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Single-Undertaking and Sectoral Approach

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This paper considers two alternative procedures for multi-issue bargaining, so-called sectoral approach (issue-by-issue bargaining) and single-undertaking (single package bargaining), and compares the outcomes under the alternative procedures. It is asserted that if early agreement in an issue is particularly important to a bargaining party so that it makes his overall delay costs too high, he may strictly prefer to bargain the issue separately rather than bargain both issues at once

Key words: single-undertaking, sectoral approach, sequential bargaining

I. Introduction

Bargaining often involves multiple issues. When multiple issues are involved, the issues may be bargained over either on separate negotiation tables or simultaneously on one table. Firm and labor union often bargain issue by issue over the wage rate, working conditions and health benefits etc. and in UR negotiations many issues were handled on one table at once. The latter is called "single-undertaking (single package bargaining)", while the former is called "sectoral approach (issue-by-issue bargaining)". Also, it is usual that one bargaining party insists on linkage of one issue with another while the other party does not. For example, the long-running dispute over the Kuril Islands between Japan and Russia has not been resolved because Japan keeps trying to link the territorial problem with economic cooperation, whereas Russia wants to separate two issues.

Then, what are the points of those who support respective bargaining modality? Single-undertaking has the advantage of enhancing the possibility of agreements through trade-offs among issues, while it has the disadvantage of delaying the agreement since it requires bargainers to agree over all the issues. U.S. has supported the sectoral approach which is the other extreme form of bargaining mode, since the initial stage of the rule meeting in New Round. U.S. has argued that single-undertaking has an adverse effect of delaying free trades due to hiding bargaining cards until the last moment of the negotiation.[1]

Then, what is the true reason that some bargainers prefer sectoral approach and others prefer single-undertaking bargaining? The answer seems related with the relative importance between the issues they have to bargain over. In this paper, we will show that if early agreement in an issue is especially important to a bargaining party so that it makes his overall delay costs too high, he will strictly prefer to bargain the issue separately rather than bargain both issues at once.

II. Model

Two parties I and II bargain over two independent issues with pies X and Y, each of size one. The parties derive utility from the shares of the pies. Denoting player i's shares for pie X, Y by x_i, y_i, we assume player i gets utility $x_i + y_i$ when an agreement is reached that party i has (x_i, y_i), where i=I,II.

1) See Schott (2000) for more details.

Bargaining over multiple issues may proceed in a variety of ways. We may think of two possible ways. One way is to address both issues at once. Another way is to handle them one by one in such a way that each party employs two agents each of whom is in charge of each issue.

We assume that in either case the bargaining game proceeds as follows a la Rubinstein (1982): in the first period, party I proposes that he receive the share (or shares) of the issue (or issues) that is (or are) bargained over. Party II immediately decides whether to accept it or not. If he accepts, the game ends; otherwise, in the second period, he makes a counteroffer and so on.

It is assumed that delay hurts both parties, but in different ways between parties and issues.[2] Moreover, we assume that delay costs are constant over periods.[3] Let $c_{i,\zeta}$ be party i's one period delay cost in issue, ζ, i=1, 2, ζ = X, Y. Then, we will make the following assumption.

Assumption 1 $c_{1,x} > c_{2,x} = c_{2,y} > c_{1,y}$

This assumption says that delay in an agreement in X hurts party I more severely than in an agreement in Y, while it does not make any difference

2) We may imagine a situation where parties have borrowed different amounts for each project X, Y and have to pay interest if it is not possible to launch the projects in time due to delay in agreements, or a situation where they should defray different consulting fees to legal consultants who are in charge of each issue.

3) This is an assumption that makes it convenient to model different delay costs across issue. As well known in the bargaining literature, it is purely a matter of modeling whether the modeler uses the constant discount rate or the constant delay costs. For example, it would be more relevant to use the fixed discount rate in a situation where a party has to pay interests for borrowed money if the agreement is delayed, whereas the constant delay cost is more appropriate if a worker does not get paid a fixed income until a wage agreement is made.

to party II, i.e., party II is neutral between X and Y in term of delay costs. It implies that party I is in a weak position in X and in a strong position in Y.

Letting $c_{2,x} = c_{2,y} = c$, we will make an additional assumption on delay costs.

Assumption 2 $c < 1$[4)]

If $c \geq 1$, even one-period delay would not allow party II positive utility. Thus, party II cannot but accept any offer made by party I in the first period. This makes the analysis uninteresting since it reduces this infinite-period model to essentially the same as the one-period one with take-it-or-leave-it offer.

III. Analysis

In this section, we will discuss the outcome of the bargaining game under alternative bargaining procedures, sectoral approach and single-undertaking bargaining.

1. Sectoral Approach

First, we will consider a bargaining situation where two parties bargain over two separate issues on separate tables.

Before we analyze this type of bargaining, we will assume that each party is allowed to eat his share of the pie after they agree in a partition of a

4) $c_{i,x}$ may be greater than, equal to or less than 1.

particular pie.[5]

Let an agreement in each issue be denoted by a pair $p=(p_1,p_2)\in\triangle$, where $\triangle=\{(p_1, p_2)\in R^2 \mid p_1 + p_2 = 1, p_i \geq 0, i = 1, 2\}$ and let $t\in T = \{1,2,3, \Lambda\}$. Then, a bargaining outcome in each issue can be represented by (p, t) which is interpreted as the reaching of agreement p in period t. Let the utility that each party gets if an agreement in issue ζ is reached at period t be denoted by $u_{i,\zeta}(p_i, t)$. Then $u_{i,\zeta}(p_i, t) = p_i - c_{i,\zeta}(t\text{-}1)$. If the parties do not reach an agreement forever, both of them get utility $-\infty$. Let each party's total utility function be $U_i : \triangle^2 \times T^2 \rightarrow R$ Then, if bargaining outcomes in X and Y are (p, t), (p', t') respectively, then, $U_i(p,p',t,t') = u_{i,x}(p_i,t) + u_{i,y}(p'_i,t')$.

To characterize our equilibrium, we will define $d_i : [0,1] \times T \rightarrow [0,1]$ by $d_i(p_i, t) = \inf\{q_i \in [0,1] \mid u_{i,\zeta}(q_i, 1) \geq u_{i,\zeta}(p_i, t)\}$. Then, it is easy to see that

$$d_i(p_i,\ t) = \begin{cases} p_i - c_{i,\zeta}(t-1) & \text{if } \ p_i \geq c_{i,\zeta}(t-1) \\ 0 & \text{if } \ p_i \leq c_{i,\zeta}(t-1) \end{cases}$$

Defining q_1^* and p_2^* by $q_1^*=d_1(p_1^*, 2)$ and $p_2^*=d_2(q_2^*, 2)$, we can establish the following theorem

Theorem 1 The following strategy profile constitutes a unique subgame perfect equilibrium (SPE) of the bargaining game over each issue; (i) party I proposes the agreement p^* whenever it is his turn to make an offer, and accepts an offer q made by party II if and only if $q_1 \geq q_1^*$; and accepts p with $p_2 \geq p_2^*$.

Proof. See the appendix

5) Alternatively, we may assume that both parties are not allowed to eat their shares of all the pies until negotiations in both issues are over. This would affect our result.

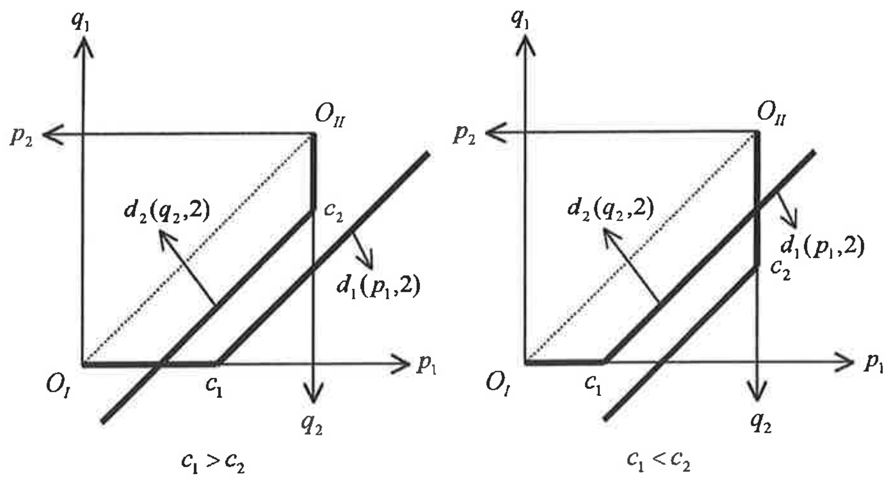
Remark. The equilibrium outcome implied by this theorem is that party I offers p^* in period 1 and party II immediately accepts it.

Computing p^*, q^* explicitly leads to the following corollary.

Corollary 1 In equilibrium, in a bargaining over X, party I makes the offer $(c,1-c)$ in the first period and it is accepted immediately by party II and, in a bargaining over Y, player I makes the initial offer (1, 0) which is also accepted immediately by party II.

Proof. See figure 1.

〈Figure〉



This corollary implies that if delay costs are smaller for some bargainer, he can get the whole pie, but that, if delay costs are higher, he can get only a fraction equal to the other party's delay costs. Furthermore, it suggests that in either case his share is independent of his own delay costs.

2. Single-Undertaking Bargaining

In a single-undertaking bargaining, all issues are on the table at once. Let the set of all possible agreements in this type of bargaining e $\triangle^2=\{(p,q)\in R^2 \times R^2 \mid p_1+p_2=1, q_1+q_2=1, p_i \geq 0, q_1 \geq 0, i=1,2\}$. If we note that X and Y are perfect substitutes, it is sufficient to consider the sum of the offers in X and Y, p and q as an offer. Let r=p+q. Then, the set of possible agreements can be reduced to $S=\{r\in R^2 \mid r_1+r_2=2, r_i \geq 0, i=1,2\}$. Then, each party's utility function in this be defined by $U_i^{SP}: S\times T \rightarrow R$ can be defined by $U_i^{SP}(r,t)\equiv U_i(p,q,t,t)=p_i+q_i-c_{i,x}(t\text{-}1)-c_{i,y}(t\text{-}1)$.

Then, in a similar way as in the sectoral approach, we can establish the following theorem.

Theorem 2 As long as $c_{1,x}+c_{1,y} \neq 2c$[6], there exists the unique SPE: In this equilibrium, if $c_{1,x}+c_{1,y} > 2c$, party I makes the offer (2c, 2-2c) in the first period and it is accepted immediately by party II and, if $c_{1,x}+c_{1,y} < 2c$, party I makes the initial offer (2, 0) which is also accepted immediately by party II.

3. Comparison between the Two Procedures

From the above analysis, we can state the following main theorem that suggests under what circumstances a bargainer prefers the sectoral

6) It is well known that, if $c_{i,x}+c_{1,y}=2c$ there may be multiple SPE possibly involving delay when the delay cost is small enough. (Rubinstein 1982)

approach.

Theorem 3 If $c_{1,x}+c_{1,y}\rangle 2c$, party I prefers the sectoral approach to single package bargaining and, If $c_{1,x}+c_{1,y}\rangle 2c$, he prefers single-undertaking bargaining. Party II's preferences always are opposed to party I's.

The intuition is crystal clear. If the overall delay costs are higher for some bargainer, but fortunately there is an issue on which delay hurts him less severely than the other party, he will prefer to bargain the issue separately since he can exploit the strong position in bargaining in the issue that he would lose by bargaining simultaneously due to the higher overall delay costs. Put differently, if urgency in a particular issue weakens a party's overall bargaining position, he would rather bargain the issue separately, thereby retain his strong position on the other issue. On the contrary, If the overall delay costs are smaller for a bargainer, he cannot gain by the sectoral approach. In that case, he will be better off by bargaining simultaneously.

IV. Discussions and Conclusion

We have shown that if early agreement in an issue is particularly important to a bargaining party, he may strictly prefer to bargain issue by issue rather than bargain at once, which is consistent with the stance taken by the U.S. in New Round.

Among related works to this paper, Fershtman (1990) asserts that when bargainers have differing preferences over individual issues, each bargaining party prefers bargaining over the issue first that is less important to him. Bac and Raff (1996) demontrates that when there is incomplete information on bargaining strength among parties, a strong (patient) party prefers the sectoral approach to single-package bargaining to signal his patience. This paper thus provides an alternative explanation for why bargainers sometimes prefer the sectoral approach.

We may wonder how robust this result can be to specification of the model. First, it is easily checked that the identity of the first proposer does not affect the result in the light of Theorem 1 and Corollary 1. However, if we consider fixed discount factor instead of fixed delay costs, theorem 3 will not be valid. In that case, both parties always prefer single-undertaking bargaining. For the efficiency gain from bargaining multiple issues simultaneously dominates the strategic effect from the difference in relative importance in issues. Also, if the parties bargain in a cooperative way, the outcome of the cooperative game turns out to be identical to that of the noncooperative game in the case where the common discount factor is almost 1.

Finally, we may suspect that information structure on the other party's delay costs may alter the result. This issue will be worth to pursue.

V. Appendix

Proof of theorem 1

The proof consists of two parts. In the first part, it is shown that the strategy profile described in theorem 1 is a SPE. In the second part, we argue that it is the only SPE.

1. Equilibrium:

Let Γ_i be the subgame starting from party i's offer. First, consider the subgame Γ_1.

Claim 1 Given party II's strategy, to offer p^* at any t is optimal for party I.

If he offers p^*, it will be immediately accepted by party II and the bargaining outcome will be (p^*,t). Any other strategy leads to either (p, t′) with $p_1 \leq p_1^*$, $t''\rangle t$ or (q^*,t'') with $t''\rangle t$ or $(-\infty, -\infty)$. Since $p_1^* \rangle q_1^*$ from the definition of p^* and q^*, party I has no incentive to offer any p other than p^*.

Claim 2 Given party I's strategy, to accept p with $p_2 \geq p_2^*$ only at any t is optimal for party II.

Acceptance of p leads to the outcome (p, t). Otherwise, the outcome will be either (p^*,s') with $s'\rangle t$ or (q,s'') with $q_2 \leq q_2^*$ and $s''\rangle t$ or $(-\infty, -\infty)$. Thus, the best alternative outcome for party I is $(q^*,t+1)$. Since. $p_2^* = d_2(q_2^*,2)$, $u_{2,\xi}(p^*,1) \geq u_{2,\xi}(q^*,2)$ or in general, $u_{2,\xi}(p^*,t) \geq u_{2,\xi}(q^*,t+1)$.

Suppose $p_2 \geq p_2^*$ then $u_{2,\xi}(p,1) \geq u_{2,\xi}(q^*,2)$ since $p_2 \geq p_2^*$. Therefore, party II has no incentive to reject p with $p_2 \geq p_2^*$ at any t.

Suppose $p_2 \langle p_2^*$. Since $p_2^* = d_2(q_2^*,2) = \inf\{ p_2 \mid u_{2,\xi}(p^*,1) \geq u_{2,\xi}(q^*,2)\}$,
$u_{2,\xi}(p,1) \langle u_{2,\xi}(q^*,2)$. Such that $p_2 \langle p_2^*$. Then party II has no incentive to accept p with $p_2 \langle p_2^*$. For party II's offer q^* in the next period will be accepted by party I.

Similarly, we can show that the strategy profile also constitutes a SPE in the subgame Γ_2

2. Uniqueness

For uniqueness, first notice that p_1^*, q_2^* are uniquely determined if $c_{1,\xi} \neq c_{2,\xi}$. (see figure 1). Let $\overline{v_i}$,$\underline{v_i}$ be supremum (or infimum) of V_i where V_i is the set of SPE utility levels that parties get in the subgame where party i makes the first offer. We only need to show $\overline{v}_1 = \underline{v}_1 = p_1^*, \overline{v}_2 = \underline{v}_2 = q_2^*$.

Claim 3 $\underline{v}_2 \geq 1\text{-}d_1(\overline{v}_1, 2)$

If party I rejects some offer made by party II, he will get at most $\overline{v}_1$ in equilibrium in the next period. Taking the delay cost into account, he will accept any offer greater than or equal to $d_1(\overline{v}_1, 2)$. Therefore, $\underline{v}_2 \geq 1\text{-}d_1(\overline{v}_1, 2)$.

Claim 4 $\overline{v}_1 \leq 1\text{-}d_2(\underline{v}_2, 2)$

Similar arguments lead to this result.

By combining claim 3 and 4, we can easily see that $\overline{v}_1 = p_1^{*}{}'$ $\underline{v}_2 = q_2^*$, from figure 1. By similar arguments, $\underline{v}_1 = p_1^*$, $\overline{v}_2 = q_2^*$. Q.E.D.

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