 (3), 378–388.

Northcraft, G. B., Neale, M. A., 1987. Experts, amateurs, and real estate: An anchoring-and-adjustment perspective on property pricing decisions. Organizational Behavior and Human Decision Processes 39 (1), 84–97.

Orr, D., Guthrie, C., 2006. Anchoring, information, expertise, and negotiation: New insights from meta-analysis. Ohio State Journal on Dispute Resolution 21, 597–1093.

Osborne, M. J., Rubinstein, A., 1990. Bargaining and markets. Academic Press.

Ritov, I., 1996. Anchoring in simulated competitive market negotiation. Organizational Behavior and Human Decision Processes 67 (1), 16–25.

Ritov, I., Moran, S., 2008. Missed opportunity for creating value in negotiations: reluctance to making integrative gambit offers. Journal of Behavioral Decision Making 21 (4), 337–351.

Rubinstein, A., 1982. Perfect equilibrium in a bargaining model. Econometrica 50 (1), 97–109.

Rubinstein, A., 1985. A bargaining model with incomplete information about time preferences. Econometrica 53 (5), 1151–1172.

Sobel, J., Takahashi, I., 1983. A multistage model of bargaining. The Review of Economic Studies 50 (3), 411–426.

Strack, F., Mussweiler, T., 1997. Explaining the enigmatic anchoring effect. Journal of Personality and Social Psychology 73 (3), 437–446.

Van Poucke, D., Buelens, M., 2002. Predicting the outcome of a two-party price negotiation: Contribution of reservation price, aspiration price and opening offer. Journal of Economic Psychology 23 (1), 67–76.

Yukl, G. A., 1974. Effects of situational variables and opponent concessions on a bargainer's perception, aspirations, and concessions. Journal of Personality and Social Psychology 29 (2), 227–236.