

# Political Autonomy and Independence: Theory and Experimental Evidence

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## Abstract

We study the process by which subordinated regions of a country can obtain a more favourable political status. In our theoretical model a dominant and a dominated region first interact through a voting process that can lead to different degrees of autonomy. If this process fails then both regions engage in a costly political conflict which can only lead to the maintenance of the initial subordination of the region in question or to its complete independence. In the subgame-perfect equilibrium the voting process leads to an intermediate arrangement acceptable for both parts. Hence, the costly political struggle never occurs. In contrast, in our experiments we observe a large amount of fighting involving high material losses, even in a case in which the possibilities for an arrangement without conflict are very salient.

## Keywords

Secession, collective action, independence movements, laboratory experiments, rent-seeking

## JEL Classification Codes

C92, C93, D72, D74

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## 1. Introduction

Many countries consist of several parts or regions with populations that have different interests or identities. Often one of the parts of the country is politically dominant due to its size, historical circumstances or other reasons. In many of such cases there are conflicts - peaceful or violent - over parts of countries attempting to obtain more political autonomy or to secede and obtain independence. Different degrees of political autonomy including independence imply differences in the allocation of government spending, in tax arrangements, in the degree of self-government between the communities involved, as well as in the satisfaction that derives from more or less possibilities of cultural expression and recognition. In figure 1 we show just some of the places in the world with such ethno-political conflicts.

The process by which such regions obtain a different political status can be very costly and often violent. For instance, the civil war fought over a Kurdish state independent from Turkey<sup>1</sup> has claimed about 30,000 lives, without any sign of success for the seceding party. Separatists in East Timor have been more successful, since the country gained fully recognised sovereignty in 2002. Independence came at a price, though, with a death toll of at least 100,000 in a 25-year civil war with Indonesia. The struggle for Abkhazia's secession from Georgia, which resulted in the region's *de facto* independence<sup>2</sup>, involved an act of *ethnic cleansing* displacing 250,000 ethnic Georgians. Even in less violent cases the costs of such conflicts can be substantial. Abadie and Gardeazabal (2003) estimate that terrorism and political instability arising from the Basque conflict have led to a decline of per capita GDP of about 10 percentage points. In other cases the record is less bleak. In the last twenty years Catalonia has reclaimed considerable legislative powers from Spain in a purely political non-violent process. Similarly, the sovereignist movement of Québec peacefully achieved substantial concessions from Canada and in 1995 even forced a referendum on full sovereignty. The motion failed only by the narrowest of margins (49.4% versus 50.6%).

The question arises as to why the different regions are often not able to agree on an intermediate solution to the conflict, involving some degree of power sharing, while others are able to compromise without bloodshed. In many cases the struggle revolves around the extreme solutions; it is about whether the dominant region maintains complete control or whether independence – or a similar status - of the dominated region is attained. One possible explanation for this is that intermediate solutions are somehow not stable, because, due to the particular set of feasible distributions of resources, they are very unsatisfactory for the regions

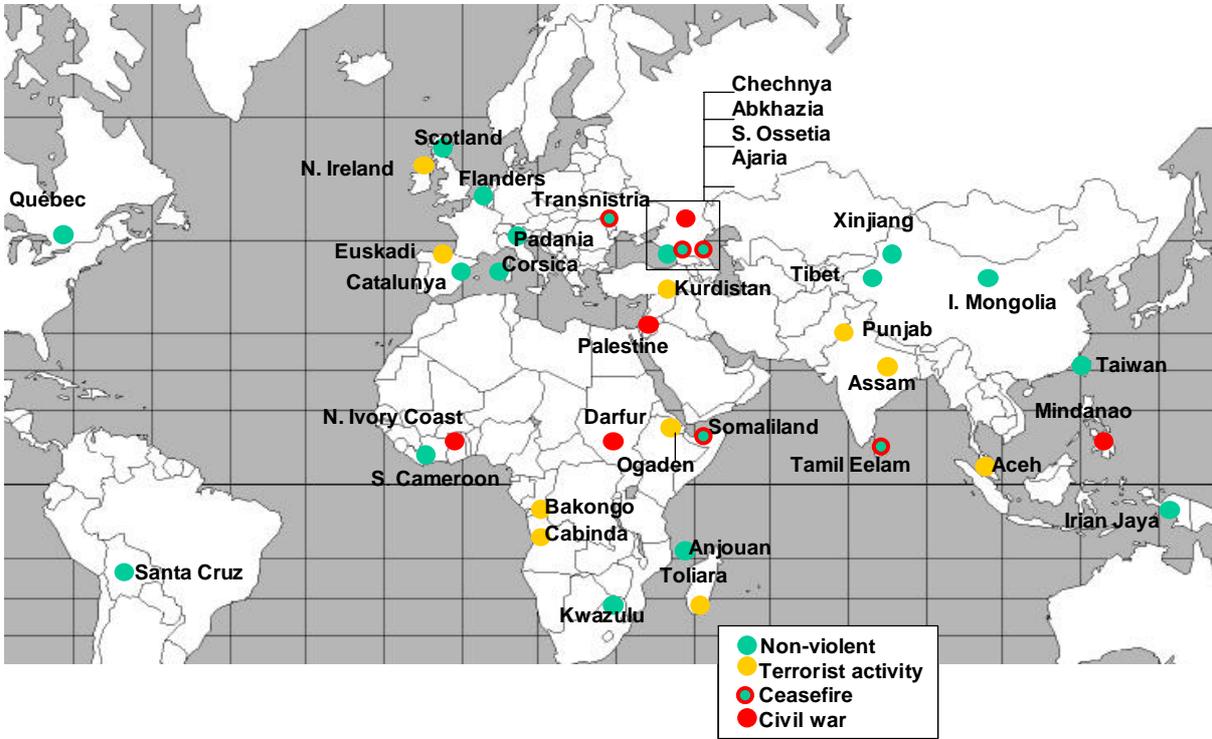
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<sup>1</sup> Significant Kurdish populations are also resident in Syria, Iran and Iraq. In the latter country they run a *de facto* independent region without much interference from Baghdad.

<sup>2</sup> So far only Russia has recognised the Republic of Abkhazia in a controversial move following the 2008 South-Ossetian war. However, since 1992 the central government in Georgia has had no control over the region, in which power has been held entirely by a regional government.

involved. The interdependence of preferences may play a role here. For example, if the recognition of some of the symbolic identifiers of one of the regions is in a way unbearable for the inhabitants of the other region then an intermediate solution may be hard to implement.

Another explanation is that intermediate solutions are in a material sense stable, but that purely emotional forces, which arise in the process of attempting to find an intermediate solution, prevent them from being reached. What emotional forces could come into play here? One possibility is that when different strongly cohesive communities are involved then conflict as such is positively valued. Another possibility is that the fact that the starting point is a status quo involving the preponderance of one of the regions makes it very hard for the citizens of the dominated region to accept the process.



**Figure 1. Ethno-political conflict in the world**

In this paper we combine a theoretical model and the analysis of experimental data based on an implementation of the model to shed light on some of the issues just discussed. First, we present a simple theoretical model in which to study the purely material payoff-based determinants of whether intermediate solutions can be reached and, hence, costly conflict can be avoided. The experiment we designed is directed at studying the process through which an agreement is or is not reached. It has been shown that group sentiment and dissatisfaction with the process by which certain payoffs are reached can influence behaviour in experiments. With the experiments we present here we want to find out whether such influences are also significant in the kind of political environments that we are interested in.

There is a long tradition of modelling political conflict in game-theoretic terms. One of the early contributions is Schelling (1960) "The Strategy of Conflict". Indeed, since its beginnings game theory has been used to study the strategic aspects of military and political conflicts. Gershenson and Grossman (2000) uses a theoretical model of civil conflict to identify the factors that determine whether civil conflict is ended or never ending.

Currently issues of power-sharing and secession are being studied both in economics and political science. In economics a number of recent studies have focused on the determinants of the number of independent countries. Alesina and Spolaore (1997, 2005 and 2006) study the equilibrium determination of the number of independent countries under different political and economic conditions, the relationship between international conflict and the size distribution of countries and the relation between endogenous border formation and the choice of defence spending in a world with international conflict, respectively. Le Breton and Weber (2003) construct a model of a country with heterogeneous population and examine compensation schemes that may prevent a threat of secession by dissatisfied regions. Spolaore (2008) studies under what conditions regions will divert costly resources to fight each other over political borders. Jehiel and Thisse (2005) look at issues of collective decision-making within a confederation of independent countries and Esteban and Ray (forthcoming) study the interaction between population size, income inequality and ethnic activism.

In political science the book by Powell (1999) uses models to study how states can respond to threats by others. Hechter (2000) suggests how nationalistic violence can be contained, Hale (2000 and 2004) tests several theories of secession in the Soviet setting and takes a broader look at the determinants of federal success, Wood (2003) analyses the determinants of civil war settlements and Lustick, Miodownik and Eidelson (2004) study whether power sharing arrangements prevent or encourage secession in multicultural states. Fearon (1995) discusses how ethnic conflict can be the result of the commitment problem that arises when two political communities find themselves without a third party that can guarantee agreements between them. In their influential book Acemoglu and Robinson ((2006) follow-up on the importance of commitment limitations. Ruta (2005) and Kyriacou (2005) contain recent surveys of work on all these issues.

The issue of secession and the fight for independence has, to our knowledge, not been previously studied experimentally. Even the more general experimental literature on political conflict is surprisingly sparse. A few experiments on political systems focus on the emergence of regimes in a model in which citizens can devote their efforts to production or appropriation (Durham, Hirshleifer, and Smith (1998), Carter and Anderton (2001), Duffy and Kim (2004)). Others (Abbink and Pezzini (2005), Cason and Mui (2006)) study revolting behaviour in a dictatorship. With the conflict model we use our study is also related to the literature on rent-seeking games (Millner and Pratt (1989), Potters, de Vries, and van Winden (1998), Weimann, Yang, and Vogt (2000), Anderson and Stafford (2003)).

We show under which conditions the subgame-perfect equilibrium of our game leads to an intermediate arrangement acceptable for both parts without any costly political conflict. In contrast, in the experiments based on the model we observe a large amount of fighting involving high material losses, even in a case in which the possibilities for an arrangement without conflict are very salient. In our experimental environment intermediate solutions are feasible and stable, but often participants fail to reach them.

Our design consists of two parts. In what we call the original set-up, we test the predictions of the theoretical model, using three treatments with what we thought ex-ante were varying likelihood for peaceful solutions. In what we call the additional sessions, we vary the subject pool and the way the situation is presented to subjects in the experimental instructions with the aim of testing for the robustness and representativeness of behaviour observed in our original data.

## **2. The model**

Before we introduce the details of the model we want to briefly discuss some of the essential features of the kind of context that we want to represent. We start by saying that we do not model an authoritarian situation in which a single individual or a small group dictates the political outcome. Rather, we focus on conflicts between different communities as such, which initially live together under certain rules that favour one of the communities. In such cases the process by which a change in the political arrangement is sought often has a democratic character, but suffers from the difficulty that the citizens of the dominant region inevitably are the majority in the political entity. Hence they can prevent the dominated region from obtaining a more satisfactory status. Given these circumstances, the citizens of dominated regions may consider the outcome of this particular democratic process unacceptable and may organise to reject it.

Another central aspect of our model is that only a given set of payoff distributions are feasible. This is a standard for an economic approach to the problem. However, it is important to point out that we see this mainly as a short run restriction. In the long run the feasible arrangements can be changed. Economic growth naturally pushes out the material frontier, new infrastructures may favour both regions and constitutional innovations also enlarge the space of what can be accomplished. Finally in the realm of symbolic representation and community time may also change things in favour of intermediate arrangements. Here we focus on the situation at a particular point in time.

The third building block of our model that we want to highlight at this point is our representation of conflict. We represent conflict as an intense sort of rivalry, in the sense that only one of the sides involved can obtain its preferred status. Conflict involves potentially large losses. In the way we model things, the losses from conflict will be inefficiencies that

need not occur. The study of how these inefficiencies arise and how they can be avoided is the main motivation for our work.

We now present the model in a general version, in section 2.2 we will introduce the specific parameter configurations that we use in our experiments. We start with agents and preferences. A state or country is divided into two exogenously given regions, A and B. In region A there are  $n_A$  type A citizens, region B is inhabited by  $n_B$  type B citizens. We assume  $n_A > n_B$ , type A citizens are the majority in the state.

In accordance with many real-life cases, the smaller region is the one striving for a more favourable institutional arrangement. Type A citizens prefer the status quo which can be interpreted as a centralised regime, while type B citizens prefer other possible institutional arrangements and their ideal state of the world is at the other extreme of the policy space, which we envision as being complete autonomy or independence. For simplicity, we assume that all citizens within one region have identical preferences with respect to region B's autonomy.<sup>3</sup>

In between complete centralisation and complete independence there are various levels of autonomy that region B can be granted. In this section we assume, to keep things neat, a continuous measure of possible regimes, ordered from 0 (complete centralisation) to 1 (independence).<sup>4</sup> Different values on this line represent different combinations of self-determination rights. Along this line, type A individuals prefer a smaller value to a larger one, while type B individuals always prefer the larger one. Without loss of generality we normalise type A citizens' utility of full independence to zero, and denote their utility from full centralisation as  $\Delta_A$ .

The ordering follows the citizens' preferences, but there is no meaningful scale that can be given to the zero to one range. We therefore normalise the variable in a way that the type A individuals' utility is a linear function of the autonomy level  $x$ , i.e.  $u_A(x) = -x\Delta_A$ . The utility of a type B citizen,  $u_B(x)$  is then an increasing function of the autonomy level, and implicitly a decreasing function of type A's utility.<sup>5</sup> We denote this function by  $f(x)$ . Note that there is no a priori natural assumption to be made about the curvature of  $f$ . This is because  $f$  reflects the relative strength of preferences between the two types of individuals.<sup>6</sup> Figure 2 depicts an example constellation.

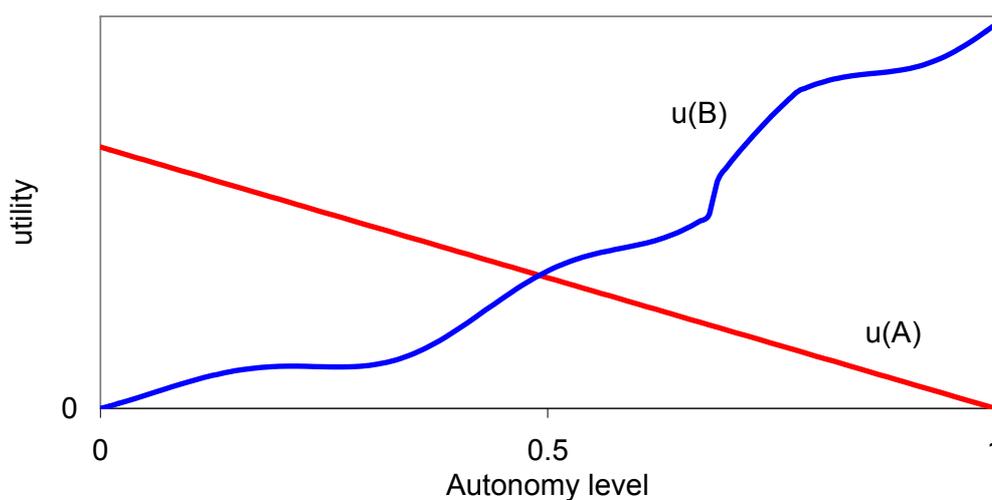
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<sup>3</sup> It is possible to allow for some heterogeneity in the model without changing the main results. It is sufficient to require a majority of citizens in each region to have a certain type of preferences.

<sup>4</sup> Continuity is not crucial for the analysis. It will turn out that very similar results can be obtained if the function has kinks, jumps, or even a discrete domain.

<sup>5</sup> Monotonicity is not technically required, but is a sensible assumption. If there is a policy measure that makes both types of citizens better off, it should simply be implemented and is not part of the interregional conflict.

<sup>6</sup> Implicitly we assume that interpersonal comparison of preferences is feasible and meaningful, which would be the case if utilities represent money equivalents.



**Figure 2. Utility functions for citizens of both types**

With this framework of preferences, we can now construct the strategic model, which is also illustrated in the timeline shown in figure 3. Our game consists of up to four stages. The four stages represent what we think are the crucial steps in the process by which a new institutional arrangement between the two regions is reached. Consider that at the outset of the game the state is organised in full centralisation. This assumption is not crucial for the theoretical analysis of the game that we present below, but it corresponds to the frame that we present to subjects in the experiment. We consider that the initially dominant region A has the political initiative at the beginning of the process. Region B then reacts to A's initiative.

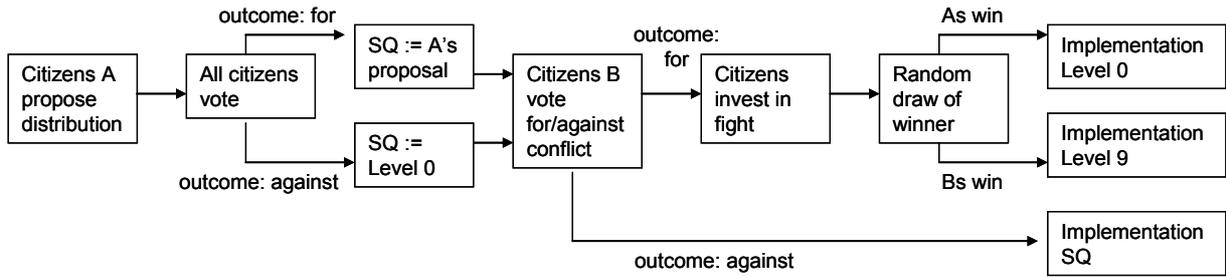
To represent this, in the first stage it is one of the type A player who proposes a level of autonomy,  $x$ , between 0 and 1 inclusively, over which the citizenship as a whole – all As and all Bs – will decide by a majority vote. Lacking a natural “leader” in the experimental context, we opted for having the proposer randomly selected among all A type players.<sup>7</sup> This should be seen as a very simplified representation of a process in which the A type citizens have all the initiative. All type A players are identical and they are in the majority with respect to the B types. Thus, if there is a proposal that is optimal for the type A players, it should be expected to always be made and always win the ballot. The voting behaviour of the type B citizens will not matter in this case.

The second stage consists in the majority rule voting decision advanced above: all citizens, including both type A and type B, vote on this proposal versus the status quo of full centralisation. The winning alternative becomes the starting point for the third stage of the game.

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<sup>7</sup> However, it will be seen that the structure of the proposal process does not affect the theoretical results.

In the third stage type B citizens vote on whether or not they open a conflict for full independence. If a majority votes against the conflict then the interim status quo (the winner of the previous voting stage) is implemented. If a majority votes in favour of opening the conflict for independence, then the conflict – the fourth stage of the process - is fought out. The voting process in the third stage is meant to be a very stylised rendering of the political interaction that takes place between the citizens of the subordinate region.



**Figure 3. Timeline of the game**

The winners of the conflict (either citizens A or B) get their most preferred state implemented, i.e. full centralisation if the citizens A win, and complete independence if the citizens B are victorious. This reflects that after a conflict the winning side can impose its rule on the losers.

Who wins the conflict is determined using a binary lottery. Before the actual fight takes place, each citizen can contribute to its group's "war chest".<sup>8</sup> Thus a type B citizen contributes to the independence campaign of region B, and a type A citizen contributes to its region's movement to maintain complete centralisation. After the contributions have been made, a binary lottery is played out. If the outcome is in region B's favour, then region B becomes an independent state. If region A wins the lottery, then the original status quo of full centralisation is implemented.

The probability with which the two groups win is determined by

$$\text{prob}(\text{CEN}) = \frac{\sum_{i=1}^{n_A} a_i}{\sum_{i=1}^{n_A} a_i + \sum_{j=1}^{n_B} b_j}, \text{ and } \text{prob}(\text{IND}) = \frac{\sum_{j=1}^{n_B} b_j}{\sum_{i=1}^{n_A} a_i + \sum_{j=1}^{n_B} b_j}$$

<sup>8</sup> This term is not to be taken literally. The fourth stage contest might represent a violent conflict, but it does not need to be that way. The contributions could as well stand for efforts taken in political campaigns, like demonstrations, strikes, or propaganda. The recent history of non-violent revolutions (e.g. in Yugoslavia, Georgia, Bolivia, Ukraine or Kyrgyzstan) shows that these methods can effectively overturn political systems. In our design the only costs from conflict are the foregone resources invested in group strength. A more complete model could include direct destruction costs by having (apart from conflict costs) final payoffs shrinking with the intensity of conflict. Whether those additional direct costs would reduce the occurrence of conflict is an interesting open question.

where CEN denotes full centralisation, IND stands for independence. The variables  $a_i$  and  $b_j$  denote the individual contributions of a type A or type B citizen, respectively.

The last stage subgame is a contest game, in which players compete for a prize by investing in campaigning. A contest success function based on the set of the players' (non-refundable) investments determines which contestant receives the prize. We use the lottery contest function proposed Gordon Tullock (1967, 1980) in which each contesting party has a probability of winning the prize equal to the proportion of its investment out of the total investment by all parties. This is, in our view, a very natural way of representing the kind of wasteful rivalry that we want to portray here and is commonly used in conflict models.<sup>9</sup> One important difference of our game to the standard rent-seeking model is that the players are groups whose voluntary contributions form the investment in rent-seeking. Further, the prize may differ for the two groups, which is also non-standard in the rent-seeking literature.<sup>10</sup>

## 2.1. Game-theoretic analysis

We now turn our attention to the equilibrium analysis of our model. For the theoretical analysis we conventionally assume that each player maximises his own expected utility. We study the symmetric subgame perfect equilibria of the game.

At the final stage of the game, each citizen contributes to his region's war chest. For convenience we define the variable  $\Delta_B$  which denotes the difference in a citizen B's payoff between the best (full independence) and the worst (full centralisation) outcome. Recall that for the type A players this difference is  $\Delta_A$  due to the normalisation of their utility from full independence to zero, while for the type B players this difference is  $\Delta_B = f(1) - f(0)$ . We first look at a type B player's maximisation problem. The citizen maximises the expected payoff, which is determined by the stakes in the lottery and the probability of winning. Thus the player maximises

$$\Pi_A = \Delta_A \frac{a_i + A_{-i}}{a_i + A_{-i} + B} - a_i$$

where  $a_i$  denotes player  $i$ 's contribution,  $A_{-i}$  the aggregate contribution of all other type A players, and  $B$  the aggregate contribution of all type B players. Note that player A's payoff in the case of not winning the lottery is normalised to 0.

After some rearrangements, the first order condition of the above maximisation problem

$$a_i = \sqrt{B\Delta_A} - A_{-i} - B \tag{1}$$

Symmetry of all players of the same type then requires that

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<sup>9</sup> For a discussion of the pros and cons of different specific contest functions see Hirshleifer (1989, 1991) and for general surveys of the literature on conflict see Garfinkel and Skaperdas (2006) and Konrad (2007).

<sup>10</sup> For experiments on rent-seeking where players are individuals see Millner and Prat (1989), Davis and Reilly (1998), Potters, de Vries and van Winden (1998) and Anderson and Stafford (2003).

$$A = n_A a_i = \sqrt{B\Delta_A} - B$$

A type B citizen's maximisation problem is analogously

$$\Pi_B = \frac{b_i + B_{-i}}{a_i + A + B_{-i}} \pi_B^{\text{IND}} + \left(1 - \frac{b_i + B_{-i}}{a_i + A + B_{-i}}\right) \pi_B^{\text{CEN}} - b_i \rightarrow \max!$$

With  $\pi_B^{\text{IND}} - \pi_B^{\text{CEN}} = \Delta_B$  and  $B_{-i} = (n_B - 1)b_i$  – for symmetry – we obtain that

$$B = n_A b_i = \sqrt{A\Delta_A} - A$$

Substituting this into (1) yields after some rearrangements the type A player's contribution function

$$a_i = \frac{1}{n_A} \Delta_B \left( \frac{\Delta_A}{\Delta_A + \Delta_B} \right)^2$$

The contribution function for a type B player is completely analogous

$$b_i = \frac{1}{n_B} \left( \frac{\Delta_B}{\Delta_A + \Delta_B} \right)^2$$

Perhaps not surprisingly, these reaction functions have a similar structure to those for standard rent-seeking games. If  $n_A = n_B = 1$  and  $\Delta_A = \Delta_B$  then they are identical to each other. Note that rent dissipation decreases considerably as the groups become larger. Since  $\Delta_j$  is the prize that *each* individual of group  $j$  receives when winning the lottery, the total amount won by the winning team is  $n_j \Delta_j$ . The sum of all group members' contributions, however, just adds up to a contribution equivalent to the individual player case.

With the equilibrium contributions we can now calculate the expected payoff of conflict for a citizen of each region. The probability of region A winning the contest is obtained by substituting the equilibrium contributions into the probability function, thus

$$\text{prob(CEN)} = \frac{\left( \frac{\Delta_B}{\Delta_A + \Delta_B} \right)^2}{\Delta_B \left( \frac{1}{\Delta_A + \Delta_B} \right)^2 + \left( \frac{\Delta_B}{\Delta_A + \Delta_B} \right)^2} = \frac{\Delta_A}{\Delta_A + \Delta_B}.$$

Since a citizen's contribution is lost in any case, the A's expected payoff is

$$E_A(\text{war}) = \frac{\Delta_A^2}{\Delta_A + \Delta_B} - \frac{1}{n_A} \Delta_B \left( \frac{\Delta_A}{\Delta_A + \Delta_B} \right)^2$$

The expected payoff for a citizen B is calculated analogously. In any case a B citizen will get  $f(0)$ , the payoff for the worst case of full centralisation. The additional expected payoff from conflict is then the winning probability times the prize, thus

$$E_B(war) = f(0) + \frac{\Delta_B^2}{\Delta_A + \Delta_B} - \frac{1}{n_B} \left( \frac{\Delta_A}{\Delta_A + \Delta_B} \right)^2$$

From here the analysis of the voting stages is straightforward. If there is an autonomy level which generates a higher utility than the expected payoff of conflict for both A and B citizens, then there will be no conflict. It is always better for a citizen A to propose such a level than one that leads to conflict. All players A vote for it rather than remaining at full centralisation in order to avoid conflict.<sup>11</sup> Since the As form the majority, they will win the vote regardless of the voting behaviour of the citizens B. The citizens B will vote against opening conflict, since their utility at that autonomy level is higher than their conflict payoff as well. If there is more than one autonomy level that has these properties, then the proposing citizen A will pick the one with lowest autonomy, since an A's utility decreases with the level of autonomy.

One of the questions that brought us here is under what conditions an appeasement level of autonomy exists. It is not difficult to see that this depends on the shape of the citizens B's utility function.

**Proposition.** If the citizens B's utility function  $f(x)$  is concave, then there will be no conflict in a subgame perfect equilibrium of the game.<sup>12</sup>

**Proof.** It is sufficient to show that one autonomy level  $x$  exists which generates higher payoffs for both types of citizens than their respective expected payoff of conflict. Suppose

$$x = \frac{\Delta_B}{\Delta_A + \Delta_B}. \text{ A citizen A's payoff at that autonomy level is } 1 - x = \frac{\Delta_A}{\Delta_A + \Delta_B}. \text{ This is higher}$$

than the conflict payoff of  $\frac{\Delta_A}{\Delta_A + \Delta_B} - \frac{1}{n_A} \Delta_B \left( \frac{\Delta_A}{\Delta_A + \Delta_B} \right)^2$ , since the citizen A does not pay

contributions to the war chest. Concavity of citizen B's utility function implies that

$$\begin{aligned} f\left(\frac{\Delta_B}{\Delta_A + \Delta_B}\right) &\geq f(0) + \left(\frac{\Delta_B}{\Delta_A + \Delta_B}\right) \Delta_B = \\ &= f(0) + \frac{\Delta_B^2}{\Delta_A + \Delta_B} > f(0) + \frac{\Delta_B^2}{\Delta_A + \Delta_B} - \frac{1}{n_B} \left(\frac{\Delta_A}{\Delta_A + \Delta_B}\right)^2 = E(\Pi_B) \end{aligned}$$

Hence  $f(x) > E(\Pi_B)$ . ■

<sup>11</sup> In our equilibrium description we assume sincere voting. Strictly speaking, sincere voting is the unique best response only if a voter is pivotal. As a result there are multiple equilibria in which an individual voter's choice does not matter and thus any vote is a best response. However, since these equilibria involve playing weakly dominated strategies we select against them.

Concavity is thus a sufficient, though not necessary, condition for the existence of a peace equilibrium. An example of such a constellation is depicted in figure 4, where we use  $E_i(\text{war})$  to refer to expected payoff from conflict. The intersection of the citizens B's utility function and the expected conflict payoff marks the left boundary of autonomy levels in which peace is at least as good as conflict. Autonomy levels to the left of that point would please the citizens A, but citizens B would prefer conflict. Levels to the right of the intersection of the citizens A's utility function and their conflict payoff would not be suggested by any player A, since they would leave the As worse off. All levels in between these boundaries improve the payoff for both types of citizens over their conflict level. Since the citizens A wish to maximise their payoff, they would propose the smallest autonomy level available that improves both types' payoffs, marked by the vertical line, labelled SPE for subgame-perfect equilibrium.

If the Bs' utility function is too convex, then an appeasement level of autonomy (and thus a peace equilibrium) does not exist. Strong convexity of B's utility function implies that to obtain sizeable increases in B's utility one has to lower A's considerably. In this case conflict is inevitable and one region will get its most preferred outcome. A constellation like this is illustrated in figure 5.

It is worth stressing that the existence of a peaceful interior equilibrium depends on the shape of the utility functions relative to one another. It does not depend on the intensity of the emotions attached to national sovereignty. It is well possible that self-determination issues stir strong emotions among the citizens of a state (or have substantial economic consequences), but nevertheless a peaceful agreement granting limited autonomy can be reached. On the other hand, even if national identity issues are relatively low-key, conflict may arise if the relevant utility function is convex.

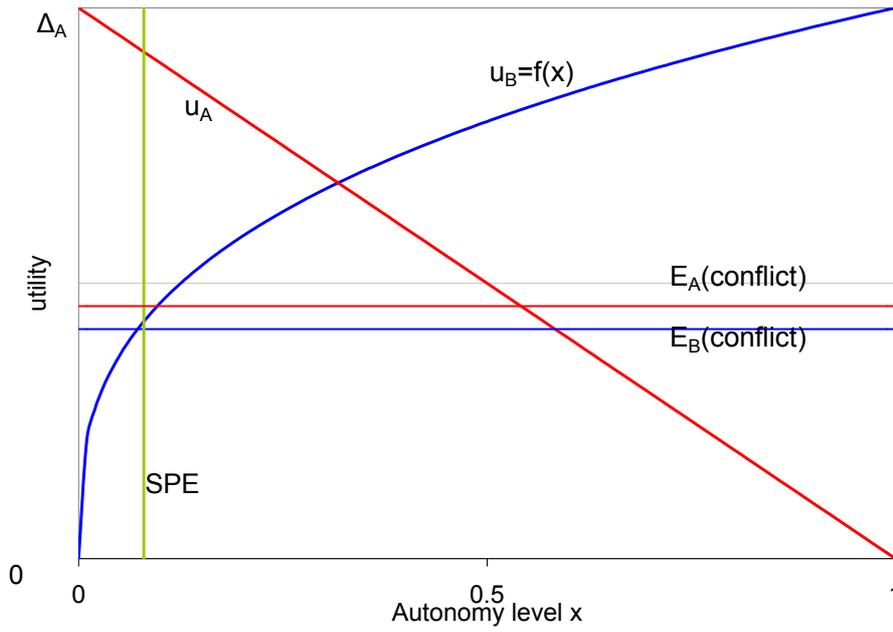
## 2.2. Experimental design and research questions

The analysis of the previous section is based on the assumption that people are only motivated by their own material payoffs. However, we know from many other experiments on interactive situations that relative material payoffs (Fehr & Schmidt, 1999), efficiency considerations (Charness and Rabin, 2002), emotional forces (De Quervain et al., 2004), issues of process satisfaction (Bolton et al., 2005) etc. may also come into play and have substantial influence on behaviour. This is what we want to study with our experiment.

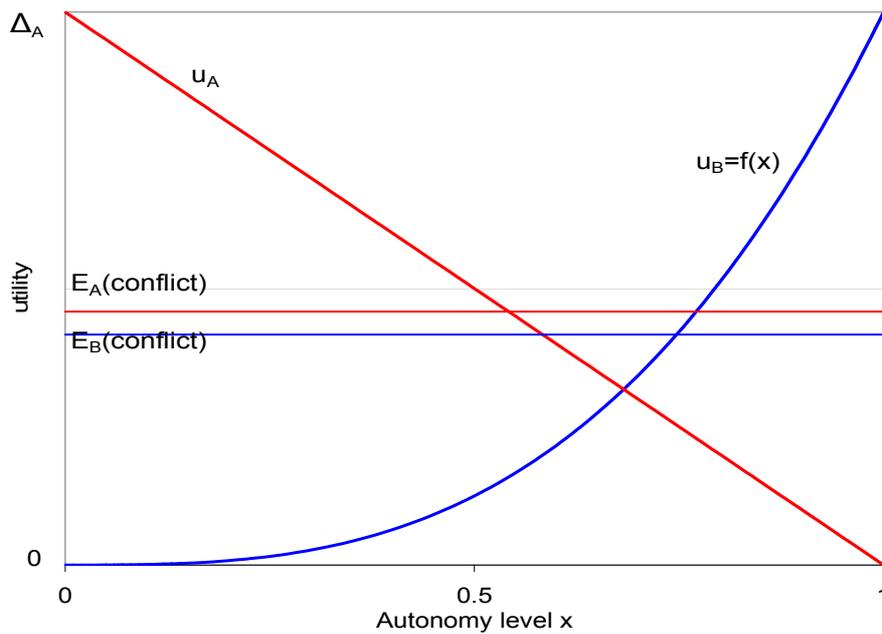
Starting with the first stage of the game, it is possible that the selected A citizens do not propose the payoff corresponding to the subgame-equilibrium presented in section 2.1. Among the reasons for this there could be a concern for others' payoffs as well as a tendency to take advantage of the position of initiative that the timing of the game gives to that player.

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<sup>12</sup> One can think of this result as proposing when appeasement is possible. For some reflections on appeasement see Hirshleifer (2001).



**Figure 4. Concavity and peaceful subgame-perfect equilibrium**



**Figure 5. Convexity and the absence of a peaceful subgame-perfect equilibrium**

At the voting stage deviations from the above analysis could take the form of a tough majority of As rejecting an equilibrium (or even a more favourable) offer made to the Bs. A perhaps more likely possibility is that tough Bs reject an equilibrium proposal to express their dislike of the situation, but possibly also in the hope of being (together with some tough As who reject the proposal for other reasons) in an overall majority who rejects the proposal. The

motivation for Bs voting in this way could be the idea that the “the worse the better”. Once the proposal has been rejected the game is back to the original status quo which is more likely to lead to a conflict when the Bs decide on it.

In the third stage in which the Bs decide on the acceptance of the proposal that has come out of the referendum rejections of the equilibrium (or even better) proposals can again arise. The Bs may be unsatisfied with the process as a whole, in which the As carry the initiative, and may want to express this.

Behaviour in the final fourth stage is also not easy to gauge beforehand. In the game as a whole the conflict stage should never be reached, so that formally it is unclear what to expect. However, we do have a prediction for the As’ and Bs’ contributions to the war chest, for the case in which this conflict game is played in isolation. The question that arises is how good that prediction will be. Once a reasonable proposal has been rejected by the Bs, this may open the door to very emotional behaviour and hence to above equilibrium contributions to the respective war chests.

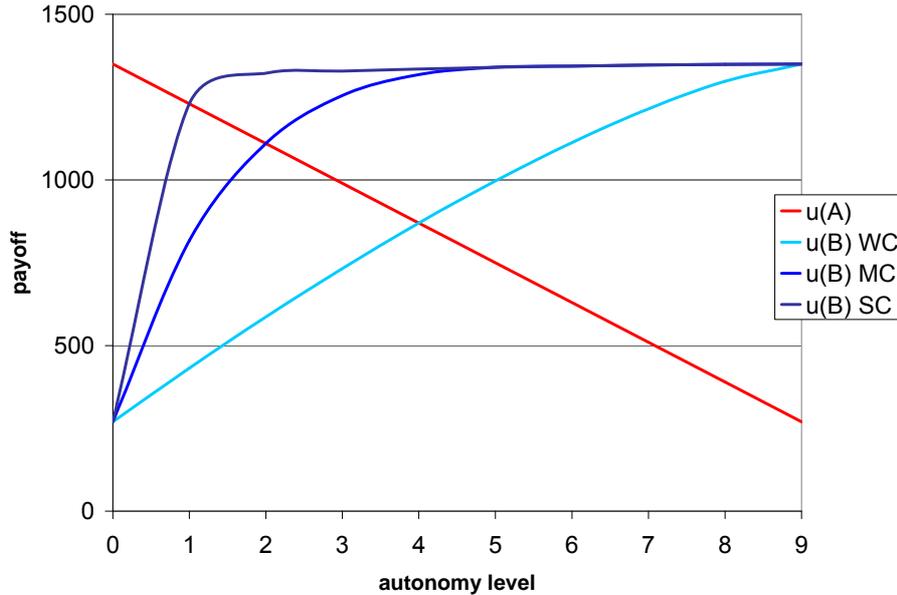
The four possible deviations just discussed are the focus of our study. To get a more complete view of behaviour we also study some of the comparative statics of the model. In particular, we study three different degrees of concavity of the payoff functions and test whether “peace” equilibria are more likely to be achieved the more concave the preferences of the seceding region’s citizens with respect to their autonomy level.

In all six treatments of the experiment there were six citizens of type A and three citizens of type B. We chose this configuration because we wanted to have a substantial majority of A type citizens, and also wanted to make sure that the number of Bs as well as the total number of citizens is odd, in order to ensure that in the voting stages ties were impossible. Space limitations did not allow us to use even larger numbers, given that we wanted to have at least two complete countries in parallel in every session for reasons of anonymity.

In the original set-up we studied three conditions. The treatment variable was the curvature of the payoff function for the citizens of region B. These three functions were derived from the function  $\Pi_B = 270 + 1080x^\beta$ , where  $x \in [0;1]$  is the autonomy level. Note that the linear transformation of the payoff functions, which we applied to generate more convenient integer payoffs in the experimental set-up, does not alter the theoretical predictions in any way. Type A players’ payoffs were also transformed as  $\Pi_A = 1350 - 1080x$ , for the same reason. In one treatment, which we label “weakly concave” (WC hereafter) the value for  $\beta$  was set to 1.38. A second, so-called “medium concave” (MC) treatment, this value was set  $\beta = 5.99$ . Finally, we conducted a “strongly concave” (SC) treatment with  $\beta = 18.65$ . The parameter values were chosen such that there was one autonomy level in which payoffs for all citizens were equal. Figure 6 visualises the payoff functions we used in the experimental sessions.<sup>13</sup>

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<sup>13</sup> We do not study the case of convex preferences of the Bs. We conducted a pilot session using a moderately concave payoff function and no payoff-equalising focal point. In this session, 39 out of 40 games ended in



**Figure 6. Payoff functions in the experiment**

We limited the number of feasible autonomy levels to a discrete grid of 10 equidistant levels, again to improve the presentation of the game to participants. As a result of these manipulations we obtain payoff tables as reproduced in table 1. In the three different treatments the column for the payoff of the As was used together with one of the three columns corresponding to the payoffs of the Bs. These payoffs are rounded values as obtained from the above functions, with the following exception. In the MC and SC treatments, more than one high autonomy level would yield the maximum payoff of 1350. To prevent possible ambiguity resulting from this we slightly changed the payoffs in these cases. In table 1 the subgame perfect equilibrium predictions are shaded.<sup>14</sup> Lower autonomy levels than the equilibrium imply a prediction of conflict, since what the Bs obtain is lower than their conflict payoff.

### 2.3. The conduct of the original set-up sessions

The experimental sessions for the original set-up were all conducted at the *Universitat Autònoma de Barcelona* (UAB), Spain. The experiment was computerised, with software developed using the *RatImage* programming package (Abbink and Sadrieh (1995)).<sup>15</sup> Subjects were recruited with posters placed all over the university campus. Each subject was

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conflict. We figured that to give peace a chance, we would need to create a more favourable environment. For the first real session (MC treatment) we increased concavity and introduced payoff-equalising outcomes.

<sup>14</sup> Apart from the subgame-perfect equilibrium some other distributions of the ones shown in table 1 are worth highlighting. The egalitarian distribution is for WC at an autonomy level of 4, for MC at a level of 2 and for SC at a level of 1, which coincides with the subgame-perfect equilibrium. The utilitarian distributions are for WC at 0, for MC at 2 and for SC at 1.

<sup>15</sup> The appendix contains a copy of the instructions for the original set-up.

allowed to participate in only one session, and no subject had participated in experiments similar to the present one. The subjects were undergraduate students from a wide range of disciplines, with slightly more women than men. The participants in the experiment were mostly Catalan and Spanish students. We chose this location for the original set-up of our experiment because these subjects are precisely immersed in a conflict – albeit a peaceful one – of the type that we want to study. Thus the participants could be seen as more representative of the real-life agents than participants in a country without interregional dispute. The agents in the model represent voters who have pronounced political opinions, but are not necessarily themselves politicians or professionals in policy-oriented areas. So students, who are well-educated potential opinion leaders, seemed the most appropriate subject pool for our study. Later we also ran sessions at the University of Amsterdam, the Netherlands to control for the influence of the subject pool. We present the design and the results from these sessions in section 4.

**Table 1. The payoffs in the three treatments of the experiment**

Autonomy level	Each A receives	Each B receives		
		WC	MC	SC
0	1350	270	270	270
1	1230	432	817	1230
2	1110	587	1110	1322
3	990	733	1255	1329
4	870	870	1318	1335
5	750	997	1340	1340
6	630	1113	1344	1344
7	510	1214	1347	1347
8	390	1298	1349	1349
9	270	1350	1350	1350

In all sessions two experimental countries were run in parallel. There was no migration between these countries and subjects interacted in fixed groups of 9 subjects. Subjects were not told who of the other participants were in the same group, but they knew that the composition of the groups did not change. The subjects were seated distantly from one another in order to ensure that they could not influence each other’s behaviour other than via their decisions in the game.

Each session began with one of the experimenters reading aloud the written instructions (reproduced in appendix 1). In the original set-up the language used in the instructions was always naturalistic, i.e. we did not disguise the situation by using abstract terms only. Players were labelled “citizens” living in two “regions” of a “country”, and they decided on “levels of autonomy” and “opening a conflict” (translations from Spanish). We did, however, avoid very loaded terms like *independence*, *violence* or *war*. Compared with a neutral framing this choice of language has the advantage that the parallelism between experiment and real-life

environment is improved if the language in the experiment echoes the one used in real life.<sup>16</sup> We later also ran sessions with abstract framing, in order to isolate possible emotional influences triggered by wording. These sessions are reported in section 4.

After all questions were answered, the computer programme started play. In each round every citizen A proposed an autonomy level first; one of them was then randomly selected. In this way we could generate a richer data set for citizen A proposals. All citizens were then informed about the selected proposal and asked to vote on it. Like in most real-world ballots, players were informed about the distribution of votes, separately for the two regions, but not on individual voting behaviour. Then the type B citizens voted on whether or not to open the conflict for full autonomy. Again, the distribution of votes was transmitted to all citizens. If a conflict was opened, then all players were asked for their contributions, after which the total contributions in each region was made public. The lottery was then played out, visualised by a wheel of fortune on the computer screens. Participants interacted in fixed groups for 20 rounds.

The total earnings of a subject from participating in this experiment were equal to the sum of all the profits he made during the experiment. A session lasted for about two hours (this includes the time spent to read the instructions). At the end of the experiment, subjects were paid their total earnings anonymously in cash, at a conversion rate of one euro for 1500 talers. Subjects earned between €5.00 and €55.40 with an average of €27.58, which is considerably more than students' regular wage in Barcelona. At the time of the experiment, the exchange rate to other major currencies was approximately US-\$1.20, £0.70, ¥140 and RMB10.5 for one euro.

We conducted four experimental sessions (a session refers to a particular time period in the lab) with each of the three treatments (i.e. each of the three payoff functions introduced above). In each session two separate groups of nine subjects, each corresponding to a "country" played in parallel. Since there is no interaction between the participants of the different countries, each country can be considered a statistically independent observation. Thus we gathered eight independent observations per treatment.

### **3. Results for the original set-up**

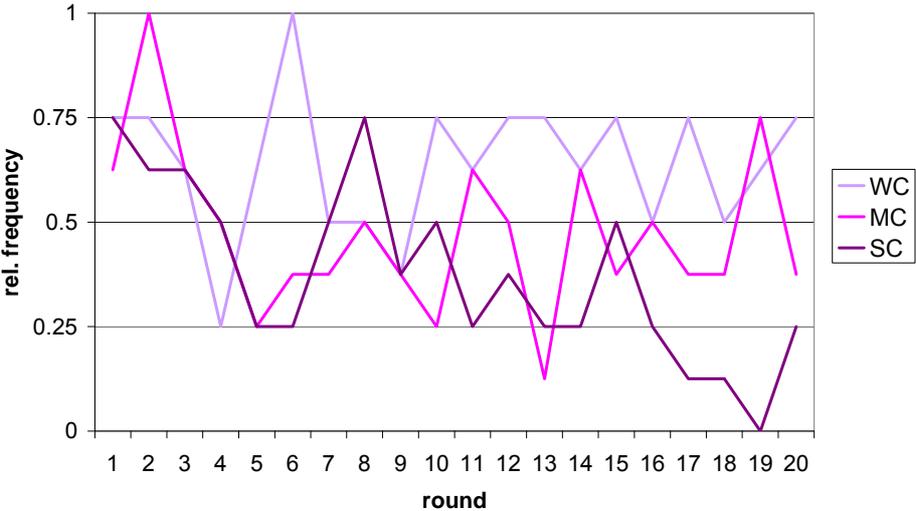
The main focus of our experiment is on the likelihood of conflict and its resolution under the different sets of induced preferences. Therefore, we jump in our results presentation to the last stage of the game and first look at the frequency of an outbreak of conflict. Figure 7 shows the relative frequency of conflict in the three treatments over the twenty rounds of the

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<sup>16</sup> See Baldry (1986), Alm, McClelland, and Schulze (1992), Burnham, McCabe, and Smith (2000), and Abbink and Hennig-Schmidt (2002) for results on instruction framing.

experiment, aggregated over all sessions in each treatment.<sup>17</sup> Recall that concavity of preferences in all treatments implies that – if subjects are guided by these preferences - there should be no conflict at all according to the subgame-perfect equilibrium prediction.

Observe that in all three treatments the proportion of rounds in which no peaceful solution could be achieved is substantial. Even in the strongly concave condition more than one third (37.5%) of all rounds ended in conflict. This is surprising given that the autonomy level of 1 in this treatment is vastly more efficient than conflict. Recall that at this level each citizen gains a sure payoff of 1230, which is only slightly less than the winning party’s per-capita payoff of 1350 (while the losers get a mere 270 each). In addition, citizens lose their contributions to the war chest in conflict. While in the SC treatment the frequency of conflict diminishes over the course of the experiment, no such trend can be observed in the MC and the WC treatment. Rather, conflict frequencies stay high at slightly less than one half even in later rounds. Recall that in these treatments there exist peaceful solutions, autonomy levels 2 and 1 respectively, that provide high (1110 and 1230 talers, respectively) and equal payoffs to all citizens.

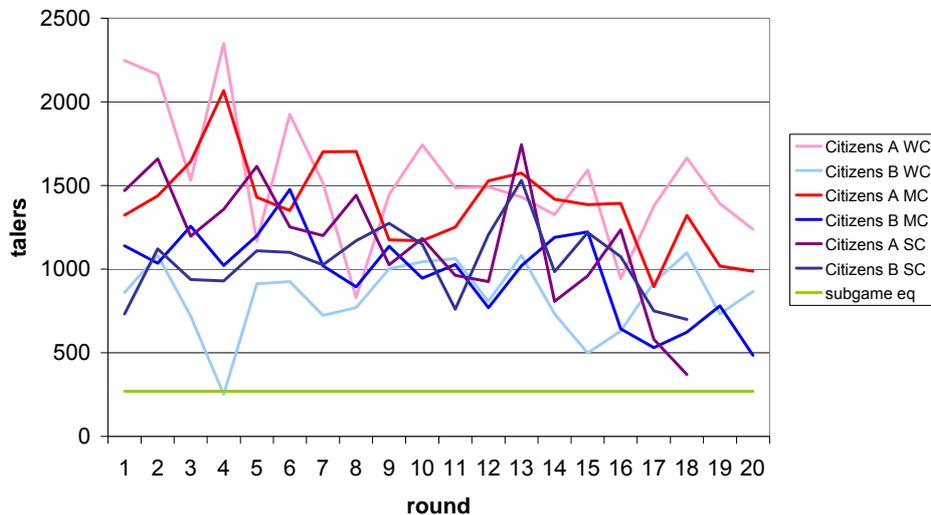


**Figure 7. Conflict frequency**

Over-fighting is strongly pronounced in all three treatments of the experiment, but we can establish a relationship between concavity and the likelihood of conflict. The respective conflict frequencies are 63.8%, 47.5% and 37.5% in the WC, MC, and SC treatment. Thus there is a tendency that a higher degree of concavity leads to a lower incidence of conflict. However, this effect is statistically significant only for the comparison between the WC and the SC treatment ( $\alpha = 0.01$  one-sided, Fisher’s two-sample randomisation test). The other two pair-wise comparisons (WC vs. MC and MC vs. SC) are not significant.

<sup>17</sup> In figure 6 we include both conflicts that emerge after an equilibrium or an even more favourable proposal and

**Result 1.** *In all three treatments the B citizens often vote for conflict even if they had previously accepted the proposal for a new status. Instead of the absence of conflict predicted in the subgame equilibrium we observe conflict frequencies of 63.8% for SC, 47.5% for MC and 37.5% for WC.*



**Figure 8. Average aggregate contribution to conflict**

The core of our interest is in the existence of peaceful solutions to inter-regional conflicts of the ethno-political type. In that respect result 1 can be seen as the bottom line. However, once a conflict has erupted there is still a question of how strong or intense the conflict will be in terms of the contributions to the war chests. Figure 8 shows the average total group contributions, conditional on there being a conflict, over the twenty rounds of the experiment.<sup>18</sup> The subgame equilibrium prediction for the conflict games considered in isolation is a total contribution of 270 for both the group of A citizens and the one of the B citizens, with individual contributions of 45 for each A and 90 for each B citizen.

One can see that the tendency towards over-fighting manifests itself further in the massive contribution levels once a conflict has been opened. In fact the average contribution we observe in the experiment is 4.4 times higher than in the subgame equilibrium, with an average total contribution of 1376.3 for the A and 949.4 for the B citizens. Thus, not only is there far more conflict than predicted, but if there is conflict it is also far more intense.<sup>19</sup>

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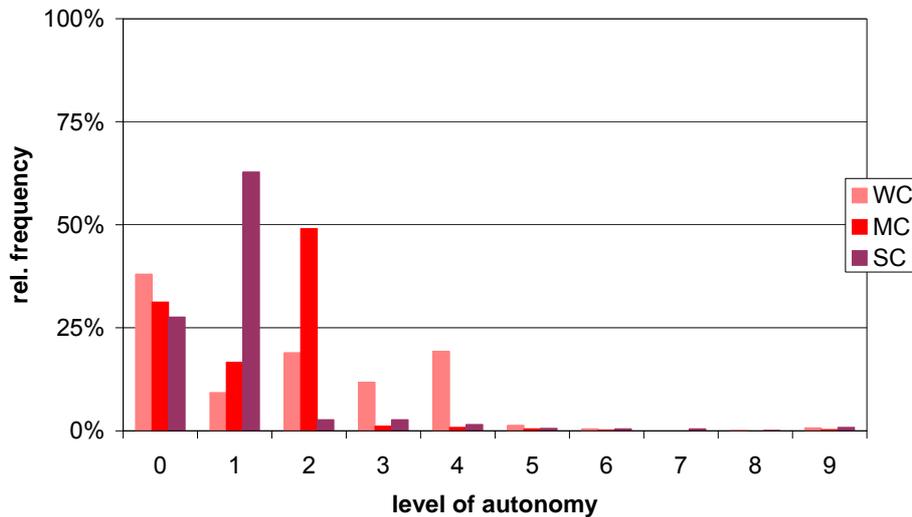
those that emerge after an out of equilibrium proposal.

<sup>18</sup> For the SC treatment there was never conflict in round 19, in round 20 there were conflicts and the average contributions were 1756 for the A citizens and 1009.5 for the B citizens.

<sup>19</sup> Most experimental studies on rent-seeking games show that investment in conflict is larger than in equilibrium, but to a far lesser extent. In all existing rent-seeking experiments individuals play for their own good. In our experiment individuals contribute to their group effort. The theoretical prediction would let us expect strong free-riding behaviour. Such an effect, however, is virtually absent in the data.

Significant treatment differences cannot be observed with respect to the contributions. However, once a conflict breaks out the subgame is identical in the three treatments, thus the absence of such effects might not be surprising.

**Result 2.** *In all three treatments we observe strong over-fighting with respect to the equilibrium level of the conflict stage as such.*



**Figure 9. Distribution of citizens A's proposals**

### 3.2. Causes of over-fighting

The massive over-fighting we observe in both frequency and intensity is especially surprising given that we designed the experiment purposefully to give peace its best shot. Recall that in all treatments there is an attractive payoff-equalising proposal. Equal payoffs are known to be very salient focal points from a plethora of bargaining experiments. So the question is why participants fail so frequently to agree on them. Do the As offer too little or the Bs demand too much? We look into the offers the As make and the voting behaviour of the Bs to find out.

We start with the distribution of the proposals made by the As in the first stage, which are shown in figure 9. This includes all proposals made by the A citizens and not only those randomly selected to actually be presented to the B citizens. Recall that the payoff equalising autonomy level is 4 in WC, 2 in MC, and 1 in SC, and the subgame-perfect equilibrium autonomy level is 3 for WC and 1 for both MC and SC.

Figure 9 shows that in the WC treatment more than 80 per cent of all proposals fall short of the payoff equalising autonomy level. In the other treatments payoff equalisation is the modal proposal, but the distribution is clearly skewed towards offers less favourable to the Bs. Overall, type A citizens frequently fail to make proposals acceptable to the B citizens. About one third of the proposals involve an autonomy level of zero, which means the citizen A refuses to offer any level of autonomy and therefore near-certainly opts for conflict.

**Result 3.** *The A citizens frequently propose to the B citizens autonomy that are disadvantageous to the B citizens.*

Table 2 shows that the As' frequent failure to make payoff-equalising proposals is indeed the key to explaining the high conflict frequency. The table shows how often a certain proposal ended in conflict. Payoff-equalising offers rarely lead to conflict, in all treatments this fraction is no more than one in eight. Lower offers, as we have observed them frequently, typically end in conflict because the Bs reject them, higher offers typically do not pass the first voting stage because the fellow As are not satisfied.

**Table 2. Conflict frequency conditional on selected proposal**

Prop	WC			MC			SC		
	#peace	#war	% war	#peace	#war	% war	#peace	#war	% war
0	1	67	98.5%	0	41	100.0%	4	33	89.2%
1	1	5	83.3%	14	16	53.3%	79	9	10.2%
2	9	15	62.5%	61	2	3.2%	3	2	40.0%
3	9	8	47.1%	2	1	33.3%	4	1	20.0%
4	21	3	12.5%	1	1	50.0%	1	1	50.0%
5	0	1	100.0%	1	0	0.0%	0	0	--
6	0	0	--	0	0	--	2	0	0.0%
7	0	0	--	0	0	--	1	0	0.0%
8	0	0	--	0	0	--	0	0	--
<b>9</b>	0	0	--	0	0	--	0	0	--

**Result 4.** *Payoff equalising proposals rarely end in conflict. Lower or higher offers often are rejected by one of the groups.*

#### 4. Additional sessions with a new subject pool and new instructions

The previous analysis suggests an explanation for why there is a high frequency of conflict despite the concave payoff functions that guarantee the existence of Pareto superior peaceful solutions. Aspiration levels (Simon 1955, 1959) of some citizens A and the citizens B appear to be incompatible. Citizens B are not satisfied with less than equity and opt for conflict even if accepting lower proposals would still be materially better than conflict. This explanation still leaves us with the puzzle of why fighting is also much too intense, as compared to the equilibrium level of the conflict game as such.

One natural conjecture is that this is due to the particular subject pool and to the use of naturalistic language in the instructions. Many Catalans have strong feelings about issues of national identity and self-determination. Given the naturalistic instructions, an unsatisfactory interaction process leading to a conflict situation may - in such a subject pool - trigger an intense emotional response which leads to the very high investment levels we observe. However, it is also possible that the game as such, involving group competition, leads to strong fighting regardless of the framing and the subject pool.

To study these possibilities we varied the instructions and the subject pool. We ran additional sessions for three new treatments. First, we conducted additional sessions in Barcelona using the same game as in our original MC treatment, but with instructions worded in abstract language. These can be found in appendix B. As can be seen all loaded terms like “country”, “region”, “autonomy level”, “conflict” etc. have been replaced by neutral abstract expressions. Without these linguistic hints the game is harder to identify as a model of an independence struggle, thus we may expect that the emotional response would be weaker, leading to lower contributions.

Second, we conducted sessions with both loaded and neutral instructions at the University of Amsterdam, the Netherlands. There is no independence conflict that concerns the Netherlands at the moment, so one would expect that people have less strong feelings about such issues.<sup>20</sup> If there is a framing effect of loaded instructions, one would expect it to be weaker in Amsterdam than in Barcelona.

The Barcelona subjects came from the general student population of the UAB, the Amsterdam subjects came from the general student population of the University of Amsterdam. We gathered some demographic information and found the subject pools to be similar. In both pools the modal age was 19, economics students formed the largest group, an overwhelming majority were born in the local country and native speakers of a local language.<sup>21</sup> Atheists formed the largest “religious” denomination, followed by Christians. Minor differences were that the majority in Barcelona were women, in Amsterdam men. However, this difference was small. We also asked the subjects in Barcelona a question on their national identity. They were requested to indicate whether they saw themselves as “only Spanish”, “more Spanish than Catalan”, “equally Spanish and Catalan”, “more Catalan than Spanish”, or “only Catalan”. The modal answer was “more Catalan than Spanish”, followed by “equally Spanish and Catalan”, with few responses at the extreme ends.<sup>22</sup>

As before, we conducted four experimental sessions with each of the three new treatments and gathered eight statistically independent observations per treatment.

We start with the comparisons of conflict frequency across treatments. Figure 10 shows the average percentage of conflict in the six treatments of the experiment. Inspection of the figure suggests that the differences between subject pools and framing conditions are not large. Of the pairwise comparisons for the four treatments with the MC payoff function, only the

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<sup>20</sup> Suriname, a former Dutch colony, won independence in 1975. The students in our subject pool are thus too young to remember, and there is little reverberation of the event in the Dutch political debate today. The status of the remaining overseas territories (Aruba and Netherlands Antilles) is a very low-key issue, certainly not comparable with the situation in Spain.

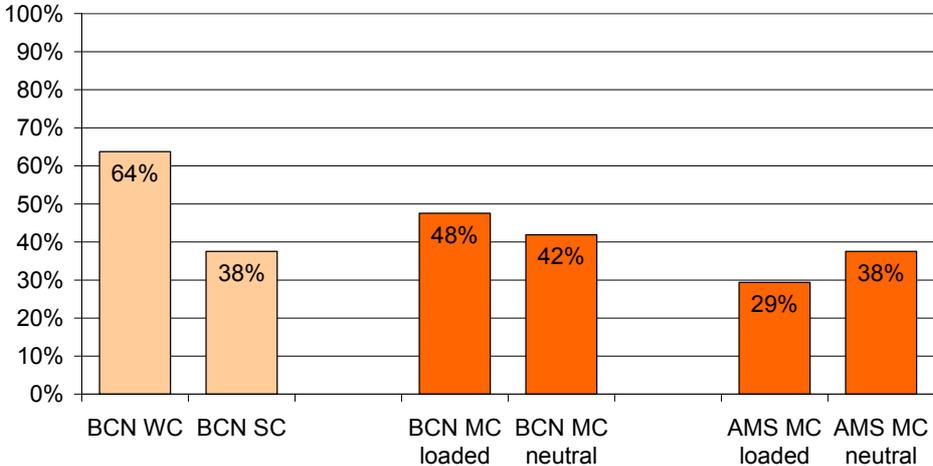
<sup>21</sup> The University of Amsterdam has a very international student population. To make sure that mainly Dutch students took part in the experiment, the e-mail invitations to the experiment were sent out in Dutch, though the language of the instructions was English, the language of instruction for most students in Amsterdam.

<sup>22</sup> The distribution in our sample is only slightly more skewed towards a more Catalan identity than in the general population. The question we asked is regularly used in opinion polls.

difference between BCN-loaded and AMS-loaded is significant, but observe that the lower of these conflict frequencies reaches the considerable level of 29%. Between the Barcelona sessions the framing effect is small and insignificant, between the Amsterdam treatment the effect is even (but not significantly) in the opposite direction.

How can we rationalize the perhaps unexpected the pattern of differences shown in figure 10? As we have seen above, conflict stems from incompatibilities between the two groups' aspiration levels. This incompatibility of aspiration levels between groups in a conflict environment may just be an instance of a more general kind of coordination failure that is not much affected by an emotional involvement in the situation.

**Result 5.** *Neutral framing of the instructions significantly reduces contributions in the Barcelona subject pool, while Amsterdam students show a much weaker response to framing.*



**Figure 10. Conflict frequency**

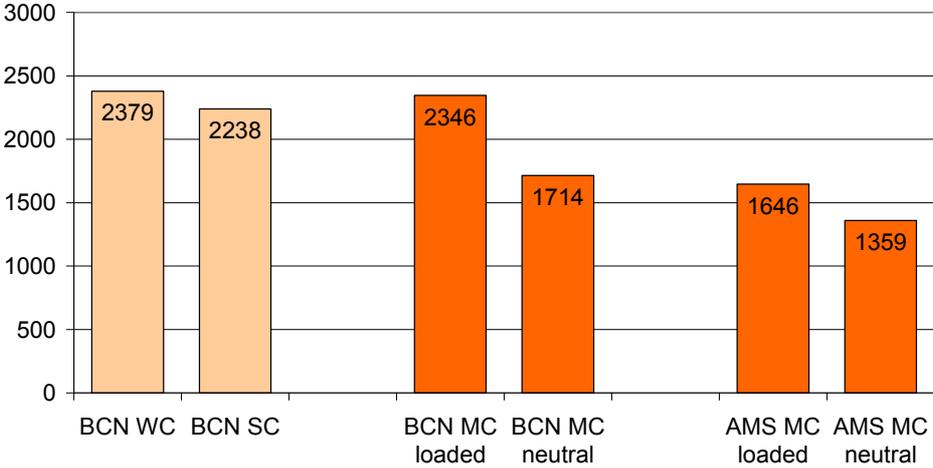
Given the rather similar conflict frequencies across the new treatments, we now move to the comparisons of conflict intensity. Figure 11 shows average total conflict investment levels in the six treatments of the experiment. Now we find clearer differences that go in the hypothesized directions. There is a strong framing effect among the Catalan subjects. Contributions drop by 26.9 per cent. The difference is significant at  $p=0.032$  (one-sided), according to Fisher's two-sample randomisation test applied to average investment levels in each country. Further, the framing effect is much weaker in the Amsterdam sessions, whose subjects should generally be less emotionally involved in the matter. The difference we observe is not statistically significant.

The figure also shows that contributions in Amsterdam are lower than those in Barcelona. Direct comparisons across subject pools are notoriously difficult, since despite our best efforts it can never be ruled out that there are some idiosyncratic subject pool characteristics that remain uncontrolled for. Nevertheless, the tendency is clearly in the predicted direction.

Further, the subject pool difference is highly significant with loaded instructions ( $p=0.004$ ), but not significant in the treatment with neutral instructions ( $p=0.125$ ).

**Result 6.** *Neutral framing of the instructions significantly reduces contributions in the Barcelona subject pool, while Amsterdam students show a much weaker response to framing.*

We have shown that subject pools and framing conditions have a minor effect on conflict frequency and an important effect on conflict intensity. However, despite the strong framing effect in Barcelona and the difference between the subject pools, the emotional response triggered by involvement and loaded instructions cannot explain all of the above-equilibrium contributions. Even in the least susceptible treatment, with neutral instructions and Amsterdam students, contributions are still 2.5 times higher than in the subgame-perfect equilibrium. Thus, a substantial part of the over-fighting must be induced by the group dynamics the contest as such may generate.



**Figure 11. Total conflict investment**

### 5. Summary and Conclusions

We study an experimental game capturing essential features of a dependent region’s fight for more political autonomy in a democratic context. For the concave preferences we study, theory prescribes a “peace equilibrium” with an intermediate degree of political autonomy and no conflict.

In our original set-up with a Barcelona subject pool and moderately loaded instructions, we observe that conflict not only happens frequently, but it also much more intense than it should be. We can attribute the frequent occurrence of conflict to a failure of the dominant region’s citizens to make acceptable proposals, where acceptability is defined as equity across groups. The excess intensity is due to a combination of responses triggered by the political context

and group dynamics inherent to the context. In an emotionally discharged setting, using neutral wording and/or an uninvolved subject pool, conflict intensity drops considerably. It remains, however, still substantially above equilibrium levels.

The interaction between the two groups, set in an emotionally loaded context, leads to the emergence of some kind of group cohesion, which in turn leads to unacceptable offers. This triggers unreasonable investment levels in the inter-group conflict. Our results are an instance of how political, psychological and economic factors can interact: a biased – albeit democratic - political process can trigger emotional forces which lead to an important destruction of material resources. Conducting the experiment in what be seen as an emotionally loaded context leads to an increase in conflict intensity.

The behaviour we observe is not simply guided by a tendency to gain material benefit for one's group and to hurt members of the other group, as documented in Tajfel, Billig, Bundy and Flament (1971). Our results are more related to those obtained by Bornstein and Ben-Yossef (1994) using a social dilemma game. They find that placing people into groups triggers higher competitiveness, even though that competition may result in losses for all concerned. Pemberton, Insko and Schopler (1996) suggest that part of the problems could be that individuals, assuming that acting in groups triggers competitive behaviour, expect the members of the *other* group to act in a competitive way. This may lead to the consistency of expectations and behaviour of both groups. In our particular framework this would explain why the As act aggressively towards the Bs by often not proposing fair outcomes; they may simply act in anticipation of aggressive responses by the Bs.

In relation to the interpretation of actual ethno-political conflicts outside the laboratory the results are not encouraging. We observe very unreasonable behaviour in the very moderately emotional climate of the lab. The emotional forces that lead to the behaviour we observe can be conjectured to be much more intense in natural environments involving communities that have been in conflict for generations.

We close with some speculative remarks intended to inspire further research. The question arises as to how, in the light of our results, costly conflict could be reduced. According to the notion put forward by Fearon (1995) that the problem of ethnic violence is connected to the absence of a third party that can guarantee agreements, one possible way to reduce conflict would be mediation by a neutral third party. Part of the problem with our environment is that the A citizens have the initiative in proposing an outcome. This seems to make them somehow aggressive in their demands. At the same time the B citizens respond aggressively to the As proposals, as if they felt hurt in their pride due to the fact that they are assigned a more passive role. If a proposal for a reasonable arrangement were made by an independent mediator much of the aggressiveness displayed by both sides might disappear. Indeed, mediation is very frequently observed in situation of conflicts between communities, as in the former Yugoslavia.

Another way to improve relations between the two communities could be a change in the rules of the game to a situation with more symmetric roles for the As and the Bs. Perhaps if the initial proposals were launched by a small subset of As and Bs, a balanced expert commission of some sort, acceptance of equilibrium proposals might increase.

Our results show that concavity of relative preferences between the two groups does matter, albeit only moderately. In the experiment, of course, these preferences were induced by payoff tables. External validation of our results would require extensive survey studies to assess the preference profile in different countries in which autonomy struggles prevail. Such studies would systematically assess how different bundles of policy measures can be ordered to preference profiles as we use in our model. It would then be possible to evaluate the concavity of relative preferences between the median voters in the regions. In a cross-cultural survey our results could be empirically validated and potentially guide policy-makers in their effort to find peaceful solutions to the respective countries' problems.

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# Appendix A. Naturalistic Instructions

## General information

We thank you for coming to the experiment. The purpose of this session is to study how people make decisions in a particular situation. During the session it is not permitted to talk or communicate with the other participants. If you have a question, please raise your hand and one of us will come to your desk to answer it. During the session you will earn money. At the end of the session the amount you will have earned during the experiment will be paid to you in cash. Payments are confidential, we will not inform any of the other participants of the amount you have earned.

During the experiment you will be in a group with eight other participants. You will be grouped with the same participants throughout the experiment. You will not be informed of the identity of the persons you are grouped with. Six of the persons in your group will be in subgroup A and three in subgroup B throughout the experiment.

The experiment consists of 20 separate rounds.

## Decision stages of each round

In each round participants will make decisions in three stages.

### Stage 1

All participants live together in a country, with the As living in region A and the Bs in region B. Stage 1 of every round starts with original status quo payoffs of  $x$  for each of the participants in region A and of  $y$  for each of the participants in region B. These original status quo payoffs will be the same in all rounds. It is possible that there will be a referendum among all the members of a group about whether to replace the original status quo by another level of autonomy implying a different payoff combination. The table below shows the different possible autonomy level with corresponding payoff combinations.

		Payoff combinations of the different autonomy levels [see main text]								
Autonomy level	Original status quo	1	2	3	4	5	6	7	8	Full autonomy
Every A gets										
Every B gets										

Before the referendum can take place each of the As will propose simultaneously which autonomy level (original status quo, I, II, ..., full autonomy) they want to replace the original status quo with. The proposal of one of the As will be chosen at random. If the randomly

chosen proposal is the original status quo itself, then the original status quo remains, no referendum takes place and the round moves directly to stage 2. If the randomly chosen proposal is not the status quo then all the As and Bs will be called to vote in favour of the new proposal or the original status quo. Whichever of the two possibilities obtains more votes wins and becomes the new status quo. Then the round moves to stage 2.

## **Stage 2**

In this stage there will be a referendum among only the Bs to decide whether they accept what now is the status quo. If the majority of the Bs says yes the round ends and the As and Bs in the group earn the payoff corresponding to the new status quo. If the majority says no, then a conflict arises and the round moves to stage 3.

## **Stage 3**

In this stage each of the participants in a group can campaign by investing money either in a “original status quo account” or in a “full autonomy” account. All participants make this decision simultaneously. Once all have made their decision the computer will randomly determine whether the payoff combination of the original status quo or the payoff combination of full autonomy will be implemented. The probability that the original status quo will be selected is:

$$\frac{\text{(Money in the original status quo account)}}{\text{(Money in the original status quo account + Money in the full autonomy account)},}$$

and the probability that full autonomy is selected is:

$$\frac{\text{(Money in the original full autonomy account)}}{\text{(Money in the original status quo account + Money in the full autonomy account)}.$$

Note that the two probabilities sum to one, i.e. one of the two payoffs, the original status quo or full autonomy, will be selected with certainty. Note also that the more money in one of the accounts relative to the other, the more likely that the first account will be selected.

Once the final payoff combination has been selected the round ends. After that the next round will start, until a total of 20 rounds.

## **Earnings**

At the beginning of the experiment each of you will receive 1000 talers credited to your account. After each round, your round earnings are credited to your account. At any moment during the experiment you will be able to check the money in your account on the screen.

At the end of the experiment the talers will be converted to euros at the exchange rate of 1.50 euros for each 1000 talers.

## **Appendix B. Neutral Instructions**

**General information**

We thank you for coming to the experiment. The purpose of this session is to study how people make decisions in a particular situation. During the session it is not permitted to talk or communicate with the other participants. If you have a question, please raise your hand and one of us will come to your desk to answer it. During the session you will earn money. At the end of the session the amount you will have earned during the experiment will be paid to you in cash. Payments are confidential, we will not inform any of the other participants of the amount you have earned.

During the experiment you will be in a group with eight other participants. You will be grouped with the same participants throughout the experiment. You will not be informed of the identity of the persons you are grouped with. Six of the persons in your group will be in subgroup A and three in subgroup B throughout the experiment.

The experiment consists of 20 separate rounds.

**Decision stages of each round**

In each round participants will make decisions in three stages.

**Stage 1**

All participants are together in a group, with the As in subgroup A and the Bs in subgroup B. Stage 1 of every round starts with initial payoffs of  $x$  for each of the participants in subgroup A and of  $y$  for each of the participants in subgroup B. These initial payoffs will be the same in all rounds. It is possible that there will be a vote among all the members of a group about whether to replace the initial payoff distribution by a different payoff combination. The table below shows the different possible payoff combinations.

		Payoff combinations								
Name of payoff distribution	Initial payoff distribution	1	2	3	4	5	6	7	8	9
Every A gets										
Every B gets										

Before the vote can take place each of the As will propose simultaneously which payoff distribution (initial payoff distribution, 1, 2,..., 9) they want to replace the initial payoff distribution with. The proposal of one of the As will be chosen at random. If the randomly chosen proposal is the initial payoff distribution itself, then the initial payoff distribution remains, no vote takes place and the round moves directly to stage 2. If the randomly chosen proposal is not the initial payoff distribution then all the As and Bs will be called to vote in

favour of the new proposal or the initial payoff distribution. Whichever of the two possibilities obtains more votes wins and becomes the newly proposed initial payoff distribution. Then the round moves to stage 2.

## **Stage 2**

In this stage there will be a vote among only the Bs to decide whether they accept what now is the newly proposed payoff distribution. If the majority of the Bs says yes the round ends and the As and Bs in the group earn the payoff corresponding to the newly proposed payoff distribution. If the majority says no, then a conflict arises and the round moves to stage 3.

## **Stage 3**

In this stage each of the participants in a group can invest money either in a “initial payoff distribution account” or in a “payoff distribution number 9” account. All participants make this decision simultaneously. Once all have made their decision the computer will randomly determine whether the payoff combination of the initial payoff distribution or the payoff combination number 9 will be implemented. The probability that the initial payoff distribution will be selected is:

$$\frac{\text{(Money in the initial payoff distribution account)}}{\text{(Money in the initial payoff distribution account + Money in the payoff distribution number 9 account)}}$$

and the probability that payoff distribution number 9 is selected is:

$$\frac{\text{(Money in the payoff distribution number 9 account)}}{\text{(Money in the initial payoff distribution account + Money in the payoff distribution number 9 account)}}$$

Note that the two probabilities sum to one, i.e. one of the two payoffs, the initial payoff distribution or the payoff distribution number 9, will be selected with certainty. Note also that the more money in one of the accounts relative to the other, the more likely that the first account will be selected.

Once the final payoff combination has been selected the round ends. After that the next round will start, until a total of 20 rounds.

## **Earnings**

At the beginning of the experiment each of you will receive 1000 talers credited to your account. After each round, your round earnings are credited to your account. At any moment during the experiment you will be able to check the money in your account on the screen.

At the end of the experiment the talers will be converted to euros at the exchange rate of 1.50 euros for each 1000 talers.