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Open- versus closed-door negotiations

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We examine noncooperative bargaining between two agents, one of whom (agent 1) represents a constituency. Under "closed-door" bargaining, constituents must approve the final bargaining agreement. In the "open-door" case, constituents may also terminate bargaining after intermediate offers have been made and rejected. A "learning effect" and a "termination effect" arise in open-door bargaining. The former increases and the latter decreases the payoff to agent 2 from rejecting offers. The termination effect dominates, making agent 2 less likely to reject offers and hence making agent 1 more aggressive in the open-door case.

1. Introduction

■ Recent work in noncooperative bargaining has focused attention on how relative rates of impatience and imperfect information determine bargaining outcomes.[1] In practice, a host of other considerations affect bargaining outcomes. This article explores the role of one such factor: whether bargaining is conducted secretly, or behind "closed doors," so that only the final agreement can be observed, or is conducted behind "open doors," with intermediate as well as final proposals observed.

The question of whether bargaining should proceed behind open or closed doors often poses significant obstacles to initiating negotiations. The following statement is typical of the arguments raised in connection with this issue:[2]

> The new administration in its first labor negotiation committed a sin of collective bargaining by letting a third party into private contract negotiations. It will be very difficult for this or any other labor leader to have exploratory talks with top city officials when the subject matter may become part of an editorial. . . . This union will not negotiate its contract with you [the New York Times], and we hope the city will not negotiate with us through the news media.

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[1] The role of relative rates of impatience is explored in Rubinstein (1982) and Binmore, Rubinstein, and Wolinsky (1986). For a summary of work on bargaining, see Fudenberg and Tirole (1991) and Osborne and Rubinstein (1990) (especially chapter 4, where an exogenous risk of breakdown appears that is similar to the termination risk endogenously created by the constituents in our model).

[2] Letter written to the *New York Times* by Barry Feinstein, President, New York City Employees Union Local 237, September 20, 1990.

Our point of departure for examining closed- versus open-door bargaining is the observation that bargainers frequently negotiate not for themselves but as representatives of a constituency, where a constituency consists of a large number of individuals. These individuals may in turn have conflicting goals, may be affected in quite different ways by the failure to reach an agreement, and may be only partially informed about each others' payoffs. As a result, the relationship between the constituents and the agent typically does not match that of a conventional principal-agent problem, in which the constituents write sophisticated contracts to provide incentives for the agent. Instead, the constituents' role is often limited to deciding, at various points during the course of a negotiation, whether to let the bargaining continue or to terminate negotiations.

Labor negotiations between a firm and a representative of a union are an example. The role of the union is to ratify a proposed agreement or to reach an agreement on terminating negotiations, i.e., to strike, before an agreement has been reached. International negotiations provide another example. Agents negotiate on behalf of legislatures. These legislatures must ratify any agreement and again can terminate negotiations, perhaps ensuring that a conflict continues, before an agreement is reached.[3]

In closed-door negotiations, constituents receive no information until an agreement has been concluded and only then are allowed to accept the agreement or terminate negotiations (reject the agreement). In open-door negotiations, concluded agreements must again be approved. In addition, constituents may intervene and terminate bargaining even before an agreement is reached if the progress of the negotiations leads them to be apprehensive about future agreements.

Constituents typically decide by voting whether to ratify an agreement or terminate negotiations. In labor negotiations, a majority vote of the union is required to approve a contract or call a strike. International treaties must be ratified by (two-thirds in the case of the United States) majority votes of senates or parliaments. In the course of voting, each constituent compares the expected payoff from ratifying the agreement or allowing negotiations to continue with the payoff from terminating negotiations. Because this latter payoff is likely to differ across constituents, as they may be affected in quite different ways by a strike or warfare, constituents may well disagree as to the merits of a potential agreement.

In addition, labor and especially international negotiations are often quite lengthy. A constituency may change as the bargaining proceeds. Some members may leave the constituency and new members may join, a process familiar to any elected official. Constituents must take this turnover into account when voting. A constituent may accordingly vote to terminate negotiations out of fear of the future agreements that may be approved by a changing constituency. The constituents are thus driven by strategic rather than merely myopic considerations.

For example, Israeli Prime Minister Itzhak Shamir fell prey to such strategic considerations in 1992. In the course of the Middle East negotiations, the Israeli delegation proposed limited autonomy for residents of the West Bank and Gaza. This was rejected on the spot by the Palestinian negotiators. In spite of this rejection, the fact that such an offer was made sufficed for the Israeli Knesset to topple Shamir's government and force new elections, halting negotiations. The bargainers were nowhere close to an agreement in this case, but the offer prompted the conservative members of the Knesset to vote

[3] Our formal model assumes that if constituents either reject a proposed agreement or decide to terminate negotiations before an agreement is reached, then agents receive their disagreement payoffs, which we interpret as a strike or continued conflict. In practice, negotiations might continue after constituents have rejected a proposed agreement. Incorporating this possibility into the model would make the calculation of continuation payoffs more complicated, but would not affect the nature of the results. The key features of the model are that it is costly to have constituents terminate negotiations, and that the cost of a termination without an agreement is at least as high as the cost when an agreement has been reached.

against the government in an attempt to terminate negotiations and avoid the agreements that future constituents might approve. The outcome of these negotiations might have been very different if they had been conducted behind closed doors, with Shamir perhaps avoiding an election and retaining power.

We examine the question of open- versus closed-door bargaining in the simplest possible model, with two periods and only one bargainer representing a constituency. The two-period assumption does not drive the result; we return to this point in Section 5. We show that if (only) one side to the negotiation is a representative of a constituency, then that side will prefer an open-door negotiation to a closed one, while the other side will prefer a closed-door negotiation.

Two forces interact to drive this result. Consider what happens under open-door negotiations when player 1, who is bargaining on behalf of a constituency, makes an offer that is rejected by player 2. Each constituent must now vote whether to terminate negotiations. If the projected outcome of future rounds of negotiation is worse for a constituent than disagreement, then the constituent will vote to terminate negotiations, opting to take the disagreement payoff rather than running the risk that future constituents will accept an unfavorable bargaining outcome. If the constituents vote to continue negotiations, this implies that the required majority of constituents prefers the future outcome to disagreement.

Player 2 is likely to be incompletely informed as to the disagreement payoffs of player 1's constituents, but is aware of this constituent decision process. A constituency decision to continue negotiations then provides player 2 with "good news," implying that player 1's constituents have relatively low disagreement payoffs and hence are likely to approve agreements that are relatively favorable to player 2. This "learning effect" increases the payoff to player 2 for rejecting offers and makes him more likely to reject. This in turn creates a force for player 1 to prefer the closed-door framework, because under closed doors no information about player 1's constituents is revealed until after an agreement has been concluded. Our original intuition was that the learning effect would drive players representing constituents to prefer closed-door negotiations.

On the other hand, each rejected proposal under open-door negotiations creates another opportunity for player 1's constituents to intervene and terminate the negotiation. Because the composition of the constituency changes over time, there is a new risk of termination each time constituents vote. In particular, changes in a constituency may cause the constituents to terminate negotiations after seeing an offer that in earlier rounds would have induced them to continue. This "termination risk" increases the cost to player 2 of rejecting offers, because it exposes player 2 to a requirement that current constituencies must allow negotiations to continue, as well as requiring that the future constituency approve an agreement. This requirement does not arise under closed-door negotiations. This makes player 2 less likely to reject offers and provides a reason for player 1 to prefer open-door negotiations. We find that this is the stronger effect and that player 1 will prefer to negotiate with an open rather than a closed door.

Why does the termination effect dominate? Suppose that none of player 1's constituents are replaced between periods 1 and 2 and that player 2 has just rejected a period-one offer from player 1. In the open-door model, player 1's constituents will now agree to continue negotiations if and only if enough of them have sufficiently low disagreement payoffs. Player 2 will then use this revealed information about disagreement payoffs to make an even lower (i.e., more favorable to player 2) period-two offer. But the compound probability that disagreement payoffs are sufficiently low (and hence negotiations are allowed to continue) and that player 2's lower period-two offer is accepted is simply equal to the unconditional probability that player 2's offer is accepted. Because this latter probability is the relevant one for a closed-door model, in which nothing is learned in passing to period two, player 2 can always (by making the period-two open-door offer) get at least as high a payoff in the closed-door as in the open-door model, and hence, at least weakly prefers the closed-door model. If, however, some constituents are replaced between period 1 and period 2, then less is learned from the fact that negotiations are allowed to continue to period 2. This weakens the learning effect and hence makes open-door bargaining less attractive, causing player 2 to strictly prefer closed-door negotiations.

In the following section we present the model. In Section 3 we examine closed-door bargaining. Section 4 examines the open-door case and derives the basic result. Section 5 concludes.

2. The model

■ We consider two players, 1 and 2, who must negotiate the division of a pie with a value of unity to both players, where this represents the discounted present value of a constant utility flow. There are 2 periods. We let x denote an offer in the first period and z an offer in the second period. We measure divisions of the pie in terms of the share allocated to player 1. An agreement on $x \in [0, 1]$, reached in the first period, then gives player 2 a payoff of $1 - x$. Player 2's payoff from an agreement z, reached in the second period, is given by $D(1 - z)$, where $D \in (0, 1)$ is the discount factor. Player 2's payoff from disagreement is zero.[4]

Player 1 negotiates on behalf of a constituency of N members (and is hence hereafter referred to as agent 1 rather than player 1). We assume that N is finite, though we find it most natural to think of N as being large.[5] At the end of the first period, γ of agent 1's constituents are randomly chosen to be replaced by new constituents, where $0 < \gamma \leq N$. This may be caused, for example, by elections to a legislative body or changes in union membership. We believe that labor and international negotiations often take long enough to make $\gamma > 0$ a natural assumption.[6]

The utility to a member of agent 1's constituency from an agreement x or z is given by x or Dz. Each member of agent 1's constituency, whether present in the initial period or a replacement constituent appearing in the second period, has a disagreement payoff, v, that is drawn independently from the density f: $[0, 1] \rightarrow \mathbb{R}$, where f is continuous and has full support and v is again the present value of a constant utility flow. We model disagreement payoffs as being drawn from the distribution f to capture the fact that bargainers are likely to be uncertain as to which agreements constituents will approve.[7]

The payoff to agent 1 from an agreement is also given by x (in the first period) or Dz (in the second period). Two observations motivate this formulation. First, remuneration contracts for negotiators, such as union leaders or statesmen, typically do not feature high-powered incentives based on performance but rather provide a fixed payment regardless

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[4] It will be clear from the analysis that the results would be unchanged if utility were a nonlinear function of the share of the pie.

[5] We take N to be finite so that the process of independently selecting constituents to be replaced (with both old and new constituents having disagreement payoffs independently drawn from a common distribution) can affect the period-two distribution of disagreement payoffs and hence affect the probability that a given agreement is approved. We could work with an infinite number of agents, with disagreement payoffs distributed on a continuum, so long as some systematic feature of the constituent replacement process allowed the period-two disagreement-payoff distribution to differ from that of period 1.

[6] A similar belief in the lengthiness of negotiations motivates the use of discounting in bargaining models. In some cases, the replacement of constituents may reflect changes of mind rather than actual changes of constituents.

[7] This appears to be a realistic assumption in the case of international negotiations, such as when constituents surprise negotiators by rejecting treaties the negotiators thought would be ratified (e.g., the United States' refusal to ratify the League of Nations treaty). This assumption also holds in labor negotiations, in which unions occasionally reject contracts where ratification was expected. Our basic results would continue to hold if constituents' disagreement payoffs were known, so long as replacement constituents' disagreement payoffs could differ from those of existing constituents.

of outcome.[8] This is especially the case for negotiators who represent a large number of possibly diverse constituents.[9] At the same time, the agent is more likely to obtain future negotiating roles the higher the payoff secured in the current negotiation. This causes agent 1 to maximize the payoff from the current negotiation, and allows us to model the agent's payoff from the agreement as matching that of the constituents.[10] Agent 1's disagreement payoff is zero.

At various points during the course of play, constituents vote whether to continue or terminate negotiations in order to receive their disagreement payoffs. We think of the decision to terminate as a decision to abandon bargaining in favor of an outcome such as a continued strike in the case of labor relations, conflict in the case of international negotiations, a trade war in the case of commercial negotiations, or a trial in the case of a class action lawsuit. The bargaining continues if and only if at least α constituents decide to continue negotiations. We assume $0 < \alpha < N$.

We consider two bargaining models, the closed- and open-door models. In each case, the only decision that constituents ever face is whether to terminate or continue negotiations. The two models differ in the opportunities they provide for making this decision. Under the closed-door model, agent 1 makes an offer in period 1. Player 2 either accepts or rejects. If player 2 rejects, then bargaining proceeds to the second round, where player 2 makes an offer that agent 1 either accepts of rejects. After an acceptance in either period (and only then), the proposed agreement is submitted to agent 1's constituents, who vote whether to terminate negotiations or implement the agreement. A decision to terminate negotiations in this case amounts to rejecting the proposed agreement in favor of receiving disagreement payoffs. We describe this as "closed-door" negotiations, because constituents make a termination decision only after negotiators have emerged from behind their closed doors with an agreement.

In the open-door model, agent 1 again makes an offer in period 1 which player 2 either accepts or rejects. Then, the constituents of agent 1, knowing agent 1's offer and player 2's response, consider whether to terminate negotiations. If player 2 has accepted the offer, a termination yields disagreement payoffs, while not terminating implements the offer. If player 2 rejects, termination again gives disagreement payoffs, while not terminating causes the game to enter the second period. The second period then begins with player 2 making an offer and agent 1 either accepting or rejecting. A rejection ends the game with disagreement payoffs, while an acceptance is submitted to agent 1's constituents, who are then informed of player 2's offer and agent 1's acceptance. An approval implements the agreement, while a rejection again yields disagreement payoffs. We call this the "open-door" case, because constituents make a termination decision at the end of each round of bargaining, regardless of whether negotiators have reached an agreement, and constituents make this decision knowing the outcome of the previous bargaining round.

Voting games typically yield many equilibria. If there are at least three voters, for example, then under majority rule it is an equilibrium (on any question) for all voters to vote yes or for all to vote no, because no voter can affect the outcome by changing his

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[8] The issues change significantly if this is not the case. Contracts in which payoffs are linked to bargaining outcomes can be used by principals to effectively commit their agents to preferences and hence strategies that are to the principals' advantage. See, for example, Fershtman, Judd, and Kalai (1991). Haller and Holden (1992) examine a model in which contracts between constituents and agents, as well as agent preferences, are similar to ours.

[9] In such cases, the bargaining problem by which constituents would agree on a contract with the agent is likely to be of such complexity as to preclude all but the simplest contracts. Similar issues, involving the difficulty of reaching a bargaining agreement with a large number of diverse, incompletely informed parties, appear in Mailath and Postlewaite (1990).

[10] We think this is the most natural formulation. The qualitative results are preserved so long as agent 1's payoffs are not too different from those of the constituents.

or her vote. To avoid these unnatural equilibria, we assume that voters choose only voting strategies that are not weakly dominated (alternatively, we could restrict attention to perfect equilibria of the voting stage).

The only undominated strategy in the voting game is to vote sincerely in every stage. That is, each constituent votes to continue (terminate) negotiations if the expected value of continuing provides the constituent with a higher (lower) expected payoff than the constituent's disagreement payoff.[11]

3. Closed-door negotiations

■ In the closed-door model, the progression of bargaining to the second period reveals no information about agent 1's constituents. Let $F(x)$:[0, 1] $\rightarrow$ [0, 1] be a cumulative distribution function that identifies, for offer x, the probability that at least α out of N draws from the density f yield a disagreement payoff less than x. Hence, if an agreement x is submitted to agent 1's constituents in the first period, then it will be approved with probability $F(x)$.

In the second period, the probability that an agreement z is approved by agent 1's constituents is again $F(z)$. This holds even though γ of these constituents are new, because both new and first-period constituents have disagreement payoffs drawn from the density f.

We seek a perfect Bayesian equilibrium (because of the uncertainty about constituents' disagreement payoffs). Suppose that period 2 has been reached. Any nonzero offer by player 2 will be accepted by agent 1. Player 2 will accordingly choose an offer z^c that solves

$$z^c \in \text{argmax } (1 - z)F(z). \tag{1}$$

The maximand in (1) is the payoff to player 2 from an agreement on z, given by $(1 - z)$, multiplied by the probability that agent 1's constituents approve the offer, given by $F(z)$. Because f is continuous, F is also continuous, and the maximization in (1) has a solution. If there are multiple solutions, we assume that one of them, or some mixture over them, is chosen according to some tie-breaking rule. Our results hold for any such rule.

Now consider period 1 and suppose that agent 1 has made an offer of x. Player 2's payoffs from accepting and rejecting are

$$\text{Accept: } (1 - x)F(x) \tag{2}$$

$$\text{Reject: } D(1 - z^c)F(z^c), \tag{3}$$

where z^c is any solution to (1). A comparison of (2) and (3) immediately reveals that there exist offers that player 2 will accept in the first period, and that any z^c is such an offer.[12] It cannot then be optimal for agent 1 to choose an offer that player 2 will reject: rejecting provides agent 1 with a payoff of $Dz^cF(z^c)$ for some z^c solving (1), while a payoff of $z^cF(z^c)$ can be obtained by making an offer of z^c, which player 2 will accept in the first period. Agent 1 will then choose the largest offer that player 2 will accept, which is uniquely defined. We summarize these arguments in the following.

[11] To make the exposition more convenient, we shall ignore throughout the case of a constituent whose disagreement payoff exactly equals the expected value of continuing. This equality occurs with probability zero, and the constituent's decision can be assigned arbitrarily in this case.

[12] There is no guarantee that the set of offers that player 2 will accept is an interval. It must be nonempty and closed, which suffices.

Lemma 1. There exists a unique perfect Bayesian equilibrium of the closed-door game. Player 1 makes the largest offer that equates (2) and (3), and player 2 accepts that offer in the first period.

We let x^c denote the first-period equilibrium offer in the closed-door model.

4. Open-door negotiations

■ Now consider the open-door version of the game. If the second period is reached, some offer x must have been made by agent 1 in the first period and rejected by player 2, and agent 1's constituents must then have allowed negotiations to proceed.

The fact that negotiations proceeded, in spite of the fact that an offer was made and rejected, provides information to player 2 in the open-door model. We let $G(z, w, \gamma)$ be the probability that an offer of z will be approved by agent 1's constituents in period 2 given that (i) the period-one offer was rejected by player 2, (ii) the strategy of agent 1's constituents is to vote for continuing (terminating) negotiations if their disagreement payoff is less than (greater than) w, (iii) bargaining was allowed to continue, and (iv) γ of the N agents in agent 1's constituency have been replaced between periods 1 and 2. Notice that w may depend on the period-one offer that was rejected and w will be determined as part of the equilibrium. We shall see that in equilibrium there must be a level $w \in [0, 1]$ such that constituents with disagreement payoffs $v < w$ [$v > w$] vote to continue (terminate) negotiations.

It will be useful to note some properties of $G(z, w, \gamma)$ before examining the open-door equilibrium. We begin with

$$G(z, w, N) = F(z). \tag{4}$$

This is the statement that if all agents are replaced between periods 1 and 2, then the period 1 and 2 populations are both described by the cumulative distribution F, both being constructed by N independent draws from the density f.

Next, if no constituents are replaced between periods (contrary to our assumption), then the information updating process is given by truncating the distribution F at w and rescaling:

$$G(z, w, 0) = \begin{cases} \dfrac{F(z)}{F(w)} & \text{if} \quad z < w \\ 1 & \text{otherwise.} \end{cases} \tag{5}$$

More generally, for all γ, we have

$$G(z, w, \gamma) \geq F(z). \tag{6}$$

This indicates that the information obtained by player 2 between periods can only be good news. Condition (6) holds because an approval to continue negotiations indicates that at least α first-period constituents have disagreement payoffs less than w, and that this information cannot decrease the probability that α second-period constituents have disagreement payoffs less than z.

Finally, for $\gamma \geq 1$ and $z \in (0, 1)$, we have

$$G(z, w, \gamma - 1) \geq G(z, w, \gamma), \tag{7}$$

with strict inequality if $w < 1$. To see why this holds, note that approving a (rejected) offer signals that constituents are more amenable to accept offers than was previously expected, as indicated by (6), and are strictly so if $w < 1$ (in which case continuation is not automatic). However, this information pertains only to constituents who survive from the first to the second period. Decreasing the number of survivors (replacing $\gamma - 1$ with γ) then cannot make the information stronger, i.e., cannot increase the posterior probability of acceptance, and makes the information strictly weaker in the case of $w < 1$.

We now seek an equilibrium of the open-door game. Agent 1's second-period best reply is to accept any positive offer. Suppose then that an offer of x was made and rejected in the first period. We now have a game played between player 2 and agent 1's constituents. A pure strategy for player 2 is a choice of $z \in [0, 1]$ (to be made if agent 1's constituents vote to continue negotiations). Player 2's payoff if agent 1's constituents allow the game to continue is given by $(1 - z)G(z, w, \gamma)$, where $G(z, w, \gamma)$ is the probability that offer z is approved by constituents in period 2, given that at least α period-one constituents had disagreement payoffs below w and hence voted to continue. A pure strategy for a constituent with disagreement payoff v is a choice to vote to either continue or terminate negotiations. We take the payoff of continuing to be given by $D[zG(z, w, \gamma, v) + (1 - G(z, w, \gamma, v))v]$, while the payoff from terminating is given by Dv, where $G(z, w, \gamma, v)$ denotes the probability that offer z is approved by agent 1's constituents in the second period, given that one of the constituents has disagreement payoff v. This is the relevant probability for a constituent who knows his disagreement payoff is v.[13] Call this the "extended period-two game" ("extended" because constituents' period-one voting decisions are included).

To show that the extended period-two game has an equilibrium, we construct an artificial game. Player 2 has pure strategies $z \in [0, 1]$ and payoff $(1 - z)G(z, w, \gamma)$. Player C (for "constituent") has pure strategies $V \in [0, 1]$ and payoff

$$\int_0^V (zG(z, w, \gamma, v) + v(1 - G(z, w, \gamma, v)))f(v)dv + \int_V^1 vf(v)dv. \tag{8}$$

$G(z, w, \gamma, v)$ differs from $G(z, w, \gamma)$ because N is finite, so that identifying one constituent's disagreement payoff as being v (rather than simply being drawn from f) alters the probability that z is approved in the second period.[14] Player B (for "beliefs") has pure strategies $w \in [0, 1]$ and payoff $-(V - w).^2$ This artificial game satisfies the conditions needed to apply Glicksberg's (1952) theorem for the existence of a Nash equilibrium in mixed strategies (continuous payoff functions on compact subsets of a metric space; see Glicksberg (1952) or Fudenberg and Tirole (1990)). It follows from the structure of the payoff functions that only player 2 can mix in the equilibrium of this artificial game. Let an equilibrium of the artificial game be denoted (σ^*, V^*, w^*), where σ^* is a mixture over

[13] These payoffs build into the game the requirement that every constituent act as if he were pivotal in the voting, which reflects our desire to work with constituents who do not choose dominated voting strategies. Writing the arguments of G as $G(z, w, \gamma, v)$ also assumes that constituents' strategies take the form of voting to continue (terminate) if $v < w$ $[v > w]$ for some w. The Appendix shows that constituents' strategies must take this form in *any* perfect Bayesian equilibrium of the open-door model in which constituents play undominated strategies. Finally, this formulation assumes that no constituent expects to be replaced between periods or, equivalently, that a constituent's payoff in the event of replacement does not depend upon the outcome of the negotiations, as is likely to be the case for a constituent removed from the system.

[14] Player B's payoff function obviously has a unique maximizer for any mixed strategies on the part of players 2 and C (only the latter is relevant). Differentiating player C's payoff function with respect to V gives (A1) in the Appendix, evaluated at $v = V$. The Appendix shows that as long as player 2 does not attach unitary probability to an offer of zero, then (A1) is decreasing in V, and hence C's payoff function has a unique maximizer. If player 2 attaches unitary probability to zero in equilibrium, then it must be that $w^* = 0$ (because $G(0, w, \gamma) = 0$ if $w > 0$, preventing player 2 from optimally attaching unitary probability to zero). Hence, $V^* = w^* = 0$, and again players B and C choose pure strategies.

[0, 1]. Notice that this equilibrium must satisfy $V^* = w^*$. Then it is an equilibrium in the original extended period-two game for player 2 to play σ^* and a constituent with a disagreement payoff v to vote to continue (terminate) negotiations if $v < w^*$ [$v > w^*$]. Constituents play undominated pure strategies in this equilibrium and player 2 attaches positive probability only to offers that solve

$$z^o \in \text{argmax } (1 - z)G(z, w^*, \gamma). \tag{8}$$

Notice that (8) matches (1), except that the updated distribution $G(z, w^*, \gamma)$ appears in (8). Furthermore, examining this artificial game gives us *every* perfect Bayesian equilibrium of the extended period-two game in which constituents choose undominated strategies.[15] Notice that constituents are completely rational and farsighted. Their decision whether to allow negotiations to continue depends on their projection of the future course of bargaining. Finally, the Appendix shows that $w^* < 1$ must hold in equilibrium, so that constituents with very high disagreement payoffs vote to terminate. Notice that if player 2 is playing a pure strategy consisting of offer z^o, then the equilibrium must feature $w^* = z^o$ (this follows from (A1) in the Appendix).

There may be multiple equilibria in the extended period-two game between constituents and player 2. Notice also that the set of equilibria of the extended period-two game does not depend on the (rejected) period-one offer x: each equilibrium for any value of x is an equilibrium for all values of x. In particular, the identity of a rejected period-one offer can affect the equilibrium of the extended period-two game only to the extent that it can affect the information revealed if constituents choose to continue negotiations. However, this information is derived from a constituent decision rule that compares the payoff from terminating negotiations with the payoff of continuing to receive a period-two offer, neither of which depends upon the identity of the rejected period-one offer.

We assume that some equilibrium in the extended period-two game is chosen for each period-one offer x. We say that the choice of equilibrium in the extended period-two game is stationary, and the resulting perfect Bayesian equilibrium of the entire game is stationary, if the same equilibrium is chosen in the extended period-two game for all values of x. Let $w^*(x)$ denote the constituents' strategy in the extended-period-two-game equilibrium given offer x, so that constituents vote to continue (terminate) negotiations if their disagreement payoffs are less than (greater than) $w^*(x)$. In the stationary case, we shorten this to w^*.

We now consider the first period and temporarily restrict attention to stationary equilibria. Let agent 1 make an offer of x. If it is accepted by player 2, agent 1's constituents approve with probability $F(x)$. If it is rejected, agent 1's constituents approve with probability $F(w^*)$, where w^* is determined as part of the equilibrium of the extended period-two game but does not depend on x. The payoffs to player 2 of accepting and rejecting are then

$$\text{Accept: } (1 - x)F(x) \tag{9}$$

$$\text{Reject: } DF(w^*)\,(1 - z^o)G(z^o, w^*, \gamma), \tag{10}$$

[15] A Nash equilibrium of the extended period-two game can fail to be a perfect Bayesian equilibrium only if constituents terminate negotiations with probability one and player 2 chooses a strategy that would not be optimal had continuation occurred. However, we force player 2 in the artificial game to choose as if continuation had occurred, ensuring that our equilibria are perfect Bayesian equilibria in the original extended period-two game. The fact that the artificial game gives us *all* perfect Bayesian equilibria of the extended period-two game, in which constituents play undominated strategies, is immediate once one notes that in any such equilibrium, constituent strategies must be specified by a w^* such that a constituent with disagreement payoff v votes to continue (terminate) if $v < w^*$ [$v > w^*$] (see the Appendix).

where z^o is any offer in the support of player 2's strategy in the equilibrium of the extended period-two game. The payoff to rejection is given by the discounted value of the second-period outcome, namely, $D(1 - z^o)G(z^o, w^*, \gamma)$, multiplied by the probability that agent 1's constituents allow bargaining to proceed to the second period, given by $F(w^*)$.

As in the closed-door case, we would like to first argue that there exist offers that player 2 will accept in the first period, and that z^o is such an offer. From (9) and (10), this is immediate if we can show that for all values $w < 1$ and z (taken to be w^* and z^o in this application), we have

$$G(z, w, \gamma)F(w) < F(z). \tag{11}$$

To verify (11), we need only note that if $\gamma = 0$, then (11) holds with equality because of (5). The strict inequality is obtained by noting that $\gamma > 0$ and $w < 1$ and then by repeatedly applying (7).

Next, we again note that it cannot be optimal for agent 1 to choose an offer that player 2 will reject, because doing so provides agent 1 with a payoff of at most $D\bar{z}^oF(w^*)G(\bar{z}^o, w^*, \gamma)$, where $\bar{z}^o$ is the largest offer in support of player 2's equilibrium mixed strategy, and a higher payoff of $\bar{z}^oF(\bar{z}^o)$ can be obtained by making a period-one offer of $\bar{z}^o$, which player 2 will accept. Any stationary equilibrium of this game accordingly calls for player 1 to make the largest offer for which player 2's payoff from rejection at least equals that of accepting, with player 2 accepting the offer in the first period. Such an offer exists, and we shall call it x^o. We have just established the first part of the following.

Lemma 2. (i) For every perfect Bayesian equilibrium of the extended period-two game, there exists a stationary perfect Bayesian equilibrium in the open-door model in which player 1 makes the largest offer that player 2 will accept, with player 2 accepting in the first period. (ii) This offer allocates more pie to agent 1 than does the closed-door equilibrium.

Proof. We have established (i). For (ii), it suffices to show that in any open-door equilibrium, player 2 would strictly prefer to accept the first-period offer x^c that is made in the closed-door equilibrium (and thus would also accept a slightly higher offer, given stationarity). Hence, it suffices to show the following, where z^o is any offer in support of player 2's strategy in the open-door extended-period-two-game equilibrium:

$$(1 - x^c)F(x^c) > DF(w^*)(1 - z^o)G(z^o, w^*, \gamma). \tag{12}$$

However, if $\gamma \geq 1$, we have

$$(1 - x^c)F(x^c) = D(1 - z^c)F(z^c) \geq D(1 - z^o)F(z^o) > DF(w^*)(1 - z^o)G(z^o, w^*, \gamma), \tag{13}$$

where the first equality follows from the fact that the optimal period-one closed-door offer makes player 2 indifferent between accepting and rejecting, the second inequality appears because z^c is an optimal period-two closed-door offer, and the third follows from (11), which holds with strict inequality (because $\gamma > 0$ and $w^* < 1$). *Q.E.D.*

Condition (13) holds for all equilibria of the open-door model, stationary or nonstationary (in which case $w^*(x)$ replaces w^*). This suffices to show that agent 1 prefers open-door negotiations, and it immediately follows that player 2 has the reverse preference. We have then established our main result, comparing open- and closed-door negotiations.

Proposition 1. If $\gamma \geq 1$, then agent 1 prefers *every* perfect Bayesian equilibrium (in which constituents play undominated strategies) of the open-door model to the perfect Bayesian equilibrium of the closed-door model, while player 2 has the reverse preference.

Player 1 will thus always prefer open-door negotiations, and player 2 will always prefer closed-door negotiations. To see the forces behind this comparison of the open- and closed-door models, consider the final inequality in (13). These terms give the value to player 2 of rejecting a period-one offer, given that an offer of z^o will be made in the second period, with and without agent 1's constituents having made a decision on continuing negotiations. Without such a decision, the period-two payoff is $D(1 - z^o)F(z^o)$. With such a decision, the payoff is $D(1 - z^o)F(w^*)G(z^o, w^*, \gamma)$. The fact that $G(z^o, w^*, \gamma)$ rather than $F(z^o)$ appears represents the learning effect and increases player 2's expected value of rejecting an offer. The presence of $F(w^*)$ is indicative of the termination effect, and this reduces the payoff to player 2 of rejecting an offer. Equation (11) is then the statement that the termination effect dominates. This makes player 2 less willing to reject offers in open-door negotiations, prompting player 1 to be more aggressive and to prefer such negotiations.[16]

5. Conclusion

■ The theory of bargaining is often silent on issues that appear to be important in negotiations. For example, it has long been the case that negotiations in the Middle East are conducted in secret, or behind closed doors, often through the means of "shuttle diplomacy" on the part of the U.S. Secretary of State. These closed-door sessions have frequently yielded offers that are surprisingly less aggressive than public or open-door positions. More recently, an historic agreement involving mutual recognition of Israel and the Palestinian Liberation Organization was negotiated behind closed doors, while very little progress was being made in open-door negotiations.

This model represents a first attempt at capturing these open- versus closed-door considerations. We find that two forces arise in the open-door model, a learning effect and a termination risk effect. We show that termination risk considerations dominate. When one agent represents a constituency that agent would like to bargain with open doors while the opponent would prefer to bargain behind closed doors.

We have pursued the difference between open- and closed-door bargaining in the simplest possible model. The results extend beyond two-period models. For example, suppose that we have an infinite horizon bargaining model. Let most rounds be closed door, so that constituents do not observe proposals, but let a finite number of rounds be open door, where agent 1's constituents have the opportunity to terminate negotiations after a proposal. This might represent a situation in which an agent regularly confers with constituents. Then in each open-door round, we have results analogous to those of this article: agent 1 prefers the open to closed door, while player 2 prefers the closed door. Moreover, agent 1 prefers more to fewer rounds of open-door bargaining.[17]

We have examined a model in which the choices open to constituents are limited, consisting of a choice between continuing or terminating negotiations. Additional work is required to explore models with richer choice sets for constituents. At the same time, we think that constituents actually have very limited options in many cases, so that the analysis of this article is applicable. Notice also that constituents might find it in their best interests to deliberately limit their options, so as to more effectively wield the threat of termination.

[16] If $\gamma = 0$, so that no constituents are replaced between periods, then $G(z, w(x), 0)$ is given by (5). Comparing (1)–(3) with (8)–(10) in this case shows that the open- and closed-door solutions coincide, and all players are indifferent between open- and closed-door negotiations. There is no termination effect in this case. Player 2 learns about agent 1's constituents if the second period is reached, but the additional information does not affect player 2's actions or *ex ante* expected payoffs.

[17] To verify this, note that the last open-door round yields an analysis matching that of our article, except that payoffs continuing beyond period 2 are not zero, but rather the expected payoff in an infinite horizon closed-door bargaining game, whose equilibrium offers are determined in the same way as those of Rubinstein's (1982) game. A backward induction then extends the result to earlier open-door rounds.

Appendix

■ We prove that in any perfect Bayesian equilibrium of the open-door model in which constituents do not play dominated strategies, there must exist a $w < 1$ such that constituents vote to continue (terminate) if $v < w$ [$v > w$]. Let σ^* be a probability measure on [0, 1] denoting player 2's equilibrium strategy. If $\sigma^*(\{0\}) = 1$, then the equilibrium strategy for a constituent with a disagreement payoff $v > 0$ must be to vote to terminate: Termination ensures a payoff of v, while continuing yields a payoff of either v (if player 2's offer of zero is rejected next period) or zero (if player 2's offer is accepted, which must occur with positive probability if zero is to be an equilibrium offer for player 2). Hence, $w = 0$ and the result is established for this case. Now let $\sigma^*(\{0\}) < 1$. For a constituent with value v, the difference in expected payoffs between continuing and terminating is given by

$$\int_0^1 (zG(z, \gamma, v) + v(1 - G(z, \gamma, v)))\, d\sigma^*(z) - v \equiv \Xi(v), \tag{A1}$$

where we suppress the argument w in G, so that $G(z, \gamma, v)$ is the probability that an agreement on offer z is approved by constituents in the next period, given that γ constituents are replaced and one constituent has disagreement payoff v. It suffices to show that if $v < v'$, then $\Xi(v) > \Xi(v')$. Hence, if a constituent with disagreement payoff v finds it optimal to vote to terminate ($\Xi(v) \leq 0$), then every constituent with disagreement payoff $v' > v$ finds termination strictly optimal. Let $v' > v$. Then, from (A1),

$$\Xi(v) - \Xi(v') = \int_0^1 (z - v)\, G(z, \gamma, v) d\sigma^*(z) - \int_0^1 (z - v')\, G(z, \gamma, v')\, d\sigma^*(z).$$

However, $G(z, \gamma, v)$ and $G(z, \gamma, v')$ coincide for values $z < v$ and $z > v'$, because the period-two behavior of constituents with disagreement payoffs v and v' coincides in these cases: voting to reject the agreement in the first case and accept it in the latter. Hence, we have

$$\begin{aligned}\Xi(v) - \Xi(v') = (v' - v) \int_{[0,v)\cup(v',1]} G(z, \gamma, v)\, d\sigma^*(z) + \int_{[v,v']} (z - v)G(z, \gamma, v) d\sigma^*(z) \\ - \int_{[v,v']} (z - v')\, G(z, \gamma, v')\, d\sigma^*(z).\end{aligned} \tag{A2}$$

Expression (A2) is clearly nonnegative. Because $\alpha < N$, so that no constituent has veto power, $G(z, \gamma, v) > 0$ and $G(z, \gamma, v') > 0$ for all $z > 0$. The first (second, third) term in (A2) can then be zero only if $\sigma^*([0, v) \cup (v', 1]) = 0$ [$\sigma^*((v, v']) = 0$] [[$\sigma^*([v, v')) = 0$]]. Hence, because $\sigma^*(\{0\}) < 1$, at least one of the terms in (A2) is strictly positive, yielding $\Xi(v) > \Xi(v')$. Finally, it is clear from (A1) that we can have $w = 1$ only if $\sigma^*(\{1\}) = 1$, which cannot be an equilibrium because it gives player 2 a zero payoff.

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