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Bargaining with Non-Monolithic Players

Summary

This paper analyses strategic bargaining in negotiations between non-monolithic players, i.e. agents starting negotiations can split up in smaller entities during the bargaining process. We show that the possibility of scission in the informed coalition implies that it loses its information advantages. We also show that when the possibility of a scission exists the uninformed player does not focus on his or her beliefs about the strength of the informed coalition but on the proportion of weak/strong players within this coalition. Finally, our results show that the possibility of a scission reduces the incentives for the leader to propose a high offer to ensure a global agreement. We apply this framework to international negotiations on global public goods and to wage negotiations.

Keywords: Strategic bargaining, Non-monolithic players, Scission, Noncooperative game-theory

JEL Classification: C72, D74, Q28

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1. Introduction

We are interested in the impact on negotiations of the fact that one of the players is not monolithic. Using Lax and Sebenius‘s (1992) terminology, we are interested in multiparty or multilateral bargaining and more precisely in what they call party arithmetic (adding or subtracting parties). As Lax and Sebenius pointed out over a decade ago, most of the work on bargaining within the strategic framework started by Rubinstein’s (1982) seminal paper has been done assuming bilateral bargaining between two monolithic players. Nevertheless, there are a number of relevant bargaining situations where this assumption is not pertinent.

International negotiations on trade tariffs, on agricultural subsidies in the Northern countries, or on climate change mitigation generally take place between coalitions of countries. Standard coalitions in these negotiations are the countries of the European Union, which have, however, kept their autonomy at the international arena, or the G77 and China, a highly heterogeneous coalition regrouping large developing countries (China, India or Brazil), rich oil producers (Saudi Arabia) and extremely poor countries (the Least Developed Countries). In recent negotiations between the United States and its allies (mainly the European Union) on the terms and conditions of a military intervention in Iraq, the weakness of the coalition formed by the European Union has been evident once more. Negotiations started between the United States and the European Union, but once the possibility to split up the coalition was clear, the United States did not any more focus on the demands of the coalition as a whole, but on the demands of a particular sub-coalition, the one formed by the countries meeting at the Azores (United Kingdom, Spain, Portugal and Poland). However, not always apparently weak coalitions split-up. In the long negotiations on climate change, G77 and China have essentially managed to talk with a single voice during all the negotiation process[2], and this in spite of the very different impacts that climate change, or an agreement to fight climate change, could have on their economies. As stated above, G77 and China regroups oil producers which would be harmed by any climate agreement (Saudi Arabia), large developing countries whose main interest is not to be constraint in their urgently needed development (China and India), but also small islands (AOSIS) or extremely poor countries (The Least Developed Countries) which are the most vulnerable to climate change (Caparrós *et al.*, 2004).

The importance of not negotiating between monolithic parties is also obvious in negotiations between an entrepreneur and the trade union representing his or her employees.

[2] With some exceptions, as in the first meeting in Argentina.

Lax and Sebenius (1992) illustrate their point by recalling negotiations between the National Football League (NFL) and its Player's Association (the NFLPA) over a contract in 1981. The NFLA was a coalition made up of a few "stars" and numerous "journeymen". Although all players benefited, to some extend, by a union that could create a unified front with respect to the league, different contracts could confer relative advantage to stars or to journeymen. When the NFL's original proposal failed and a strike began, it floated an offer for limited free agency that suited the stars. When some of the stars began crossing the picket line, the union's resolve appeared to weaken. As Lax and Sebenius pointed out, "analyzing this situation as if it were two monolithic parties would overlook crucial coalitional dynamics".

During the nineties multilateral coalitional bargaining, within the strategic framework, has been an important research issue. However, the models developed focus mainly on coalition formation, without externalities (Chaterjee *et al*., 1993; Perry and Reny, 1994) and with externalities (Bloch, 1996; Ray and Vohra, 1999). The issue typically modeled is the formation of a coalition where one party proposes a coalition structure and other parties accept it or propose an alternative coalitional structure. Nevertheless, these models do not explicitly address the particularities of a negotiation between two (or more) non-monolithically parties over a particular issue: a money transfer from the North to the South as development aid, a technology transfer to fight climate change, the conditions of a military intervention in Iraq or simply a salary to be paid by the entrepreneur to his workers. In addition, the models quoted above assume that the coalitions are formed having in mind the problem under consideration. However, in many real life situations the coalitions that start negotiating are formed in a pre-game phase, so that the question is if they will negotiate as a monolithic coalition or if they will split up. Using the examples above, the European Union was not formed having in mind the military intervention in Iraq, the G77 and China was not created to deal with climate change and the NFLPA was also not created to negotiate the 1981 contract.

Manzini and Mariotti (2005) analyze, as we do, negotiations that do not occur between individuals but among groups (they use companies, trade unions or political parties as examples). However, they analyze the impact on the negotiations outcome of different voting rules (unanimity or majority) and do not explicitly analyze the impact of a potential scission. Although Manzini and Mariotti refer to alliances, their paper assumes, as ours, a bargaining framework à la Rubinstein and differs therefore from standard literature on alliances (see Sandler and Hartley (2001) for a survey of the economics of alliances and Garfinkel (2004) for a recent development that does not assume that "peace" prevails within the alliance).

To analyze this kind of negotiation we develop a simple dynamic bargaining model where one monolithic party negotiates with a non-monolithic party that has private information. We assume that the uninformed party has a leader role in the negotiations. Thus, he, she or it (he from now on) moves first and proposes an offer which is accepted or not, and in case of refusal, proposes a new offer. This model is well suited to analyze negotiations between the United Stated and the European Union described above (where the United States play a leader role but do not know exactly the minimum demands of the European Union) and also to model negotiations between an entrepreneur and his workers (the NFL has an obvious leader role but it does not know the minimum requirements of its players). Finally, it can also shed some light on the issue of negotiations between the industrialized countries and G77 and China, as long as we assume that the industrialized countries are a monolithic party[3].

Our results show that the possibility of a scission[4] increase the chances to obtain an agreement while it reduces the chances to obtain an agreement based on a significant amount of transfers from the leader to the informed party. We also show that the possibility of scission implicitly implies that the informed party looses the advantages that it had from its private information. Thus, the informed party may benefit if it can commit before the game starts to preclude any kind of scission, since banning the possibility of a scission leads to 'more aggressive' negotiation tactics. This result is, to some extent, similar to the result obtained in Manzini and Mariotti (2005) that the unanimity rule favors more aggressive negotiation tactics.

Finally, we show that while in a static game the leader still "sees" the original coalition, in the dynamic game his beliefs about the original coalition disappear completely from the expression that shapes his offers. That is, in a static game, even with the possibility of a scission, the leader offers an amount or another taking into account his beliefs about the strength or the weakness of the non-monolithic coalition that he is facing. However, in a dynamic context, his offers are by no means shaped by his beliefs upon the original coalition, but only on his beliefs about the *proportion* of weak or strong members of this coalition.

That is, when the United State negotiate with the European Union about an issue (the military intervention in Iraq or agricultural subsidies) they take into account its beliefs about the strength or the weakness of the EU demands only if they are convinced that a scission

[3] In the case of climate change negotiations, the United State actually rejected the common position of the industrialized countries of ratifying Kyoto. However, the model proposed in this paper could eventually be applied to future negotiations between Annex I countries that have ratified Kyoto and the G77 and China.
[4] We use the term "scission" to distinguish it from the closely related term of "deviation" used in cooperative game theory and from the conceptually totally different term "player splitting" (Perea y Monsuwe *et al*., 2000).

among the European Union cannot happen. On the contrary, if they think that a scission may in fact occur, and the negotiations take longer than a single period (as they usually do) the United States do not take into account the demands of the European Union as a whole while shaping its offers, but just the proportion inside the European Union of strong or weak parties. Of course, turning the argument up-side-down provides a strong incentive for potentially unstable coalitions (the EU or G77 and China) to preclude any scission. In fact, this is the behavior that G77 and China has tried to keep during the climate change negotiations, where they have managed to precluded any scission in despite of their internal diversity. The stability of that coalition could be seen as a consequence of the presence of asymmetric information.

We will also show, however, that the straightforward strategy of assuming directly that a given non-monolithic coalition does in fact not exist (focusing on the smallest units) is not pertinent either, since under a given set of circumstances the perfect Bayesian equilibrium will in fact imply that the coalition acts as a single coalition during the whole game.

The rest of the article is organized as follows. Section 2 presents the basic model and solves it assuming that both parties are monolithic. Section 3 relaxes the assumption that parties are monolithic and puts forward the link between the possibility of scission and the shape of the agreement. Section 4 concludes.

2. The model without scission

The basic model that we are going to use is inspired by Fudenberg and Tirole (1983). Let N={1,2} be two players negotiating over the transfer that player 1 will grant player 2 to obtain a product or service that benefits both to some given extend. The good under consideration can be the provision of a public good (e.g. fight against international terrorism or climate change mitigation) or the provision of a good to be sold in the market (cars, or football matches as in the example above). Player 1 is a monolithic party, a single country as the United States, an entrepreneur or any coalition which is assumed to be stable over the complete game. This monolithic party has a leader role in the game, because he is the owner of the company, because the country suffered a large terrorist attack and internal pressure forces it to act, or because it regroups a group of countries responsible for the degradation of a common good such as climate (see footnote 2). We will call this party the “leader” of the negotiations. Player 2 is a coalition of agents (the countries forming the European Union or the football players), which we will assume, for the time being, to be a monolithic coalition.

We will call this group of agents the original coalition, or just the coalition. We note e_i the level of effort and π_i the welfare function of player i, i$\in$ N. Welfare functions are supposed to be continuous and concave:

$$p_1(e_1+e_2,t_1) = B_1(e_1+e_2) - C_1(e_1,t_1) \quad (1)$$

$$p_2(e_1+e_2,t_1) = B_2(e_1+e_2,t_1) - C_2(e_2), \quad (2)$$

where B_i is the benefit obtained by player *i* from the efforts undertaken by both players and C_i are the costs of the efforts for player *i*. t_1 refers to the transfers (money, technology transfers, concessions in other subjects) received by the coalition from the leader to incentive its efforts to provide the (public) good. This transfer is proposed by the leader and satisfies the following assumptions:

$$\frac{\partial C_1}{\partial t_1} > 0 \qquad \text{and} \qquad \frac{\partial B_2}{\partial t_1} > 0\,. \quad (3)$$

Thus, the transfer is a ‘loss’ for the leader and a ‘gain’ for the coalition. That is, both players perform an effort to provide the good (the United States and the European Union both fight terrorism, the industrialized countries and the G77 and China both fight climate change, the NFL and the NFLPA both provide and effort to perform football games), both benefit from the provision of the public good (this is probably more obvious in the case of public goods such as international terrorism or climate change than in the case of the football games, although fame could be an additional benefit for players beyond salary), and finally the leader is ready to transfer some benefit to the coalition (this may be political concessions in the case of the US-EU negotiations, technology or money transfers in the case of climate change negotiations and the salary in the case of the football League negotiations). This means that even if both players are concerned about the (public) good, their interests diverge.

Given the leadership role that we have assigned to player 1 (the leader), he plays first and proposes, at the same time, his level of effort (e_1) and the amount of transfer granted to the coalition to incentive its efforts. If the coalition accepts the offer, the agreement is struck and it provides the agreed efforts. If the coalition does not accept, negotiations go on with a new proposition from the leader, formed by a new program of efforts and a new amount of transfers. If this offer is accepted, an agreement is concluded; otherwise, no agreement is reached and both players act independently.

All features of the negotiation are known with certainty by both parties, except that the leader does not know the real capacities (demands) of the coalition. We assume that the total level of effort that the leader needs to obtain, adding the effort performed by the coalition and the effort performed by himself, is given. We further assume that a strong coalition, in the sense that it is able to perform a high level of effort, will have high demands, while a weak one will have low demands. Using the example of the NFL: a coalition dominated by stars will only play with a high salary, while a coalition of journeymen will play for less money although unmotivated stars may perform poorly (therefore, the owner will need to perform an important additional effort if he wants to have spectators in the matches). In climate change negotiations (or in negotiations on efforts against international terrorism), if a coalition with high emission reduction capacities gets a high amount of transfers it will be able to perform a high level of abatement, while a coalition with low capacities will only be able to perform small emission reductions, whatever the level of transfers granted. However, the coalition with high capacities, knowing its key role, will have high demands as well. This was the case of Russia during the negotiations on the Kyoto Protocol, where it demanded, and obtained, a significant amount of concessions.

To simplify, we assume that the capacities (demands) of the coalition take one of the two following values: e_2^- and e_2^+, where $e_2^- < e_1 < e_2^+$. Either the capacities of the coalition are low (a "weak" coalition), or they are high (a "strong" coalition). We can reduce the model from two decision variables to only one, the amount of transfers, by setting:

$$e_2^- = e_2^-(t_2^-)\,, \quad e_2^+ = e_2^+(t_2^+) \quad . \tag{4}$$

That is, we distinguish the type of coalition in function of the transfers granted (i.e. we have a t_2^+ and a t_2^- coalition, with $t_2^- < t_1 < t_2^+$). That is, we will note t_1 the amount of transfer proposed by the player 1 (leader) and t_2 the demands of player 2, the coalition, which actually defines the type of the coalition. Hence, a t_2^+-coalition will only accept a certain level of effort in exchange of a significant transfer (t_2^+). On the contrary, a t_2^--coalition will provide the effort as soon as it gets a transfer equal to t_2^-. We assume further that the leader wishes to reach a global target $\bar{e}$ which can be obtained by two ways: a low (respectively high) level of effort for the leader and a high (respectively low) effort for the coalition, such that $\bar{e} = e_1^- + e_2^+$ or $\bar{e} = e_1^+ + e_2^-$. In the first case, when the leader beliefs that he is faced with a coalition able to provide a high level of effort, the leader has to offer a high level of transfer t_2^+ to get a high effort. However, given the asymmetry of information, a high amount of transfer does not guarantee a high level of effort. That is, the outcome may be a lower level effort as initially expect by the leader, implying that the target is missed: $e_1^- + e_2^- < \bar{e}$.

The leader has an *a priori* distribution of probability on $[t_2^-, t_2^+]$:

$$p(t_2^+) = p_1^+, \qquad p(t_2^-) = p_1^- = 1 - p_1^+. \tag{5}$$

This probability distribution implicitly refers to $[t_2^-, t_2^+]$, as the efforts provided are a function of the amount of transfer granted.

We set, without loss of generality:

$$p_1(e_1^+, t_2^-) = 0, \tag{6}$$

This means that the leader's welfare is normalized to zero when he offers a small amount of transfers ($t_1 = t_2^-$) to a t_2^+-coalition. Since the demands of this coalition are high, it will refuse to cooperate.

A family of conditional probabilities for the leader is an application that associates for every history of transfer propositions and corresponding answers, a distribution of probabilities on $[t_2^-, t_2^+]$. Since the game has only two periods and finishes at the first period in case of agreement, only conditional probabilities on the type of the coalition in case of a refusal to the transfer t_1 proposed at the first period are relevant. We note $[p_{11}^-, p_{11}^+]$ the distribution of probabilities of the leader at the beginning of the second period when the amount t_1 proposed in the first period was refused:

$$p_{11}^- = \text{p}(t_2^- / \text{refusal } \ \text{t}_1) \qquad \text{and} \qquad p_{11}^+ = \text{p}(t_2^+ / \text{refusal } \ t_1) = 1 - p_{11}^-. \tag{7}$$

A pure strategy for the leader is a pair $(t_1, t_{11}(.))$ where t_1 is the amount proposed at the first period and $t_{11}(.)$ a function that associates a transfer t_{11} in the second period to any transfer t_1 refused in the first period (i.e., we note t_{11} the transfer proposed by player 1, the leader, in the second period). A mixed strategy for the leader is formed by a distribution of probabilities on $\Re^+$ and an application that associates, for any transfer t_1 refused in the first period, a distribution of probabilities on $\Re^+$ (the set of possible transfers for the second period).

A pure strategy for the coalition is a pair of applications $(f_2(.), f_{22}(.))$. The first application associates to its private information $t_2 \in [t_2^-, t_2^+]$ and to any transfer t_1, an element $f_2(t_2, t_1)$ of the set {a,r} of possible answers. The second application associates to the private information, to any transfer t_1 refused and to any transfer t_{11}, an element $f_2(t_2, t_1, t_{11})$ of {a,r}. A mixed strategy for the coalition is composed by (i) a family of distribution of probabilities on {a,r}, which are conditional to (t_2, t_1) and noted $m_2(f_2 / t_2, t_1)$, and (ii) a family of distribution on {a, r}, which are conditional to (t_2, t_1, t_{11}) and that we note $m_2(f_{22} / t_2, t_1, t_{11})$.

The equilibrium concept used is the perfect Bayesian equilibrium. The strategies of both players in each period of the game, together with the associated beliefs, form a perfect Bayesian equilibrium if the constraints of sequential rationality and Bayesian coherence hold: (i) at every step of the game, the strategies are a Nash Bayesian equilibrium, given the beliefs; (ii) following the equilibrium path, beliefs are determined according to Bayes' rule.

We note d_1 and d_2 the discount factors of players 1 and 2 (with $0 < d_i < 1$, i=1,2). The highest transfer accepted at the first period by the t_2^--coalition when it anticipates that the transfer proposed in the second period will be $t_{11} = t_2^+$ is noted $\hat{t}_2$. Thus, $\hat{t}_2$ is defined by:

$$(1\text{-}d_2)C_2(e_2^-) = B_2(e_1^+ + e_2^-, \hat{t}_2) - d_2 B_2(e_1^- + e_2^-, t_2^+)\,. \qquad (8)$$

We only consider variations of the game corresponding to pure strategies of the leader (i.e. we exclude the possibility that the leader proposes a lottery, since this is not pertinent in the kind of situations that we are modeling).

Definition

A perfect Nash Bayesian equilibrium (PNBE) of a game is a quadruplet of strategies $\left[(e_1, t_1),\ (e_{11}(.), t_{11}(.)),\ f_1(.), f_2(.)\right]$ *and a system of beliefs* $\left[\left(p_1^-, p_1^+\right), \left(p_{11}^-(\cdot), p_{11}^+(\cdot)\right)\right]$ *that satisfies properties (1) and (2):*

(1) For the system of beliefs $\left[\left(p_1^-, p_1^+\right), \left(p_{11}^-(\cdot), p_{11}^+(\cdot)\right)\right]$ *and for any stage of the game the strategies of both players* $\left[(e_1, t_1),\ (e_{11}(.), t_{11}(.)),\ f_1(.), f_2(.)\right]$ *form a Nash Bayesian equilibrium (NBE).*

(2) For the equilibrium strategies, the system of beliefs follows Bayes' rule.

Formally, this type of equilibrium is obtained by backward induction (Selten, 1965). In the next section we will determine the Nash Bayesian equilibria in anyone of the two periods of the game (since the rules of the game and the space of strategies are essentially the same in the first and in the second period).

2.2. Nash Bayesian equilibria

We will start by analyzing the outcome of the sub-game that takes place in each of the two periods under consideration as if it would be a static game in itself. This will allow us to compare the results in a static environment with the results in a dynamic framework. However, and in order to be able to use the results in the next sub-section, we will use the concept of Bayesian equilibrium.

In this game, a pure strategy for the leader is an amount of transfer t_1, and a mixed strategy is a distribution of probability on $\Re^+$ (the set of all possible transfers). A pure strategy for the coalition is a function $f_2(.)$ which associates to its private information $t_2 \in [t_2^-, t_2^+]$ and to every proposed transfer t_1 an element $f_2(t_2, t_1)$ of the set of possible answers {a,r}. A mixed strategy for the coalition (noted $m_2(f_2 / t_2, t_1))$ is a family of probability distributions on {a, r} conditional to (t_2, t_1).

Given our assumptions, we can limit the pure strategies of the leader (uninformed) to the non-dominated strategies $t_1 = t_2^+$ and $t_1 = t_2^-$, and to the mixed strategy $t_1 = a t_2^+ + (1-a) t_2^-$ for $\alpha \in$ [0,1]. If the leader adopts the pure strategy $t_1 = t_2^-$, the expected gain is:

$$Ep_1^- = p_1^- p_1 (e_1^+ + e_2^-, t_2^-) + p_1^+ p_1 (e_1^+, t_2^-), \tag{9}$$

and the t_2^+-coalition will not accept the offer because the amount of transfer is lower than its expected amount. If the leader chooses $t_1 = t_2^+$, the expected gain is:

$$Ep_1^+ = p_1^- p_1 (e_1^- + e_2^-, t_2^+) + p_1^+ p_1 (e_1^- + e_2^+, t_2^+). \tag{10}$$

The pure strategy $t_1 = t_2^+$ is optimal if and only if the expected gain associated to $t_1 = t_2^+$ is strictly higher than the expected gain associated to $t_1 = t_2^-$. This gives:

$$p_1^+ > \frac{\left[p_1 (e_1^+ + e_2^-, t_2^-) - p_1 (e_1^- + e_2^-, t_2^+)\right]}{p_1 (e_1^- + e_2^+, t_2^+) + \left[p_1 (e_1^+ + e_2^-, t_2^-) - p_1 (e_1^- + e_2^-, t_2^+)\right]} = G. \tag{11}$$

When this condition holds, the Bayesian equilibrium is, for the leader, to play the strategy $t_1 = t_2^+$. That is, G gives us the minimum probability of being matched with a t_2^+-coalition for which the leader is interested in offering a high amount of transfer. This transfer will be accepted by both types of coalition, since it is the maximum and they cannot expect a better offer.

If the inequality is reversed:

$$p_1^+ < G, \tag{12}$$

it is beneficial for the leader to propose $t_1 = t_2^-$. This is the minimum transfer and only the t_2^--coalition (the coalition that will provide the lowest level of effort) will accept it.

Finally, if we have:

$$p_1^+ = \text{G}, \qquad (13)$$

the Bayesian equilibrium consists for the leader to play the strategy $t_1 = t_2^+$ with probability α and $t_1 = t_2^-$ with probability (1- α), for $\alpha \in [0,1]$. This means that the leader is indifferent about playing t_2^+ or t_2^-. The coalition will accept the level of transfer t_1 if it is at least equal to the requested amount of transfer t_2. This allows us to write the following proposition:

Proposition 1

The Nash Bayesian equilibrium is:

(i) for the leader to propose:

$t_1 = t_2^+$ *if the beliefs of the uninformed player about the probability of being faced with a strong coalition are high (* $p_1^+ > G$ *);*

$t_1 = t_2^-$ *if this beliefs are low (* $p_1^+ < G$ *);*

$t_1 = a t_2^+ + (1-a) t_2^-$ *for* $a \in [0,1]$ *if this beliefs are* $p_1^+ = G$.

(ii) for the coalition to accept any transfer such that $t_1 \geq t_2$.

The term in brackets in G (always positive) can be seen as the cost born by the leader when it proposes t_2^+ to a t_2^--coalition (i.e. the cost associated to the asymmetry of information in favor of the coalition). Thus, G can be seen as a measure of the relative importance of this cost compared to the benefit obtained when t_2^+ was the right amount to offer since the coalition was t_2^+ (i.e. $p_1(e_1^- + e_2^+, t_2^+)$). When this cost is high, the leader tends to offer a low amount of transfer whereas he tends to offer a low transfer if the opposite is true.

Formally, we can rewrite the results in proposition 1 and specify each of the Nash Bayesian equilibria based on the amount of transfers:

- either $t_1 = t_2^+$ and [$m_2(a / t_2^-, t_1) = 1$ and $m_2(a / t_2^+, t_1) = 1$];
- or $t_1 = t_2^-$ and [$m_2(a / t_2^-, t_1) = 1$ and $m_2(a / t_2^+, t_1) = 0$];
- or $t_1 = a t_2^+ + (1-a) t_2^-$ for $a \in [0,1]$ and

[$m_2(a / t_2^-, t_1) = 1$ if $t_1 \geq t_2^-$, = 0; and $m_2(a / t_2^+, t_1) = 1$ if $t_1 \geq t_2^+$, = 0].

As expected, the asymmetry of information reduces the optimality of negotiations, since several inefficient issues are conceivable. No-agreement may be the outcome or an agreement that does not reflect the type of the coalition. Actually, the responsibility for a positive outcome corresponds to the leader. The signature of an agreement depends upon its capacity to overcome the additional cost associated to the asymmetry of information. Even if this loss is tolerable (i.e. it is compensated by the gain resulting from cooperation), it reduces the expected gain of the leader.

2.3 Negotiation outcomes

We will now analyze the complete two stage game. We assume only two periods since we are interested in investigating the impact of the minimal amount of dynamics on the results. However, the approach could easily be extended to any (finite) number of periods. Nevetheless, increasing the number of periods does not really add anything substantial, while it obviously complicates the resolution. The negotiation outcomes are summarized in equations (2) and (3).

Proposition 2

If $p_1^+ > G$*, a unique perfect Bayesian equilibrium exists:*

(i) for the leader:

$$either\ t_1 = t_2^+ \ and\ t_{11}(t_1) = t_2^+,$$

$$or\ t_1 = \hat{t}_2 \ and\ t_{11}(t_1) = t_2^+;$$

(ii) for the coalition:

$$m_2(a/t_2^+, t_1) = 1 \text{ for } t_1 \geq t_2^+, = 0 \text{ otherwise},$$

$$m_2(a/t_2^-, t_1) = 1 \text{ for } t_1 \geq \hat{t}_2,$$

$$m_2(a/t_2, t_1, t_{11}) = 1 \text{ for } t_{11} \geq t_2, = 0 \text{ otherwise}.$$

Proof : see appendix 1.

Consequently, with the conditions associated to proposition (2), we can distinguish two possible perfect Bayesian equilibria. In the first one, the leader proposes the highest amount of transfers at any period of the game. This is accepted in the first period by the coalition, whatever its type. In the second possible equilibrium, the leader proposes the average amount

$\hat{t}_2$ in the first period and the maximum transfer t_2^+ in the second period. If the coalition is a t_2^--coalition, it accepts $\hat{t}_2$ in the first period. If it is a t_2^+-coalition, it will wait until the second period.

Proposition 3

If $p_1^+ < G$, there is a unique perfect Bayesian equilibrium:

(i) for the leader:

either $t_1 = t_2^+$ *and [* $t_{11}(t_1) = t_2^+$ *or* $t_{11}(t_1) = t_2^-$ *],*

or $t_1 = \hat{t}_2$ *and* $t_{11}(t_1) = t_2^+$ *,*

or $t_1 = t_2^-$ *and* $t_{11}(t_1) = t_2^-$ *with probability*

$$e(t_1) > \frac{p_2(e_1^+ + e_2^-, t_1) - d_2 p_2(e_1^- + e_2^-, t_2^+)}{d_2[B_2(e_1^+ + e_2^-, t_2^-) - B_2(e_1^- + e_2^-, t_2^+)]};$$

(ii) for the coalition:

$m_2(a/t_2^+, t_1) = 1$ *for* $t_1 \geq t_2^+$ *, = 0 otherwise,*

$m_2(a/t_2^-, t_1) = 1$ *for* $t_1 \geq \hat{t}_2$ *, =* $\dfrac{G - p_1^+}{G(1 - p_1^+)}$ *otherwise,*

$m_2(a/t_2, t_1, t_{11}) = 1$ *for* $t_{11} \geq t_2$ *, = 0 otherwise.*

Proof : see appendix 2.

Proposition (3) shows that, depending on the parameters of the model, three equilibria are possible. If the leader opens the negotiations by offering the maximum amount of transfer, the coalition accepts it in the first period, whatever the type of the coalition. On the contrary, if the leader proposes the average amount of transfer $\hat{t}_2$, only a t_2^--coalition accepts it. In this case, the leader proposes in the second period the maximum transfer, which is always accepted. Thus, the asymmetry of information tends to reduce the leading position of the leader. Finally, if the minimum amount of transfer is proposed in the first period and again, with a probability $e(t_1)$, in the second period, the coalition accepts only if it is a t_2^--coalition. More precisely, the coalition accepts the offer with a certain probability in the first period, and always in the second period if they refused it in the first.

Extending negotiations for a finite number of periods does not ensure a less costly agreement for the leader. Even more, the repetition can be disadvantageous for them. Indeed, even if negotiations begin with a low amount of transfer, a coalition that has low requirements and that anticipates for the following period a higher proposition (with a probability 1- $e(t_1)$), may behave as if it had higher demands. Thus, a refusal will not necessarily provide reliable information about the type of the coalition. Moreover, when the leader gets a refusal, it has to wait longer to obtain an agreement, which is an additional cost. In any case, propositions (2) and (3) show that, although information is acquired during the negotiation due to the Bayesian revision of the *a priori* probabilities, this does not ensure the signature of the agreement in the first period. Thus, a first rank optimum will not necessary be obtained, since the discount factors are strictly lower than one.

3. The model with the possibility of scission in the coalition

3.1 Nash Bayesian equilibria

Until now, we have considered the coalition as a stable coalition. This assumption reduces the space of strategies of the members forming this coalition. Although this member can be countries, football players or whatever, we will call them countries from now on to simplify the exposition. When the coalition is a t_2^+ coalition, its behavior is rather intransigent: it commits itself only with an agreement on a high amount of transfer. We now consider that a coalition with high claims may adapt its behavior to the offer of the leader. For a small offer of amount of transfer, this coalition may split up into two sub-coalitions. Countries for which the transfer that is proposed is equal to the sum of their claims form one sub-coalition (the t_2^--coalition). More demanding countries form another sub-coalition (the $(t_2^+ - t_2^-)$-sub-coalition). We assume that the total sum of demands of both sub-coalitions still equals t_2^+, with $t_2^+ - t_2^- > t_2^-$. In this context, negotiations may finish in the first period with one sub-coalition and continue only with the stronger sub-coalition in the second period.

We suppose that the sub-coalition which has more (respectively less) demanding claims, ie the $(t_2^+ - t_2^-)$-sub-coalition (respectively the t_2^--sub-coalition), represents a proportion equal to b (respectively 1- b). We obtain for a offer $t_1 = t_2^-$ of the leader:

$$E\pi_1^- = p_1^- \pi_1(e_1^+ + e_2^-, t_2^-) + p_1^+ [b\pi_1(e_1^+, t_2^-) + (1-b)\pi_1(e_1^+ + e_2^-, t_2^-)]. \tag{14}$$

When he offers $t_1 = t_2^+$, $E\pi_1^+$ is given by equation (10). Using:

$$H = \frac{p_1(e_1^+ + e_2^-, t_2^-) - p_1(e_1^- + e_2^-, t_2^+)}{p_1(e_1^- + e_2^+, t_2^+) + b p_1(e_1^+ + e_2^-, t_2^-) - p_1(e_1^- + e_2^-, t_2^+)} \quad , \tag{15}$$

we can write the following proposition:

Proposition 4

With the possibility of scission in the coalition, the Nash Bayesian equilibrium is:

(i) if $p_1^+ > H$*, the leader proposes* $t_1 = t_2^+$*, which is accepted by the coalition whatever its type;*

(ii) if $p_1^+ < H$*, the leader proposes* $t_1 = t_2^-$*, which is accepted by a* t_2^-*-coalition and by a* t_2^-*-sub-coalition;*

(iii) if $p_1^+ = H$*, the leader proposes* $t_1 = t_2^+$ *with any probability and* $t_1 = t_2^-$ *with the complementary probability. The offer is accepted by a* t_2*-coalition if* $t_1 \geq t_2$ *and by a* t_2^-*-sub-coalition if* $t_2 > t_1$*.*

Comparing Propositions (1) and (4) we can write the following corollary:

Corollary 1

The probability of reaching an agreement is larger with the possibility of a scission. The probability of reaching an agreement based on a high amount of transfers is smaller with this option.

Proof: direct from propositions (1) and (2) since $G \leq H$ given that $0 \leq b \leq 1$.

Hence, while the space of strategies is wider for a t_2^+-coalition with the possibility of scission, the possibility of reaching an agreement based on a high amount of transfer is reduced. Thus, the leader will be more willing to propose a higher level of transfer in the game where it may deal with an uncompromising t_2^+-coalition (i.e. a coalition without the possibility of scission) than in the case where a scission may occur. The intuition behind this result lies in the difficulty to reach an agreement. In the game where the coalition may be either a t_2^--coalition or an uncompromising t_2^+-coalition, negotiations may fail if the offer of the leader is not high enough (if the coalition is of the type t_2^+). By adopting the "all or nothing" strategy, an uncompromising coalition faces the leader with an ultimatum. Since the coalition knows its influence, it will reject any compromise which fails to meet its demands.

To avoid the failure of negotiations, the leader has to offer $t_1 = t_2^+$. This ultimatum situation overwhelms the problem of potential free-riding by the t_2^--coalition. On the contrary, in the game with the possibility of scission, since some of the members of the coalition may accept to adapt to the offer of the leader, the leader takes the signature of an agreement for granted. Since he is no longer threatened by a negotiations failure, the leader will try to minimize the risk of opportunist behavior from a t_2^--coalition. Thus, the leader will be more willing to propose a low amount of transfer and the probability of reaching an agreement on a high amount of transfer shrinks. This is confirmed by the fact that the H-bound is a decreasing function of b. The higher the proportion of the coalition that would refuse the t_2^- offer, the nearer we come to the situation where the coalition is uncompromising. Therefore, the leader is interested in avoiding the failure of negotiations.

3.2. Negotiation outcomes

We will know analyze the complete two period game with the possibility of scission. In this configuration, if a proposition t_1 during the first period is strictly lower than t_2^+, then a t_2^+ coalition may split up (or not). In this last section, we combine the three main characteristics of negotiations: dynamics, asymmetric information and the possibility of scission. We can write propositions (5) and (6).

Proposition 5

If the proportion (b) of countries inside the coalition with strong demands checks

$$b > \frac{2m_2(r / t_2^-, t_1)}{1 + m_2(r / t_2^-, t_1)}, \qquad (16)$$

there is a unique perfect Bayesian equilibrium. The equilibrium strategies for the leader are:

$t_1 \in [t_2^-, t_2^+]$ *and* $t_{11}(t_1) = t_2^+$ *or* $t_{11}(t_1) = t_2^+ - t_2^-$,

and for the coalition:

$m_2(a / t_2^+, t_1) = 1$ *for* $t_1 \geq t_2^+$, $= 1 - b$ *for* $t_2^+ > t_1 \geq \hat{t}_2$, $= 0$ *otherwise,*

$m_2(a / t_2^-, t_1) = 1$ *for* $t_1 \geq \hat{t}_2$, $= 0$ *otherwise,*

$m_2(a / t_2, t_1, t_{11}) = 1$ *for* $t_{11} \geq t_2$, $= 0$ *otherwise.*

Proof: see appendix 3.

Proposition 6

If the proportion (b) of countries inside the coalition with strong demands checks

$$b < \frac{2m_2(r / t_2^-, t_1)}{1 + m_2(r / t_2^-, t_1)}, \qquad (17)$$

there is a unique perfect Bayesian equilibrium. The equilibrium strategies for the leader are:

either $t_1 \in [t_2^-, \hat{t}_2[$ *and* $t_{11}(t_1) = t_2^-$ *or* $t_{11}(t_1) = t_2^+ - t_2^-$

or $t_1 \in [\hat{t}_2, t_2^+]$ *and* $t_{11}(t_1) = t_2^+$ *or* $t_{11}(t_1) = t_2^+ - t_2^-$*;*

and for the coalition:

$m_2(a / t_2^+, t_1) = 1$ *for* $t_1 \geq t_2^+$, $= 1 - b$ *for* $t_2^+ > t_1 \geq \hat{t}_2$, $= 0$ *otherwise*

$m_2(a / t_2^-, t_1) = 1$ *for* $t_1 \geq \hat{t}_2$, $= 0$ *otherwise*

$m_2(a / t_2, t_1, t_{11}) = 1$ *for* $t_{11} \geq t_2$, $= 0$ *otherwise.*

Proof : same principle as the proof in appendix (3).

Proposition (5) shows that when the offer is rejected in the first period, an agreement will always be signed at the second period, based on the maximum transfer. Since the proportion of countries with strong demands inside the coalition is high, the leader will offer t_2^+ in the second period. With an offer in the interval $[t_2^-, t_2^+[$, a refusal in the first period leads the leader to determine with certainty his interlocutor's type. If the initial offer was rejected by the whole coalition, the leader will propose t_2^+ in the second period. If a scission appeared in the first period and only a sub-coalition rejected the offer (i.e. when the initial offer checked $t_2^+ > t_1 \geq \hat{t}_2$), the leader will propose $(t_2^+ - t_2^-)$ to this sub-coalition in the second period.

As Proposition (6) shows, when the proportion of strong countries within the coalition is low, the leader proposes t_2^- in the second period. When the leader is faced with a refusal to an offer comprised in $[t_2^-, \hat{t}_2[$ in the first period, he is not able to determine with certainty the type of the coalition. Thus, he will adopt a precautionary strategy and offer t_2^- in the second period. This may lead to the failure of the negotiations if the type of the coalition is t_2^+. Finally, if the weak coalition (t_2^--coalition) refuses the proposition in the first period to accept that of the second period, we get a configuration for which by prolonging the negotiation, it looses all the advantages that it had due to its private information.

Remark that in propositions (5) and (6) the bound separating one or another proposal from the leader is not anymore the beliefs about the strength/weakness of the coalition (p_1^+ or p_{11}^+) but the proportion of strong (weak) members forming the original coalition (b). That is:

Corollary 2

If a scission is possible and the proportion of weak/strong members of the coalition is known, the system of beliefs $\left[\left(p_1^-, p_1^+\right), \left(p_{11}^-(\cdot), p_{11}^+(\cdot)\right)\right]$ *plays no role in shaping the offers of the leader.*

Proof: direct from propositions (5) and (6).

At least since Riker (1962) we know that coalitions tend to split up to its minimum expression, however, what we have shown here is that even before they have split up the leader of the negotiation does not anymore "see" the nominal coalition and already focuses on the proportion of strong/weak members while shaping his offers. However, whatever the value of b we have situations where the coalitions stays together and only single offers and unique answers are observed, so that a model assuming that the coalition does not really exist would miss the point.

We can now compare negotiations with and without the possibility of scission. Without the possibility of scission, an agreement will only be reached if the coalition gets at least its minimum requirements. On the contrary, with the possibility of scission we can obtain as many possible agreements as possible amounts of transfers exist. Therefore, the leader should prefer to enter negotiations when a scission is still possible. The scission allows the formation of a sub-coalition that adapts its behavior to the leader's proposal, even if the initial coalition was potentially able to demand more. The probability of reaching an agreement is higher, but based on reduced objectives.

From the point of view of a strong coalition (t_2^+-coalition), the absence of the possibility of scission increases its credibility vis-à-vis the leader. Since the t_2^+-coalition knows its informational power, it will choose, if this option is available, not to have the possibility of scission to make this power effective. This alternative is even more attractive since this commitment implies significant transfers. Thus, it becomes possible to explain the stability of the coalition based on the capacity of the members of the coalition to preserve their private information. The asymmetry of information strategically favors them as long as they remain within the same coalition. Producing a scission will automatically reveal the characteristics of the coalition. Thus, in spite of the asymmetry of information, the game will turn in favor of the leader. On the contrary, banning the possibility of a scission forces the leader into a negotiation with a reduced probability of reaching an agreement, and forces him to propose a high amount of transfers.

Coming back to our examples, we have shown that when negotiating with the United States the European Union should try to preclude any scission if it wants to keep the advantages of its private information and to have high chances to obtain an important transfer (e.g. political concessions). Of course, on the other hand, the United States are interested in “dividing to conquer” if the scission is possible. As stated above, the G77 and China have tried to follow the first line in climate change negotiations, while the National Football League followed the second line in the 1981’s labor negotiations.

4. Conclusion

This paper has analyzed strategic bargaining in negotiations between non-monolithic players, in the sense that the agents starting negotiations can split-up in smaller entities during the bargaining process. We have shown that the possibility of scission in the informed coalition implies that it looses its information advantages. We have also shown that with the possibility of scission the uninformed player does not focus on his or her beliefs about the strength of the informed coalition but on the proportion of weak/strong players within this coalition. Finally, we have shown that the absence of the possibility of scission increases the chances to obtain an agreement based on high amount of transfers, while the possibility of scission increases the chances to obtain an agreement, but based on more modest objectives. Examples in international negotiations on global public goods, such as war against international terrorism or climate change, and in wage negotiations have shown the relevance of explicitly considering the possibility of scission when modeling negotiations between non-monolithic players (i.e. a coalition of countries, such as the European Union or the G77 and China, or a trade union).

References

Bloch, F., 1996. Sequential Formation of Coalitions in Games with Externalities and Fixed Payoff Division. *Games and Economic Behavior* 14: 90-123.

Caparrós A., Péreau J.C. and Tazdaït T., 2004. North-South Climate Change Negotiations: A Sequential Game with Asymmetric Information. *Public Choice* 121: 455-480.

Chaterjee, K., Dutta, B., Ray, D. and Sengupta, K., 1993. A Noncooperative Theory of Coalitional Bargaining. *Review of Economic Studies* 60: 463-477.

Fudenberg, D. and Tirole, J., 1983, Sequential Bargaining with Incomplete Information, *Review of Economic Studies* 50, 221-247.

Garfinkel, M.R., 2004. Stable alliance formation in distributional conflict. *European Journal of Political Economy* 20: 829-852.

Lax, D. and Sebenius, J.K., 1992. Thinking coalitionally: parthy arithmetic, process opportunism, and strategic sequencing. In: H-P. Young (ed.) *Negotiation Analysis*. The University of Michigan Press, Michigan.

Manzini, P. and Mariotti, M., 2005. Alliances and Negotiations. *Journal of Economic Theory* 121(1): 128-141.

Perea y Monsuwé, P., Jansen, M. and Vermeulen, D., 2000. Player Splitting in Extensive Form Games. *International Journal of Game Theory* 29: 433-450.

Perry M. and Reny P., 1994. A Non-Cooperative View of Coalition Formation and the Core. *Econometrica* 62: 795-817.

Ray D. and Vohra R., 1999. A Theory of Endogenous coalition Structure. *Games and Economic Behavior* 26: 286-336.

Riker, W., 1962. *The Theory of Political Coalitions*. Yale University Press, New Haven.

Rubinstein, A., 1982. Perfect Equilibrium in a Bargaining Model. *Econometrica* 50: 97-108.

Sandler, T. and Hartley, K., 2001. Economics of alliances: the lessons for collective action. *Journal of Economic Literature* 39: 869-896.

Selten, R., 1965. Spieltheoretiche Behandlung eines Oligopolmodelles mit Nachfrageträgheit. *Zeitschrift für die Gesamte Staatswissenschaft* 12: 301-324.

Appendix 1: Proof of proposition (2)

- Suppose an equilibrium in which the transfer announced during the first period by the leader is $t_1 \in [t_2^-, t_2^+[$. If this transfer is refused, the leader reviews its beliefs with Bayes' rule:

$$p_{11}^- = \frac{p(e_2^-, r/t_1)}{p(r)} = \frac{m_2(r/t_2^-, t_1)\, p_1^-}{p(r)},$$

with:

$$\text{p(r)} = m_2(r/t_2^-, t_1)\,p_1^- + m_2(r/t_2^+, t_1)\,p_1^+ \quad .$$

Since $m_2(r/t_2^+, t_1) = 1$ for $t_1 < t_2^+$, we get:

$$p_{11}^- = \frac{m_2(r/t_2^-, t_1)\, p_1^-}{m_2(r/t_2^-, t_1)\, p_1^- + p_1^+} \quad \text{and} \quad p_{11}^+ = 1 - p_{11}^- = \frac{p_1^+}{m_2(r/t_2^-, t_1)\, p_1^- + p_1^+} \quad .$$

Since we are in the case where: $p_1^+ > G$, for any $t_1 \in [t_2^-, t_2^+[$ and for any $m_2(r/t_2^-, t_1)$, we have $p_{11}^- < p_1^-$, $p_{11}^+ > p_1^+$ and $Ep_{11}^+ > Ep_1^- \geq Ep_{11}^-$. This last condition gives:

$$p_{11}^- \pi_1 (e_1^- + e_2^-, t_2^+) + p_{11}^+ \pi_1 (e_1^- + e_2^+, t_2^+) > p_1^- \pi_1 (e_1^+ + e_2^-, t_2^-) \geq p_{11}^- \pi_1 (e_1^+ + e_2^-, t_2^-).$$

The left hand side of the inequality is the net expected gain of the leader at the second period, estimated at the beginning of the second period when t_2^+ was proposed. The right hand side represents the net gain when t_2^- was proposed. Thus, for any equilibrium satisfying $t_1 \in [t_2^-, t_2^+[$ and where the coalition refuses the offer, the leader will propose t_2^+ in the second period.

- In any equilibrium with $t_1 \in [t_2^-, t_2^+[$, only the t_2^--coalition could accept the offer in the first period and, by definition of $\hat{t}_2$, we have $m_2(a/t_2^-, t_1) = 1$ if $t_1 \geq \hat{t}_2$, $= 0$ otherwise. Proposition (2) indicates the coalition's behavior in the second period. In any equilibrium of this kind, the expected gain for the leader is: $p_1^- \pi_1 (e_1^+ + e_2^-, t_1) + d_1\, p_1^+ \pi_1 (e_1^- + e_2^+, t_2^+)$ if $t_1 \geq \hat{t}_2$.

- The leader is not interested in deviating from this equilibrium. Since his characteristics are known by the coalition, he cannot modify the coalition's beliefs by playing a strategy outside the equilibrium.

- The coalition is not interested in deviating from the equilibrium either. A deviation consists for the coalition in changing its response to the first proposition of the leader. However, since the leader will play at the equilibrium, in any case, t_2^+ in the second period, such deviation is unfavorable for the coalition.

Appendix 2: Proof of proposition (3)

- If $t_1 = t_2^+$, the coalition accepts the offer whatever its type. Indeed: $m_2(a/t_2, t_2^+) = 1 \; \forall \; t_2 \geq t_2^+$. The negotiation is over in the first period and the net gain for the leader is:

$$Ep_1^+ = p_1^- p_1 (e_1^- + e_2^-, t_2^+) + p_1^+ p_1 (e_1^- + e_2^+, t_2^+) .$$

- If $t_1 \in [\hat{t}_2, t_2^+[$, by definition of $\hat{t}_2$, the coalition does not accept if it is an t_2^--type, since in this case $m_2(a/t_2^-, t_1) = 1$, by definition of $\hat{t}_2$ since in all cases $t_2 \leq t_2^+$. On the contrary, if the coalition is a t_2^+-type, it will refuse the offer since $m_2(a/t_2^+, t_1) = 0$. Hence: $p_{11}^+ = 1$. Thus, in case of refusal in the first period, the leader knows that it faces a t_2^+-coalition and will propose t_2^+. Their expected gain is $p_1^- p_1 (e_1^+ + e_2^-, t_1) + d_1 \, p_1^+ p_1 (e_1^- + e_2^+, t_2^+)$. This expression is maximal for $t_1 = \hat{t}_2$.

- If $\hat{t}_2 > t_1 \geq t_2^-$, we will suppose that the proposition t_1 has been refused, in order to determine the offer in the second period. In this case: $m_2(a/t_2^+, t_1) = 0$.

Let g be the value of $m_2(a/t_2^-, t_1)$ that leaves the leader indifferent between t_2^- and t_2^+ in the second period when the t_2^+-coalition refuses t_1.

As shown in appendix (1), the reviewed distribution of probabilities of the leader about the type of the coalition is:

$$p_{11}^- = \frac{(1-g)p_1^-}{(1-g)p_1^- + p_1^+} = \frac{(1-g)p_1^-}{1-g\,p_1^-} \quad \text{and} \quad p_{11}^+ = 1 - p_{11}^- = \frac{1-p_1^-}{1-g\,p_1^-} \quad .$$

But, since the leader is indifferent about the gains obtained by strategies $t_{11} = t_2^+$ and $t_{11} = t_2^-$, g satisfies:

$$\frac{p_1^+}{1-g\,p_1^-} p_1 (e_1^- + e_2^+, t_2^+) + \frac{(1-g)p_1^-}{1-g\,p_1^-} p_1 (e_1^- + e_2^-, t_2^+) = \frac{(1-g)p_1^-}{1-g\,p_1^-} p_1 (e_1^+ + e_2^-, t_2^-)$$

or:

$$g = \frac{G - p_1^+}{G(1-p_1^+)} < 1 \quad .$$

Hence, we will show that when $\hat{t}_2 > t_1 \geq t_2^-$:

$$m_2(a/t_2^-, t_1) = g \; .$$

We know that undominated pure strategies of the leader in the second period are $t_{11} = t_2^+$ and $t_{11} = t_2^-$. Thus, t_2^+ is preferred to t_2^- if and only if:

$$m_2(a/t_2^-, t_1) > \frac{G - p_1^+}{G(1 - p_1^+)} \quad .$$

In general: (i) the leader plays $t_{11}(t_1) = t_2^+$ if and only if $m_2(a/t_2^-, t_1) > g$; (ii) plays $t_{11}(t_1) = t_2^-$ if and only if $m_2(a/t_2^-, t_1) < g$; and (iii) plays some mixed strategy on $[t_2^-, t_2^+]$, that we note $[e(t_1), 1\text{-}e(t_1)]$, if and only if $m_2(a/t_2^-, t_1) = g$. Consequently, three cases have to be considered.

1st case: $m_2(a/t_2^-, t_1) > g$.

In this case the leader plays $t_{11}(t_1) = t_2^+$ in the second period. The t_2^--coalition which anticipates this strategy, never accepts a proposition $t_1 < \hat{t}_2$ in the first period. Hence, $\forall\ t_1 \in [t_2^-, \hat{t}_2[$ $m_2(a/t_2^-, t_1) = 0$, which contradicts the hypothesis $m_2(a/t_2^-, t_1) > g$. Thus, this case is impossible.

2nd case: $m_2(a/t_2^-, t_1) < g$.

The coalition knows that the leader will propose $t_{11} = t_2^-$ in the second period. They are interested in accepting any offer $t_1 \in [t_2^-, \hat{t}_2[$. Hence, $m_2(a/t_2^-, t_1) = 1$ $\forall\ t_1 \in [t_2^-, \hat{t}_2[$, and we find another contradiction. Thus, $\forall\ t_1 \in [t_2^-, \hat{t}_2[$ we must have:

$$m_2(a/t_2^-, t_1) = \gamma \quad .$$

In this case both coalitions adopt a mixed strategy. The question is now how to make the associated probabilities compatible to get a perfect Bayesian equilibrium.

Since the t_2^--coalition plays a mixed strategy (to accept the strategy t_1 with a probability $g \in]0,1[$), it is indifferent about accepting t_1 or refusing t_1. If it accepts, its net gain is: $p_2(e_1^+ + e_2^-, t_1)$. If it refuses, its expected net gain is:

$$Ep_2(e_1^+ + e_2^-, t_{11}) = d_2[e(t_1)p_2(e_1^+ + e_2^-, t_1^-) + (1 - e(t_1))p_2(e_1^- + e_2^-, t_2^+) \quad .$$

Thus, we must have:

$$p_2(e_1^+ + e_2^-, t_1) = Ep_2(e_1^+ + e_2^-, t_{11}),$$

or:

$$e(t_1) = \frac{p_2(e_1^+ + e_2^-, t_1) - d_2 p_2(e_1^- + e_2^-, t_2^+)}{d_2[B_2(e_1^+ + e_2^-, t_2^-) - B_2(e_1^- + e_2^-, t_2^+)]} \quad .$$

Since we know the values of g and $e(t_1)$, we can calculate the expected gain for the leader associated to this mixed strategy:

$$Ep_1 = p_1 g_1 p_1 (e_1^+ + e_2^-, t_1) + \frac{(1-g) p_1^-}{1-g\, p_1^-} d_1 p_1 (e_1^+ + e_2^-, t_2^-) .$$

This gain is maximized with $t_1 = t_2^-$. Thus, the leader adopts the strategy: $t_1 = t_2^-$, $t_{11}(t_1) = t_2^-$ with a probability $e(t_1)$, and $t_{11}(t_1) = t_2^+$ with the complementary probability.

Appendix 3: Proof of proposition (5)

To have a complete proof, follow the same reasoning as for proposition (2). We will just show that in the second period, the leader will propose t_2^+ under condition (16). We consider the case in which: (i) the offer t_1 has been refused, and (ii) the leader reviews its beliefs according to Bayes' rule and adopts the optimal strategy $t_{11}(t_1) = t_2^+$ if and only if $Ep_{11}^+ > Ep_{11}^-$. Thus:

$$p_{11}^- = \frac{m_2(r / t_2^-, t_1)(2-b)\, p_1^-}{p(r)} \qquad \text{and} \qquad p_{11}^+ = \frac{b\, p_1^+}{p(r)} ,$$

with:

$$p(r) = m_2(r/t_2^-, t_1) p_1^- + m_2(r/t_2^-, t_1)(1-b) p_1^- + m_2(r/t_2^+ - t_2^-, t_1)\, b\, p_1^+$$

$$= m_2(r/t_2^-, t_1)(2-b) p_1^- + b\, p_1^+$$

Condition (16) can be deduced from the following inequalities:

$$p_{11}^- < p_1^- \qquad \text{and} \qquad p_{11}^+ > p_1^+ \qquad .$$

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(lxviii) This paper was presented at the ENGIME Workshop on “Governance and Policies in Multicultural Cities”, Rome, June 5-6, 2003
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