First Things First? The Agenda Formation Problem for Multi-issue Committees*

by

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*I wish to thank Lutz-Alexander Busch, Jernej Copic, Roman Inderst, Campbell Leith, Marco Mariotti, Gareth Myles, Abhinay Muthoo and the participants of the First World Congress of the Game Theory Society and the ESRC research seminars in Game Theory. All errors remain mine.

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Abstract

It is often argued that multi-issue committees should discuss issues simultaneously to avoid inefficiency. However, in practice, parties can be constrained to discuss issues sequentially and in this case, existing game-theoretical models give inconclusive results: either parties have different preferences over agendas or they are indifferent. We show that when there is an important issue, parties have the same preferences over agendas, in particular they prefer to discuss the most important issue first. Moreover, when an issue is difficult/urgent (in the sense that the rejection of a proposal on this issue implies a game breakdown with a positive probability) parties prefer to postpone the negotiations over the difficult/urgent issue. We highlight several incentives that players need to take into account in forming their preferences over agendas. Since these are often in conflict, the existence of a Pareto optimal agenda is of particular interest.

1 Introduction

The problem of forming an agenda, which states the order in which parties should discuss issues, is of interest, since different agendas can lead to different outcomes. If in a peace process difficult issues were postponed then different outcomes could be imagined; if a buyer and a seller could agree over the price of valuable items first then the outcome of the bargaining can be expected to be different from the results of negotiations in which the initial items bargained over are the least valuable. The agenda formation problem is relatively new, despite the fact the amount of economic activity intermediated every year by negotiated agreement is very large and that the literature on bargaining is already well developed (extensive reviews are in Muthoo, 1999, Osborne and Rubinstein, 1990 and Ray and Vohra, 1997).

It has been argued that a simultaneous procedure (in which all the issues are discussed at the same time) should be the prevailing phenomenon, since it both saves time and makes full use of all valuable trading opportunities across issues (Inderst, 2000, Busch and Horstmann, 1997, Weinberger, 2000). This does not seem to have a strong support in practice, where parties bargain over issues sequentially (e.g., departmental meetings, firm-union bargaining, buy-and-sell processes, etc.), partially because the parties cannot deal with many issues at the same time. A key question is then when parties bargain sequentially over issues which issue should they discuss first?

This question seems simple, however it is unanswered and has not received much formal attention from a game theoretical perspective. We focus on very simple frameworks with complete and perfect information in which players attempt to divide each surplus (or cake) as in the standard alternating offer bargaining model (Rubinstein, 1982). Before describing in more details the features of our model, we define the key aspects of a multi-issue bargaining procedure. First of all, when parties can bargain over more than one issue, the agreements may be implemented as soon as they are reached (sequential implementation) or only after all the issues have been settled (simultaneous implementation). As in Busch and Horstmann (1997, 1999) and Inderst (2000), we assume that the implementation is sequential. This assumption is consistent with a large number of cases (for instance, departmental meetings or a buyer and a seller bargaining over the price of different items)[1].

One of the key assumptions in our model is that after reaching an agreement over an issue there is an interval of time before players attempt to reach an agreement over another item[2]. For instance, after agreeing over the price of an item the buyer can walk out of the shop and after a certain period of time he will be back to start bargaining over the price of another item (or alternatively, there is an interval of time

[1] For an analysis of agenda formation with complete information under simultaneous implementation see Fershtman (1990), Lang and Rosenthal (2001) and Weinberger (2000).

[2] Our framework also supports alternative interpretations (see discussion in section 2).

to search for another item over which to bargain); in departmental meetings after completing the discussion on an item, parties gather the material for the discussion of the next item. We show that this assumption is relevant in driving our results on the best agenda. As Muthoo (1995b) pointed out, in general, not only this interval exists but it is often larger than the interval of time between a rejection and a new proposal.

The main message of our analysis is that players need to take into account many strategic effects in forming their preferences over agendas, and although these can be in conflict, a Pareto optimal agenda can exist. The best agenda requires discussing the most important issue first (Proposition 3 focuses on the common assumption of players with exactly the same preferences on issues, while Proposition 4 generalises the result to players with similar valuations of the issues). This result is new in the literature which uses game theoretical models similar to ours (a description of this literature is below). Only Winter (1997) shows a result similar to ours but in a very different framework (players are required to have semi-lexicographic preferences and moreover, there is no timing). This result appears intuitive but it is not obvious. We highlight the different incentives that players have in forming their preferences over agendas. These include 1) a player's incentive to discuss his more important issue first 2) to postpone the bargaining over the opponent's more important issue and 3) to be first mover when bargaining over his more important cake. Clearly, these incentives can be in conflict and this is why the existence of a Pareto optimal agenda is particularly interesting.

The models closer to ours are Busch and Horstmann (1997, 1999) and Inderst (2000). The most significant differences are the following. First of all their focus is different. The former compare a simultaneous with a sequential procedure, while the latter fully endogenise the agenda selection problem. We restrict our analysis to sequential procedures. Differently from Busch and Horstmann (1997, 1999) and Inderst (2000), we are able to define the Pareto optimal agenda among sequential procedures. Moreover, their focus is on the case in which all the frictions are represented by a common discount factor, δ, which vanishes, $\delta \to 1$ (and in Busch and Horstmann, 1997, 1999, players have specific valuations of the importance of an issue). We allow players to differ in their valuation of the cakes and their time preferences. We believe that these differences may be important in real-life negotiations and they should be taken into account. Indeed, we show that when these differences are not allowed, the interplay of the forces in the bargaining process is strongly modified. Finally, as already noted above, Muthoo (1995b) considered the possibility of an interval of time between different bargaining stages. However, since his main aim was to analyse repeated games, an infinite number of identical cakes are to be shared. In our framework, where the main focus is the agenda formation problem, a finite number of heterogeneous cakes are considered.

In the case in which a Pareto optimal agenda does exist, one can easily think of a procedure in which players select that agenda. However, when players' preferences over agendas conflict, the agenda selection is relevant. Accordingly, we consider a number of pre-games not only to solve the problem of how players select an agenda, but also to highlight different characteristics of the following bargaining process.

Finally, the paper focuses on negotiations with a difficult/urgent issue. An issue is difficult (but not necessarily the most important) if a rejection of a proposal regarding such an issue can compromise future negotiations. The difficult issue can also be interpreted as urgent, in the sense that players discount more strongly utilities derived from a delayed agreement on that issue. We show that when there is a difficult/urgent issue, the Pareto superior agenda consists in postponing such an issue. This is in accordance with the common observation that the chance of successfully bargaining over a difficult issue is higher when the first issue is easier to negotiate. For example, in Winter (1997), p. 340: Israel and Palestinians are better off 'when the Jerusalem issue is pushed down to the bottom of the agenda [since it] is without doubt the most emotionally loaded issue and perhaps the most difficult one'. However, we show that the driving force in our framework is quite different. Players need to postpone the difficult issue regardless of its importance to avoid compromising future negotiations. This explains why, in firm-union negotiations, the level of employment is often discussed before anything else.

The paper is organised as follows: in the next section the main model is presented. This is solved and analysed in section 2.1. We then focus on the agenda formation problem (section 3). First, we show that in spite of the complex interplay of the forces in the bargaining model, players may have the same preferences over agendas (section 3.1). Then, by the means of pre-games, we tackle the agenda selection problem (section 3.2). Finally, players' preferences over agendas are derived for the case of a difficult/urgent issue (section 4). Some final remarks conclude the paper in section 5.

2 A Two-Player Two-Cake Bargaining Game

We model the agenda formation problem as a two-stage bargaining game. Two players, 1 and 2, negotiate over the partition of two cakes, named 1 and 2, as well. At each stage, players negotiate over the division of a cake according to an alternating-offer procedure as in the classic Rubinstein bargaining model (Rubinstein, 1982, henceforth RBM). Players can start the negotiations over the second cake only after reaching an agreement on the first cake (a sequential bargaining protocol). A time period is indicated by t, with $t = 0, 1, 2....$ However, periods can take different lengths of time. In particular, between a rejection and a new proposal (within a bargaining stage), an interval of time Δ passes, while between an acceptance and a new proposal (between bargaining stages) an interval of time τ passes. For instance, a buyer walks out of the shop after buying an item, and only after a certain period of time he is back in the shop to start the negotiations over the price of another item. To take these differences into account, player i's time preferences are represented by his *within-cake* discount factor $\delta_i = \exp(-r_i\Delta)$, which applies after a rejection and his *between-cake* discount factor $\alpha_i = \exp(-r_i\tau)$, which applies after an acceptance, where r_i is player i's discount rate, with $i = 1, 2$. As we said above, Muthoo (1995b) firstly introduced these parameters in a two-person alternating-offer bargaining model in which an infinite number of cakes (of constant size) are to be shared.

Since each cake represents an issue over which players attempt to find an agreement, we allow players to differ in their cake valuations. A non-negative parameter λ_i represents not only the relative importance of cake i to player i but also the relative importance of cake i between the players (see payoff functions below), with $i = 1, 2$.

Player 1 is assumed to be the first mover at the beginning of the game ($t = 0$), while a successful proposer at the first stage becomes a responder at the beginning of the second stage. The switch of players' roles at the second stage is not crucial in the sense that the following analysis is robust to the case in which either the first mover at second stage is randomly selected or the role of the players is fixed and independent of the sequence of moves at the first stage. The only case we need to exclude, because trivial, is the one in which the first mover at the second stage is assumed to be the proposer who made a successful proposer at the first stage. This case would be as if the bargaining were on a larger cake, which is the sum of the two. Consequently, a successful proposer would demand the Rubinsteinian share over all the cakes.

The implementation of the agreement is assumed to be sequential, in other words, delays in the agreement over the division of the first cake affect the second stage, while subsequent delays in the agreement over the second cake do not affect the partition agreed in the first stage. For example, if a buyer and a seller agree over the price of an item, the agreement can be implemented immediately, subsequently parties can start to bargain over the price of another item.

If an agreement is not reached on the partition of a cake, players get zero payoffs (disagreement) at that stage. Then, if disagreement takes place at the first stage the second stage cannot take place and players' overall payoff is zero. In our framework we consider two agendas, agenda i states that cake i is negotiated first, with $i = 1, 2$. In this section we focus on agenda 1. If, after t rounds, an agreement is reached on the division of the first cake, $(x, 1-x)$, where x is the share player 1 obtains, and after $n+1$ periods (a period of length τ and n periods of length Δ) another agreement is reached $(1-y, y)$, then the payoff player i obtains, v_i, is as follows, with $i = 1, 2$.

$$v_1 = \delta_1^t(\lambda_1 z + \delta_1^n \alpha_1 (1-y)) \tag{1}$$

$$v_2 = \delta_2^t(1 - z + \delta_2^n \alpha_2 \lambda_2 y) \tag{2}$$

In this model player i's valuation of the second game stage has two dimensions, namely, α_i, the between-cake discount factor, and, λ_i, the relative valuation of the cake size. When cake i is valued equally by the players, then λ_i is equal to 1. This implies that there is at least one player (player i) who has a similar valuation of the two cakes. This is not a limiting restriction, since the relative valuations of the cake, rather than the absolute values, is what matters.

As pointed out in footnote 2, the parameter α_i has two alternative interpretations. First, suppose that after an agreement there is no time lapse and parties are able to start immediately the negotiations over the second cake. However, player i perceives that there is a probability of game breakdown after the first agreement α_i, with $i = 1, 2$. The probability of game continuation represents all the exogenous frictions and difficulties that can impede the bargaining over a new issue. Players may have a different probability of game continuation α_i, not because they have different information, but because they may have different perceptions of the 'rules' of the game in a given situation (Muthoo, 1995a, where the common prior assumption does not hold). Alternatively, we can also think of α_i, as a rescaling factor representing player i's optimism. If we assume that this perception/characteristic is constant and exogenously given, then the framework described in this section can also represent these cases.

2.1 The Equilibrium

The focus is on subgame perfect equilibria (SPE). The second stage is simply the RBM where players may have different valuations of the cake (in general, $\lambda_2 \neq 1$). Then, in spite of the differences in players valuations of the size of cake 2, the equilibrium partition is as in the RBM (player i's demands is $(1-\delta_j)/(1-\delta_i\delta_j)$ with $i, j = 1, 2$ and $i \neq j$). This independence is due to the multiplicative form of the model (the relative importance ratio λ_i multiplied the share obtained), however, it is not problematic, since what matters is the overall payoff and this is dependent on both λ_i's. In the following, the SPE strategies are stated first for the case of a positive interval of time between an acceptance and a new proposal (proposition 1), then for the limit case of Δ which tends to zero (corollary 1).

Proposition 1 *If $\lambda_i > 0$ and $v_i > 0$, with $i = 1, 2$, where v_i is defined in (5) and (6) below, there is a unique SPE in which the agreement is reached immediately over the partition of every single cake. At the first stage the equilibrium demand of player* 1 *(2) is x_1 (y_2, respectively), as defined in (3) and (4) below. At the second stage, parties play the RBM.*

$$x_1 = \frac{(1-\delta_2)[(1-\delta_1\delta_2)\lambda_1 + (1-\delta_1)(\alpha_2\lambda_1\lambda_2(1+\delta_2) - \delta_2\alpha_1(1+\delta_1)]}{\lambda_1(1-\delta_1\delta_2)^2} \tag{3}$$

$$y_2 = \frac{(1-\delta_1)[(1-\delta_1\delta_2)\lambda_1 + (1-\delta_2)(\alpha_1(1+\delta_1) - \alpha_2\lambda_1\lambda_2\delta_1(1+\delta_2)]}{\lambda_1(1-\delta_1\delta_2)^2} \tag{4}$$

The equilibrium payoff to player i is given by v_i for $i = 1, 2$ defined as follows:

$$v_1 = \frac{1-\delta_2}{(1-\delta_1\delta_2)^2}[(1-\delta_1\delta_2)(1+\alpha_2\lambda_2)\lambda_1 + (\delta_1-\delta_2)(\alpha_1-\alpha_2\lambda_1\lambda_2)] \tag{5}$$

$$v_2 = \frac{(1-\delta_1)\delta_2}{(1-\delta_1\delta_2)^2\lambda_1}[(1-\delta_1\delta_2)(\lambda_1+\alpha_1) + (\delta_1-\delta_2)(\alpha_1-\alpha_2\lambda_1\lambda_2)] \tag{6}$$

Proof. The solution is based on the usual indifference conditions between accepting and rejection an offer. The reasoning to show the subgame perfection and the uniqueness is standard (for instance, Osborne and Rubinstein, 1990). ■

Corollary 1 *Under the conditions specified in Proposition 1, in the limit as Δ tends to zero, there is a unique SPE in which the agreement is reached immediately over the partition of every single cake. At the second stage, players demand half of the cake, while in the first stage the SPE demands are defined below,*

$$x_1 = \frac{r_2[(r_1+r_2)\lambda_1 + 2r_1(\alpha_2\lambda_1\lambda_2-\alpha_1)]}{\lambda_1(r_1+r_2)^2} \tag{7}$$

$$y_2 = \frac{r_1[(r_1+r_2)\lambda_1 + 2r_2(\alpha_1-\alpha_2\lambda_1\lambda_2)]}{\lambda_1(r_1+r_2)^2} \tag{8}$$

Then, equilibrium payoffs are,

$$v_1 = \frac{r_2}{(r_1+r_2)^2}[(r_1+r_2)\lambda_1 + (r_2-r_1)\alpha_1 + 2\alpha_2 r_1\lambda_1\lambda_2)] \tag{9}$$

$$v_2 = \frac{r_1}{(r_1+r_2)^2\lambda_1}[(r_1+r_2)\lambda_1 + \alpha_2\lambda_1\lambda_2(r_1-r_2) + 2\alpha_1 r_2] \tag{10}$$

The equilibrium specified above has interesting characteristics. First of all, players' demands in equilibrium are complicated functions of the parameters of the model and typical results obtained in the context of bargaining over a single cake, such as the first mover advantage, ($v_1 > v_2$), may not exist in this game. Moreover, an important feature of the bargaining process is represented by the product $(\alpha_1 - \alpha_2\lambda_1\lambda_2)(\delta_1 - \delta_2)$ (see also corollary 1, with reference to $r_1 - r_2$) which characterised both players' payoff functions in equilibrium, see (5) and (6). If parties have the same within-cake discount factor, $\delta_1 = \delta_2$, which is a common assumption in the literature, the interplay of the forces in the bargaining process is greatly simplified. As a result player i's payoff does not depend on α_i. Moreover, player 2's payoff is also independent of his relative valuation of cake 2 (λ_2). This aspect of the bargaining process will have a strong impact on the agenda formation problem. To see the effects of the common discount factor assumption, let's consider the case in which the product $(\alpha_1 - \alpha_2\lambda_1\lambda_2)(\delta_1 - \delta_2)$ differs from zero - although, the payoffs v_i are positive. In particular, player 1 is the more patient player and he has a higher valuation of the future bargaining, (i.e., $\alpha_1/\lambda_1 > \alpha_2\lambda_2$), then both parties are better off. The intuition is that when the second stage matters to a player, he will make concessions over the first bargaining stage to pass to the second. However, if he is impatient he will make concessions which are too large, since he would like to avoid any rejection. If he is relatively patient then his concessions are not as large and he is better off. On the other hand, a relatively impatient rival, who does not mind about the future, is advantaged by these concessions.

Finally, in general the feasibility conditions, that is, $v_i > 0$ with $i = 1, 2$, specified in (5) and (6), are satisfied. In particular when the factors $(\alpha_1 - \alpha_2\lambda_1\lambda_2)$ and $(\delta_1 - \delta_2)$ have either the same sign or one is null, the feasibility conditions are always satisfied, while when these factors have the opposite sign, in some specific cases restrictions need to be imposed to have positive payoffs v_i, with $i = 1, 2$. For instance, suppose that player 1 is more patient than player 2 ($\delta_1 > \delta_2$), moreover, player 1 considers the future bargaining stage sufficiently more important than his rival (i.e., $\alpha_1/\lambda_1 < \alpha_2\lambda_2$). In this case, player 1's payoff v_1, defined in (5), is positive, while player 2's payoff v_2, defined in (6), is positive only when $a > \delta_2 b$ where $a = \alpha_1 + \lambda_1 - \delta_1(\alpha_2\lambda_1\lambda_2 - \alpha_1)$ and $b = \delta_1(\alpha_1 + \lambda_1) - (\alpha_2\lambda_1\lambda_2 - \alpha_1)$. This inequality is always satisfied regardless of the sign of a and b, except in one case, that is, when both a and b are negative (which exists only if $2\alpha_1 < (\alpha_2\lambda_2 - 1)\lambda_1$). In this particular case, players discount factors need to be sufficiently close, that is, $\delta_1 > \delta_2 > a/b$, to ensure a positive payoffs v_2. In the special cases in which the feasibility conditions are not satisfied, the equilibrium described in Proposition 1 either does not exist (when $v_i < 0$) or is not unique (when $v_i = 0$). There are equilibria characterised by corner solutions (shares x_1 and y_2 such that the overall payoff for a player is zero) and, possibly, delays. Since these equilibria arise for specific values of the parameters of the model, in the following we focus only on interior solutions (share x_1 and y_2, such that the payoffs defined in (5) and (6) are positive).

Before discussing the agenda formation problem, a note on another extreme case. When a player does not care about an issue, the SPE can be inefficient as shown in the following remark.

Remark 2 *If $\lambda_1 = 0$ (and λ_2 is finite), there is an inefficient SPE with a delay. Player 1 induces a rejection at $t = 0$. At $t = 1$, player 2 asks for the entire cake, player 1 accepts this and at the second stage they divide cake 2 as in the RBM.*

Proof. If $\lambda_1 = 0$, player 1 does not mind about the division of the first cake. Moreover, player 1 is indifferent between dividing the first cake immediately or inducing a rejection. A rejection will take place if player 1 asks for a share x_1 larger than

$$(1-\delta_2)(1+\alpha_2\lambda_2(1-\delta_1)(1+\delta_2))/(1-\delta_1\delta_2) \tag{11}$$

However, with or without rejection, player 1 gets the same payoff, $\alpha_1\delta_1(1-\delta_2)/(1-\delta_1\delta_2)$, while player 2 is worse off when there is a rejection,

$$1+\lambda_2\alpha_2\delta_2(1-\delta_1)/(1-\delta_1\delta_2) < \delta_2(1+\lambda_2\alpha_2\delta_2(1-\delta_1)/(1-\delta_1\delta_2)) \tag{12}$$

If the parameter λ_2 is infinite, then no delay can take place, since player 2 accepts any offer at the first round. ■

In conclusion, in our framework, SPE with delay can exist, although they are Pareto dominated. Usually, in bargaining theory, SPE with delay under complete information are regarded as interesting, since they represent inefficiencies even in simple set ups. However, the delay obtained in this framework is mainly a technical result which depends on the specific values that the parameters of the model assume. For this reason, in the following sections we only focus on the SPE without delay.

3 Agenda Formation Problem

In this section first we focus on SPE under agenda 2, that states that cake 2 is shared first. We then define under which conditions players prefer the same agenda. We show that a Pareto optimal agenda exists, however the subtle strategic effects that players need to take into account in forming their preferences over agendas, are often conflicting.

The SPE under agenda 2 is similar to the one defined for agenda 1, in particular, since the order of the cakes is reversed, the shares demanded on the first cake under agenda 2 is as x_1 and y_2 in (3) and (4), where the parameter λ_i is substituted by $1/\lambda_i$ (with $\lambda_i > 0$). Then, the SPE payoffs under agenda 2, u_i with $i = 1, 2$ are as follows:

$$u_1 = \frac{1-\delta_2}{\lambda_2(1-\delta_1\delta_2)^2}[(\lambda_2+\alpha_2)(1-\delta_1\delta_2)+(\alpha_2-\alpha_1\lambda_1\lambda_2)(\delta_2-\delta_1)] \tag{13}$$

$$u_2 = \frac{\delta_2(1-\delta_1)}{(1-\delta_1\delta_2)^2}[\lambda_2(1+\alpha_1\lambda_1)(1-\delta_1\delta_2)+(\alpha_2-\alpha_1\lambda_1\lambda_2)(\delta_2-\delta_1)] \tag{14}$$

As for agenda 1, under the assumption of a common discount factor, the bargaining process is strongly simplified, since the product $(\alpha_2 - \alpha_1\lambda_1\lambda_2)(\delta_2 - \delta_1)$ in the payoff functions (13) and (14) is zero. We allow players to have different discount factors, as long as the feasibility conditions, $u_i > 0$, are satisfied[3].

3.1 The Pareto Optimal Agenda

Whenever the differences in player i's payoffs $v_i - u_i$, with $i = 1, 2$, have the same sign, players prefer the same agenda. More precisely, agenda 1 is preferred by player 1 when (15) below is positive and vice-versa agenda 2 is favoured when (16) below is negative.

$$\frac{(1-\delta_2)}{(1-\delta_1\delta_2)^2\lambda_2}[(\lambda_1\lambda_2^2-1)(1+\delta_2)\alpha_2(1-\delta_1)+\lambda_2(\lambda_1-1)(1-\delta_1\delta_2+\alpha_1(\delta_2-\delta_1))] \quad (15)$$

Similarly, agenda 1 (2) is preferred by player 2 when (16) below is positive (negative, respectively):

$$\frac{\delta_2(1-\delta_1)}{(1-\delta_1\delta_2)^2\lambda_1}[(1-\lambda_1^2\lambda_2)(1+\delta_1)\alpha_1(1-\delta_2)+\lambda_1(1-\lambda_2)(1-\delta_1\delta_2+\alpha_2(\delta_1-\delta_2))] \quad (16)$$

The main results are presented in the following propositions. In Proposition 3, we consider a common case in the literature, that is, players have exactly the same valuations of the issues. Differently from this literature, we derive a new result. That is, a Pareto optimal agenda exists. This is then generalised in proposition 4.

[3] In general the feasibility conditions will be satisfied without any restrictions on players discount factors. For a discussion see section 2.1 above.

Proposition 3 *If players have exactly the same valuation of the issues and one issue is the most important (i.e., $\lambda_1 = 1/\lambda_2 \neq 1$), then they prefer to discuss such an issue first.*

Proof. If $\lambda_1 = 1/\lambda_2$, then (15), respectively (16), can be written as follows:

$$\frac{(1-\delta_2)(1-\lambda_2)[(1-\alpha_2)(1-\delta_1\delta_2)+(\alpha_1-\alpha_2)(\delta_2-\delta_1)]}{(1-\delta_1\delta_2)^2\lambda_2} \tag{17}$$

$$\frac{\delta_2(1-\delta_1)(\lambda_1-1)[(1-\alpha_1)(1-\delta_1\delta_2)+(\alpha_1-\alpha_2)(\delta_2-\delta_1)]}{(1-\delta_1\delta_2)^2\lambda_1} \tag{18}$$

When there is consensus over the importance of the issues (for instance, cake 1 represents the most important issue, $\lambda_1 = 1/\lambda_2 > 1$), the expressions (17) and (18) have the same sign (in this example, positive). Note that if either there are no frictions after an acceptance (i.e., $\alpha_i = 1$ for any i) or all the frictions are represented by a common discount factor ($\delta_i = \alpha_j = \delta$ for $i, j = 1, 2$) which vanishes ($\delta \to 1$), players are indifferent between agendas. ■

Proposition 3 establishes an intuitive result on the efficiency of sequential procedures. When there is an important issue, this should be discussed first. However, this result is new in the literature which uses game theoretical models similar to ours (for instance, Busch and Horstmann, 1997, 1999, and Inderst, 2000)[4]. An important feature of your model is that players have not only a within-cake but also a between-cake discount factor. In other words, as soon as a proposal is accepted, players cannot start

[4]Only Winter (1997) finds a similar result, but the framework is completely different (fundamentals are preferences and these are required to be semi-lexicographic, moreover there is no timing).

bargaining immediately, but only after some time. Often it is assumed that either there is no interval of time between an acceptance and a new proposal ($\alpha_i = 1$), or the interval of time has the same length as the interval of time between a rejection and a new proposal ($\delta_i = \alpha_j = \delta$ for $i, j = 1, 2$) and since the frictions vanish ($\delta \to 1$), this interval tends to zero (see, Busch and Horstmann, 1997, 1999, and Inderst, 2000). It is straightforward to show that in this case Proposition 3 cannot be established (see proof of Proposition 3). In particular, players are indifferent between procedures. However, it is reasonable to assume that in general during negotiations the interval of time between a rejection and a new proposal (Δ) is different from the interval of time between an acceptance and a new proposal (τ) and as Muthoo (1995b) pointed out, the former is often smaller than the latter ($\Delta < \tau$).

The result shown in Proposition 3 is now extended to the case of players with different valuations of the issues. In this case, the length of the interval of time between an acceptance and a new proposal plays a more explicit role as shown in the following proposition.

Proposition 4 *If there is an important issue and the α_i of one player is sufficiently small, then it is Pareto optimal to discuss the most important issue first.*

Proof. Given the result in Proposition 3, we focus on the case in which players do not have exactly the same valuations of the issues ($\lambda_1 \neq 1/\lambda_2$), although both prefer the same cake, say 1 (i.e., $\lambda_1 > 1$ and $\lambda_2 < 1$). With a similar reasoning, it can be shown that players prefer to postpone the negotiations over cake 1, if this represents the less important issue. The first terms in squared bracket in (15) and (16) cannot be both positive simultaneously (for instance, if $\lambda_1\lambda_2^2 > 1$, then $\lambda_1^2\lambda_2 > 1$). However, they can be either both negative or one term is negative while the other is positive (we omit the proof for the cases of a null term, since this is straightforward). Suppose that one term is negative while the other is positive, in particular, $\lambda_1 > 1/\lambda_2^2 > 1$, then if $\alpha_1 < \underline{\alpha_1} = \frac{(1-\lambda_2)\lambda_1(1-\delta_1\delta_2+\alpha_2(\delta_1-\delta_2))}{(\lambda_1^2\lambda_2-1)(1+\delta_1)(1-\delta_2)}$, agenda 1 is Pareto optimal. Alternatively, if $\lambda_1^2\lambda_2 < 1$ (which implies $\lambda_1\lambda_2^2 < 1$), then agenda 1 is Pareto optimal for $\alpha_2 < \underline{\alpha_2} = \frac{(\lambda_1-1)\lambda_2(1-\delta_1\delta_2+\alpha_1(\delta_2-\delta_1))}{(1-\lambda_1\lambda_2^2)(1+\delta_2)(1-\delta_1)}$. Finally, we show that if both first terms in (15) and (16) are negative, in other words, both players strongly prefer cake 1 (that is, λ_1 is sufficiently larger than 1 while λ_2 is sufficiently smaller so that $\lambda_1^2\lambda_2 > 1$ but $\lambda_1\lambda_2^2 < 1$), only one player's between-cake discount factors is required to be sufficiently small. To show this, we focus on (15) first. For any value of α_1 in [0,1], expression (15) is positive if α_2 is close to zero (since λ_1 is larger than 1). Moreover, expression (15) is decreasing in α_2 (since $\lambda_1\lambda_2^2 < 1$). This implies that for α_2 sufficiently large, (15) is negative (although this may requires a value of α_2 larger than 1). The same reasoning holds for (16) with α_i replaced with α_j with $i, j = 1, 2$ and $i \neq j$. Then, to conclude the proof we need to show that when both α_1 and α_2 are large, (15) and (16) cannot be both negative. Since these expressions are both monotonic, let both α_i be equal to 1, with $i = 1, 2$. In this case, (15) and

(16), respectively, can be written as follows.

$$\frac{(1-\delta_2)(1+\delta_1)(1+\lambda_1)(1-\lambda_1\lambda_2)}{(1-\delta_1\delta_2)^2\lambda_2} \tag{19}$$

$$\frac{(1-\delta_1)(1+\delta_2)(1+\lambda_2)(\lambda_1\lambda_2-1)}{(1-\delta_1\delta_2)^2\lambda_2} \tag{20}$$

These expressions never have the same sign when there is an important issue ($\lambda_i \neq 1$ for any i), since $\lambda_1 \neq 1/\lambda_2$ (for the case of $\lambda_1 = 1/\lambda_2$, see Proposition 3). This implies that only one constraint $\alpha_i < \underline{\alpha_i}$ has to be binding to obtain consensus over the importance of the agendas. Moreover, players never agree in postponing an important issue (if $\alpha_i > \underline{\alpha_i}$ player have different preferences over agendas). ■

Since the constraint over the parameter α_i stated in Proposition 4 depends on the parameters λ_i, with $i = 1, 2$, agreement over agendas can also take place when the between-cake discount factor α_i is large, although it has to be smaller than 1 for a player. This implies that to establish consensus over the best agenda, a player is required to focus only on the first stage. What characterises such a player is a high valuation of an issue (see proof above). To understand this result, we need to recall the strategic effect represented by a positive product $(\alpha_1 - \alpha_2\lambda_1\lambda_2)(\delta_1 - \delta_2)$ in players' equilibrium payoffs. In particular, large concessions are made over the division of an initial cake, when the future matters (if $\alpha_1/\lambda_1 > \alpha_2\lambda_2$ with $\delta_1 > \delta_2$, then player 1 makes large concessions over the division of cake 1 under agenda 1). Then, the responder (in this case player 2) may prefer to postpone the important issue if this implies large concessions from his opponent. That is why the player who minds relatively more about an initial issue is required to have a small between-cake discount factor. This result can be shown in a more transparent manner by focusing on the limit case of Δ which tends to zero, that is, the interval between an acceptance and a new proposal vanishes.

Corollary 2 *In the limit, as $\Delta \to 0$, if there is consensus over the importance of the issues and the α_i of one player is sufficiently small, then it is Pareto optimal to discuss the most important issue first.*

Proof. Since when $\Delta \to 0$, $\exp(-r_i\Delta)$ can be approximated by $1 - r_i\Delta$, at the limit (15) and respectively (16) can be written as follows:

$$\frac{r_2}{(r_1+r_2)^2\lambda_2}[2\alpha_2 r_1(\lambda_1\lambda_2^2 - 1) + \lambda_2(\lambda_1 - 1)(r_1 + r_2 + \alpha_1(r_1 - r_2))] \tag{21}$$

$$\frac{r_1}{(r_1+r_2)^2\lambda_1}[2\alpha_1 r_2(1 - \lambda_1^2\lambda_2) + \lambda_1(1 - \lambda_2)(r_1 + r_2 + \alpha_2(r_2 - r_1))] \tag{22}$$

Then, the proof follows the same reasoning as in the Proposition 4. ■

In this case, when player 1 minds very much about cake 1 (i.e., $\lambda_1 > 1/\lambda_2^2 > 1$), he is required to have a relatively low between-cake discount factor (otherwise, player 2 prefers agenda 2, i.e., (22) is negative). Finally, by using the limit case of Δ that tends to zero (see (21) and (22)), it is straightforward to show that when players do not agree over the importance of the issue, they have opposite preferences over agendas. Differently from Fershtman (1990), where the agenda plays no role for players infinitely patient, in our framework Proposition 4 still holds.

The remaining part of this section highlights some strategic effects that arise in the agenda formation framework. In particular, we show that players need to take into account many incentives in choosing the best agenda and these can be in conflict. This makes the existence of a Pareto optimal agenda of particular interest. Firstly, when players have the same valuation of the cakes size, $\lambda_1 = \lambda_2 = 1$, they are indifferent between the two agendas, however, when only one player considers the issues equally important, he prefers the agenda that puts the issue most important to his rival at the bottom of the list. The reason is that the rival will concede a higher share on the first cake to pass to negotiations over the second one. As expected, the rival prefers the agenda that puts his most important issue first so that fewer concessions are made. Players' disagreement over the best agenda is even stronger, when they have opposite valuation of the cakes' size, $\lambda_1 = \lambda_2 \neq 1$.

Moreover, a player prefers to discuss his more important issue also because the between-cake discount factor decreases the utility obtained by the division of the second cake. For the purpose of the argument, let's assume that the between-cake discount factor is a rescaling factor which represents players' optimism. Then, even though a player, say 1, becomes infinitely patient ($\delta_1 \rightarrow 1$) his optimism can be assumed to be strictly smaller than 1. In this case, player 1 is the only one to rank agendas, while his rival is indifferent. Player 1 prefers to discuss his more important issue first (he prefers agenda 1 if and only if $\lambda_1 > 1$ and agenda 2 if and only if $\lambda_1 < 1$). The reason is that player 1 always gets the whole cake, however since the optimism makes the cake discussed second smaller, he prefers to put his more important issue at the top of the list, while his rival is indifferent between agendas, since he always gets zero.

Finally, the expression (16) can be positive even when $\lambda_2 > 1$. That is, λ_1 is sufficiently small. In this case, player 2 prefers agenda 1 even though his more important issue is represented by cake 2. The reason is that he enjoys not only the concessions made by player 1 at the first stage but also a first mover advantage at the second stage.

In conclusion, in this section three main strategic effects have been pointed out: one is a player's incentive to discuss the more important issue first; another is the preference to be a first mover over the most important cake; finally, there is an incentive to postpone bargaining over the rival's more important issue. These incentives can be in conflict in determining players' preferences over agendas, however, as shown in Proposition 3, 4, and Corollary 2, the best agenda can be established. This is in contrast to otherwise similar frameworks adopted in the literature, which do not distinguish between different discount factors.

3.2 Agenda Pre-Games

Since in our framework a Pareto optimal agenda can exists, the problem of selecting an agenda is not crucial in the sense that players will select the best agenda when this exists. The agenda selection problem is more relevant when players have different preferences over agendas (for instance due to different valuations of the importance of the issues). In this section, we solve the agenda selection problem by means of a pre-game, that is a procedure which precedes the two-stage bargaining model, in which players choose an agenda, then they will bargain according to the agenda selected. Given the structure of the model, a solution of a pre-game allows us to highlight different features of the following bargaining game. We consider two pre-games the first one is one-shot, (in its 'soft' and 'tough' version), while the final one is an infinitely repeated game.

In the first pre-game, called soft, players are assumed to choose simultaneously an agenda. If the same agenda is chosen, then the bargaining game takes place under this agenda, if not, players toss a coin (not necessarily fair), and with probability $0 < p < 1$ (respectively $1 - p$) agenda 1 (2) is selected. Then, the Nash equilibrium (NE) of this game depends strongly on the analysis of the best agenda, presented in section 3.1, as it is based on the sign of the differences $v_1 - u_1$ and $v_2 - u_2$. In particular, if there is a Pareto superior agenda, players choose it in equilibrium. However, if there is not (for instance because there is no consensus over the importance of the issues) then players have different dominant strategies and in the unique NE they choose different agendas. In other words, the best players can do is to state their best agenda and toss a coin, regardless of whether it is fair or not, as long as p is different from 0 and 1 (so as to avoid multiple SPE).

The soft one-shot game can be solved by the analysis of the Pareto optimal agenda. However, if players are assumed to get zero payoffs when they do not choose the same agendas (tough version), the game is strongly modified. In this case, there are two NE in pure strategies, as long as the payoffs v_i and u_i are positive. Either agenda 1 or agenda 2 is selected. Moreover, there is a unique NE in mixed strategies. Players' NE randomisation is of interest in highlighting some characteristics of the following bargaining process. When players have the same discount factor δ, their equilibrium randomisation strategies is independent of δ, even though players' payoffs under the two agendas depend on δ. This is due to an equilibrium consideration: players are made indifferent among agendas, in an SPE in mixed strategies. Moreover, (with $\delta_i = \delta$) if player 1 becomes more optimistic, α_1 increases, player 2's payoffs increases in both agendas. However, the increase in agenda 2 is higher, player 1 will make larger concessions, if λ_1 is larger than 1. Then, the probability player 1 attaches to agenda 1 in equilibrium increases if cake 1 represents his most important issue ($\lambda_1 > 1$).

The final pre-game we consider is an alternating-offer bargaining model à la Rubinstein, in which players sequentially propose a probability to play an agenda. Once players have agreed over such a probability, an agenda is selected with the accepted probability and the two-stage bargaining game will start under the chosen agenda. This is similar to Busch and Horstmann (1999)'s game in which players bargain over probabilities attached to different bargaining procedures instead of agendas. As Busch and Horstmann (1999) pointed out, this game represents bargaining over types of arbitrator who will regulate the players' agenda. Each type of arbitrator is characterised by a probability of setting an agenda. Once the type is chosen, this arbitrator will define the agenda according to the probability which characterised him (for instance, in some countries the owners of the flats in a building need to agree on whom will be the administrator, that is an individual or society which will regulate the meeting among the owners over the issues regarding the maintenance of the building).

The infinitely repeated game is a deep modification of the pre-game structure, however, obviously, it still reflects some of the characteristics of the subsequent subgame. For instance, in the case of complete symmetry (i.e., $\delta_i = \delta$, $\alpha_i = \alpha$, $\lambda_i = \lambda \neq 1$ for $i = 1, 2$), if the interval between a rejection and a new proposal, Δ, goes to zero, an agenda is selected with probability $\frac{1}{2}$ in the unique SPE. The intuition is that players prefer different agendas but each of them can obtain an acceptance only by proposing to toss a fair coin. When cake 1 is infinitely more important to player 1, $\lambda_1 \to \infty$ (or alternatively, $\lambda_2 \to \infty$), the equilibrium probabilities are equal to the Rubinsteinian shares $(1/(1+\delta), \delta/(1+\delta))$. Player 1 prefers agenda 1, but he cannot do anything better than attaching the maximum probability to agenda 1 so that player 2 accepts it, while player 2, who prefers agenda 2, proposes the minimum probability of playing under agenda 1, so that his opponent accepts it.

In conclusion, in this section the agenda selection problem has been solved by means of pre-games. The one-shot game in its soft version is strictly related to the Pareto optimal agenda, while its tough version can be complementary to the analysis of the comparative statics. Finally, the game à la Rubinstein is interesting to describe players' ability to set the agenda they prefer most. In the following, we consider a possible modification of the bargaining game to include the possibility of difficult issues.

4 How to Deal with a Difficult or Urgent Issue

In this section we assume that one issue is *difficult* in the sense that a rejection of a proposal regarding this issue may lead to the negotiations breaking down. For instance, in a peace process there can be an issue characterised by this feature, similarly, in the bargaining between a buyer and a seller there can be a difficult item. In these cases how should the agenda be set?

To investigate this case we modify the model described in section 2 in two ways. First, we assume that there is no time lapse between bargaining stages ($\tau = 0$), this is a simplifying assumption (the result below can be re-established when τ is positive).

Second, the parameter α now represents the probability of game continuation after a rejection of a proposal regarding the difficult issue, say cake 1. In other words after a rejection of a proposal regarding the division of cake 1, not only does the discount factor δ_i apply but also the probability of game continuation α, while after a rejection regarding the proposal of cake 2, only the discount factor δ_i applies. This does not imply that cake 1 also represents the most important issue. The importance of an issue still depends on the parameters λ_i with $i = 1, 2$ as in the model described in section 2. When there is a rejection in the bargaining stage related to the division of cake 1, it is as if players are characterised by a smaller discount factor, $\delta_i\alpha$ (rather than δ_i). In other words, cake 1 represents an *urgent* issue in the sense that the bargaining round related to the division of cake 1 is longer than the bargaining round in which players attempt to divide cake 2. Bearing in mind this double interpretation, we derive the Pareto optimal agenda in the presence of a difficult/urgent issue.

4.1 The Equilibrium Payoffs and the Optimal Agenda

Under agenda 1, in the second stage players play the Rubinsteinian game as in section 2, then the equilibrium demand (x_1, y_2) at the first stage are given by the usual indifference conditions between accepting and rejecting an offer,

$$\begin{cases} \lambda_1(1-y_2)+\frac{1-\delta_2}{1-\delta_1\delta_2} = \alpha\delta_1(x_1\lambda_1+\frac{(1-\delta_2)\delta_1}{1-\delta_1\delta_2}) \\ 1-x_1+\lambda_2\frac{1-\delta_1}{1-\delta_1\delta_2} = \alpha\delta_2(y_2+\lambda_2\frac{(1-\delta_1)\delta_2}{1-\delta_1\delta_2}) \end{cases} \tag{23}$$

Therefore, the equilibrium payoffs to player i is indicated by v_i with $i = 1, 2$, as follows,

$$v_1 = \frac{\alpha\delta_2(\lambda_1\lambda_2(1-\delta_1)(1-\alpha\delta_2^2)+\lambda_1(1-\delta_1\delta_2)(1-\alpha\delta_2)+(1-\delta_2)(\delta_1-\alpha\delta_2))}{(1-\delta_1\delta_2)(1-\alpha^2\delta_1\delta_2)} \tag{24}$$

$$v_2 = \frac{\lambda_1\lambda_2(1-\delta_1)(\delta_2-\alpha\delta_1)+\lambda_1(1-\delta_1\delta_2)(1-\alpha\delta_1)+(1-\delta_2)(1-\alpha\delta_1^2)}{\lambda_1(1-\delta_1\delta_2)(1-\alpha^2\delta_1\delta_2)} \tag{25}$$

Under agenda 2, where the agreement on cake 1 is represented by the Rubinsteinian solution with discount factor $\alpha\delta_i$, the SPE equilibrium payoffs can be derived in the same manner. Then, the equilibrium payoff to player i is u_i, described below for $i = 1$ and 2 respectively,

$$\frac{\lambda_1\lambda_2(1-\alpha\delta_2)(\alpha\delta_1-\delta_2)+\lambda_2(1-\alpha^2\delta_1\delta_2)(1-\delta_2)+(1-\alpha\delta_1)(1-\alpha\delta_2^2))}{\lambda_2(1-\delta_1\delta_2)(1-\alpha^2\delta_1\delta_2)} \tag{26}$$

$$\delta_2\frac{\lambda_1\lambda_2(1-\alpha\delta_2)(1-\alpha\delta_1^2)+\lambda_2(1-\alpha^2\delta_1\delta_2)(1-\delta_1)+\delta_1(1-\alpha\delta_1)+\alpha\delta_2(1-\alpha\delta_2)}{(1-\delta_1\delta_2)(1-\alpha^2\delta_1\delta_2)} \tag{27}$$

To derive the Pareto optimal agenda we study the sign of the differences in players' payoffs under the two agendas $v_i - u_i$, with $i = 1, 2$. Since in general these differences are complicated functions of the parameters in the model, α, δ_i and λ_i with $i = 1, 2$, we consider two simplifying cases. The first is the symmetry case, where players have the same parameters, which implies that they have opposite preferences over issues, unless $\lambda = 1$. In the second case, we assume that $\delta_i = \alpha = a$, for any i, but there is agreement over the importance of the issues. The following two propositions summarise the results. The proofs are in the appendix.

Proposition 5 *When there is symmetry (i.e., $\delta_i = \delta$, $\lambda_i = \lambda$ with $i = 1, 2$), there exists an interval for λ, $[\lambda_{r2}, \lambda_{r1}]$, with λ_{ri} in $(0, 1)$, for $i = 1, 2$, where both players prefer to discuss the more difficult/urgent issue second. When λ does not belong to $[\lambda_{r2}, \lambda_{r1}]$, players do not agree over agendas.*

In general, players have different preferences over agendas. However, when the more difficult issue is the more important to player 2, both players prefer to postpone it - although only for a subinterval of $\lambda \in (0, 1)$. It is intuitive that player 1 prefers agenda 2, since it puts his more important issue first, and the more urgent but also less important second. Then, player 1 can ensure an agreement over his more important issue, since his rival will be reluctant to reject a proposal. Why does player 2 prefer to postpone his more important and urgent issue? One reason can be that player 2 can ensure a first mover advantage over his relevant issue. However, as we show below, the driving force is that player 2 is better off in conceding over his important issue, to enjoy the division of the easy issue first. To see this more clearly, let's assume that there is consensus over the importance of the issues.

Proposition 6 *When $\delta_i = \alpha = a$, for any i and there is consensus over the importance of the issue, the Pareto optimal agenda is the one in which the easy (or less urgent issue) is discussed first.*

Then, in general, players do not have the same preferences over agendas. However, when they do, they prefer to postpone the discussion of the difficult issue. This is intuitive when the more difficult issue is also the less important. In this case players prefer to enjoy the agreement over the important and easy issue first. However, players prefer to postpone a difficult/urgent issue also when it is the most important, as any rejection of the proposals regarding this issue are so costly that any further bargaining may be precluded. This is consistent with the fact that in firm-union negotiations, the level of employment is discussed first, since it is considered 'less difficult' than other issues.

5 Conclusions

In many bargaining situations the only available procedure is sequential (e.g., negotiations between a buyer and seller discussions in a departmental meeting, and so on). To define how parties should select agendas, we investigated a two-person alternating-offer model, where players differ in terms of their time preferences and valuations of the issues. In this model, the parameters interact in a complex way (the common assumption of players with the same discount factor strongly simplifies the interplay of the forces in the bargaining model). We identified three basic incentives affecting players preferences over agendas. A player prefers (1) to put his rival's more important issue at the bottom of the list, (2) to discuss his more important issue first and (3) to be the first mover in bargaining over his important issue. These incentives can conflict. However, if there is consensus over the importance of the issues, we showed that players prefer the agenda that puts the most important issue first. When players have different preferences over agendas, we solved the agenda selection problem by means of pre-games. The two pre-games considered highlight different characteristics of the following bargaining game, since the solution of each pre-game depends on which strategic effects are dominant in the subsequent bargaining game. Moreover, we showed that when there is an urgent/difficult issue, in the sense that a rejection of a proposal regarding this issue can compromise the negotiation process, it is Pareto optimal to postpone such an issue. These are new findings in the agenda formation problem from a game theoretical perspective.

Appendix

Proof of Proposition 5. From (24), (25), (26) and (27), we can derive $v_i - u_i$ under symmetry. These differences are as follows,

$$v_1 - u_1 = q[\lambda^2(1-\delta)(1-\alpha\delta^2) + (1-\alpha)\lambda\delta(2-\delta(1+\alpha)) - (1-\alpha\delta)(1-\alpha\delta^2)] \quad (28)$$

$$v_2 - u_2 = -\delta q[\lambda^2(1-\alpha\delta) + \alpha\delta^2(1-\delta) + (1-\alpha)\lambda\delta(2\alpha\delta^2-(1+\alpha)) - \alpha(1-\delta)(1-\alpha\delta^2)] \quad (29)$$

$$\text{where } q = \frac{(1+\lambda)}{\lambda(1-\delta^2)(1-\alpha^2\delta^2)}$$

The difference $v_1 - u_1$ in (28) is an increasing function of λ, while $v_2 - u_2$ in (29) is a decreasing function of λ. Since the unique positive root of the equation $v_1 - u_1 = 0$ (named, λ_{r1}, see (30) below) is larger than the unique positive root of the equation $v_2 - u_2 = 0$ (λ_{r2}) and both vary between $0, 1$ in the space α δ in $(0,1)^2$, then the differences $v_1 - u_1$ and $v_2 - u_2$ have the same sign only when λ belong to $[\lambda_{r2}, \lambda_{r1}]$, moreover the sign of these difference is negative.

$$\lambda_{r1} = \frac{\delta(1-\alpha)(1-\delta+1-\alpha)+\sqrt{\Delta_1}}{2(1-\delta)(1-\alpha\delta^2)} \quad (30)$$

$$\lambda_{r2} = \frac{\delta(1-\alpha)(1+\alpha-2\alpha\delta)+\sqrt{\Delta_2}}{2(1-\alpha\delta)(1-\alpha\delta^2)} \quad (31)$$

where

$$\Delta_1 = \alpha^4\delta^4 - 4\alpha^3\delta^3 - 6\alpha^2\delta^4 + 12\alpha^2\delta^3 + 4\alpha^2\delta^2 + \delta^4 - 4\delta + \tag{32}$$
$$-4\delta(1-\delta)(\delta+3\alpha) + 4(1-\alpha\delta)(1-\delta^5\alpha^2) - 4\alpha^3\delta^5$$

and

$$\Delta_2 = \delta^2 - 4\alpha^4\delta^3(1-\delta)(1+\delta^2) + 12\alpha^2\delta^3(1+\alpha\delta) + \alpha^4\delta^2 - 6\alpha^2\delta^2 + \tag{33}$$
$$12\alpha^3\delta^3 - 4\alpha\delta^3(1-\alpha\delta) + 4\alpha(1-\delta) - 4\alpha^3\delta^5 - 4\alpha^2\delta.$$

Proof of Proposition 6. By using (24), (25), (26) and (27), the differences $v_i - u_i$ for $i = 1, 2$ when $\delta_i = \alpha = a$ are as follows.

$$v_1 - u_1 = -g_1[\lambda_2(1+\lambda_1) - \lambda_2^2\lambda_1(1+a) + 2a(1+a(1-\lambda_1\lambda_2) + \tag{34}$$
$$-a\lambda_1\lambda_2(3+a\lambda_2) + a^2\lambda_2(1+a) + 1 + a^3]$$

$$v_2 - u_2 = -ag_2\{\lambda_1\lambda_2(1+\lambda_1) + a[-(1+a) - a^2(1+\lambda_1) + \tag{35}$$
$$+\lambda_1\{a^2\lambda_2(1+\lambda_1) + 2a\lambda_1\lambda_2 - 3a - 2 + \lambda_2\}]\}$$

$$\text{where } g_i = [\lambda_j(a+1)^2(1+\alpha^2)]^{-1} \text{with } i, j = 1, 2 \text{ and } i \neq j. \tag{36}$$

These both have a negative sign, that is players prefer agenda 2, if λ_2 belongs to [0,

$\lambda_2^*]$ and $\lambda_1$belongs to $[1, \lambda_1^*]$, where

$$\lambda_2^* = \frac{a^3 - a^2 - 3a + \sqrt{7a^4 + 2a^5 + 26a^3 + 29a^2 + 12a + 4}}{2(a^2 + a + 1)} \tag{37}$$

$$\lambda_1^* = \frac{1 + \lambda_2 + 2a + a^2\lambda_2 + 2a^2 + a^3 + a^3\lambda_2}{\lambda_2(1 + \lambda_2 + 3a + a\lambda_2 + 2a^2 + a^2\lambda_2)} > 1 \text{ if } \lambda_2 < \lambda_2^*. \tag{38}$$

References

Busch, L.A. and Horstmann, I.J. (1997): Bargaining Frictions, Bargaining Procedures and Implied Costs in Multi-issue Bargaining, Economica 64, 669-80.

Busch, L.A. and Horstmann, I.J. (1999): Endogenous Incomplete Contracts: A Bargaining Approach, Canadian Journal of Economics 32, 956-75.

Fershtman, C. (1990): The Importance of the Agenda in Bargaining, Games and Economic Behavior 2, 224-238.

Herrero, C. (1989): Single-Package versus Issue-by-Issue Bargaining. Mimeo.

Inderst, R. (2000): Multi-issue Bargaining with Endogenous Agenda, Games and Economic Behavior 30, 64-82.

Lang, K. and Rosenthal, R.W. (2001): Bargaining Piecemeal or All at Once?, Economic Journal 111, 526-40.

Muthoo, A. (1995a): A Bargaining Model with Players' Perceptions on the Retractability of Offers, Theory and Decision 38, 85-98.

Muthoo, A. (1995b): Bargaining in a Long Run Relationship with Endogenous Termination, Journal of Economic Theory 66, 590-98.

Muthoo, A. (1999): Bargaining Theory with Applications. Cambridge University Press, Cambridge.

Osborne, M. J. and Rubinstein, A. (1990): Bargaining and Markets, Academic Press, San Diego, California.

Ray, D. and Vohra, R. (1997): Equilibrium Binding Agreements, Journal of Economic Theory 73, 30-78.

Rubinstein, A. (1982): Perfect Equilibrium in a Bargaining Game, Econometrica 50, 97-109.

Weinberger, C. J. (2000): Selective Acceptance and Inefficiency in Two-Issue Complete Information Bargaining Game, Games and Economic Behavior 31, 262-293.

Winter, E. (1997): Negotiation Analysis in Multi-issue Committee, Journal of Public Economic 65, 323-342