Pre-negotiation Public Commitment in Domestic and International Bargaining

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Abstract

We develop a formal bargaining model to examine why, in many domestic and international bargaining situations, one or both negotiators may find themselves making public commitments to some policy or benefit which it would be costly to back down from. We find that when only one negotiator can make such a public commitment, it enhances her bargaining position. However, when both negotiators can make public commitments, a prisoner's dilemma is created in which both sides make high public demands which can't both be satisfied, and both negotiators would be better off if they could commit to not making public demands. However, making a public demand is a dominant strategy for each negotiator, and this leads to a suboptimal outcome. Escaping this prisoner's dilemma provides a rationale for secret negotiations.

1 Introduction

In many domestic and international bargaining situations, one or both negotiators may find themselves making public announcements committing themselves to obtaining certain benefits before the negotiations even begin. That is, they make public statements about the minimal share of the benefits that they expect to obtain in the negotiations. In his pathbreaking work *The Strategy of Conflict* (1960), Thomas Schelling suggests that (28) "When national representatives go to international negotiations knowing that there is a wide range of potential agreement within which the outcome will depend on bargaining, they seem often to create a bargaining position by public statements, statements calculated to arouse a public opinion that permits no concessions to be made."

For example, before the Copenhagen summit of the European Union (EU) in December 2002, the Turkish government asked the EU to decide at the summit on a date to start membership negotiations with Turkey. Anticipating that it was more likely that the EU summit would instead agree on a date for the European Union simply to review whether Turkey had met membership conditions, the leader of Turkey's incumbent Justice and Development Party, Recep Tayyip Erdogan, publicly announced that a review date was not acceptable at all (Financial Times, December 7, 2002).

In a similar vein, in the negotiations surrounding a peace deal in Northern Ireland in the mid 1990s, all of the parties involved made numerous public statements about their bargaining positions. In the lead-up to the negotiations that culminated in the “Good Friday Agreement" of April 1998, Prime Minister John Major of Britain declared that all of the Irish paramilitaries had to “decommission" their weapons before negotiations could begin. Similarly, the leader of the pro-union Ulster Unionist Party (UUP), David Trimble, publicly stated that there was “no question of negotiations without decommissioning." Meanwhile, Gerry Adams, head of the Irish Republican Army's (IRA) political wing, Sinn Fein, publicly announced that the IRA's weapons would be decommissioned only after the conclusion of the negotiations (Lloyd 1999).

What is the motivation behind this type of posturing in front of the public before negotiations begin? In this paper, we examine the logic behind this bargaining tactic of making public commitments before the official negotiations begin. We assume that backing down from such public commitments is costly. That is, we assume that public statements generate potential “audience costs" for the leader (Fearon 1994, 1997). A large literature spawned by Putnam's (1988) seminal work on “two-level games" has examined the bargaining leverage (or lack thereof) provided in international bargaining by *exogenously* imposed domestic constraints such as ratification by a legislature (Hammond and Prins 1999; Iida 1993, 1996; Milner 1997; Milner and Rosendorff 1997; Mo 1994, 1995; Pahre 1997, 2001; Reinhardt 1996; Smith and Hayes 1997; Tarar 2001). In contrast, we investigate how leaders can enhance (or otherwise affect) their bargaining position by *endogenously* imposing domestic constraints on themselves by making public statements that it would be costly to back down from.

We consider a model in which two negotiators bargain to divide a pie between themselves, as in the classical Rubinstein (1982) bargaining model. Before the negotiations begin, one negotiator can make a public statement in front of her domestic audience about the minimal share of the pie that she expects to obtain in the negotiations. The negotiators then begin a bargaining game to divide the pie. If the committing negotiator ends up receiving less in the bargaining game than what she publicly committed to, then she pays an audience cost for violating her public commitment (we discuss the possible sources of the audience cost below). The bigger the disparity between what she publicly committed to and what she actually receives, the bigger the audience cost that she pays. Hence, in contrast to other formal models of audience costs, we let the size of the audience cost be endogenous to the model; in particular, it depends on the equilibrium commitment that she makes and the equilibrium share of the pie that she receives.

In equilibrium, we find that the committing negotiator receives a larger share of the pie than she would if no public commitment was allowed, and the other negotiator receives less. Hence, the ability to make a public commitment provides a negotiator with bargaining leverage, because with a (large enough) public commitment she now requires a larger share of the pie for it to be worthwhile to reach an agreement, and the other negotiator realizes this and hence compromises.

We derive a number of interesting predictions regarding the optimal commitment that the negotiator makes in equilibrium. First, the optimal commitment is large enough that the negotiator doesn't actually expect to achieve it. Hence, in equilibrium she expects to pay an audience cost. However, the greater share of the pie that the optimal commitment secures more than makes up for this, and the negotiator is better off in net terms. Thus, our model explains why negotiators make big public demands, bigger demands than they actually expect to achieve. Second, we find that the optimal public commitment that the negotiator makes is not optimal for the "public", which would like its negotiator to make a larger commitment. This is because the larger the public commitment, the larger the share of the pie that the negotiator secures, and the public doesn't pay the cost for violating the public commitment, only the negotiator does. However, in equilibrium the negotiator makes a limited commitment in order to limit the audience cost that she pays. Hence, a principal-agent situation is created in which the agent (negotiator) brings benefits to the principal (public), but those benefits are limited by the agent's own interests.

We then extend the model to allow both sides to make public commitments, and find that the results are quite different in this case. In equilibrium, both negotiators end up demanding more than half of the pie but only expect to receive half, and hence expect to pay an audience cost while obtaining no more of the pie than they would if they both agreed not to make public commitments (and hence didn't pay audience costs). Thus, the negotiators end up in a sub-optimal outcome in which they end up paying audience costs while not obtaining any benefit. However, they can't escape this sub-optimal outcome simply by making an (unenforceable) agreement not to make public statements, because each side has a dominant strategy to violate the agreement and make a public commitment regardless of what it thinks the other side is going to do. We discuss how the negotiators can escape from this prisoner's dilemma in a repeated negotiations framework, but also suggest that this analysis provides a new rationale for secret negotiations. In secret negotiations where the public is unaware that their leaders are even negotiating, there is nothing to publicly commit to and hence the negotiators can avoid the sub-optimal outcome.

Under the reasonable working hypothesis that democratic leaders pay significant audience costs for violating public commitments whereas autocratic leaders don't (Fearon 1994), our results have a number of regime-type implications for international bargaining. First, we would expect that in negotiations between a democracy and an autocracy, the autocratic leader would want to keep the negotiations secret whereas the democratic leader would have an incentive to keep them public so that she could capitalize on the bargaining leverage that public commitments provide in the one-sided case. In bargaining between two democracies, on the other hand, both sides would have incentives to keep the negotiations secret so that they could avoid the sub-optimal outcome of the two-sided case. In bargaining between two autocracies which can't generate audience costs, it makes no difference in the outcome whether the negotiations are kept secret or held publicly.

Before proceeding, we need to consider why it might be costly for a leader to violate a public commitment. There are four possibilities that have been discussed in the literature. First, Fearon (1994) suggests that a leader that backs down from a public commitment may pay a domestic audience cost (e.g., perhaps is less likely to be reelected) because the domestic audience has perceived that she has violated the "national honor". Second, he and Smith (1998) suggest that a leader that makes a public commitment and then has to back down from it may be perceived by the domestic public to be *incompetent*, and hence be less likely to be reelected.[1] Third, Sartori (2002) shows that a leader caught bluffing may pay an *international* audience cost because that leader's rhetoric is less likely to be considered credible by leaders of other countries in the future: the cost is due to loss of future international credibility. Finally, Guisinger and Smith (2002) point out that this international audience cost can also lead to a domestic audience cost: if the rhetoric of a leader caught bluffing is less likely to be believed by other leaders in the future, this may be reason for the public to depose that leader

[1] Schelling (1960) also suggests that national leaders can use public statements to put the "national honor and prestige" (6) on the line, and that individual negotiators might "suffer intolerable loss of personal prestige or bargaining reputation" (25) by backing down.

and insert a new one with a fresh reputation.

We believe that all of these arguments, especially the last one, have merit. However, our own results suggest a new rationale for audience costs. In our model, the ability to generate audience costs provides bargaining benefits to a negotiator, benefits that accrue to her public as well. Therefore, in a repeated negotiations framework in which a country is repeatedly negotiating international agreements, if the public's strategy is to punish a leader (perhaps electorally) who violates her public commitment, then this strategy allows their leader to generate audience costs and hence to secure bargaining benefits for them. On the other hand, if their strategy is to *not* punish their leader for violating a public commitment, then no extra bargaining leverage is obtained. Hence, voters in a democracy have an incentive to punish their leader for violating a public commitment not because of any vindicative or "national honor" related reasons, but simply because such a strategy provides them with a stream of bargaining benefits over the long run.[2]

In our model, we don't directly model the source of the cost for violating a public commitment, but instead examine the effect that such costs can have on international bargaining assuming that they exist. However, our results also suggest a reason for why rational democratic publics would want to punish a leader who violates a public commitment.

The paper proceeds as follows. In the next section, we present and analyze the results from a model in which only one negotiator can make a public commitment, and then the negotiations begin. We then extend the model to allow both negotiators to make public commitments. We conclude by summarizing the results of the models and discussing their implications.

2 One-Sided Public Commitment

2.1 The Model

The model is built on the following version of the Rubinstein (1982) bargaining model. Two players, labelled player 1 (a "she") and player 2 (a "he"), take turns making proposals to divide a pie of size 1. One of the negotiators is randomly chosen (each with probability $\frac{1}{2}$) to make the first proposal, after which they alternate making proposals. If player 1 is chosen to make

[2]Fearon (1997, 581, 585) also finds that a state's ex ante expected payoff is increasing in the rate at which it can generate audience costs, in a crisis bargaining setting.

the first proposal, let $(x, 1-x) \in \Re^2$ where $0 \leq x \leq 1$ denote player 1's proposal. If player 2 accepts this proposal, then player 1 receives payoff x, player 2 obtains utility $(1-x)$, and the game ends. If player 2 rejects the proposal, bargaining continues with probability $0 < \delta < 1$ and breaks down with probability $(1-\delta)$, in which case both players receive payoff 0. If the bargaining process continues, player 2 gets to make the next proposal. Let $(1-y, y) \in \Re^2$ where $0 \leq y \leq 1$ denote player 2's proposal. If player 1 accepts this proposal, player 1 obtains utility $(1-y)$, player 2 receives payoff y, and the game ends. If player 1 rejects the proposal, bargaining breaks down with probability $(1-\delta)$ and continues with probability δ, in which case player 1 gets to make the next proposal. The game continues until one player accepts the other's proposal or the bargaining process breaks down. Rubinstein (1982) shows that there is a unique subgame perfect equilibrium (SPE) of this game in which the players always propose $x = y = \frac{1}{1+\delta}$ for their own share and $(1-x) = (1-y) = \frac{\delta}{1+\delta}$ for the other player's share, and in which the players reach an agreement in the first period of the game.[3]

Here, we consider a variant of this model in which one of the players (negotiators) can make a public commitment to obtaining some certain share of the pie before the formal bargaining process begins. Without loss of generality, suppose negotiator 1 can make the public commitment (in the next section, we consider the case where both negotiators can make public commitments). In the first move of the game, negotiator 1 publicly commits to receiving an amount of the pie at least equal to a, where $0 \leq a \leq 1$. The amount a is negotiator 1's public commitment or demand. If negotiator 1 receives at least a in the bargaining game, then her payoff is simply the share of the pie that she obtains. On the other hand, if she obtains less than a, then she pays a cost for backing down from her public commitment. Let $C(z, a)$ denote negotiator 1's cost for violating her public commitment, when she commits to receiving at least a and actually receives z. Then we assume that:

$$C(z,a) = \begin{cases} 0 & \text{if } z \geq a \\ \phi(a-z) & \text{otherwise, where } \phi \geq 0 \end{cases}$$

The interpretation is that if negotiator 1 obtains at least as much as she publicly committed to, then she doesn't pay any cost. Otherwise, she pays

[3] See Osborne and Rubinstein (1990) for an excellent exposition of the Rubinstein (1982) bargaining model.

a cost for getting less than what she publicly committed to and we assume that this cost increases linearly with the deficit between what she publicly commits to and what she actually receives: the greater the deficit, the greater the cost. The "cost coefficient" ϕ measures how costly it is for the negotiator to violate a public commitment by a given amount: the higher ϕ is, the more costly it is.

It seems reasonable to assume that ϕ is higher in democracies than in autocracies, where the leader is not as accountable to the public. In fact, it may be reasonable to assume that $\phi = 0$ for autocracies, in which case the one-sided commitment model can be interpreted as bargaining between a democracy and an autocracy. In the next section, we consider the case where both negotiators can make public commitments, which is more akin to bargaining between two democracies. In a democracy, it seems to be a reasonable assumption that ϕ is higher just prior to elections, when backing down from a public commitment would be especially costly for the leader. Finally, it seems that ϕ would be low for issues that the public doesn't particularly care about.

The timing of the game is as follows. First, negotiator 1 makes her public commitment a. Then, one of the negotiators is randomly drawn (each with probability $\frac{1}{2}$) to make the first proposal to divide the pie, after which they alternate. Suppose negotiator 1 is drawn to make the first proposal. If negotiator 1 proposes $(x, 1-x)$ and negotiator 2 accepts this proposal, then negotiator 2's payoff is $(1-x)$ and negotiator 1's utility is $x - C(x, a)$, and the game ends. If negotiator 2 refuses this proposal, the bargaining moves on to the next period with probability δ and negotiator 2 makes a proposal $(1-y, y)$. If negotiator 1 accepts this proposal, then her payoff is $(1-y) - C(1-y, a)$ and negotiator 2's utility is y, and the game ends. If negotiator 1 refuses this proposal, then the bargaining moves on to the next period with probability δ and negotiator 1 makes a new proposal. The game continues until one of the negotiators accepts a proposal or the bargaining process breaks down. If the bargaining process breaks down, both negotiators receive utility 0.

2.2 Results

Proposition 1 *The following is the stationary subgame-perfect equilibrium of this game: negotiator 1 makes the public commitment* $a^* = \frac{1+\phi}{(1+\phi)+\delta}$ *and when she does, in the bargaining subgame the negotiators use the following* *strategies:*

(a) Negotiator 1 always proposes $(x, 1-x) = (\frac{1+\phi}{(1+\phi)+\delta}, \frac{\delta}{1+\phi+\delta})$ *and always accepts any proposal* $(1-y, y)$ *such that* $y \leq \frac{1}{1+\phi+\delta}$.

(b) Negotiator 2 always proposes $(1-y, y) = (\frac{\phi+\delta}{1+(\phi+\delta)}, \frac{1}{1+\phi+\delta})$ *and always accepts any proposal* $(x, 1-x)$ *such that* $x \leq \frac{1+\phi}{(1+\phi)+\delta}$.

Note that agreement is reached in the first period. If negotiator 1 deviates and chooses some $a' \neq a^*$*, then in the bargaining subgame the negotiators use the strategies specified in lemmas 1-3 in the appendix for that value of* a'.

Figure 1 shows negotiator 1's expected share of the pie $P_1(a)$ as well as her expected utility $V_1(a)$ (share of the pie minus the cost, if any, for violating her public commitment) as a function of her public commitment a, as a ranges from 0 to 1.[4] When negotiator 1 makes a low public commitment (in particular, when $a \leq \frac{\delta}{1+\delta}$), then the commitment is too low to have any effect on the bargaining game and the outcome is the same as in the Rubinstein (1982) model in which no public commitments are allowed.[5] Extremely low public commitments have no effect, because the share of the pie that goes to the committed negotiator if no commitments were allowed is enough to satisfy a low commitment, and so it is as if no commitment were made.

On the other hand, when negotiator 1's public commitment gets in the medium range (in particular, when $\frac{\delta}{1+\delta} \leq a \leq \frac{1+\phi}{(1+\phi)+\delta}$), then her expected share of the pie $P_1(a)$ starts increasing in a because the higher her public demand, the bigger are negotiator 1 and 2's equilibrium proposals for negotiator 1, x and $1-y$ respectively (see Figure 2). Now negotiator 1's public commitment is large enough that it ensures that she gets bigger offers, because with a large enough public commitment she requires a larger share of the pie for it to be worthwhile to reach an agreement, and the other negotiator realizes this and hence compromises.

In this region, negotiator 1's expected utility $V_1(a)$ is slightly lower than her expected share of the pie $P_1(a)$ because when negotiator 2 gets to make the first proposal, he offers negotiator 1 less than her public commitment

[4]In particular, Figure 1 shows her expected payoff and expected share of the pie in the stationary subgame perfect equilibrium of the bargaining subgame, for that value of a (see lemmas 1-3 in the appendix). All of the figures are drawn for the values $\phi = 0.2$ and $\delta = 0.9$. The graphs have the same overall shape, however, for all values of ϕ and δ.

[5]In the Rubinstein (1982) model, player 1 and 2's expected payoff is given by $V_1 = V_2 = \frac{1}{2} \cdot \frac{1}{1+\delta} + \frac{1}{2} \cdot \frac{\delta}{1+\delta} = \frac{1}{2}$, which is the same as $P_1(a)$ in Figure 1 for $a \leq \frac{\delta}{1+\delta}$.

($1 - y < a$), and so negotiator 1 pays an audience cost because she accepts this offer. However, the difference between $P_1(a)$ and $V_1(a)$ is only slight because when negotiator 1 is chosen to make the first proposal, her proposal for herself is larger than her public commitment ($x > a$), and hence she doesn't pay an audience cost in this case. Because negotiator 1 is getting bigger offers and is only paying the cost of violating her public commitment when negotiator 2 proposes, her payoff is increasing in a.

Once a gets too large, however (in particular, when $a \geq \frac{1+\phi}{(1+\phi)+\delta}$), then negotiator 1's expected payoff $V_1(a)$ starts decreasing in a. She is still getting bigger and bigger offers, x and $1 - y$; however, these are now increasing at a smaller rate (see Figure 2). More importantly, a is now high enough that even negotiator 1's own proposal for herself is less than her public commitment: $x < a$ in addition to $1 - y < a$. Therefore, although negotiator 1 is still getting bigger and bigger offers, she is now always paying a cost for violating her public commitment, and the net result is that her expected payoff is decreasing in a (but is still bigger than her expected utility if she made no public commitment at all).

Therefore, as seen in Figure 1, negotiator 1's expected payoff is maximized at $a^* = \frac{1+\phi}{(1+\phi)+\delta}$ ($> \frac{1}{2}$), and in equilibrium, this is the public commitment that she makes. At this point, negotiator 1's expected utility is $V_1(a^*) = \frac{(1+\phi)(1+\delta)}{2(1+\phi+\delta)}$, which is bigger than her expected payoff of $\frac{1}{2}$ in the Rubinstein (1982) model with no public commitments. Therefore, when only one negotiator can make public commitments that are costly to violate and the other side knows this, it is a bargaining advantage for her, and of course a liability for the other side.[6] This suggests that democratic leaders can use public commitments to obtain bargaining leverage when negotiating with autocratic leaders who don't pay costs for violating public commitments. Moreover, this also suggests that in bargaining between a democracy and an autocracy, the autocratic leader would want the negotiations to be kept secret until their conclusion, whereas the democratic leader would want their existence to be publicly known so that she can capitalize on this source of bargaining leverage. Work on two-level games (Putnam 1988) suggests that exogenously imposed domestic constraints (e.g. ratification by a legislature or by referendum) can provide bargaining leverage in international negotiations; our results point out how leaders can obtain bargaining leverage by *endogenously* imposing

[6]Note that $V_2(a^*) = \frac{1+\delta}{2(1+\phi+\delta)} < \frac{1}{2}$, so negotiator 2 is worse off than if no public commitments were allowed.

domestic “constraints" on themselves, by making public statements that it would be costly to back down from.

The results suggest a number of other interesting predictions. First, note from Figure 1 that when only one negotiator can make a public commitment, it is always a bargaining advantage relative to the no-commitment case, even if she doesn't choose the optimal level of commitment. As long as the negotiator doesn't commit to more than the total amount of benefits available, the commitment can never hurt her.

Next, note that in the equilibrium, $x = a^*$ and $1 - y < a^*$. Hence, negotiator 1 gets exactly her public commitment when she is chosen to make the first proposal, and gets less than her public commitment when negotiator 2 gets to make the first proposal. Hence, her *expected* share of the pie is less than what she publicly committed to, and she *expects* to pay a cost for violating her public commitment (in fact, she never gets more than her public commitment — she gets either the same or less). However, she is better off in net terms because $V_1(a^*) = \frac{(1+\phi)(1+\delta)}{2(1+\phi+\delta)} > \frac{1}{2}$. This provides a rationale for why leaders make greater public demands than they expect to get (in fact, the model predicts that the optimal demand is such that they might obtain as much, but never more). Although they expect to pay a cost for doing so, the increased share of the pie that the commitment leads to more than compensates for this. The model explains why leaders publicly demand a lot (but not too much — see below).[7]

Another interesting result is that a^* is not the public commitment that maximizes *country* 1's expected payoff. As seen from Figure 1, country 1's expected payoff $P_1(a)$ (this simply the expected share of the pie for country 1) is increasing in a as a ranges from $\frac{\delta}{1+\delta}$ to 1. This is because the higher the public commitment, the higher country 1's expected share of the pie (the proposals for country 1 x and $1 - y$ are both increasing in a; see Figure 2), and the people of country 1 don't have to pay the cost of getting less than the public commitment, only the executive does. Therefore, the people of country 1 want the public demand to be as high as possible, so as to obtain a maximum share of the pie. In particular, the people of country 1 would prefer that the executive publicly demand the entire pie, i.e. $a = 1$.

However, executive 1 would choose not to do this, because the cost she pays for getting less than her public commitment would make it not worth-

[7]Note that $a^* > \frac{1}{1+\delta}$, i.e. the negotiator publicly commits to getting more than its largest possible payoff in the Rubinstein (1982) model with no public commitments.

while. This illustrates an interesting point: it is the credibility that the executive will be punished that allows her to use a public commitment to extract a bargaining concession from the other side, a concession that benefits both the executive and the public; however, it is this very credibility that also ensures that the executive won't use the commitment to the public's maximum advantage. The public's ability to impose costs on their leader is to their benefit; however, it also ensures that the benefit won't be all that it can be. The ability to make a public commitment generates a principal-agent situation in which the agent brings benefits to the principal (and to herself), but the agent's own interests limit the extent of the principal's benefits.

Finally, note that a^*, $P_1(a^*)$, and $V_1(a^*)$ are all increasing in ϕ.[8] The greater the cost for violating a given level of public commitment, the greater will be the negotiator's public commitment, her county's share of the pie, as well as her personal payoff. The bargaining advantage that arises from the ability to make public commitments increases the more costly it is to violate those commitments. More accountable democratic leaders obtain greater benefit from the ability to make public commitments that are more costly to violate. We would expect this to be the case just prior to elections, for example, when it would be especially costly for the leader to violate a public commitment. Hence, the model predicts that the bargaining leverage provided by being the only side able to make public commitments should be greater prior to elections than at other times when the leader is more politically secure.

3 Two-Sided Public Commitment

3.1 The Model

Having established that when only one side can make public commitments it is a bargaining advantage for that side, we now examine the case where both negotiators can make public commitments.

The model is the same as the previous one except that now negotiator 2 also makes some public commitment b before the formal bargaining process begins, where $0 \leq b \leq 1$. If the actual share of the pie that negotiator 2 ends

[8]Note that $a^* = \frac{1+\phi}{(1+\phi)+\delta}$, $\frac{\partial a^*}{\partial \phi} = \frac{\delta}{(1+\phi+\delta)^2} > 0$, $V_1(a^*) = \frac{(1+\phi)(1+\delta)}{2(1+\phi+\delta)}$, $\frac{\partial V_1(a^*)}{\partial \phi} = \frac{\delta(1+\delta)}{2(1+\phi+\delta)^2} > 0$, $P_1(a^*) = \frac{1+2\phi+\delta}{2(1+\phi+\delta)}$, $\frac{\partial P_1(a^*)}{\partial \phi} = \frac{1+\delta}{2(1+\phi+\delta)^2} > 0$.

up receiving in the bargaining game is z, then the cost $C(z,b)$ that he pays for violating his public commitment is as follows:

$$C(z,b) = \begin{cases} 0 & \text{if } z \geq b \\ \phi(b-z) & \text{otherwise, where } \phi \geq 0 \end{cases}$$

The timing of the game is as follows. First, both negotiators simultaneously announce their public commitments a and b. Then one of the negotiators is randomly drawn (each with probability $\frac{1}{2}$) to make the first proposal to divide the pie, after which they alternate. Suppose negotiator 1 is drawn to make the first proposal and proposes $(x, 1-x)$. If negotiator 2 accepts this proposal, his payoff is $(1-x)-C(1-x,b)$, negotiator 1's utility is $x-C(x,a)$, and the game ends. If negotiator 2 refuses to accept this proposal, then the bargaining moves on to the next period with probability δ and negotiator 2 makes a proposal $(1-y,y)$. If negotiator 1 accepts this proposal, her payoff is $(1-y)-C(1-y,a)$, negotiator 2's utility is $y-C(y,b)$, and the game ends. If negotiator 1 refuses to accept this proposal, then the bargaining moves on to the next period with probability δ and negotiator 1 makes a new proposal. The game continues until one of the negotiators accepts a proposal or the bargaining process breaks down. If the bargaining process breaks down, both negotiators receive payoff 0.

3.2 Results

Proposition 2 *The following is the stationary subgame-perfect equilibrium of this game: both negotiators make the same public commitment* $a^* = b^* = \frac{1+\phi}{1+2\phi+\delta}$ *and when they do, in the bargaining subgame the negotiators use the following strategies:*

(a) Negotiator 1 always proposes $(x, 1-x) = (\frac{1+\phi}{1+2\phi+\delta}, \frac{\phi+\delta}{1+2\phi+\delta})$ *and always accepts any proposal* $(1-y, y)$ *such that* $y \leq \frac{1+\phi}{1+2\phi+\delta}$.

(b) Negotiator 2 always proposes $(1-y, y) = (\frac{\phi+\delta}{1+2\phi+\delta}, \frac{1+\phi}{1+2\phi+\delta})$ *and always accepts any proposal* $(x, 1-x)$ *such that* $x \leq \frac{1+\phi}{1+2\phi+\delta}$.

Note that agreement is reached in the first period. If a player deviates from the equilibrium public commitment, then the strategies used in the bargaining subgame are specified in the proof in the appendix.

In this equilibrium, both negotiators make the same level of public commitment $a^* = b^*$, which is lower than the optimal commitment in the one-sided case, but still greater than $\frac{1}{2}$.[9] Moreover, each negotiator's proposal for herself is the same as her public commitment, whereas her proposal for the other side is less than its public commitment ($x = y = a^* = b^*$, but $1-x = 1-y < a^* = b^*$).[10] Hence, as in the one-sided case, each negotiator's equilibrium public commitment is such that she expects to obtain less in the bargaining game, and expects to pay a cost for violating her public commitment. Also, the principal-agent situation also arises in that given the other side's equilibrium public commitment, the public of each country wants its negotiator's public commitment to be as high as possible, as this secures a greater expected share of the pie (see Figure 3). However, choosing a higher public commitment than the equilibrium level makes the negotiator worse off, because she will then always pay the cost for violating the commitment, and hence she chooses not to do this. In fact, the only major qualitative feature of the one-sided results that doesn't hold in the two-sided case is that in the two-sided case, given the other side's equilibrium public commitment, a negotiator is worse off by making too high a public commitment than by making no commitment at all (see Figure 3). This is because she doesn't secure that big a share of the pie, since the other side also has a public commitment to honor, but she always pays the cost for violating her commitment.[11]

Of main interest, however, is the fact that both negotiators' expected utility in this equilibrium is:

$$V_1(a^*, b^*) = V_2(a^*, b^*) = \frac{(1+\phi)(1+\delta)}{2(1+2\phi+\delta)} < \frac{1}{2}$$

That is, both negotiators expect to do worse than in the Rubinstein (1982)

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[9] Also note that $a^* = b^* < \frac{1}{1+\delta}$ — in contrast to the one-sided case, in the two-sided case a negotiator demands less than her highest possible payoff in the Rubinstein (1982) model with no public commitments.

[10] It strikes us that in real world bargaining situations, the act of making a public commitment may in some sense be construed as also making the first offer in the actual bargaining process. We don't impose this restriction in the model because it would provide an artificial first-mover advantage. However, in the one-sided as well as the two-sided model, we find that *in equilibrium* the committing negotiator's proposal is the same as his or her public commitment, which we believe provides substantive support for the model.

[11] Another interesting feature of this equilibrium is that $\frac{\delta}{1+\delta} < 1-x = 1-y < \frac{1}{2} < x = y < \frac{1}{1+\delta}$. That is, when both sides can make public commitments, this causes the two sides to be more equitable in their proposals to each other, relative to the Rubinstein (1982) model in which public commitments aren't allowed.

model in which public commitments aren't allowed. This is because each negotiator's expected share of the pie is simply $\frac{1}{2}$, the same as in the Rubinstein (1982) model (this also means that the people in both countries are no better off when both leaders can make public commitments): however, each negotiator also expects to pay a cost for violating its public commitment (recall that $a^* = b^* > \frac{1}{2}$), and hence the negotiators expect to be worse off than if no public commitments were allowed.

In contrast to the one-sided case, where the ability to make a public commitment is a bargaining benefit, when both negotiators can make public commitments their equilibrium level of commitments make them worse off than if no commitments were allowed. The advantage that accrues to one side when only it can make a public commitment becomes a liability for both sides when both can make public commitments. This suggests that in bargaining between democracies, the ability of both sides to make public commitments creates a situation where both leaders are worse off than if no public commitments were allowed: each side demands more than half of the pie, but only obtains half, and hence pays a cost for violating its public commitment.

This suggests that prior to entering into negotiations, two farsighted democratic leaders would make an agreement to refrain from making public commitments. However, the problem turns out not to be so simple, since the ability of both sides to make public commitments actually creates a prisoner's dilemma in which both sides have a dominant strategy of making a public commitment. Table 1 shows the strategies and the resulting payoffs. Each side's most preferred outcome is where it makes a public commitment but the other side doesn't (this is the one-sided case); after that, each side prefers that neither make a public commitment; next, each side prefers that both make public commitments; and finally, each side's worst outcome is where it doesn't make a public commitment but the other side does (again, the one-sided case).[12] This preference ordering induces the familiar prisoner's dilemma in which each side's dominant strategy is to make a public commitment (in the traditional parlance of the prisoner's dilemma, to "defect"): if you believe that the other side is not going to make a public commitment, you want to make one in order to obtain the bargaining leverage of the one-sided case; and if you believe that the other side *is* going to make a public

[12] The following is the relationship among the payoffs in Table 1: $\frac{(1+\phi)(1+\delta)}{2(1+\phi+\delta)} > \frac{1}{2} > \frac{(1+\phi)(1+\delta)}{2(1+2\phi+\delta)} > \frac{1+\delta}{2(1+\phi+\delta)}$.

		Negotiator 2: No Commitment	Negotiator 2: Commitment
Negotiator 1	No Commitment	$\frac{1}{2}, \frac{1}{2}$	$\frac{(1+\delta)}{2(1+\phi+\delta)}, \frac{(1+\phi)(1+\delta)}{2(1+\phi+\delta)}$
	Commitment	$\frac{(1+\phi)(1+\delta)}{2(1+\phi+\delta)}, \frac{(1+\delta)}{2(1+\phi+\delta)}$	$\frac{(1+\phi)(1+\delta)}{2(1+2\phi+\delta)}, \frac{(1+\phi)(1+\delta)}{2(1+2\phi+\delta)}$

Table 1: *The prisoner's dilemma induced by the ability of both sides to make public commitments.*

commitment, you also want to make one in order to mitigate the bargaining leverage that the other side will otherwise have over you. Thus, no matter what you believe that the other side is going to do, you are best off making a public commitment. Each side's dominant strategy leads to the sub-optimal outcome where both sides make public commitments, an outcome which is Pareto-dominated by both sides not making public commitments.

Therefore, the model illustrates how difficult it is for two democratic leaders to refrain from making public commitments and winding up in a suboptimal outcome. However, the possibility of keeping the negotiations secret provides a solution to this problem. Although neither side will abide by an unenforceable agreement not to make a public commitment since the dominant strategy *is* to make a public commitment, if the negotiations are being conducted secretly without the public's knowledge, then there is nothing to public commit to and hence the sub-optimal outcome can be avoided. Conducting the negotiations secretly provides a mechanism for both sides to avoid making public commitments and winding up in the sub-optimal outcome. Hence, our model provides a new rationale for secret negotiations.

For instance, the 1993 Oslo Accords between the Israelis and Palestinians were conducted secretly and only made public once an agreement had been reached. Public talks sponsored by the US were occurring at the same time in Washington with a different Palestinian negotiating team. The Washington talks were publicly known and the Palestinian team was making large demands regarding settlements and Jerusalem that the Israeli team found unacceptable (Perlmutter 1995). An agreement was only able to be reached in the secret negotiations being held in Oslo.

Subsequent negotiations between the two sides have taken place in the public eye and have been much more difficult to negotiate, up to the point that in recent years the negotiation process has almost completely come to a halt. These subsequent negotiations have occurred amidst public posturing on both sides. For example, regarding the final status of Jerusalem, which the Oslo Accords left for future negotiations, Palestinian leader Yasser Arafat has repeatedly made public statements promising that Jerusalem would become the capital of a Palestinian state, while Yitzhak Rabin and subsequent Israeli prime ministers have made public promises that Jerusalem would remain the undivided capital of Israel (Perlmutter 1995).[13]

Arafat has also made numerous statements promising to secure a right of return for Palestinian refugees to their homes in Israel, whereas all Israeli prime ministers have publicly declared that that is not an option (Makovsky 2001). Makovsky writes:

> The process also allowed each side to make contrary claims at home. . . Israeli leaders were able to continually promise their constituents what they wanted — including a united Jerusalem under Israeli sovereignty — while Arafat could promise his people what they wanted — including the right of return for all Palestinians to long-abandoned homes inside Israel. Arafat sold Oslo to his public by telling them it guaranteed a return to the 1967 lines and entailed no compromises. He led his people to believe that they would get 100 percent of the land they wanted.

When Arafat wasn't offered all of what he had promised to his people at the 2000 Camp David talks, in particular exclusive Palestinian sovereignty over the Temple Mount in Jerusalem and a right of return for the Palestinian refugees, the talks ended without an agreement, and the negotiation process ground to almost a complete halt soon afterwards when the second Intifadah began and Ariel Sharon was elected prime minister of Israel. Our model, which does not incorporate third party actors such as extremists who can scuttle an agreement by diminishing trust between the two sides (see Kydd and Walter 2002), does not predict that an agreement will fail to be reached — it does predict, however, that the two sides will make mutually incompatible public demands, and that the two leaders will have less of an incentive to reach an agreement than if public commitments weren't allowed.[14]

[13] "Arafat time and again speaks of Jerusalem as the capital of Palestine, while [then Israeli Prime Minister] Rabin repeatedly assures Israelis that Jerusalem will remain Israel's eternal, indivisible capital" (Perlmutter 1995).

[14] Also see Agha and Malley (2002) for the role that the public has played in post-Oslo negotiations between the two sides.

3.3 Repeated Negotiations

Another way of obtaining "cooperation" (mutually refraining from making public commitments) in this prisoner's dilemma situation is if the two sides are negotiating repeatedly (Axelrod 1984; Taylor 1987). If each side adopts a strategy that it will refrain from making public commitments if the other side does but will start making public commitments if the other side does, then as long as the negotiators attach sufficient value to the future benefits that would be forgone by exploiting the other side once in the present, then mutual cooperation can be sustained in a repeated negotiations framework.

We consider the following model to analyze this situation. The two negotiators negotiate an agreement according to the previous model an infinite number of times. Each period, the negotiators play the above prisoner's dilemma game, that is, the two negotiators simultaneously decide whether to make a public commitment or not, and then they divide the pie of size 1 via the alternating-offers bargaining procedure (with the first proposer being randomly selected) within that period. Negotiators discount future payoffs with discount factor β, with $0 < \beta < 1$ (an alternative interpretation is that the negotiators don't necessarily play an infinite number of times, but after each period, they believe that with probability β they will meet again and negotiate another agreement in the future).

Now consider the following "grim trigger" strategy for each negotiator: in the first period of the game, make no public commitment; in subsequent periods, make no public commitment if neither side has previously; but if either negotiator ever makes a public commitment, afterwards always commit to $\frac{1+\phi}{1+2\phi+\delta}$.

For this strategy profile, which leads to neither side ever making a public commitment, to be a subgame-perfect equilibrium of the repeated negotiation model, a necessary and sufficient condition is that the total payoff from neither side ever making a commitment ($\frac{1}{2}$ forever) has to exceed the payoff from exploiting the other side once by making an optimal public commitment while the other side doesn't, and then getting the payoff from *both* sides making optimal commitments forever after:

$$\frac{1}{1-\beta} \cdot \frac{1}{2} \geq \frac{(1+\phi)(1+\delta)}{2(1+\phi+\delta)} + \frac{\beta}{1-\beta} \cdot \frac{(1+\phi)(1+\delta)}{2(1+2\phi+\delta)}$$

This inequality holds if and only if the discount factor β is greater than a threshold level β_c, that is the inequality holds if and only if the negotiators don't discount future payoffs too much (or if they are sufficiently likely to bargain again in the future):

$$\beta \geq \beta_c = \frac{\delta(1 + 2\phi + \delta)}{\delta(1 + 2\phi + \delta) + (1 - \delta)(1 + \phi + \delta)}$$

Note that the critical threshold β_c is increasing in ϕ:

$$\frac{\partial \beta_c}{\partial \phi} = \frac{(1 - \delta)(1 + \phi + \delta) + \delta(1 - \delta)(1 + 2\phi + \delta)}{[\delta(1 + 2\phi + \delta) + (1 - \delta)(1 + \phi + \delta)]^2} > 0$$

That is, the greater the cost for violating a given level of public commitment, the less the negotiators have to discount future payoffs (or the more likely they must be to bargain again in the future) for the cooperative outcome to be possible. This is because the greater the cost of violating a given level of public commitment, the greater the bargaining leverage provided by being the only side to make a public commitment, and hence the greater the temptation to defect and exploit the other once in the present. Hence, our model predicts that negotiators who face particularly large costs for violating a given level of public commitment will find it difficult to avoid the sub-optimal outcome by relying on the threat of punishment in a repeated negotiations framework, and will instead be more likely to rely on the secret negotiations mechanism.

4 Conclusion

Since Schelling's pathbreaking work *The Strategy of Conflict* (1960), scholars have been interested in understanding the sources of strength in bargaining situations where the actors have common as well as conflicting interests. Motivated by Putnam (1988), a large number of works in political science have examined the effect on bargaining of exogenously imposed domestic constraints such as ratification by a legislature (Hammond and Prins 1999; Iida 1993, 1996; Milner 1997; Milner and Rosendorff 1997; Mo 1994, 1995; Pahre 1997, 2001; Reinhardt 1996; Smith and Hayes 1997; Tarar 2001). In this paper, we investigate the effect on bargaining of another type of negotiating tactic: making a public statement before a domestic audience that one expects to obtain at least a certain share of the benefits in the negotiations.

When backing down from such a public commitment is costly, we find that when only one negotiator can make such a (potentially costly) public statement, it allows her to obtain a bargaining concession from the other side, because the committing negotiator now requires a bigger share of the pie for it to be worthwhile for her to reach an agreement, and the other negotiator realizes this and hence compromises. The model makes a number of interesting predictions regarding such a public commitment. First, the optimal commitment is high enough that the negotiator doesn't actually expect to achieve it, and expects to pay a cost for violating it. However, the greater share of the pie that the optimal commitment secures for the negotiator more than makes up for this, and the negotiator is better off in net terms. The model explains why negotiators publicly demand a lot.

Second, the model predicts that the ability to make a public commitment generates a principal-agent situation in which the public (the principal) wants its leader (the agent) to make as big a public commitment as is possible, since this secures the biggest share of the pie. However, in equilibrium the leader makes only a limited public commitment that brings a limited benefit to the public, because the leader's own interest mandates her to not choose so high a public commitment that she will certainly end up violating it and paying a cost. Although the model explains why leaders publicly demand a lot, it also explains why there are nevertheless limits on those demands.

Finally, the model predicts that the more costly it is to violate a given level of public commitment, the more bargaining leverage that this negotiating tactic provides. Also, the public commitment will be higher in this case. We conjecture that it will be especially costly for the leader to violate a public commitment prior to an election and at other times of political vulnerability, and the model predicts that the bargaining leverage of the public commitment tactic is highest at these times.

When both sides can make public commitments, however, we find that the results are quite different. When both sides can make public commitments that are costly to violate, then in equilibrium each side winds up in a sub-optimal outcome where it publicly commits to receiving more than half of the pie but only expects to receive half. Therefore, each side expects to pay a cost for violating its public commitment while getting no more of the pie than it would if neither side made a public commitment (and hence didn't pay a cost). However, getting out of this sub-optimal outcome is not as easy as making an agreement not to make a public commitment, since each side has a temptation to violate this agreement regardless of whether it thinks the other side will honor or violate it. One way of getting out of this prisoner's dilemma-induced sub-optimal outcome is through the threat of punishment in a repeated negotiations framework. However, this solution becomes more difficult the greater the cost for violating a given level of public commitment, since this provides more temptation to defect. An alternative solution is to conduct the negotiations secretly so that there will be nothing to publicly commit to and the sub-optimal outcome can thus be avoided. Our model thus provides a new rationale for secret negotiations.

It seems to be a reasonable working hypothesis that democratic leaders can face significant costs for violating public commitments whereas autocratic leaders, who aren't accountable to the public, generally don't (Fearon 1994). Therefore, in terms of regime type, our models provide a number of predictions. First, in negotiating between a democracy and an autocracy, a democratic leader can use public commitments to obtain bargaining leverage. This bargaining leverage will be greater the more costly it is for the democratic leader to violate a given level of public commitment, e.g. just before elections or at a time when the leader is particularly vulnerable domestically. An implication of this is that the democratic leader will want the negotiations to be publicly known whereas the autocratic leader will want them to be held secretly (provided that the autocratic leader really believes that the democratic leader will pay a cost for violating her public commitment).

In bargaining between two democracies, because of the risk of ending up in the sub-optimal outcome, both leaders will have an incentive to keep the negotiations secret (provided they realize that otherwise they can end up in a suboptimal outcome). This incentive increases the greater the cost for violating a given level of public commitment, since this means that alternative means of avoiding the sub-optimal outcome such as relying on the threat of punishment in a repeated-negotiations framework is less likely to work. Two democratic leaders who are facing elections or who are otherwise domestically vulnerable have particularly high incentives to keep the negotiations secret.

For well over a decade now, scholars have been intensely interested in moving beyond neorealism's treatment of the state as a unitary actor (Waltz 1979) and understanding the impact of domestic political factors on international relations. Previous work on international bargaining has focused on exogenous domestic factors that are largely out of the executive's direct control. This paper seeks to examine how leaders can directly manipulate domestic factors to affect international bargaining, and we hope it spurs further research in this direction.

5 Appendix

To establish Proposition 1, we first prove 3 lemmas. These lemmas establish the subgame perfect equilibria of the bargaining subgame when player 1 makes a "low" demand, a "high" demand, and a "medium" demand. That is, these are "partial equilibrium" results for the bargaining subgame, *given* the public commitment that player 1 makes. After establishing the expected payoffs for player 1 given her public commitment, in Proposition 1 we identify the public commitment that maximizes her expected payoff.

Lemma 1 *If negotiator 1 makes a low public commitment $a \leq \frac{\delta}{1+\delta}$, then the following is a subgame-perfect equilibrium of the bargaining subgame:*

(a) Negotiator 1 always proposes $(x, 1-x) = (\frac{1}{1+\delta}, \frac{\delta}{1+\delta})$ and always accepts any proposal $(1-y, y)$ such that $y \leq \frac{1}{1+\delta}$.

(b) Negotiator 2 always proposes $(1-y, y) = (\frac{\delta}{1+\delta}, \frac{1}{1+\delta})$ and always accepts any proposal $(x, 1-x)$ such that $x \leq \frac{1}{1+\delta}$.

Proof: Because $a \leq \frac{\delta}{1+\delta}$, the normal proposals that are made by both players for player 1 in the unique SPE of the Rubinstein (1982) bargaining model satisfy player 1's public commitment, and hence she doesn't pay a cost. Therefore, it is easy to see that the unique SPE of the Rubinstein game is also a SPE in this game. Q.E.D.

In this equilibrium, with probability $\frac{1}{2}$ negotiator 1 is chosen to make the first proposal and proposes $(x, 1-x) = (\frac{1}{1+\delta}, \frac{\delta}{1+\delta})$ and negotiator 2 accepts this. With probability $\frac{1}{2}$, negotiator 2 is chosen and proposes $(1-y, y) = (\frac{\delta}{1+\delta}, \frac{1}{1+\delta})$ and negotiator 1 accepts this. Negotiator 1 does not bear any cost of commitment since $a \leq \frac{\delta}{1+\delta}$. Therefore, negotiator 1's expected payoff is as follows:

$$V_1(a) = \frac{1}{2} \cdot \frac{1}{1+\delta} + \frac{1}{2} \cdot \frac{\delta}{1+\delta} = \frac{1}{2}$$

Lemma 2 *If negotiator 1 makes a high public commitment $a \geq \frac{1+\phi}{(1+\phi)+\delta}$, then the following is a subgame-perfect equilibrium of the bargaining subgame:*

(a) Negotiator 1 always proposes $(x, 1-x) = (\frac{(1+\phi)+\delta\phi a}{(1+\phi)(1+\delta)}, \frac{(1+\phi)\delta-\delta\phi a}{(1+\phi)(1+\delta)})$ and always accepts any proposal $(1-y, y)$ such that $y \leq \frac{(1+\phi)-\phi a}{(1+\phi)(1+\delta)}$.

(b) Negotiator 2 always proposes $(1-y, y) = (\frac{\delta(1+\phi)+\phi a}{(1+\phi)(1+\delta)}, \frac{(1+\phi)-\phi a}{(1+\phi)(1+\delta)})$ and always accepts any proposal $(x, 1-x)$ such that $x \leq \frac{(1+\phi)+\delta\phi a}{(1+\phi)(1+\delta)}$.

Proof: We conjecture that there exists a stationary SPE in which $x \leq a$ and $1 - y \leq a$. That is, player 1 and player 2's offers to player 1 give her no more than her public commitment. We will first derive the equilibrium assuming that it exists and then derive the condition (namely $a \geq \frac{1+\phi}{(1+\phi)+\delta}$) under which it exists.

In equilibrium, negotiator 1 proposes $(x, 1-x)$ and negotiator 2 accepts it. Negotiator 2 proposes $(1-y, y)$ and negotiator 1 accepts it. Thus, the share of negotiator 2 in 1's proposal should be equal to what he would receive if he rejects negotiator 1's proposal, makes a counter proposal himself and negotiator 1 accepts it. Moreover, negotiator 1's overall payoff if she accepts 2's proposal should be equal to her overall payoff if she rejects 2's proposal, makes a counter proposal herself and negotiator 2 accepts it.

$$1 - x = \delta y$$
$$(1-y) - \phi(a - 1 + y) = \delta(x - \phi(a - x))$$

Solving this pair of simultaneous equations for x and y, we obtain:

$$y = \frac{(1+\phi) - \phi a}{(1+\phi)(1+\delta)}$$
$$x = \frac{(1+\phi) + \delta\phi a}{(1+\phi)(1+\delta)}$$

All that remains is to verify that $x \leq a$ and $1 - y \leq a$. First note that $x \leq a$ can be rearranged to obtain $a \geq \frac{1+\phi}{(1+\phi)+\delta}$. Also, $1 - y \leq a$ can be rearranged to obtain $a \geq \frac{\delta(1+\phi)}{1+\delta(1+\phi)}$. Note that $\frac{1+\phi}{(1+\phi)+\delta} > \frac{\delta(1+\phi)}{1+\delta(1+\phi)}$ can be simplified to obtain $\delta^2 < 1$, which is true. Therefore, the binding condition for this equilibrium to exist is that $a \geq \frac{1+\phi}{(1+\phi)+\delta}$.[15] Finally, note that $\frac{1+\phi}{(1+\phi)+\delta} > \frac{\delta}{1+\delta}$ can be simplified to obtain $\delta^2 < 1 + \phi$, which is true. Therefore, it is appropriate to call this a "high" public commitment. Q.E.D.

In this equilibrium, with probability $\frac{1}{2}$, negotiator 1 is chosen to make the first proposal and proposes $(x, 1-x)$ and negotiator 2 accepts this. With probability $\frac{1}{2}$, negotiator 2 is chosen and proposes $(1-y, y)$ and negotiator

[15] Also note that this implies that $1 - y < a$, so that negotiator 1 receives strictly less than her public commitment when negotiator 2 makes a proposal.

1 accepts this. Negotiator 1 bears the cost of commitment regardless who makes a proposal. Thus, negotiator 1's expected payoff is

$$V_1(a) = \frac{1}{2} \cdot (x - \phi(a - x)) + \frac{1}{2} \cdot (1 - y - \phi(a - 1 + y)) = \frac{(1 + \phi) - \phi a}{2}$$

First note that $V_1(a)$ is decreasing linearly in a. Also note that at the end-points, $V_1(a = \frac{1+\phi}{(1+\phi)+\delta}) = \frac{(1+\phi)(1+\delta)}{2(1+\phi+\delta)}$ and $V_1(a = 1) = \frac{1}{2}$. Thus, for $a \in [\frac{1+\phi}{(1+\phi)+\delta}, 1]$, $V_1(a)$ decreases linearly from $\frac{(1+\phi)(1+\delta)}{2(1+\phi+\delta)}$ to $\frac{1}{2}$.[16]

Lemma 3 *If negotiator 1 makes a medium public commitment* $\frac{\delta}{1+\delta} \leq a \leq \frac{1+\phi}{(1+\phi)+\delta}$*, then the following is a subgame-perfect equilibrium of the bargaining subgame:*

(a) Negotiator 1 always proposes $(x, 1-x) = (\frac{(1+\phi)(1-\delta)+\phi\delta a}{(1+\phi-\delta^2)}, \frac{\delta(1+\phi-\delta-\phi a)}{(1+\phi-\delta^2)})$ *and always accepts any proposal* $(1-y, y)$ *such that* $y \leq \frac{(1-\delta)+\phi(1-a)}{(1+\phi-\delta^2)}$.

(b) Negotiator 2 always proposes $(1-y, y) = (\frac{\phi a+\delta(1-\delta)}{(1+\phi-\delta^2)}, \frac{(1-\delta)+\phi(1-a)}{(1+\phi-\delta^2)})$ *and always accepts any proposal* $(x, 1-x)$ *such that* $x \leq \frac{(1+\phi)(1-\delta)+\phi\delta a}{(1+\phi-\delta^2)}$.

Proof: We conjecture that there exists a stationary SPE in which $x \geq a$ and $1 - y \leq a$. That is, when player 1 makes a proposal she gets at least as much as her public commitment, and when player 2 makes a proposal player 1 gets no more than her public commitment. We will first derive the equilibrium assuming that it exists and then derive the condition (namely $\frac{\delta}{1+\delta} \leq a \leq \frac{1+\phi}{(1+\phi)+\delta}$) under which it exists.

In equilibrium, negotiator 1 proposes $(x, 1-x)$ and negotiator 2 accepts it. Negotiator 2 proposes $(1-y, y)$ and negotiator 1 accepts it. Thus, the share of negotiator 2 in 1's proposal should be equal to what he would receive if he rejects negotiator 1's proposal, makes a counter proposal himself and negotiator 1 accepts it. Moreover, negotiator 1's overall payoff if she accepts 2's proposal should be equal to her overall payoff if she rejects 2's proposal, makes a counter proposal herself and negotiator 2 accepts it.

$$1 - x = \delta y$$
$$(1 - y) - \phi(a - 1 + y) = \delta x$$

[16]Note that $\frac{1}{2} < \frac{(1+\phi)(1+\delta)}{2(1+\phi+\delta)} < 1$.

Solving this pair of simultaneous equations for x and y, we obtain:

$$y = \frac{(1-\delta)+\phi(1-a)}{(1+\phi-\delta^2)}$$
$$x = \frac{(1+\phi)(1-\delta)+\phi\delta a}{(1+\phi-\delta^2)}$$

All that remains is to verify that $x \geq a$ and $1-y \leq a$. First note that $x \geq a$ can be rearranged to obtain $a \leq \frac{1+\phi}{(1+\phi)+\delta}$. Also, $1-y \leq a$ can be rearranged to obtain $a \geq \frac{\delta}{1+\delta}$. Therefore, the condition for this equilibrium to exist is that $\frac{\delta}{1+\delta} \leq a \leq \frac{1+\phi}{(1+\phi)+\delta}$. Q.E.D.

In this equilibrium, with probability $\frac{1}{2}$, negotiator 1 is chosen to make the first proposal and proposes $(x, 1-x)$ and negotiator 2 accepts this. With probability $\frac{1}{2}$, negotiator 2 is chosen and proposes $(1-y, y)$ and negotiator 1 accepts this. Negotiator 1 bears the cost of commitment only when negotiator 2 makes a proposal. Thus, negotiator 1's expected payoff is as follows:

$$V_1(a) = \frac{1}{2}\cdot x + \frac{1}{2}\cdot(1-y-\phi(a-1+y)) = \frac{(1+\phi)(1-\delta^2)+\delta(1+\delta)\phi a}{2(1+\phi-\delta^2)}$$

First note that $V_1(a)$ is increasing linearly in a. Also note that at the end-points, $V_1(a = \frac{\delta}{1+\delta}) = \frac{1}{2}$ and $V_1(a = \frac{1+\phi}{(1+\phi)+\delta}) = \frac{(1+\phi)(1+\delta)}{2(1+\phi+\delta)}$. Thus, for $a \in [\frac{\delta}{1+\delta}, \frac{1+\phi}{(1+\phi)+\delta}]$, $V_1(a)$ increases linearly from $\frac{1}{2}$ to $\frac{(1+\phi)(1+\delta)}{2(1+\phi+\delta)}$.

Proof of Proposition 1:

Proof: With the previous three lemmas, this result is easy to establish. We know from the previous three lemmas that negotiator 1's expected payoff $V_1(a)$ is constant at $\frac{1}{2}$ as a increases from 0 to $\frac{\delta}{1+\delta}$, increases linearly from $\frac{1}{2}$ to $\frac{(1+\phi)(1+\delta)}{2(1+\phi+\delta)}$ as a increases from $\frac{\delta}{1+\delta}$ to $\frac{1+\phi}{(1+\phi)+\delta}$, and decreases linearly from $\frac{(1+\phi)(1+\delta)}{2(1+\phi+\delta)}$ to $\frac{1}{2}$ as a increases from $\frac{1+\phi}{(1+\phi)+\delta}$ to 1. Figure 1 shows $V_1(a)$ as a function of a.

From Figure 1, we see that $V_1(a)$ is maximized at $a^* = \frac{1+\phi}{(1+\phi)+\delta}$. The equilibrium proposals can be obtained by substituting a^* into the proposals of any of the two previous lemmas, since they both include the case where $a = \frac{1+\phi}{(1+\phi)+\delta}$ (this is the boundary between the "medium" and "high" public commitment). Q.E.D.

Proof of Proposition 2:

Step 1: We conjecture that there exists a stationary SPE of the bargaining subgame in which $x, 1-y \leq a$ and $y, 1-x \leq b$. That is, each side's proposal offers each side less than its public commitment. We first derive the SPE assuming that it exists and then derive the conditions under which it exists.

In equilibrium, negotiator 1 proposes $(x, 1-x)$ and negotiator 2 accepts it. Negotiator 2 proposes $(1-y, y)$ and negotiator 1 accepts it. Thus, negotiator 2's overall payoff if he accepts 1's proposal should be equal to his overall payoff if he rejects negotiator 1's proposal, makes a counter proposal himself and negotiator 1 accepts it. Moreover, negotiator 1's overall payoff if she accepts 2's proposal should be equal to her overall payoff if she rejects 2's proposal, makes a counter proposal herself and negotiator 2 accepts it. Hence:

$$(1-x) - \phi(b - (1-x)) = \delta[y - \phi(b-y)]$$
$$(1-y) - \phi(a - (1-y)) = \delta[x - \phi(a-x)]$$

Solving this pair of simultaneous equations for x and y, we obtain:

$$x = \frac{1}{(1+\delta)} + \frac{\phi(\delta a - b)}{(1+\phi)(1+\delta)}$$
$$y = \frac{1}{(1+\delta)} + \frac{\phi(\delta b - a)}{(1+\phi)(1+\delta)}$$

Now we need to verify that $x \leq a$. This can be simplified to obtain $a \geq \frac{1+\phi-\phi b}{1+\delta+\phi}$. Now we need to verify that $1-y \leq a$ holds. This can be simplified to obtain $a \geq \frac{\delta(1+\phi-\phi b)}{1+\delta+\delta\phi}$. Note that $\frac{\delta(1+\phi-\phi b)}{1+\delta+\delta\phi} < \frac{1+\phi-\phi b}{1+\delta+\phi}$ can be simplified to obtain $\delta^2 < 1$, which is true. Therefore, the binding condition is that $a \geq \frac{1+\phi-\phi b}{1+\delta+\phi}$.

Next, we need to verify that $y \leq b$. This can be simplified to obtain $a \geq \frac{(1+\phi)-(1+\delta+\phi)b}{\phi}$. Now we need to verify that $1-x \leq b$ holds. This can be simplified to obtain $a \geq \frac{\delta(1+\phi)-b(1+\delta+\delta\phi)}{\delta\phi}$. Note that $\frac{\delta(1+\phi)-b(1+\delta+\delta\phi)}{\delta\phi} < \frac{(1+\phi)-(1+\delta+\phi)b}{\phi}$ can be simplified to obtain $\delta^2 < 1$, which is true. Therefore, $a \geq \frac{(1+\phi)-(1+\delta+\phi)b}{\phi}$ is the binding condition.

Therefore, this equilibrium of the bargaining subgame exists for all $(a, b) \in [0,1] \times [0,1]$ such that $a \geq \frac{1+\phi-\phi b}{1+\delta+\phi}$ and $a \geq \frac{(1+\phi)-(1+\delta+\phi)b}{\phi}$. The set of values of

(a, b) such that these 2 conditions hold is shown in the upper right quadrant of Figure 4. Because the two negotiators are in identical positions, we are interested in *symmetric* equilibria of the entire game in which $a^* = b^*$.

Note that the two lines in Figure 4 intersect at $(a, b) = (\frac{1+\phi}{1+2\phi+\delta}, \frac{1+\phi}{1+2\phi+\delta})$. For any point in the upper right quadrant of Figure 5, negotiator 1's expected payoff is as follows:

$$\begin{aligned} V_1(a, b) &= \frac{1}{2}[x - \phi(a - x)] + \frac{1}{2}[(1 - y) - \phi(a - (1 - y))] \\ &= \frac{1 + \phi(1 - a - b)}{2} \end{aligned}$$

V_1 is decreasing in a.

From symmetry, we have negotiator 2's expected payoff as follows:

$$V_2(a, b) = \frac{1 + \phi(1 - a - b)}{2}$$

V_2 is decreasing in b.

Thus, since a player's payoff is decreasing in her public commitment, the only candidate in the upper right quadrant of Figure 4 for being a symmetric equilibrium of the entire game is $(a^*, b^*) = (\frac{1+\phi}{1+2\phi+\delta}, \frac{1+\phi}{1+2\phi+\delta})$. Note that $V_1(a^*, b^*) = V_2(a^*, b^*) = \frac{(1+\delta)(1+\phi)}{2(1+\delta+2\phi)}$. If a player deviates by choosing a higher public commitment, her payoff decreases. Now we need to verify that a negotiator can't increase her payoff by choosing a lower public commitment.

Step 2: Suppose negotiator 2 (without loss of generality, we only need to consider whether player 2 can profitably deviate from her equilibrium strategy) deviates by choosing some b so low that both 1 and 2's proposals satisfy her public commitment, i.e. $y \geq b$ and $1 - x \geq b$. Since $a^* = \frac{1+\phi}{1+2\phi+\delta}$ and $\frac{\delta}{1+\delta} < \frac{1+\phi}{1+2\phi+\delta} < \frac{1+\phi}{1+\delta+\phi}$, the proposals in the SPE of the bargaining subgame are the same as in lemma 3, where negotiator 1 makes a medium-level public commitment and negotiator 2 can't make a public commitment.

How small does b have to be? Using $x = \frac{(1+\phi)(1-\delta)+\phi\delta a}{1+\phi-\delta^2}$ (from lemma 3) and $a = \frac{1+\phi}{1+2\phi+\delta}$, $1 - x \geq b$ can be simplified to obtain $b \leq \frac{\delta[(1+\phi-\delta)(1+\delta+2\phi)-\phi(1+\phi)]}{(1+\phi-\delta^2)(1+\delta+2\phi)}$ $(< \frac{1+\phi}{1+2\phi+\delta})$. Using $y = \frac{(1-\delta)+\phi(1-a)}{1+\phi-\delta^2}$ from lemma 3, $y \geq b$ can be simplified to obtain $b \leq \frac{(1+\phi-\delta)(1+\delta+2\phi)-\phi(1+\phi)}{(1+\phi-\delta^2)(1+\delta+2\phi)}$. Since $\delta < 1$, the binding condition is that $b \leq \frac{\delta[(1+\phi-\delta)(1+\delta+2\phi)-\phi(1+\phi)]}{(1+\phi-\delta^2)(1+\delta+2\phi)}$.

In this SPE of the bargaining subgame, $V_2(a) = \frac{1}{2} \cdot y + \frac{1}{2} \cdot (1-x)$. When $a^* = \frac{1+\phi}{1+2\phi+\delta}$, $V_2(a^*) = \frac{(1+\delta)(1+2\phi+\phi^2-\delta^2-\delta\phi)}{2(1+\phi-\delta^2)(1+\delta+2\phi)}$. Setting this less than $V_2(a^*, b^*)$ from step 1 and simplifying, we obtain $\delta^2 < 1$, which is true. Therefore, a player can't profitably deviate by choosing a public commitment so low that both players' proposals satisfy it.

Step 3: Now we derive a SPE for the bargaining subgame when $a = \frac{1+\phi}{1+2\phi+\delta}$ and negotiator 2 chooses some b such that $\frac{\delta[(1+\phi-\delta)(1+\delta+2\phi)-\phi(1+\phi)]}{(1+\phi-\delta^2)(1+\delta+2\phi)} \leq b \leq \frac{1+\phi}{1+2\phi+\delta}$ and show that negotiator 2 does worse by not choosing $b = \frac{1+\phi}{1+2\phi+\delta}$.

We conjecture that in the SPE of the bargaining subgame, $x \geq a$ and $1-y \leq a$. That is, negotiator 1 gets at least her public commitment when she herself proposes, but not when 2 does. Similarly, $y \geq b$ and $1-x \leq b$: 2 gets at least his public commitment when he himself proposes but not when 1 does. We first derive the SPE of the bargaining subgame assuming that it exists and then derive the condition (namely $\frac{\delta[(1+\phi-\delta)(1+\delta+2\phi)-\phi(1+\phi)]}{(1+\phi-\delta^2)(1+\delta+2\phi)} \leq b \leq \frac{1+\phi}{1+2\phi+\delta}$) under which it exists.

The equations for this equilibrium are:

$$(1-y) - \phi(a-(1-y)) = \delta x$$
$$(1-x) - \phi(b-(1-x)) = \delta y$$

Setting $a = \frac{1+\phi}{1+2\phi+\delta}$ and solving these two equations for x and y, we obtain:

$$x = \frac{(1+\phi)(1+2\phi^2-2b\phi^2-b\phi\delta+3\phi-b\phi-\delta^2)}{(1+\delta+2\phi)(1+\phi-\delta)(1+\phi+\delta)}$$
$$y = \frac{\delta-\delta^3+3\phi\delta-\phi\delta^2-\phi\delta^3+\delta\phi^3+3\delta\phi^2-\phi^2\delta^2+b(\phi\delta^2+\phi\delta^3+2\phi^2\delta^2)}{\delta(1+\delta+2\phi)(1+\phi-\delta)(1+\phi+\delta)}$$

Now we have to verify that $x \geq a$. This can be simplified to obtain $b \leq \frac{1+\phi}{1+2\phi+\delta}$. Similarly, setting $y \geq b$ can be simplified to obtain $b \leq \frac{1+\phi}{1+2\phi+\delta}$.

Now we have to verify that $1-x \leq b$. This can be simplified to obtain $b \geq \frac{\delta[(1+\phi-\delta)(1+\delta+2\phi)-\phi(1+\phi)]}{(1+\phi-\delta^2)(1+\delta+2\phi)}$. Finally, we need to verify that $1-y \leq a$. This can be simplified to obtain $b \geq \frac{2\delta\phi^2-\phi^2+3\phi\delta-2\phi+\delta^2+\delta-1-\delta^3}{\delta\phi(2\phi+\delta+1)}$. Note that $\frac{2\delta\phi^2-\phi^2+3\phi\delta-2\phi+\delta^2+\delta-1-\delta^3}{\delta\phi(2\phi+\delta+1)} < \frac{\delta[(1+\phi-\delta)(1+\delta+2\phi)-\phi(1+\phi)]}{(1+\phi-\delta^2)(1+\delta+2\phi)}$ can be simplified to obtain $(1-\delta)^2(1+\phi-\delta)(1+\phi+\delta)^2 > 0$, which is true. Therefore, the binding condition is that $\frac{\delta[(1+\phi-\delta)(1+\delta+2\phi)-\phi(1+\phi)]}{(1+\phi-\delta^2)(1+\delta+2\phi)} \leq b \leq \frac{1+\phi}{1+2\phi+\delta}$.

Player 2's payoff in this SPE of the bargaining subgame is

$$\begin{aligned} V_2(b) &= \frac{1}{2} \cdot [(1-x) - \phi(b - (1-x))] + \frac{1}{2} \cdot y \\ &= \frac{f(\phi,\delta) + b(1+\delta)(\phi\delta^2 + 2\delta\phi^2 + \phi\delta)}{2(1+\delta+2\phi)(1+\phi-\delta)(1+\phi+\delta)} \end{aligned}$$

where $f(\phi,\delta) = (1+\delta)(1+3\phi^2+3\phi+\phi^3-\phi\delta^2-\delta^2-\phi\delta-\delta\phi^2)$. Note that $V_2(b)$ is increasing in b. Therefore, for $\frac{\delta[(1+\phi-\delta)(1+\delta+2\phi)-\phi(1+\phi)]}{(1+\phi-\delta^2)(1+\delta+2\phi)} \leq b \leq \frac{1+\phi}{1+2\phi+\delta}$, $V_2(b)$ is maximized at $b^* = \frac{1+\phi}{1+2\phi+\delta}$, at which point $V_2(b^*) = \frac{(1+\delta)(1+\phi)}{2(1+\delta+2\phi)}$.

Step 4: Therefore, we have shown when the other negotiator is choosing a public commitment of $\frac{1+\delta}{1+2\phi+\delta}$, a negotiator is strictly worse off by choosing a public commitment higher or lower than this. Hence, $(a^*, b^*) = (\frac{1+\phi}{1+2\phi+\delta}, \frac{1+\phi}{1+2\phi+\delta})$ is an equilibrium. Q.E.D.

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