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On Creating and Claiming Value in Negotiations

MEHMET BAC
Department of Economics, Bilkent University, 06533 Bilkent, Ankara, Turkey (E-mail: bac@bilkent.edu.tr)

Abstract

This paper presents a negotiation model that includes value creation. It shows that creative negotiation efforts tend to intensify toward the deadline, and that the deadline is determined endogenously by the tension between two motives, creating more value and claiming from existing value. When the parties can present "misleading" offers in order to claim rather than create value, the outcome in early negotiation rounds may display an impasse where any proposal is rejected without inspection, while negotiation activities such as value creation through "sincere" offers and inspection of clauses intensify toward the deadline.

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1. Introduction

The parties to a negotiation often create joint value by devoting time and resources to bring into surface mutually beneficial deals, create an atmosphere conducive for making deals, exploit areas that promise a value and possibly identify a corresponding exchange of concessions by mixing and matching issues. Even in the small-scale negotiations between a contractor and a client, value is not all given but created by gathering and transmitting information (about outside opportunities, the client's preferences over various attributes of the house and the contractor's cost of supplying these attributes), discussing and exploring possible structures given the topology of the land, and making proposals about the clauses to safeguard the parties against opportunistic behavior. These activities are perhaps more obvious in large-scale negotiations reported in popular press; consider the enormous amount of research and creative efforts involved in the process leading to the conclusion of the North American Free Trade Agreement.[1]

This paper focuses on the early stages of negotiation, those in which the parties "construct the pie". It presents a multi-round negotiation model that incorporates both value-creation and value-claiming aspects, which is therefore quite different in style from standard bargaining models.[2] In each round of the basic model, the players decide noncooperatively on their value-creating efforts. These efforts represent activities that aim at pressing out toward the Pareto Frontier, searching for and exploring mutually beneficial terms of exchange and/or concessions, possibly bringing in additional issues to the negotiation table. The created value accumulates from one round to the next, and is shared at the end of the last negotiation round, when the agreement is concluded and implemented. To keep the focus on the process of value creation, I assume that the parties share efficiently and symmetrically the joint value that emerges from negotiations. I use this basic framework to address the following questions: What determines the length of the negotiation process, that is, for how many rounds will the parties keep constructing a pie? And how do incentives to create value evolve during this process? Do the parties create more value in later or in earlier rounds?[3]

Regarding the second question, the paper identifies a *deadline effect*: the parties' efforts intensify and the incremental value they create grows toward the end of negotiations. This is due to the fact that the costs and benefits of negotiation efforts are not synchronized. Given exactly the same value creation technology in each round, negotiation efforts are incurred during the process while the benefits are obtained only after the final round. In many cases of multi-round negotiations, the last rounds in fact seem to be more productive than earlier rounds. A possible explanation for this phenomenon is that the efforts and/or the information revealed in earlier rounds prepare the ground for (increase the productivity of efforts in) later rounds of negotiations. The deadline effect provides an entirely different explanation.[4]

The question regarding the length of the negotiation process is addressed in Section 4 where the number of rounds is endogenized by extending the parties' strategies to include a binary continuation/termination decision at the end of each round. Continuation for another round creates more value for future sharing, while termination yields the shares from the value created thus far. The discount factor (time preferences and/or the exogeneous probability of a breakdown) and the tension between two motives, continuation and termination to claim value, determines the maximum length of the process. A given number of negotiation rounds, say, two, arise as the most lengthy subgame-perfect equilibrium negotiation outcome for a specific intermediate range of discount factors. This result establishes a nice correspondence between the length of negotiations and the players' time preferences and/or the probability of an exogenous breakdown.

In Section 5, I combine the basic model with Rasmussen's (1994) model to investigate several other aspects of negotiations. The extended model allows for two types of clause offers (sincere and misleading), which can be rejected outright, inspected or accepted. A misleading clause is a suggested deal on the basis of manipulated or concealed information.[5] Unlike Rasmussen's model, the negotiation efforts, hence the resulting value, are determined endogenously when a (sincere) clause offer is not rejected outright. Given the same value-creation technology in both rounds through sincere clause offers, the analysis focuses on whether misleading offers, inspections, outright rejections and value creation are more likely in first or second round negotiations. I show that when inspection costs are not prohibitive and there is an incentive to offer misleading clauses in both rounds, the undominated equilibrium involves mixed strategies where the probability of a misleading offer declines, along with the probability of inspection, from round one to round two. The intuition for this result is rooted in the deadline effect and the evolution (from round one to round two) of the expected discounted payoffs from offering a sincere and a misleading clause. I characterize the equilibria of this game. There are equilibria in which no value is created with probability one in the first round while some value is created in round two with positive probability. However, there are no undominated equilibria in which first-round negotiations are more likely to generate value. The second-round outcome in general displays relatively intensive negotiation activities such as inspection, value creation and sincere clause offers.

2. A basic negotiation model with value creation

Consider two players, a proposer "*P*" and an accepter "*A*". Suppose these players have already agreed on a basic contract that generates a value normalized to zero; they are now facing *n* rounds of negotiations to improve upon the basic contract. The proposer offers a clause in each round.[6] A potential value is associated with each clause offered, but the value that will be created in round *t* depends on the players' negotiation efforts x_t^i. The variable x_t^i is thus an individual cost representing player *i*'s value-creating activities during negotiations. A clause negotiated with efforts x_t^P and x_t^A creates a value of size $s(x_t^P, x_t^A)$. I assume that the players know the function $s(.,.)$, called the value technology.[7]

The created value accumulates from one round to the next, and is shared at the end of round *n*. Thus, the benefits from creating value are obtained when the agreement is concluded and implemented, while the costs of negotiation efforts are incurred in the corresponding round. To keep the focus on the value-creation aspect, I choose not to model explicitly the process whereby the players' shares from the created value are determined. I assume that total created value is shared equally.[8]

The players have a common discount factor $\delta \in (0,1)$. The following interpretations of δ are quite useful: δ can be written as $e^{-r\Delta}$ where *r* is the personal rate of time preference and Δ is the length of a negotiation round. The discount factor increases as *r* and/or Δ decreases. Perhaps a more interesting interpretation in the context of negotiations is that δ can be thought of as the probability of proceeding from round *t* to round $t + 1$. Thus, $1 - \delta$ can be interpreted as the probability of an exogenous breakdown, for instance, of a chance that industry conditions, rival offers, government regulations, or an unexpected turn of events, etc. will change and/or kill the deal.

If *P*'s clause offers are negotiated with efforts x_t^i, *A*'s discounted payoff from *n* rounds of negotiations is[9]

$$\delta^{n-1} \sum_{t=1}^{n} \frac{s(x_t^P, x_t^A)}{2} - \sum_{t=1}^{n} \delta^{t-1} x_t^A$$

The expression of *P*'s discounted payoff is exactly of the same form, except that x_t^P should replace x_t^A in the effort costs. I assume the following about the value technology.

Assumption 1 $s(x^P, x^A)$ *is strictly concave, symmetric, and increasing in both arguments, with* $\partial s/\partial x^i \to \infty$ *as* $x^i \to 0$ *and* $s(0, x) = s(x, 0) = 0$ *for all* ≥ 0.

This assumption simply states that more negotiation effort creates a larger joint value and that each player's effort is indispensable to conclude a deal with positive value. Note that round-*t* negotiation efforts have no impact on round-$(t + 1)$ value-creation technology, nor does the value created in one round affect the possibilities to create value in another round.

Supplying the negotiation effort to create the value implicit in a clause on the negotiation table must be in the self interest of each player. Thus, for instance, in the final negotiation round *A*'s effort x^A should maximize $s(x^P, x)/2–x$ given x^P, and similarly for x^P. Since the value technology $s(.,.)$ is symmetric, the unique Nash equilibrium with positive efforts, hence the unique pair of self-enforcing effort levels, are also symmetric. Below I present an implication of this basic model, about the evolution of creative negotiation efforts.

3. The deadline effect

The presence of a deadline or a commonly expected date at which an agreement will be concluded affects the process of negotiations. Zartman and Berman (1982) point out one reason why the late rounds often display intensified negotiation activities and are relatively productive: Given the expected value associated with a prospective agreement and the pressure of time, the parties find it worthwhile exerting a final conclusive effort on unresolved issues and build up on what has been achieved in earlier rounds. This argument seems to be based on a war-of-attrition conception of negotiations where the expected benefits from holding out for a concession from the other side diminish, and thus both players end up making concessions, as the deadline approaches.[10] The present model provides a different explanation, based on the fact that potential individual costs and benefits are not synchronized.

In the subgame-perfect equilibrium (SPE) of the *n*-round game, a total surplus $\sum_{t=1}^{n} s(x_t^*, x_t^*)$ will be created and shared at the end of round *n*. In each round *t* of this symmetric equilibrium, the players exert the effort $x_t^* = argmax_x\ [(\delta^{n-1}/2)\, s(x, x_t^*) - x]$.[11] This equilibrium condition implies the following result.

Proposition 1 *Equilibrium negotiation efforts are increasing over time:* $x_t^* < x_{t+1}^*$. *The smaller the discount factor* δ, *or the larger the probability of a breakdown, the steeper is the pattern of negotiation efforts.*

The proof follows from the parties' payoff expressions and SPE conditions. For example, if $n = 2$, the individual incremental payoff viewed from the beginning of the second round is $s(x_2^P, x_2^A)/2 - x_2^i$. Viewed from the beginning of the first round where x_1^i's are chosen, the individual payoff is $[s(x_1^P, x_1^A) + s(x_2^P, x_2^A)]/2 - x_1^i - \delta\, x_2^i$. The second round negotiation effort x_2^* is larger than the first round effort x_1^* because the value created in round one is shared later, hence, discounted, whereas in the second round the value $s(x_2^*, x_2^*)$ is shared as soon as the round is concluded. In the *n*-rounds case, the relevant objective of each player in round *t* is $max_x\{\delta_{n-t}\, s(x, \bar{x})/2 - x\}$ for given $\bar{x}$. Using the equilibrium conditions, it is straightforward to verify that $x_t^* < x_{t+1}^*$. Efforts to create value intensify as the parties approach the termination date. I call this phenomenon the *deadline effect*.[12] Since the game is strongly symmetric and value creation opportunities are identical in both rounds, the deadline effect is a consequence of the interaction between time preferences, the probability of a breakdown, and the fact that private benefits and costs of negotiation are not synchronized. A larger probability of breakdown generates a steeper pattern of creative negotiation efforts, inviting more prudence in the early rounds while shifting efforts toward the end of a fixed-term negotiation process, where the probability that the gains from an agreement materialize is close to one. The next section shows that the deadline effect is not an artifact of the assumption that the number of rounds is exogenously fixed and provides an upper bound on the length of the negotiation game.

4. Endogenizing the deadline

An obvious constraint that keeps the parties from continually negotiating is a pre-specified enforceable deadline. An upper bound on the potential value associated with the finite number of issues on the negotiation table also generates a constraint. Once this value is created and shared, potential benefits from extending negotiations will be exhausted. In this section I provide another constraint that stems from the interplay of the discount factor (with the interpretations given above) and the conflict between pursuing negotiations to create more value and terminating to enjoy the value created so far. This constraint is different from the one generated by a bounded potential value because value-creation opportunities in this model are identical across the rounds, and the number of rounds is endogenized, hence potentially infinite. The constraint arises as a SPE outcome, hence, is self-enforcing.

The parties' strategies now include a binary continuation decision $\rho_t^i \in \{0, 1\}$ where $\rho_t^i = 1$ is a message that party i sends to the other at the end of round t, communicating his wish to extend negotiations for another round. Negotiations will continue for another round if and only if $\rho_t^A = 1$ and $\rho_t^P = 1$. Formally, a history h_t of the negotiation game at the end of round t can be defined as a collection of past negotiation efforts $\{x_j^P, x_j^A\}_{j=1}^t$ and continuation decisions $\{\rho_j = 1\}_{j=1}^t$. Strategies in this extended game are defined as follows: Letting H_t denote the set of all t-round histories and given a clause offered in round t, the effort strategy is $x_i^t : H_{t-1} \times \{0, 1\} \to R_+$, $i = A, P$. The SPE that displays the *longest, uninterrupted* negotiation process and thus the largest value is called the *Most Lengthy SPE (MLSPE)*. The n-round SPE is the MLSPE if it is impossible to construct an $(n + t)$-round SPE. It is uninterrupted if a positive value is created in each round $t \leq n$ along the SPE path. I make a tie-breaking assumption according to which if in round t a player obtains the same payoff from termination and continuation, then he terminates by setting $\rho_{t=0}$. The MLSPE provides an upper bound prediction on the length of uninterrupted negotiations.

Proposition 2 *There exists an intermediate range* $(\underline{\delta}_n, \bar{\delta}_n]$ *of the discount factor such that, if* $\delta \in (\underline{\delta}_n, \bar{\delta}_n]$, *the MLSPE consists of n rounds of negotiations with creative efforts* $x_1^* < x_2^* < \ldots < x_n^*$.

A discount factor not too low ensures that an n-round negotiation outcome is an equilibrium, and a discount factor not too high ensures that the most lengthy negotiation outcome is not more than n rounds. The analysis can be pursed further to investigate the efficient length of negotiations (subject to the constraint that negotiation efforts are determined noncooperatively). The (constrained) efficient number of negotiation rounds can be found by comparing the payoffs from SPEs of differential durations. Obviously, the number of rounds in the MLSPE need not be efficient; the most lengthy SPE may be too lengthy.

5. Negotiating under imperfect information about intentions

This section adds more structure into the basic model with two rounds. I drop the continuation/termination decisions but, following Rasmussen (1994), extend the strategies to include the possibilities of misleading offers and inspections of clause offers. This extension captures important aspects of negotiations, such as the parties' attempts to mislead the other side and conclude a deal on the basis of manipulated or concealed information, often a tempting option that promises to win a valuable edge. For example, to get low tax rates a foreign mining company may try to persuade local authorities about how modest profits will be, hiding, on the other hand, the full environmental impact of the project. Ignorance can be exploited by adding a supposedly meaningless "standard" clause that reverses the thrust of an agreement. The lure of these tactics is individual gain, victimizing the opponent and the joint value that would otherwise be created. As a safeguard, the parties may engage in costly inspection of proposals. In the example given above, the host country may bring environmental experts to the negotiation table, have the potential environmental aspects of the project inspected, thus devote time and resources, if the mining company seems likely to conceal these aspects to its own advantage. Costly clause inspection activities and incentives to mislead the other side may generate an impasse.[13]

To incorporate these ideas, the model is extended to include the following sequence of events. A "sincere" clause generates value when it is supplemented by negotiation efforts, whereas a "misleading" clause can generate no value. In each round, first, the proposer P decides on the type of clause he offers, "sincere" or "misleading". The accepter A does not know the type of the clause he is offered but he can inspect to learn this at a private cost c before negotiating. Besides inspecting and trusting to negotiate without inspection, A has a third choice, of rejecting the offer on the spot, without inspection. If A inspects and finds that the offer is "sincere" or if he trusts P and does not reject nor inspect the clause, the parties proceed to negotiations and determine their value-creating efforts. When an agreement based on a misleading clause is concluded, A incurs a loss L and P captures a private benefit M at the end of round two.[14] An agreement based on a sincere clause and negotiated with efforts x_t^i generates the value $s(x^P, x^A)$.

This extended model is analyzed below to derive the likely evolution of negotiation activities from round one to round two. Is A more likely to inspect, or negotiate without inspection, in the first or second round? Is P more likely to make a sincere offer in the first or the second round? As shown below, the answers to these questions depend on c, L and M, but more crucially on the evolution of potential discounted benefits and costs associated with the parties' options.[15]

The game has equilibria that display an impasse in both rounds due to the possibility of misleading behavior and a justified lack of trust, despite the existence of mutually beneficial outcomes and a nonprohibitive inspection cost. However, the deadline effect also plays a role and generates a more favorable expectation about the outcome of second-round negotiations, with intensified activities of value creation and clause inspection.

Let $\mu_t \in [0, 1]$ denote the probability that P offers a sincere clause in round $t = 1, 2$. Also, let $\sigma_t \in [0, 1]$ and $\alpha_t \in [0, 1]$ denote respectively A's mixed strategy to inspect and accept without inspection in round t. Thus, $1 - \sigma_t - \alpha_t$ is the probability that A rejects the clause outright and does not negotiate in round t. Recall that A also rejects the clause if he finds that it is misleading after inspection. His expected discounted payoff corresponding to round-one negotiations is

$$U_A = \sigma_1 (\mu_1[\delta \frac{s\,(x_1^*, x_1^*)}{2} - x_1^*] - c) + \alpha_1(\mu_1[\delta \frac{s(x_1^*, x_1^*)}{2} - x_1^*] - (1 - \mu_1)\,\delta L). \tag{1}$$

In (1), the expression following σ_1 is the payoff from inspection, and the one following α_1, from negotiating and accepting without inspection. The latter option yields A a higher payoff than outright rejection if $\mu_1 > L/[L + s(x_1^*, x_1^*)/2 - x_1^*/\delta]$, that is, if P is sufficiently likely to offer a sincere clause. Thus, incorporating this choice of A, his first-round expected payoff becomes

$$U_A = \sigma_1 (\mu_1[\delta \frac{s\,(x_1^*, x_1^*)}{2} - x_1^*] - c) \text{ if } \mu_1 < \frac{L}{L + s(x_1^*, x_1^*)/2 - x_1^*/\delta}. \tag{2}$$

That is, if P is unlikely to offer a sincere clause, A sets $\alpha_1 = 0$ because negotiating and concluding a deal is strictly dominated for A. A's relevant payoff viewed from the beginning of the second round is also as given in (1), except that $\delta = 1$ and the subscripts change accordingly. Recall that negotiation efforts intensify ($x_1^* < x_2^*$) by the deadline effect, and that no value is created if A rejects the clause. The expression of P's payoff corresponding to first round negotiations is

$$U_P = \mu_1 (\delta_1 + \alpha_1 (\delta \frac{s\,(x_1^*, x_1^*)}{2} - x_1^*) + (1 - \mu_1)\ \alpha_1 \delta M. \tag{3}$$

I focus on the *undominated SPE*, characterized in Proposition 3, and rule out "sunspot-like" equilibria triggered by the past actions of the players.[16] Let $X_1 = s(x_1^*, x_1^*)/2 - x_1^*/\delta$ and $X_2 = s(x_2^*, x_2^*)/2 - x_2^*$ denote the net discounted payoffs from creating value in periods one and two. Note that $X_2 > X_1$. The equilibrium outcome in each round depends mainly on two conditions. The first condition compares the inspection cost c with the discounted cost of accepting a misleading clause (δL in the first round, L in the second). The second condition compares P's discounted payoff (δM in the first round, M in the second) from an accepted misleading clause with the discounted payoff from offering a sincere clause that builds up value (δX_1 in the first round, X_2 in the second). The first condition determines whether A's option of inspection is dominated or not, the second condition determines whether P has an incentive to offer a misleading clause. In the case $\delta M \leq \delta X_1$, offering a sincere clause is P's dominating strategy in both rounds, therefore the equilibrium value-creation efforts follow the path described in the discussion of Proposition 1. I confine the analysis to the analytically interesting case of $M > X_1$.

Proposition 3 *Assume $M > X_1$. Undominated SPE of the two-round negotiation game with imperfect information about clause types are as follows.*

(i) If $c < d L$, in both rounds inspection dominates negotiating without inspection.

In the case $X_1 < M < X_2$, the equilibrium in round two is $\mu_2^* = \alpha_2^* = 1$. In round one, it is given by

$$\mu_1^* = 1 - \frac{c}{\delta L},\ \sigma_1^* = 1 - \frac{X_1}{M} \quad \text{and } \alpha_1^* = 1 - \sigma_1^* \text{ if } \frac{L}{L + X_1} < 1 - \frac{c}{\delta L},$$

$$\mu_1^* = \sigma_1^* = \alpha_1^* = 0 \text{ otherwise}$$

In the case $X_2 < M$, μ_1^*, α_1^* and σ_1^* are as above, while the second round equilibrium is

$$\mu_2^* = 1 - \frac{c}{L},\ \sigma_2^* = 1 - \frac{X_2}{M} \text{ and } \alpha_2^* = 1 - \sigma_2^* \text{ if } \frac{L}{L + X_1} < 1 - \frac{c}{L},$$

$$\mu_2^* = \sigma_2^* = \alpha_2^* = 0 \text{ otherwise}$$

(ii) If $\delta L \le c < L$, inspection dominates negotiating without inspection in the second round. The equilibrium strategies in the second round are as described in case (i) above. The first-round equilibrium is $\mu_1^* = \sigma_1^* = \delta_1^* = 0$.

(iii) If $L < c$, the expected type of the clause determines whether inspection dominates negotiating without inspection in both rounds. First-round equilibrium strategies are $\mu_1^* = \alpha_1^* = \sigma_1^* = 0$ as in case (ii), while the second-round equilibrium is $\mu_2^* = \alpha_2^* = 1$ if $X_1 < M < X_2$, and $\mu_2^* = \alpha_2^* = \sigma_2^* = 0$ if $X_2 < M$.

I relegate the proof to the Appendix and explain below the equilibria in Proposition 3. Note that inspection costs do not matter when *A* can trust *P*. They matter only otherwise, when *P* has an incentive to offer a misleading clause (the case $M > X_1$ in round one, and the case $M > X_2$ in round two).

There exists an intermediate range of *M* (larger than X_1 but smaller than X_2) where *P* has an incentive to offer a misleading clause only in round one. This range exists because *P*'s discounted benefit from offering a misleading clause grows slower (from δM in the first round to *M* in the second round) than does his potential benefit from offering a sincere clause (from δX_1 in round one to X_2 in round two). For *M* in this range, the second round outcome goes unaffected: *P* offers a sincere clause for negotiation and the players create the value $s(x_2^*, x_2^*)$. The outcome of the first round will be affected, as follows. If, in addition, $c > \delta L$, i.e., if *A*'s inspection cost is larger than the discounted cost of accepting a misleading clause, the unique first-round equilibrium displays an impasse: *A* does not trust *P* and rejects the first-round offer without inspecting it. If the inspection cost *c* is lower than δL, so that it may be worth inspecting the clause in round one, Proposition 3 case (i) stipulates that the relative positions of $L/[L + X_1]$ and $1 - c/\delta L$ play the crucial role. The first expression is a measure of the cost of accepting a clause of unknown type. The closer it is to one, the larger is *A*'s potential cost of negotiating without inspection. The second expression can be viewed as a measure of the benefit of inspection. The closer is $1 - c/\delta L$ to one, the more attractive is inspection relative to negotiating without inspection, given a probability μ_1 of receiving a sincere offer. If $L/[L + X_1]$ is larger than $1 - c/\delta L$, there is no range of μ_1 such that the relative benefits of inspection exceed costs. This implies that, given *P*'s incentive to offer a misleading clause in round one, *A* does not trust *P* and rejects the clause with probability one. The larger is *L*, and the larger is the inspection cost *c* relative to *L*, the more likely is an impasse in the first round. On the other hand, if $L/[L + X_1] < 1 - c/\delta L$, a mixed strategy equilibrium exists in round one, generating a random outcome which may involve inspection or acceptance (but never outright rejection) by *A*, combined with a misleading or sincere clause offer by *P*. This equilibrium, which arises because *A* can now beneficially protect himself through inspection, is obviously better than an impasse. Given the choice, *P* would also like to negotiate with an *A* who can inspect at a low cost and therefore protect himself against *P*'s opportunism.

The equilibria in the case where *P* has an incentive to offer a misleading clause in both rounds can be explained in light of the arguments presented above. Now, $M > X_2$, hence also $M > X_1$. If the inspection cost is prohibitive, that is, $c > L$, hence also $c > \delta L$, no value is created in two rounds despite existence of mutually beneficial agreements. For an intermediate range of inspection costs ($\delta L < c < L$) no value is created in the first round, but the second-round equilibrium outcome may involve mixed strategies and some value may be created with positive probability. Comparing the equilibria for different ranges of *c* suggests that low values of *c* can significantly improve the negotiators' welfare by switching the equilibrium to a more efficient one.

The game has a rich class of potential outcomes when inspection costs are relatively low ($c < \delta L$) and *P* has an incentive to offer a misleading clause in each round. Then, either no value is created with probability one, or the equilibrium outcome is random, involving mixed strategies. This makes four potential types of equilibria, according to whether the corresponding strategies in each round are mixed or pure. I show below that one of these potential equilibria can be ruled out. With probability one, the players create no value in the first round if

$$\frac{L}{L + X_1} > 1 - \frac{c}{\delta L}, \tag{4}$$

and with probability one no value is created in the second round if

$$\frac{L}{L + X_2} > 1 - \frac{c}{L} \tag{5}$$

Note that (4) is implied by (5), which means that if the equilibrium in the second round displays an impasse (zero value creation with probability one), then the first round equilibrium outcome also displays an impasse. Thus, when inspection is relatively easy, ($c < \delta L$) and *P* has an incentive to offer misleading clauses in both rounds, either (i) the negotiation process creates no value ((4) and (5) hold), or (ii) some value is created with positive probability in only the second round ((4) holds but (5) fails), or, finally (iii) the outcome in both rounds is random ((4) and (5) fail together). The following conclusion can be distilled from the analysis.

Proposition 4 *Under imperfect information about clause types, negotiation activities such as clause acceptances, sincere clause offers and value creation are likely to intensify toward the deadline.*

The two-round negotiation game has no undominated equilibria in which the probability of acceptance is larger in the first than the second round, nor does it have an equilibrium in which the probability of outright rejection is larger in the second round. When sincere clauses are offered and accepted in both rounds, a larger value is created in the second round than the first. Thus, the analysis of this fixed-round model confirms the observation that the negotiators become more active in late negotiation rounds. The extended model with continuation/termination decisions and endogenous number of rounds would further strengthen this result. Whatever the number of rounds involved in a MLSPE, the last round equilibrium will be identical to the second-round equilibrium if the fixed-round model, and the equilibrium in the round before the last will be identical to the first-round equilibrium presented above.

6. Concluding remarks

This paper presents a model that incorporates creation of value during a negotiation and investigates the dynamics of negotiation activities, intensity of value-creating efforts, likelihood of rent-seeking misleading proposals, inspections, and rejections of proposals. It identifies a deadline effect regarding the evolution of efforts to create value in negotiations: incentives to create value are enhanced as negotiations advance. The deadline effect is a testable proposition and should be at work in real-life negotiations. It stems from the fact that individual costs and benefits of negotiating are not synchronized. Because the costs are spread over the entire process while the benefits come at the end, negotiation activities intensify as the probability of an exogenous breakdown naturally decreases, toward the deadline. The basic model is extended to endogenize the deadline by including in the players' strategies a binary continuation/termination decision. This decision is shown to be shaped by the tension between value creation and value claiming: negotiating another round to create more value versus terminating the process to enjoy the shares from the existing value.

The parties to a negotiation can adopt sincere and misleading types of actions, but their intentions to create or claim value are in general private knowledge. As one party is expending creative effort to press out toward the Pareto frontier, the other may try to take advantage of his private information and knowledge by misleading to conclude a deal which ex-post will turn out to be bad for his opponent. Negotiators, or their lawyers, may inspect the deal they are offered in order to learn the intentions of their opponent. I study the dynamic consequences of imperfect information about intentions in Section 5 and confirm in the two-round model a phenomenon that can be shown in a multi-period version, namely, that the early rounds of negotiations have a tendency to be negatively affected by imperfect information about intentions. The deadline effect plays a role in this result. The relatively small opportunity cost of making misleading proposals increases the probability of an impasse in early negotiation rounds. In such an outcome the players do not trust each other and reject any proposal without inspecting and negotiating. The analysis highlights the roles of inspection costs and of the private benefits and costs associated with making and accepting misleading proposals. In a mixed-strategy equilibrium, which exists when inspection costs are relatively low and there is an incentive to make a misleading proposal, inspections and misleading proposals occur less frequently over time, as the negotiators approach the deadline.

An interesting question that should be addressed in future research is the ordering of issues in a negotiation agenda. A small number of papers address this question in a pure bargaining framework where the value associated with each issue is exogenously given.[17] The parties to a negotiation have prior beliefs about what set of issues promises the largest joint and/or individual values, and they start exploring, discussing and creating value on the basis of these priors. Should they begin with exploring the issues that promise a relatively small or large value? And how do signaling considerations affect the answer? Intuition suggests that the issues promising a large value should be negotiated in the round where incentives to create value are strongest, which is likely to be the last round as the deadline effect suggests. However, the answers will also depend on how one defines "large" and "small" issues in terms of their value technologies and perceptions of the negotiators.

7. Appendix

Proof of Proposition 2. The proof is done by constructing a MLSPE. Consider an n-round SPE with negotiation efforts $x_1^*(n), \ldots, x_n^*(n)$. For $\tau = 1, \ldots, n$, let $S_\tau = \sum_{t=1}^{\tau} s(x_t^*(n), x_t^*(n))$ denote the accumulated value, with $S_0 = 0$. Subgame perfection along the most lengthy and uninterrupted path requires that at each date $\tau < n$ the players set $\rho_\tau = 1$ and continue negotiations. Let $C_\tau(n) = \delta^{n-\tau}(S_n/2) - \sum_{t-\tau}^{n-1} \delta^{t-1} x_{t+1}^*(n)$ denote the discounted continuation payoff as viewed from the end of round τ. To have an n-round MLSPE, the continuation payoff $C_\tau(n)$ must exceed the termination payoff $S_\tau/2$ for each $\tau = 0, 1, \ldots, n-1$. At each τ, there must exist a minimum discount factor $\underline{\delta}_n(\tau)$ such that $C_\tau(n) > S_\tau/2$ for $\delta > \underline{\delta}_n(\tau)$. This follows immediately from the fact that $C_\tau(n)$ is continuous and monotonically increasing in δ, $C_\tau(n) \to 0$ as $\delta \to 0$, and $C_\tau(n) > S_\tau/2$ as $\delta \to 1$. Define $\underline{\delta}_n = \min_{\tau=1, \ldots, n-1} \underline{\delta}_n(\tau)$ as the minimum discount factor such that continuation dominates termination in all rounds $\tau = 1, 2, \ldots, n-1$.

The n-round SPE is a MLSPE if, given the value stock S_n accumulated at the end of round n, termination dominates continuation to round $n + 1$: The latter option would increase the value stock by $s(x^*, x^*)$ where x^* is the one-round Nash equilibrium effort that would be supplied in the last, $n + 1$'th round.[18] The players will terminate the process at the end of round n if

$$\frac{S_n}{2} \geq \delta[S_n/2 + s(x^*, x^*)/2 - x^*].$$

Since $s(x^*, x^*)/2 - x^* > 0$, this condition implies an upper bound on δ, denoted $\bar{\delta}_n \equiv \bar{\delta}(n)$. Thus, the n-round SPE is a MLSPE is $\delta \in \underline{\delta}_n \bar{\delta}_n]$. Q.E.D.

Proof of Proposition 3. The proof constructs the equilibria mentioned in the proposition and verifies uniqueness of undominated SPE by inspecting the strategy spaces. Because the rounds of the game consist of essentially a repeated game (except that the created value S_1 accumulates from round one to round two and the presence of a discount factor), I concentrate on the equilibria of round one, leaving to the reader to use the same arguments and fill in the details for equilibria of round two.

First, consider case (i), $c < \delta L$. Assume that

$$\frac{L}{L+X_1} > 1 - \frac{c}{\delta L} \text{ and } M > X_2. \tag{6}$$

Note that $M > X_2$ implies $M > X_1$. Assume for the moment that the second-round strategies described in the proposition form a Nash equilibrium, and consider the first-round strategies. A's best reply in the first round can be obtained from the payoff expression in (1) by varying P's strategy μ_1. Three intervals should be considered: $[0, 1-c/\delta L)$, $[1-c/\delta L, L/[L+X_1])$ and $[L/(L+X_1), 1]$. If μ_1 belongs to the first or the second interval, direct acceptance is a strictly dominated action (by outright rejection), hence $\alpha_1 = 0$. In the second interval $\sigma_1 = 0$ because $\mu_1 > 1 - c/\delta L$ implies that inspection is dominated by direct acceptance. Therefore A rejects with probability one if μ_1 lies in the second interval. For (large) μ_1 in the third interval direct acceptance becomes the best option, thus, $\alpha_1 = 1$. A's best-reply correspondence is summarized below.

$\sigma_1 = \alpha_1 = 0$ if $\mu_1 = 0$;
$\sigma_1 \leq 1$, $\alpha_1 = 0$ if $\mu_1 \in [0, 1-c/\delta L)$;
$\sigma_1 = \alpha_1 = 0$ if $\mu_1 \in [1-c/\delta L, L/(L+X_1))$;
$\sigma_1 = 0$, $\alpha_1 \in [0, 1]$ if $\mu_1 = L/(L+X_1)$;
$\alpha_1 = 1$ if $\mu_1 \in (L/(L+X_1), 1]$.

If P plays $\mu_1 = 0$, A's best reply is clearly $\sigma_1^* = \alpha_1^* = 0$. On the other hand, when A plays $\alpha = 0$, P's payoff can be written as

$$U_P = \mu_1\sigma_1\left(\delta\frac{s(x_1^*, x_1^*)}{2} - x_1^*\right), \tag{7}$$

which shows that any $\mu_1 \in [0, 1]$ is a best response of P to A's strategy $\sigma_1 = 0$. Thus, $\mu_1^* = 0$ and $\sigma_1^* = \alpha_1^* = 0$ are best replies. For round two, one can similarly show that $\mu_2^* = \sigma_2^* = \alpha_2^* = 0$ is a Nash equilibrium when $L/(L+X_2) > 1 - c/L$, as stated in the proposition.

To show that the combined strategies in round one and two form the unique SPE, I focus again on round one and consider below alternative strategy configurations. Suppose there is a SPE in which $\mu_1 \in [1-c/\delta L, 1]$. A's best reply to such μ_1 involves $\sigma_1 = 0$. If $\sigma_1 = 0$, P's payoff given in (3) dictates that $\mu_1 = 0$ because $M > X_1$, which contradicts the assumption that $\mu_1 \geq 1 - c/\delta L$ is an equilibrium strategy. Suppose now there is a SPE in which $0 < \mu_1 < 1 - c/\delta L$. As shown above, for such values of μ_1 A's best reply includes $\alpha_1 = 0$ and thus A's payoff is as given in (2) where σ_1 may be positive. Note that P's payoff, now given by (7), dictates $\mu_1 = 1$ for any $\sigma_1 > 0$, a contradiction. Uniqueness of round two Nash equilibrium described in the proposition can be established by using the same procedure.

To construct a mixed-strategy equilibrium in the first round as described in case (i), suppose that

$$M > X_1 \text{ and } \frac{L}{L+X_1} < 1 - \frac{c}{\delta L}.$$

Assume that P's strategy is $\mu_1 = 1 - c/\delta L$. Then, A is indifferent between inspecting and accepting. Now, if $\mu_1 = 1 - c/\delta L > L/[L+X_1]$ as assumed, outright rejection is strictly dominated by acceptance, hence any combination $\alpha_1 + \sigma_1 = 1$ is optimal for A. In particular, so is $\alpha_1^* = 1 - \sigma_1$ where $\sigma_1^* = 1 - X_1/M \in (0, 1)$. Inspecting P's payoff in (3) for $\alpha_1 + \sigma_1 = 1$ reveals that such a σ_1^* must exist because $M > X_1$. Given this σ_1^*, note that P is indifferent between offering a sincere clause and a misleading clause. Thus, $\mu_1^* = [1 - c/\delta L] \in (0, 1)$ is a best reply of P and the strategies therefore constitute an equilibrium for the first round. Verifying the second-round equilibrium follows similar arguments.

Proof of case (ii), where $c \in [\delta L, L]$, can be established by deriving the best reply correspondences as done above for case (i). In case (iii), $c > L$, A finds that inspection is strictly dominated (by direct acceptance) in both rounds. Then, A never inspects: $\sigma_t = 0$ for $t = 1, 2$. A's first-round best reply to μ_1 is then $\alpha_1 = 1$ if $\mu_1 > L/(L + X_1)$, $\alpha_1 \in [0, 1]$ if $\mu_1 = L/(L + X_1)$, and $\alpha_1 = 0$ otherwise. P's payoff is given in (3) where $\sigma_1 = 0$, and his optimal decision is $\mu_1 = 1$ if $X_1 > M$ and $\mu_1 = 0$ if $X_1 < M$. The rest of the verification is straightforward. To establish uniqueness it suffices to show that in each round there is no generic equilibrium in which A randomizes between direct acceptance and rejection. Assume that the second-round play is as determined in the proposition and consider the first-round strategies. Since $\sigma_1 = 0$, A would choose $\alpha_1 \in (0, 1)$ only if $\mu_1 = L/(L + X_1)$. But the expression of U_P in (3) where $\sigma_1 = 0$ reveals that the best reply μ_1^* is independent from α_1, thus $\mu_1^* = L/(L + X_1)$ only if $M = X_1$, which is a zero probability event (of measure zero). Q.E.D.

Notes

1. For a detailed discussion of the fact that negotiation is not a zero-sum game and that efforts are necessary to discover joint benefits, see Lax and Sebenius (1986) and Fisher and Ury (1981). A typical real-world example used in illustrating this fact is the negotiation between Israel and Egypt over the Sinai (See Hopmann (1996) for the details of the process leading to Camp David agreement).
2. The idea that negotiation involves both cooperation and competition is not new, recognized since long by negotiation analysts. To distinguish between negotiations with a value-creation potential and (pure) bargaining over a given value, several authors use "integrative bargaining" for the first, "distributive bargaining" for the second. See Walton and McKersie (1965), Lax and Sebenius (1986), and Sebenius (1992) from where we borrow the twin concepts of value creation and value claiming. Raiffa (1982) is a notable contribution presenting formal negotiation models that focus on different issues.
3. The received theory of bargaining ignores the value creation process and focuses on the allocation of a given value among a set of players. To our knowledge the only exceptions are Rasmussen (1994) and Frankel (1998). Rasmussen presents a two-round negotiation model, from which we borrow in Section 5, with fixed potential value and no discounting. Frankel studies some of the questions addressed below in variants of a basic model which consists of a Rubinstein bargaining model preceded by a value creation effort by one of the players.
4. In the basic model presented below, negotiation efforts in round t have no effect on productivity of negotiation efforts in round $s > t$. Assuming a positive externality from round t to round s would obviously only strengthen the deadline effect. This basic model is also related to dynamic models of private provision of public goods. Bac (1996) studies a repeated game under incomplete information about private costs of contributions, providing the conditions leading the game into a war of attrition where each player waits for the other player to contribute. Admati and Perry (1991) study the pattern of contributions to a public good or project of fixed size. The players in their model make alternating contributions. They show that contributions may increase or decrease over time, depending on the discount factor.
5. In the contractor-client example, the contractor may opportunistically propose to negotiate inclusion of an additional clause, knowing that the client (who ignores its full implications) will be dissatisfied ex-post if he negotiates and accepts without closely inspecting the clause. Proposing to negotiate a set of issues with the private knowledge that no agreement will follow can also be viewed as a misleading offer. This tactic of "playing against time" is often used in international negotiations.
6. An alternative interpretation is that in each round the proposer offers a deal, which is the "raw material" that has to be worked through in order to generate a joint value.
7. The main points stressed in this paper extend to the case of uncertain value technology.
8. This is consistent with the Nash bargaining solution and the subgame-perfect equilibrium of Rubinstein's (1982) alternating-offers bargaining game where the first offerer is selected at random, with equal probability. What matters is that the bargaining solution be known and anticipated before the players decide on their value creating negotiation efforts. Qualitatively, the analysis goes through under any positive value-sharing assumption.
9. The results hold under any convex effort disutility function. Linearity is assumed to simplify the algebra.
10. Hopmann (1996, pp. 215–217) also discusses this argument. See Chatterjee and Samuelson (1987) for an alternating offers model of pure bargaining under incomplete information, generating a war-of-attrition

outcome. Another reason for intensified negotiation efforts and activities in late negotiation rounds stems from the negotiation agenda. A commonly observed practice is that the parties often agree to tackle easy issues first, followed by hard, effort- and time-consuming issues. Raiffa (1982, p. 178) analyzes the example of Panama Canal negotiations where the parties have decided to follow an agenda, from easy issues to harder ones, "in an effort to keep the course of negotiations smooth". Hard issues demand relatively large negotiation efforts to be solved, are often more important and promise a large joint value potential. The Panamians, for instance, wanted to negotiate later the hard and important issue of compensation.

11. The game has other equilibria involving $x^i_t = 0$, $i = P, A$, generating no value in round t. These equilibria stem from Assumption 1, that individual negotiation effort are indispensable. However, there is a unique SPE with positive value in each round. I focus on this equilibrium.
12. The deadline effect also extends to the case of an uncertain, recurrent value technology. To verify this in a simple way one can include a possibility that the negotiation efforts will be unproductive, that is, generate a value zero with probability p in each round. Negotiation efforts will again be increasing in time.
13. The fact that elements of value creation through sincere behavior and value claiming through misleading behavior are simultaneously present generates a game which several authors have named "the negotiator's dilemma". See Lax and Sebenius (1986) Ch. 2 for examples.
14. The timing of the loss L and the benefit M are consistent with the assumption that all benefits and costs, except the costs of negotiation efforts, are incurred at the end of the process (the second round). Assuming that L and M are incurred in the corresponding round does not have a qualitative impact on the results.
15. Contrary to Rasmussen (1994), the extended model endogenizes value creation efforts (conditional on that a sincere offer is made) and allows for discounting, or breakdown of negotiations.
16. These equilibria are supported by rather strange beliefs. An example is, if P has proposed a sincere clause and value has been created in the first round, A's second-round strategy dictates to reject any offer, and P in the second round responds with offering a misleading clause. This equilibrium, which is ruled out here, is supported by the (fulfilled) belief that any sincere offer is followed in the second round by a misleading offer. The analysis focuses on the most efficient SPE whenever there is an alternative equilibrium to the one in which P proposes misleading offers in both rounds and A rejects.
17. The bargaining literature identifies several other factors shaping the agenda in negotiations. Bac (2000a, b), Bac and Raff (1996) and Busch and Horstmann (1999) highlight the potential signaling function of the agenda. Weinberger (2000) investigates efficiency properties of bargaining equilibria in a two-issue, alternating-offers model. See also Inderst (2000) for a recent contribution.
18. Note that if the players deviate from the n-round SPE and decide to continue for another round and terminate at round $n + 1$, they will choose noncooperatively their efforts $x^*_{t+1} = x^*$ that solves $max_x\ [s(x, x^*)/2 - x]$.

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