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Conflict as a Part of the Bargaining Process: Theory and Empirical Evidence

Santiago Sánchez-Pagés*

November 21, 2004

Abstract

This paper explores the role of conflict as a bargaining tool. It first presents a simple bargaining model with one-sided incomplete information. Parties can choose the scope of the confrontation they may want to engage in: A limited conflict that only introduces delay, or an absolute conflict that terminates the game. The outcomes of both types of confrontation are driven by the relative strength of the parties that is only known to one of them. Therefore, the non-final conflict conveys information about the eventual outcome of the absolute one. In this framework, it is shown that confrontation has a double-edged effect: It may paradoxically open the door to agreement when the uninformed party is so optimistic that no agreement is feasible. But it can also create inefficiency when agreement is possible but the informed agent has an incentive to improve her bargaining position by fighting. The second part of the paper performs a duration analysis on a sample of colonial and imperial wars fought between 1817 and 1988. The results offer evidence illustrating the use of conflict in negotiations.

Keywords: Conflict, Bargaining, Incomplete information, Duration analysis.

JEL codes: C41, C78, D74, J52, K41.

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"War is [...] a true political instrument, a continuation of political activity by other means."

Carl von Clausewitz, (1832), *On war.*

1 Introduction

Even in the presence of mutually beneficial settlements, disagreement is the rule rather than the exception. This pervasive difficulty in reaching agreements, commonly known as the *Hicks paradox*, has specially far-reaching consequences in those contexts where disagreement entails some sort of confrontation. In legal disputes, labor negotiations or international conflicts, a failure in striking a bargain provokes losses of time and money, output, equipment and human lives. It is not surprising then that understanding the bargaining process had become a key question in Economics.

Incomplete information about critical aspects of the negotiation environment (e.g. reservation price, trial value, military power) has been systematically invoked as an explanation for this puzzle. The bargaining literature contains a plethora of models that have offered important insights following this approach[1]. One should, however, remain dissatisfied with the standard incomplete information explanation. Take for instance two parties who are about to engage in a conflict. It is plausible that the role of private information in preventing an agreement between them is much less important when their observable levels of strength are very unequal[2]. But we can often observe clearly small and weak countries or individuals fighting or litigating against much larger and powerful ones. We will here refer to this also pervasive phenomenon as the *Uneven contenders paradox*.[3]

The present paper belongs to the economic tradition considering incomplete information as a powerful tool in understanding the process of negotiation. But it also explores a complementary, and perhaps more basic, line of enquiry: In order to understand how parties reach an agreement one should understand first how they disagree. A more careful analysis of the nature of disagreement reveals that *conflict is part of the bargaining process* and not only an alternative to it. This fresh look also offers new answers to the Hicks paradox and a consistent explanation to the puzzle of Uneven contenders.

The aim of this paper is thus to study the role of confrontation as a bargaining instrument. In the first part, we analyze the effect of the use of conflict in negotiations on efficiency and on the agreements that will be ultimately reached. To this end, we explore a simple two-stage bargaining model with one-sided incomplete information. The second part of the paper

[1] For a very exhaustive survey of the literature see Ausubel et al. (2002).
[2] See Blainey (1973) and Wagner (1994).
[3] This paradox was first noted by Clausewitz (1832)[1976].

offers illustrative evidence of the use of confrontation in negotiations by means of a duration analysis performed on a sample of real conflicts.

1.1 Conflict as a bargaining instrument

It is a bit surprising how the economic approach to disagreement still remains strongly tailored by Nash's seminal contribution. In his description of the *bargaining problem,* Nash (1950) embeds disagreement in the threat point, meant to be the outcome of a hypothetical non-cooperative game played after parties fail to agree on how to share the surplus of cooperation. However, no information about that game or the forces that determine the location of such point is incorporated into the description of the problem.

A careful analysis of the nature of disagreement reveals two important facts challenging this approach. First, the conflicts and confrontations often following disagreement are driven by the power relationship or *relative strength* of the parties. Examples are the renegotiation of the terms of a contract between a soccer player and his club; the negotiations between two countries on the division of some piece of territory; between workers and management on wages; or simply how a just married couple will share the chores. When parties fail to agree in these settings they can resort to coercive methods; they can go to court, they can go to war or strike; they can divorce. And although the outcomes of these conflicts are typically noisy, they still depend on military strengths, the extent of the union membership or the quality of the lawyers. That is, they depend on *power.* Consequently, any sensible agreement will be conditioned by how the conflict ensuing disagreement is resolved.

Second, disagreement is not only an outside option. Parties actually choose the *scope* and the intensity of the conflict they will fight when disagree: India and Pakistan have not used nuclear weapons, only engaged in skirmishes; Pepsi and Coca-cola do not fight worldwide price wars, but only national; family arguments do not necessarily imply divorce. This distinction is critical because after a limited (non-final) confrontation, bargaining can resume. Not in vain, disputes end mostly because parties agree on stopping hostilities rather than because, unfailingly, one side collapses. Therefore, to assume that only all-out conflicts are possible prevents us to see that conflict is part of the bargaining process.

Incomplete information plays a crucial role because the imperfect knowledge of the opponent's strength turns these limited conflicts into a bargaining instrument. Suppose that two agents are uncertain about the strength of their opponent in case of conflict, and that both parties are "strong" but believe they are facing a "weak" rival. Then, no peaceful settlement can satisfy both of them and the result of the negotiation is inevitably total confrontation. But if parties can engage in a limited conflict whose outcome is also determined by their relative power, it will convey information about the true balance of strengths and, perhaps, open the door to agreement.

1.2 Overview and results

The first part of this paper presents a simple bargaining model considering two main features. Inspired by the pioneer analysis of Clausewitz (1832), the model's first main ingredient is to allow parties to choose between two types of conflicts: *Absolute Conflict*, equivalent to an outside option and that ends the game when taken; on the contrary, the *Battle* (inspired by Clausewitz's "Real" conflicts), makes the game proceed to the next stage and therefore does not rule out the possibility of reaching a settlement. However, they share a common feature: Parties' winning probabilities in both types of conflicts are a function of their relative strength.

The second main ingredient of the model is incomplete information. We assume that the actual balance of power is only known by one side. Therefore, the Battle conveys information about the eventual outcome of the Absolute Conflict. But information is not transmitted in the battlefield only. The informed party can also make offers that may convey information about her strength. The key difference between these two sources of information is that whereas offers are typically used to misrepresent the own type, the outcome of the Battle is not subject to manipulation, it depends on the parties' true relative strength. Strategic behavior is thus limited to the decision of invoking such conflict.

We then characterize the set of equilibria of this game. The main result of the paper shows the double-edged effect of limited confrontations in bargaining: When excessive optimism precludes agreement, the Battle may be efficiency enhancing because a defeat makes the uninformed agent more pessimistic and agreement more likely. If the cost of the Battle is sufficiently low, the inefficiency associated with Absolute Conflict is (partially) avoided. But this also implies that when agreement is feasible and the informed agent triggers the Battle in order to improve his bargaining position, inefficiency is created because an immediate settlement could be designed. Therefore, the existence of a set of possible agreements is a necessary but not a sufficient condition for a settlement to be reached. Rational agents will engage in limited confrontations whenever the returns from doing so are higher than the returns from "diplomacy". This sheds new light on the two paradoxes outlined above: Among the bargaining tools at their reach, parties may find confrontation too attractive for peace to prevail. And even weak contenders may be willing to engage in conflict as a way to extract concessions from mighty opponents.

The second part of the paper provides evidence illustrating several hypothesis derived from the theoretical model. If conflict can be used as a negotiation instrument then some pattern revealing this use should be found in the behavior of real contenders and on the duration and termination of real conflicts. In particular, the main hypothesis we derive is that whenever "signalling by fighting" is relevant, actual confrontations should display an increasing hazard rate, that is, they should be more likely to end the more they last. This conjecture is drawn from both the decreasing returns of belief updating and the updating process itself (since uncertainty eventually decreases as fighting progresses). These two factors make the net benefit of an extra skirmish fought to alter the opponent's beliefs decrease over time.

We then perform a duration analysis on a sample of colonial and imperial wars that took place between 1817 and 1988. These wars were mainly caused by states aiming to expand and acquire new colonies or by dependencies trying to change their subordinate status. Hence, one can assume that the two sides were implicitly bargaining over a piece of territory or over the degree of autonomy of the non-state side. Two other reasons make this type of conflicts specially suited for our purposes. First, it is plausible that the states fighting these wars often had very partial information about the strength of their opponents. As a matter of fact, the sample contains many cases of states suffering humiliating defeats against unexpectedly strong opponents. So it is natural to assign to the state the role of the non-informed agent of our theoretical model. Second, Absolute Conflict was not a purely theoretical possibility in these wars: Many of them ended with the total obliteration of the non-sate entity or the annihilation of its population.

We classify the disputes in this sample according to their termination mode, agreement vs. no agreement. The type of ending is used as an (imperfect) measure of the importance of the bargaining component of the conflict: Wars where confrontation was used as a bargaining tool should be more likely to populate the agreement category. The rest of wars were mostly pure military contests where little bargaining took place. We then estimate a *competing risks* model with cause-specific hazard rates for each termination mode. The results show that those wars that ended in agreement display an increasing hazard rate whereas those that did not display a constant hazard. We also find that several explanatory variables used as proxies for the parameters of the theoretical model have the predicted effects.

The remainder of the paper is organized as follows. In Section 2 we introduce the basic elements of the model. In Section 3 we characterize the set of equilibria for this game as a function of the parameters of the model. The empirical analysis is performed in Section 4. Section 5 contains an overview of the related literature. In Section 6, we conclude.

2 The model

Consider a game, denoted by $G[\delta, \theta]$, where two risk neutral players bargain over the division of a cake worth one euro. We will assign to P1 the male gender and the female gender to P2. This game has two periods $t = 1, 2$.

Players are impatient and discount the future at a common factor $\delta \in (0,1]$. There is a parameter $p \in \{p_L, p_H\}$ denoting the *relative strength* of player P1 in case of confrontation and such that $1 > p_H > p_L > 0$. P1 knows his own relative strength but it is unknown to P2, who believes at the beginning of the game that $p = p_H$ with probability $\frac{1}{2}$.

At $t = 1$, P1 chooses an action in $\{A, B, x_1\}$, where $x_1 \in [0,1]$ is an *offer* on the share of the cake to P2. A is the option of *Absolute Conflict* that ends the game, and B means that the *Battle* between the two players is fought, making the game proceed to $t = 2$. In that period, the only available actions are $\{A, x_2\}$, where x_2 denotes the share of the cake offered to P2.

P2 only moves if P1 makes an offer. In that case, her available actions are $\{$*Accept*, *Reject*$\}$. If P2 accepts, agreement is reached at that period. Rejection triggers A.

An Absolute Conflict is a "fight to the finish", a confrontation in which both parties perfectly commit to defeat their opponent[4]. Therefore, it necessarily ends the game. We model this conflict as a costly lottery whose payoffs depend on the realization of p : With such probability P1 wins the conflict and P2 is defeated. This confrontation entails a fixed loss: The value of the cake reduces to $0 < \theta \leq 1$. The payoffs from A, conditional on p, are thus

$$d = (d_1, d_2) = (\theta p, \theta(1-p)) \qquad p = p_L, p_H.$$

On the other hand, the Battle is a conflict of limited scope that does not entail the end of the game: Nature simply announces a winner and the second period is reached. The outcome of the Battle is a function of the relative strength p too. For simplicity, we will assume that P1's Battle winning probability is precisely p (and $1 - p$ for P2).

We will refer to the outcome of the Battle from P1's point of view, either *Victory* (V) or *Defeat* (D). Notice that since p is unknown to P2, *the outcome of the Battle conveys information* about the true balance of strengths.

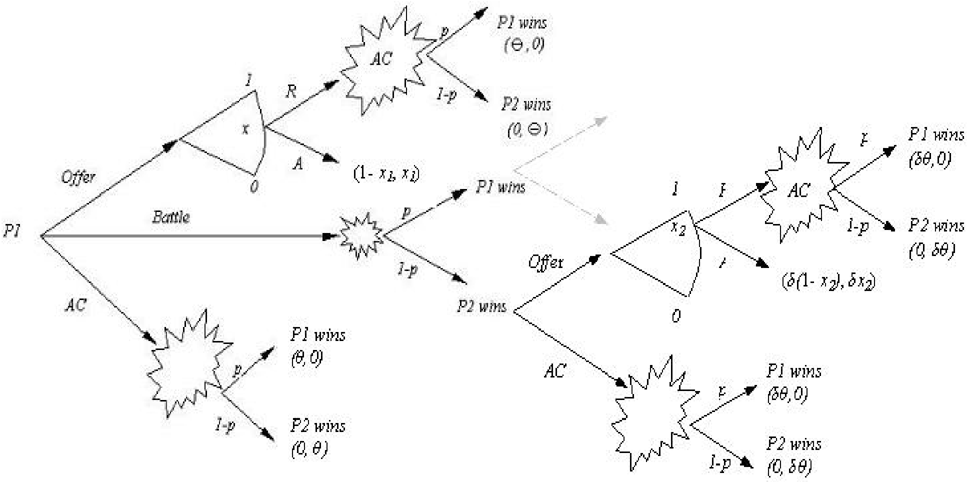
Offers constitute an additional source of information. They can be pooling, meaning that both types of P1 make them, or separating, in which case P1's true type is revealed. Then, a *history* h_t of the game includes both the offers eventually made and the outcome of the Battle.

Both the Battle and offers affect P2's beliefs about the realization of p. Beliefs consist of a probability distribution $\mu(\cdot \mid h_t)$ over the set of types that depends on the history of the game. At period t, P2's expected payoff from disagreement following history h_t is thus

$$E(d_2 \mid h_t) = \theta(1 - E(p \mid h_t)) = \theta(1 - p_H \cdot \mu(p = p_H \mid h_t) - p_L \cdot \mu(p = p_L \mid h_t)).$$

[4] In these conflicts, parties aim to render the opponent defenseless, either directly or by delegating to a third party. Here we assume that this is done *directly,* like in the case of wars, so the winner is able to impose her most preferred outcome without opposition. If this were achieved *indirectly,* as in court for instance, the final outcome would only reflect the winner's maximal aspirations partially.

Figure 1: Tree representation of the game



Note that if P2's beliefs after history h_t make her too optimistic about her probability of winning A, the sum of the perceived disagreement payoffs may be greater than one and this renders agreement impossible.

Definition 1 *Agreement is said to be* ***feasible*** *following history* h_t *whenever the sum of (expected) disagreement payoffs does not exceed the size of the cake, that is, whenever*

$$\begin{aligned} 1 &\geq E(d_2 \mid h_t) + \theta p \\ &\geq \theta(1 - E(p \mid h_t)) + \theta p. \end{aligned} \tag{1}$$

After rearranging (1) feasibility of agreement is given by

$$Q = \frac{1-\theta}{\theta} \geq p - E(p \mid h_t), \tag{2}$$

so the *Loss ratio* (Q) must exceed the difference between the actual and P2's expected value of p. So as the Loss ratio increases even a very optimistic P2 does not expect to get much from A and agreement becomes feasible.

A strategy for P1 in this game is simply a function $\sigma_1(p)$ mapping the set of histories and types into the set of actions $\{A, B, x_1, x_2\}$; similarly, a strategy for P2 is a function σ_2 mapping histories into $\{Accept, Reject\}$.

Now, one can apply the standard solution concept for this kind of games.

Definition 2 *A* ***Perfect Bayesian Equilibrium*** *(PBE) of the game* $G[\delta, \theta]$ *is a strategy profile* $(\sigma_1^*(p), \sigma_2^*)$ *and posterior beliefs* $\mu(\cdot \mid h_t)$ *such that* $\sigma_1^*(p)$ *maximizes P1's continuation value of the game for each* h_t *and for each type, P2 accepts* x_t *if and only if* $x_t \geq E(d_2 \mid h_t)$ *and* $\mu(\cdot \mid h_t)$ *is consistent with* $\sigma_1^*(p)$ *via Bayes' rule.*

3 Characterization of equilibria

In this Section we first discuss the benchmark version of the game above in which P1 simply makes a take-it-or-leave-it offer to P2 and no battle is available. Then we characterize the PBE of the full-fledged game $G[\delta, \theta]$. In the last part of the Section, we compare these two games and discuss the role and effects of limited confrontation in bargaining.

3.1 The benchmark case

Suppose that no battle is available so any confrontation in the game is final. Then P1 can either trigger A or make a take-it-or-leave-it offer. This gives rise to two different type of equilibria, *Separating* or *Pooling.*

In a Separating equilibrium, the L-type makes a fully revealing offer. He can reveal his true type by making an offer x such that

$$1 - x \leq \theta p_H,$$

because the H-type would never make it.

In a Pooling equilibrium, both types of P1 make the same offer. In this case, given the initial beliefs, the minimal acceptable offer is simply

$$x^P = \theta(1 - \frac{p_L + p_H}{2}).$$

In the next Theorem, we characterize the Perfect Bayesian Equilibria of this game. Recall that under this solution concept we need to specify not only strategies but also P2's beliefs, including those off-the-equilibrium-path since Bayes' rule imposes no restriction on them. Throughout the paper we will support these PBE with the largest possible set of parameters by employing "optimistic" (from P2's viewpoint) beliefs when necessary.

Theorem 0 (Take-it-or-leave-it-game) *In the one-period version of the game $G[\delta, \theta]$ with no battle,*

(*i*) *If the Loss ratio is not too high, i.e. $Q \leq [p_H - p_L]$, there is a* ***Separating*** *PBE in which the H-type triggers A, the L-type offers $x^L = \theta(1 - p_L)$ and P2 accepts x^L and holds beliefs $\mu(p = p_L \mid x \neq x^L) = 1$.*

(*ii*) *If agreement is feasible, i.e. $Q \geq \frac{1}{2}[p_H - p_L]$, then there exists a* ***Pooling*** *PBE in which both types of P1 offer x^P and P2 accepts.*

Proof. Given the previous discussion, it is evident that the separating offer must be

$$x = \max\{1 - \theta p_H, \theta(1 - p_L)\},$$

because any offer to be accepted by P2 must satisfy $x \geq \theta(1 - p_L)$.

However, when $Q > [p_H - p_L]$, i.e. $1-\theta p_H > \theta(1-p_L)$, separation cannot be sustained because the H-type prefers to settle rather than to trigger A. He is better off by doing so even if he were to be confused with the L-type. Hence, no off-the-equilibrium path beliefs can support a Separating equilibrium in that case.

On the other hand, the necessary and sufficient condition for the pooling offer to be an equilibrium is that the H-type must prefer to make it rather than to trigger A, that is

$$1-\theta(1-\frac{p_L+p_H}{2}) \geq \theta p_H \;\Rightarrow\; Q \geq \frac{1}{2}[p_H - p_L]. \tag{3}$$

■

The main implication of this Theorem is that when no agreement is feasible, only the Separating equilibrium exists and it entails an efficiency loss: Absolute Conflict occurs half of the time because P2 is excessively optimistic when P1 is strong. Full efficiency however can be recovered when agreement is feasible because an offer dominating agents' expected payoffs from Absolute Conflict exists. So when conflict is always final, confrontation occurs *only if* agreement is not feasible.

3.2 Pooling by battles

We now analyze the PBE of the game $G[\delta,\theta]$. First, we show that the equilibria characterized in Theorem 0 still exist. In order to sustain them, we will employ the following "optimistic" beliefs

$$\mu(p = p_L \mid h_1 = B) = 1. \tag{4}$$

The following Corollary extends Theorem 0 to the full-fledged version of the game.

Corollary 1: *In the game $G[\delta,\theta]$ and if P2 holds the off-the-equilibrium beliefs in (4):*

*(i) If $Q \leq [p_H - p_L]$, there exists a **Separating** PBE in which at $t = 1$ the L-type makes an offer and the H-type triggers A.*

*(ii) If $Q \geq \frac{1}{2}[p_H - p_L]$, there exists a **Pooling by offers** PBE in which both types of P1 make the same offer at $t = 1$.*

Note that the existence of these equilibria only depends on the value of Q and not on the discount rate δ.

Let us now focus our attention on the equilibria in which both types of P1 fight the Battle in order to change P2's beliefs.

Definition 3 *A Perfect Bayesian Equilibrium of the game $G[\delta, \theta]$ is called* ***Pooling by battles*** *if both types of P1 trigger the Battle at period $t = 1$.*

The strong type is the one with more incentives to fight the Battle because it can help him to overcome the disadvantageous position he is in due to incomplete information. On the other hand, the weak type can obtain extra benefits by mimicking because the information transmitted by the Battle is noisy.

The second period of the game is final and then almost identical to the benchmark case discussed above; separating or pooling offers can again take place. These different equilibria will arise depending on who won the Battle. Intuitively, Victory gives more room to a pooling offer since the more pessimistic P2 is, the lower her minimal acceptable offer. Under Defeat however, this offer increases and it is more likely that the H-type will prefer to trigger A instead. In that case, we should expect separation to prevail.

Definition 4 *A Pooling by battles PBE is called 1)* ***full*** *if in the second period both types make the same offer; and 2)* ***with partial separation*** *if both types make the same offer under V but only the L-type makes an offer under D.*

Therefore, the occurrence of pooling or separation at $t = 2$ crucially depends on P2's beliefs after the Battle. Conditional on its outcome, the beliefs are simply

$$\mu(p = p_H / \text{ Victory}) = \frac{p_H}{p_H + p_L} = q^+, \tag{5}$$

and

$$\mu(p = p_H / \text{ Defeat}) = \frac{1 - p_H}{2 - p_H - p_L} = q^-. \tag{6}$$

The importance of these beliefs will be made clear below.

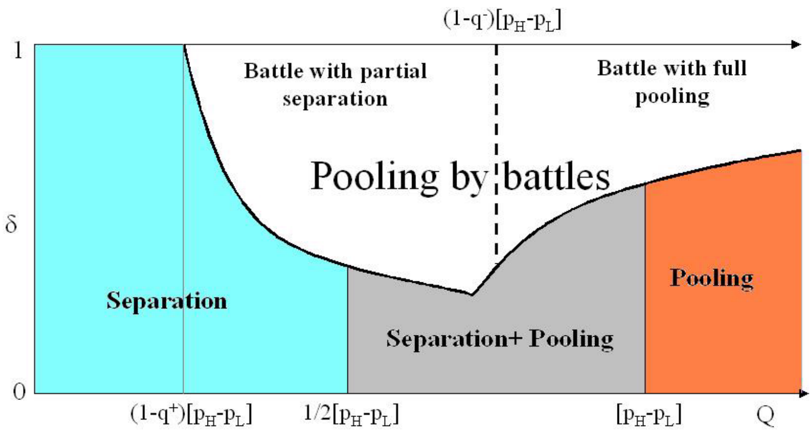
In order to support the Pooling by battles profile as a PBE we will again employ "optimistic" beliefs[5]. So deviations from the equilibrium profile will convince P2 she is facing the weak opponent, that is

$$\mu(p = p_L \mid h_1 \neq B) = 1. \tag{7}$$

We are finally in the position of stating our main Theorem characterizing the Pooling by battles PBE. This characterization is made by means of the two parameters of the model, the Loss ratio, Q, and the discount factor, δ. The discount becomes important here because if P1 is too impatient , he may prefer to take the outside option or settle immediately.

[5] A different set of beliefs would not change qualitatively our results.

Figure 2: Representation of the PBE characterized in Corollary 1 and Theorem 1



Theorem 1 (The Battle as a bargaining tool) *In the game* $G[\delta, \theta]$ *and if P2 holds the optimistic off-the-equilibrium beliefs in (7):*

(i) For intermediate values of the Loss ratio $((1-q^+)[p_H - p_L] \leq Q \leq (1-q^-)[p_H - p_L])$ *there is a threshold discount rate* $\overline{\delta}$ *such that if* $\delta \geq \overline{\delta}$ *a* ***Pooling by battles*** *PBE* ***with partial separation*** *exists.*

(ii) For moderately high values of the Loss ratio $(Q \geq (1-q^-)[p_H - p_L])$ *there is a threshold discount rate* $\overline{\overline{\delta}}$ *such that if* $\delta \geq \overline{\overline{\delta}}$ *a* ***Full pooling by battles*** *PBE exists.*

The proof of this Theorem and of Corollary 1 can be found in the Appendix A. Figure 2 depicts one possible configuration in the parameter space.

3.3 Discussion

We have fully described the taxonomy of PBE of our game. It may seem surprising that a *two-period separation* profile, in which the weak type settles immediately and the strong one fights the Battle, cannot be an equilibrium. The reason is straightforward: In that profile the outcome of the Battle is totally irrelevant; whenever the Battle takes place, P2 knows for sure she is facing the strong type. But then the weak type would deviate and fight as well unless the discount rate is very low. And this in turn would make the strong type prefer to settle immediately too. Notice that this result is quite general: it applies to versions of the game with more than two types or more than one battle. It also implies that even if multiple battles were available, both types must stop fighting battles at the same time in any equilibrium.

Bur more importantly, Theorem 1 uncovers the double-edge effect of conflict in our model.

For low values of the Loss ratio ($Q < (1-q^{+})[p_H - p_L]$) the Pooling by battles profile cannot be supported under any of the two outcomes of the Battle and the H-type always triggers A. In this case, we are back in the world where the lack of feasible agreements inevitably precipitates conflict.

When the loss from A is high enough, the Battle can facilitate agreement because a defeat changes P2's beliefs enough to make agreement feasible. If a settlement was not feasible in the first place, and the discount rate is not too low, this limited confrontation can be paradoxically *efficiency enhancing:* The strong type uses the Battle to state his true strength and obtain a settlement in the second period, thus (partially) avoiding the inefficiency caused by Absolute Conflict. The weak type, given that the Battle is a noisy channel of information, obtains an extra concession by mimicking.

Note that the existence of the Pooling by battles equilibrium is determined by two factors. First, the Loss ratio should be high enough; otherwise, Absolute Conflict is too attractive for the H-type. Second, the differential of strengths $[p_H - p_L]$ should not be too big, because in that case the Battle would become too informative, nor too small, because the change in beliefs induced by the Battle would become negligible.

But when agreement is feasible, if P1 triggers confrontation the Battle introduces a delay that is absent from the Pooling by offers scenario. This may be rational, because the Battle may grant him further advantage in the bargaining table, but it is socially inefficient.

These results also offer an explanation for the pervasiveness of conflict in negotiations: The feasibility of agreement is a necessary but not a sufficient condition for a settlement to be reached. Limited or absolute confrontations will be observed not only when agreement is impossible but also when a settlement is feasible but the returns of resorting to conflict are higher than the returns from diplomacy.

4 Empirical evidence

In this Section, we first derive several testable implications from the theoretical model on the duration and termination of conflicts. In particular, our central hypothesis will be that whenever "signalling by fighting" is relevant, conflicts should be more likely to end the more they last. We perform then a duration analysis on data from actual military conflicts. The results unveil some findings that, we believe, provide evidence supporting this hypothesis.

4.1 Hypothesis to be tested

Although the theoretical model presented above has only two periods, it provides useful insights into a scenario where multiple battles are available: Battling would continue as long as the value of the extra concession obtained from an additional battle outweights its costs. Following this line of reasoning, two factors suggest that the probability of a dispute ending should increase over time. First, the returns of conflict as a bargaining tool decrease as more skirmishes are fought. This is a natural property of Bayesian updating; one additional victory once a thousand battles have been fought induces a negligible change in beliefs. Hence, as long as battles are costly or future rents discounted, there must exist a certain point in time from which no more battles are worth fighting[6]. On the other hand, in the long run, the more the parties fight the sharper their estimates of the true balance of strengths, and the closer they are to a complete information scenario where agreement is immediate. These observations lead to the conclusion that the use of conflict as part of the bargaining process is a self-limiting phenomenon, and allow us to derive the first hypothesis to be tested:

H1: The longer a conflict lasts, the more likely it ends.

This hypothesis corresponds to the concept of increasing hazard rate in Duration analysis language. However, *we do not expect to find this pattern in any conflict*. It is plausible that some confrontations are pure contests, with no bargaining component at all and where incomplete information is largely irrelevant. Since the increasing hazard rate hypothesis does not apply for those, our analysis will aim to discriminate them.

There are two other hypothesis we test. First, our model introduced two types of costs from conflict, the delay created by battles and the fixed cost from Absolute Conflict. The former cost implies that more impatience, i.e. a lower discount rate δ, should make conflicts shorter by increasing the cost of battling. Since battles become less attractive, a low discount rate also implies that if a conflict is observed it is more likely to be an absolute one.

H2: The more impatient the informed party, the shorter the conflict and the less likely to end in agreement.

Finally, we explore the effects of a shift in the balance of strengths. The theoretical model allows several interpretations of what such a change means. In the present analysis, we identify strong informed parties with the H-type of the theoretical model. Hence, we expect them to behave according to any of the derived equilibrium strategies corresponding to that type[7]. This in

[6] Note that this conclusion is reinforced if limited conflicts can themselves result in one side fully defeating the other or if battles have accumulative costs.

[7] An alternative interpretation would to deal with a shift in power as a shift in the support of the distribution of types. Changes in power imply in this case that the regions supporting the different PBE of the game change. Intuitively, L -types who are strong in absolute terms have more incentives to engage in battling. Interesting as it may be, this interpretation creates quite cumbersome comparative statics and the resulting effects become impossible to test in a reasonable manner.

turn implies that strong informed parties make disputes less likely to end in agreement because the H-type may trigger A in equilibrium (the L-type never does so).

H3: Stronger informed parties make conflicts less likely to end in agreement.

4.2 Methodology

The duration of events can be seen as a random variable T with its own probability distribution[8]

$$F(t) = \Pr(T < t),$$

specifying the probability that an event lasts less than t. Symmetrically, the survivor function

$$S(t) = 1 - F(t) = \Pr(T > t),$$

is the probability that the duration will exceed t.

The main object of interest when studying duration dependence is the hazard rate

$$h(t) = \frac{f(t)}{S(t)},$$

or in other words, the conditional probability of event termination at duration t. An event is said to exhibit positive (negative) duration dependence when its hazard rate increases (decreases) with duration.

We employ a *competing risks* model in order to investigate multiple termination modes. Here we will consider two risks depending on whether contenders reached a settlement, coded as s, or one of the sides was totally defeated, coded as ns. Two risk-specific hazard rates

$$h_r(t) = \Pr[T = t \mid T > t,\ r] \qquad r = s, ns,$$

are estimated, where observations whose termination mode is different from r are treated as censored at the point of termination.

Assuming that risks are independent, the overall hazard becomes

$$h(t) = \sum_{r=s,ns} h_r(t). \tag{8}$$

In our analysis we will adopt a discrete-time formulation with months as the units of observation. In particular we will assume that the hazard rate takes the logistic functional form

$$h_r(t) = \frac{1}{1 + \exp -(\alpha_r X_r + \beta_{1r} t + ... + \beta_{qr} t^q)} \qquad r = s, ns, \tag{9}$$

[8]This subsection builds on Allison (1982) and Thomas (1996).

where X_r is a vector of cause-specific covariates and α_r is the vector of associated coefficients. For simplicity we will employ the same vector covariates in both risks. A positive (negative) coefficient implies that the covariate increases (decreases) the hazard rate. Duration dependence is captured by cause-specific coefficients of the polynomial of order q in t. This model is thus quite flexible: Contrary to other specifications (like Weibull) it does no restrict the hazard to be monotonic[9].

Competing risks models distinguish the effect of the explanatory variables on each termination mode. Hence, one can analyze the effect of the variables on the conditional probability of exiting via a certain risk, and not only on the unconditional one. For the case of the agreement termination this probability is simply

$$P_s(t) = \frac{h_s(t)}{h_s(t) + h_{ns}(t)}. \tag{10}$$

This implies that the conditional probability of a war ending in agreement increases (decreases) with variable X^i if and only if the corresponding coefficient α_s^i is greater (less) than α_{ns}^i.

Finally, we will be also interested on the effect of the selected variables on the likelihood of termination via each type of ending

$$\pi_r = \sum_{t=0}^{\infty} h_r(t)S(t) \qquad r = s, ns,$$

and, by extension, on the expected duration until exit via each termination mode, that boils down to

$$E_r = (\pi_r)^{-1} \sum_{t=0}^{\infty} t\ h_r(t)\ S(t).$$

4.3 The data

Our sample consists of 94 Extra-systemic wars disputed between 1817 and 1988. These cases are taken from the version 3.0 of the Correlates of War (COW) project database (Sarkees, 2000)[10]. The definition of an Extra-systemic war is a military conflict that led to more than 1000 battle casualties and that was fought between a state belonging to the interstate system and an entity that did not qualify as such (e.g. a colony, a protectorate, a

[9] We have some reservations against continuous-time specifications: (i) they often impose strong distributional assumptions on the hazard rate; and, more importantly, (ii) the data on wars are typically discrete. On the other hand, the Cox semiparametric specification imposes fewer restrictions than ours on the shape of the hazard rate because it is not directly estimated. But this feature makes this model less valuable when duration dependence is the main object of interest.

[10] This data set is publicly available at http://cow2.la.psu.edu/.

Table 1:
Descriptive statistics of the variables considered

Variables	Minimum	Maximum	Mean	Std. deviation
Duration				
Agreement	1	165	42.47	38.11
No agreement	1	114	23.14	38.20
Independent variables				
Average Deaths	0.013	11.47	0.894	1.777
Democracy	0	20	12.377	6.089
Repression	1	5	3.231	1.186
Military personnel	0.005	4	0.448	0.558
Casualties ratio	0.001	0.95	0.256	0.237
Population	0.013	5.72	0.424	0.591
Decolonization war	0	1	0.277	0.450
Previous disputes	0	2	0.213	0.461

tribe)[11]. A summary of the cases considered and of the changes made on the original database is contained in the Appendix B.

The Extra-systemic wars dataset makes the construction of dyadic variables difficult ; measures of relative strengths or the contenders' regime-type match are not available due to the lack of information about the non-state sides. When needed, we solve this problem by assuming that all non-states were identical in a certain characteristic. While this is a strong assumption in some dimensions, it is not that implausible in others: Although not all the non-states had the same regime-type, they were mostly perceived as non-democratic by the democratic states fighting them.[12]

Descriptive statistics of the variables considered can be found in Table 1 and their sources are detailed in the Appendix B. We take one observation per war, measured at the start of the conflict. We believe that this does not seriously limit our analysis. If time-varying covariates were employed, they would not change much over time because most of them are annual measures. Moreover, as Bennett and Stam (1996) argue, the present approach allows us to predict the duration and termination mode of a conflict in the same way as the involved parties would have done since this was the only information available to them when the war began.

Next, we describe the variables employed in the analysis and their predicted impacts on duration and on the probability of agreement.

Duration: The dependent variable is war duration, measured in months[13]. The data on duration from the COW dataset was cross-checked with information found in Clodfelter (1992) and Dupuy and Dupuy (1993). When

[11] A state is defined as a member of the United Nations or the League of Nations or an entity with a population greater than 500,000 and recognized by two major powers.

[12] See Ravlo et al. (2003).

[13] When the start and end date where not totally precise, we took the average of the maximum and minimum possible durations.

divergences appeared we gave priority to these sources.

Agreement: This variable classifies the observations in the sample by termination mode. We consider that a war did not end in agreement when the state completely withdrew due to a military defeat, when it stormed the capital of the opponent, or the latter totally lost its autonomy or its population was annihilated. Even very unfavorable settlements for the losers, like the acceptance of a protectorate status, are coded as agreements[14]. Following this definition, 45 out of the 94 cases considered ended in a settlement.

Average deaths: Recall that, according to H2, the greater the impatience of the informed party the shorter the war and the less likely to end in agreement. We try to proxy the discount factor δ through the non-state's monthly average of thousands of battle casualties.

Democracy: There is evidence showing that democracies and autocracies wage war differently. Democracies are less likely to support long wars because the costs to their leaders increase over time (due to the existence of a public opinion and free press), so they tend to fight shorter wars than autocracies (Bennett and Stam, 1996). The state's regime type can thus proxy the state's cost of war. We employ the Democracy score from the Polity IV dataset running from -10 to 10.[15]

Repression: Bennett and Stam (1996) argue that leaders who can effectively repress opposition are less sensitive to defeat. This may give them more incentives to engage in risky wars, typically shorter because strengths tend to be uneven. Our measure of repression, derived from the Polity IV dataset, ranges from 1 to 5, higher values representing more repressive regimes.[16]

Relative strength: Under the assumption of equal-strength across the non-state entities, measures of the state' strength can be considered as proxies for the dyadic concept of relative power:

(*i*) Population: Measures the state's population in hundred of millions.

(*ii*) Military personnel: Measures the state's total military personnel in millions of soldiers.

[14] Results do not change if these less clear cases were coded as ending in no agreement.

[15] We are aware of the potential flaws of any measure of Democracy. The Polity score focuses only on the "institutional" characteristics of a democracy and does not record other important elements like the extent of the suffrage. Within this limits, it is nevertheless a consistent measure, available for most countries since 1800.

[16] When multiples states were fighting, we create a weighted average for the Democracy and Repression variables, where a state's contribution is proportional to its COW capability index. This index computes the state's share of the world total of several economic, demographic and military indicators.

Finally, we consider a third, truly dyadic variable:

(*iii*) State's casualties ratio: We divide the state's battle deaths by the total of battle deaths as a measure of the non-state's strength.

Whereas the latter variable measures the realization of the non-state strength p, the other variables are proxies for $1-p$ given our assumption that all non-states are equally strong. Hence, according to H3, we expect an increase in the first two variables to make agreement more likely and the Casualties ratio variable to have the opposite effect.

Decolonization war: Conflicts in the sample are too heterogeneous to be treated equally; they may be structurally different. Following Ravlo et al. (2003), we propose three categories: Colonial if the war was fought in the period 1816-1870; Imperial if it was fought in the period 1871-1918; and of Decolonization otherwise. Preliminary results showed that there are no significative differences between the first two categories. Therefore, we only included a dummy taking value 1 if the war belongs to the Decolonization period and 0 otherwise.

Previous disputes: We count the number of disputes between the two sides in the 25 years before the war. Our conjecture is that more disputes make further conflicts shorter because part of the "learning" process is already done. Hence, we expect more disputes to be associated with shorter durations.

4.4 Results

Table 2 presents the results of the estimation of the single risk model, that does not distinguish between the two termination modes, and the competing risks model[17]. A quick examination of the log-likelihood shows that both models greatly improve upon the null one. The evidence however favors the competing risk approach[18]. Recall that we adopted this design for two reasons: First, the theoretical model showed that covariates might have different risk-specific effects. This is confirmed by our results: Most variables are statistically significant for one of the hazards only; several become significative when the pooled hazards model is abandoned. The data reject the hypothesis that the two cause-specific hazards are equal[19].

[17]In the estimation of these models we employed the 6.4 version of TDA (Transition Data Analysis), developed by Blossfled and Rohwer (1995). This software is specially designed for Duration analysis and it is available at http://steinhaus.stat.ruhr-uni-bochum.de/tda.html.

[18]The lower log-likelihood of the single risk model seems to indicate that it is a better model. However, let us reiterate that the two models are not directly comparable.

[19]The likelihood-ratio test statistic for this hypothesis is $2(L_{CR} - L_{SR} - N \ln \frac{1}{2})$ where L_{CR} and L_{SR} are the log-likelihood of the competing risks and single risks models respectively. The term $N \ln \frac{1}{2}$ is the adjustment factor that allows the comparison between the two models. This statistic equals 18.701 and and has an associated p-value< 0.05.

Table 2:
Estimates of the single and competing risks logistic hazard rate models

		Competing risks model	
Variables	Single risk model	No agreement	Agreement
Constant	-4.433 (0.593)***	-4.189 (0.763)***	-6.015 (1.003)***
Average Deaths	0.211 (0.078)***	0.214 (0.094)**	0.215 (0.135)
Democracy	0.062 (0.027)**	0.048 (0.037)	0.098 (0.042)**
Repression	0.219 (0.135)	0.087 (0.177)	0.412 (0.211)**
Military personnel	0.392 (0.387)	-0.383 (0.637)	1.324 (0.532)**
Casualties ratio	1.005 (0.480)**	0.374 (0.692)	1.626 (0.696)**
Population	0.144 (0.344)	0.853 (0.480)*	-1.901 (1.322)
Decolonization war	-1.243 (0.299)***	-1.305 (0.443)***	-1.210 (0.423)***
Previous disputes	-0.477 (0.259)*	-0.233 (0.316)	-0.780 (0.427)*
Time interaction	0.003 (0.004)	-0.009 (0.006)	0.012 (0.005)**
Log-likelihood	-399.245	-455.038	
$-2(L_{null}-L_{model})$	40.527	59.013	
N	94	94	

Note: Numbers in parentheses are standard errors. One asterisk indicates p<0.10, two indicate p<0.05 and three indicate p<0.01.

The second reason was motivated by the fact that duration dependence is just theoretically unexplained variance: If non-states actually used conflict in order to change their opponents' beliefs and measures of such beliefs existed, their inclusion in the analysis would make duration dependence vanish. In the absence of this information, the analysis should nevertheless aim to disentangle whether the duration dependence found is due to the reasons conjectured. So rather than claiming that all Extra-systemic wars display positive duration dependence, we used the termination mode as a way to identify those cases whose hazard rate we expect to be increasing.

The results show that, as hypothesized, wars that terminated in agreement display an increasing hazard rate, captured by the positive and significant coefficient of the time interaction[20]. The wars we identified as likely scenarios for the use of confrontation as part of the bargaining process, present thus positive duration dependence. Those wars that ended in the

[20] We estimated several models with increasing degrees of the polynomial: There was no significative improvement when the quadratic and the cubic specifications were estimated.

total collapse of one of the parties display a flat hazard rate[21]. On the other hand, the single risk model estimates no duration dependence at all: The time interaction coefficient is not significantly different from zero. This is consistent with the analysis of interstate wars by Bennet and Stam (1996). But this result also suggests that the termination modes capture differences in the aims and conduct of wars that need to be controlled for.

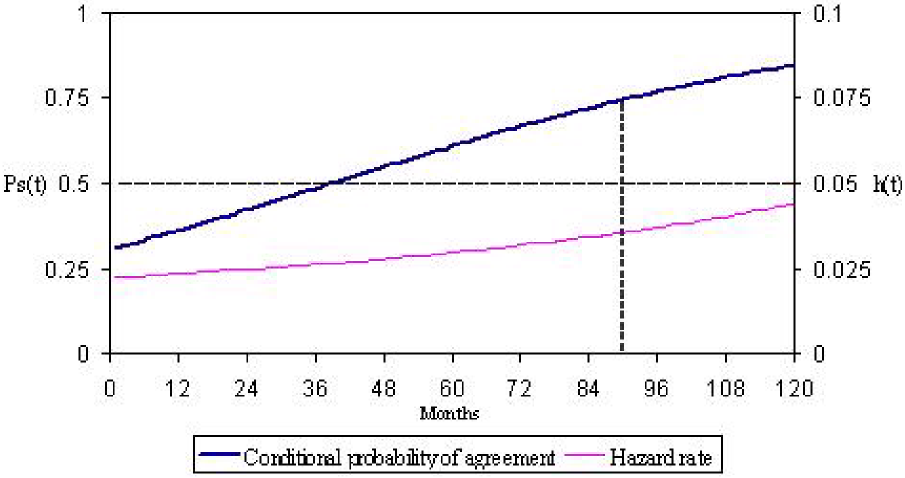
These sharp differences in duration patterns uncovered by our analysis offer evidence of the use of conflict as a bargaining instrument in real world confrontations. The improvement made when moving from the single risk to the competing risks model indicates that the termination modes are supplying relevant information. On the other hand, the existence of duration dependence only in the case of the conflicts that ended in agreement indicates the presence of unexplained variance for these conflicts; a variance that is absent from the no agreement category where we did not expect conflict to be a bargaining instrument.

Following Thomas (1996), we next examine the unconditional probability of exiting, given by expression (10). Our estimations imply that the longer the war the more likely it is to end in agreement. This pattern is consistent with the use of conflict as part of the bargaining process: As pure military contests end, the wars where confrontation could have played a role as a bargaining tool remain in the sample. These conflicts can still end in no agreement because the informed party may be unlucky in the battling process and trigger Absolute Conflict. But the likelihood of a settlement must be nevertheless higher than for the conflicts in the first category.

We illustrate this pattern by analyzing the Franco-Algerian war of 1954. Figure 3 depicts its estimated conditional probability of agreement, its hazard rate and actual duration (marked by the vertical dashed line). This conflict epitomizes the Decolonization wars, characterized by their long durations. These durations were reached precisely because the states needed a protracted confrontation to learn both (*i*) the true aims of their opponents (*ii*) and that they had hugely underestimated their strength. This was perfectly expressed at the onset of hostilities by the French minister of interior, François Mitterrand, who declared that "The only negotiation is war". After seven years of guerrilla warfare, talks opened in May 1961. Independency was granted one year later.

[21] These results cannot be attributed to "Unobserved Heterogeinity" (Kiefer, 1988) since this problem cannot spuriously generate positive duration dependence.

Figure 3:
Hazard rate and conditional probability of agreement
for the Franco-Algerian war of 1954



Let us finally analyze the estimation results for the rest of variables. We first study their effects in the light of hypothesis H2 and H3. Then we examine the impact of the explanatory variables on expected durations and the likelihood of agreement.

We find considerable support in favor of H2. As expected, our proxy for the discount rate δ, the non-state average of battle casualties, shortens conflicts and makes them less likely to end in agreement. In addition, Democracy, that we associate with more impatient states, also increases the hazard. Therefore, higher costs from confrontation, either political or in human lives, make wars shorter.

On the other hand, two of the variables capturing the balance of strengths, Military personnel and Casualties ratio, are found to be significant, whereas the third one, Population, it is so only marginally. They offer less clear support in favor of H3 though. According to this hypothesis, wars in which stronger states are involved should be more likely to end in agreement. This is compatible with the coefficient estimated for the Military personnel variable but not for the Casualties ratio one, whose effect should be the opposite.

The estimates in Table 2 only inform about the qualitative effects of the variables and not about their magnitudes. In Table 3 we report the effects on the predicted conditional expected durations and the likelihood of agreement of changes in those explanatory variables significant at the 5% level. These changes are reported in comparison to the *baseline* case for which all variables are evaluated at their mean except the Decolonization dummy and the Previous disputes variable that equal zero. The reported effects come from setting these two variables to one and from increasing the continuous variables by one standard deviation.

Table 3:
Conditional expected durations and likelihood of agreement of Extra-systemic wars and effects of changes in the independent variables

	No agreement	*Agreement*	*Likelihood of agreement*
Mean	22.8	37.0	0.44
Baseline	16.6	23.6	0.43
Changes in variables			
Average deaths	-4.4	-7.9	0.40
Democracy	-4.9	-8.9	0.47
Repression	-3.5	-6.7	0.49
Casualties ratio	-2.8	-5.4	0.48
Military personnel	-3.6	-7.0	0.64
Decolonization war	+19.0	+46.9	0.57

The variables proxing the costs of conflict have a sharp effect on duration: An increase in Democracy by one standard deviation (around six points) decreases the expected duration of wars ending in agreement by nine months. This is consistent with previous results: It is well documented that democracies fight much shorter wars because the high costs from defeat induce democratic leaders to select "easy" wars[22]. The effect of the Repression variable may seem surprising but it in fact reinforces our analysis because Repression and Democracy are negatively correlated but still present very similar effects; (roughly) one additional point in the repression score decreases expected duration and makes agreement more likely.[23]

Another striking result in Table 3 corresponds to the Decolonization dummy. As mentioned, these conflicts have much longer durations (about two more years than the baseline case) and often ended in agreement (as a matter of fact, it is the type of war with the highest proportion of agreements). This pattern suggests that non-states probably used confrontation as a "continuation of political activity" in these disputes.

5 Related literature

The term *bargaining in the shadow of power* was introduced by Powell (1996) as a way to refer to those situations where agreements are conditioned by the structure of disagreement. This idea was implicitly considered by Horowitz (1993), who used a non-cooperative bargaining game to model land reform

[22] See Bennett and Stam (1996).

[23] An alternative explanation for this result would be the existence of a non-monotonic relationship between duration and Democracy, with highly democratic and repressive states fighting shorter wars. We estimated a model with a Democracy-squared term substituting Repression, but the squared term was not statistically significant.

as a gradual process where landowners and peasants can accept or contest by arms the allocation proposed by the social planner: Land reform becomes the landowning class' optimal response to the threat of expropriation. More recently, Anbarci et al. (2002) analyzed a model where the location of the threat point is endogenously determined by agents' (wasteful) investments in arms. Then the authors compared the efficiency loss induced by several well-known bargaining solutions. Following an axiomatic approach, Esteban and Sakovics (2002) introduced the concept of *disagreement function.* This function determines the threat point for each possible bargaining set and can thus embed parties' balance of power. The authors used this function to characterize a solution, the Agreement in the Shadow of Conflict (ASC), as the result of a sequence of partial agreements.

These papers admit that agreements are conditioned by the nature of disagreement. But their common pitfall is that they fail to explain the actual occurrence of conflict. Because they share a full information set-up, a "safe" bargaining path always exists. It is here where incomplete information arises as an appealing explanation for the systematic occurrence of confrontation in real negotiations[24].

In this context, the contributions by Myerson and Satterthwaite (1983) and Banks (1990) are central. Taking a mechanism design approach, these papers derive properties of the Bayesian equilibria of any bargaining game where conflict is an outside option. In particular, Banks (1990) explicitly analyzed crisis bargaining and showed that the more powerful the informed agent the higher his equilibrium payoff and the more likely the war. In the same line, Bester and Wärneryd (1998) show that under two-sided incomplete information, and if the loss due to (final) conflict is sufficiently low, it is impossible to design a *peaceful mechanism*, i.e. one assigning zero probability to confrontation. These papers assume incomplete information but depict conflict exclusively as a costly lottery: Either one party or the other wins and captures the surplus. Conflict is then simply an alternative to the bargaining process.

The main features of the present paper come thus from different sources. First, we admit the possibility that the parties, to some extent, choose the scope of their confrontation. It was Clausewitz (1832) who coined the notions of Absolute and Real war we borrow. He made a distinction between those wars that seemed uniquely intended to the destruction of the enemy and those that were "simply a continuation of political activity by other means". The second main ingredient of our paper, namely the role of confrontation as a source of information, was informally introduced by Simmel (1904), who pointed out that since power is not easy to measure, the most effective deterrent of conflict, the perfect revelation of relative strength, is

[24] This does not need to be the unique explanation: Fernandez and Glazer (1991) show that conflict can also occur under full information.

only possible through conflict itself. In this vein, Blainey (1973) referred to war as "the stinging ice of reality" that helps to dissolve conflicting expectations about its own outcome. Furthering this reasoning, Wittman (1979) noted that if conflict is a source of information, war should occur also if there is no optimism because parties can use confrontation to extract better terms from the opponent by changing her beliefs. Finally, Wagner (2000) incorporated these ideas into an incomplete information set-up but did not carry a full formal analysis. Moreover, the author focused on the study of war. Our contention is that the role of confrontation as part of the bargaining process is common to many other scenarios and can offer new insights into the rational foundations of conflict.

To the best of our knowledge, these ideas have not been considered by the economic literature. Still, some of the main features of the paper can be traced back to some works in the field of labor and legal disputes, the two types of conflicts economists have mainly focused on. In an empirical paper, Schnell and Gramm (1987) showed the existence of a "learning by striking" phenomenon in wage negotiations, proved by the negative relation between lagged strike experience and the likelihood of further strikes. On the other hand, Cramton and Tracy (1992) presented a model in which unions can choose the intensity of the dispute by opting between strikes and holdouts.

In the case of legal disputes, Mnookin and Wilson (1998) provided a model of costly pretrial discovery. This procedure allows litigants to obtain valuable information and it is designed to help parties to settle before trial. Whereas it cannot be considered a conflict *avant la lettre*, discovery plays a similar role to our Battle: It can be used as a signaling device by the discovering party in order to convey information about the trial value. Although explicitly acknowledged, Mnookin and Wilson chose not to consider this possibility in their model.

Finally, our empirical analysis adds to recent contributions in the study of wars. Interstate wars have been approached from a wide variety of perspectives, as many as hypothesis have been tested. In contrast, little attention has been paid to Extra-systemic wars[25]; in fact, they have not been subject of any Duration analysis so far. In our analysis, we follow mainly Bennett and Stam (1996) who studied the pooled (single risk) hazard rate of Interstate wars and concluded that they do not present any duration dependence, i.e. they display a constant hazard rate. However, these authors do not take on board any bargaining consideration and neglect the information potentially provided by different termination modes. The sharp differences in the risk-specific hazards uncovered by our analysis suggest that the single risk approach might drive their results.

[25] The only exception is Ravlo et al. (2003) who use this dataset to test the Democratic peace hypothesis.

6 Conclusion

The main message of this paper is that ordinary bargaining and confrontation are the two sides of the same phenomenon. Rather than being substitutes, they are different instruments that the bargaining parties have at their reach; agents simply choose the one giving the highest returns. We see unions and countries engage in labor disputes or in military conflicts because these are other forms of bargaining. Hence, conflict will be pervasive as long as its returns as a bargaining instrument outweight those of diplomacy.

We presented a simple model exploring the role of conflict as part of the bargaining process, a role, we believe, common to many scenarios. One of the main results derived from this model is the existence of a double-edged effect of confrontation in negotiations, an effect that sheds new light on some of the most puzzling aspects of real disputes.

Regarding the Uneven contenders paradox, we argued that weak agents fight much stronger ones as a way of extracting better terms from them, although they would never go to trial, engage in a salvage strike or fight an absolute war.

On the other hand, the puzzle that motivates the Hicks paradox comes from the definition of "mutually beneficial" agreements as those that dominate the outcome of an all-out conflict. This definition neglects that parties have other instruments available. An agreement may not be mutually beneficial when compared to what parties can get by fighting a skirmish that will affect their opponent's expectations.

We hypothesized that this phenomenon should have testable implications on the duration and termination of real conflicts. Our empirical analysis offers some illustrative evidence showing that those colonial/imperial wars in which confrontation could have been a significant part of the bargaining process display an increasing hazard rate. These results contrast with the U-shaped or declining settlement rates obtained for strikes (Kennan and Wilson, 1989) and cast some doubts on the lack of duration dependence found for interstate wars (Bennett and Stam, 1996).

Finally, some comments on robustness and further extensions are in order, because we offer a stylized view of real-world negotiation processes that is potentially subject to multiple criticisms. Yet, we think that the simplicity of the ideas behind it makes the model robust to plausible objections.

As in any game in extensive form, one important issue is the particular protocol selected. For instance, it is easy to see that increasing the number of periods, and hence the number of possible battles, has no big impact on the results. Battles would become a sort of branching process. This would in turn lead to a finer division of the parameter space in regions where different types of Pooling by battles profiles can be supported. Such process must reach an end as the number of periods goes to infinity since, by the properties of Bayesian updating, at some point the concession induced by an additional victory no longer compensates the delay. This possibility deserves further analysis though.

The reader may also argue that by assuming that every offer is final we avoid further signalling through rejected P1's offers. We claim that this is assumed without loss of generality: If P2 also had the option of rejecting the offer and triggering a battle, all offers would be either uninformative or accepted in equilibrium. Any informative offer would make P2 more optimistic. Therefore, P1 *cannot gain* anything from such offer.

Another modification would be to switch roles so the uninformed party is the one who makes offers. This would lead to a scenario where battles are used to screen the opponent rather than as a signaling device. This is a very interesting possibility that we intend to explore in future research. A further extension to a two-sided incomplete information framework does not seem to add enough insights to compensate the cost of increasing complexity.

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A Appendix

Theorem A *In the game $G[\delta, \theta]$ there exist two threshold discount rates $\overline{\delta}$ and $\overline{\overline{\delta}}$ such that*

(i) If $(1-q^{+})[p_H - p_L] \leq Q \leq (1-q^{-})[p_H - p_L]$ and $\delta \geq \overline{\delta}$ then there is a ***Pooling by battles*** *PBE* ***with partial separation*** *in which P2 accepts x_2^V under V and x_2^L under D and believes that $\mu(p = p_L \mid h_1 \neq B) = 1$.*

*(ii) If $Q \geq \frac{1}{2}[p_H - p_L]$ then there exists a **Pooling by offers** PBE in which P2 accepts x_1^P and her beliefs are $\mu(p = p_L \mid h_1 = B) = 1$.*

*(iii) If $Q \geq (1 - q^-)[p_H - p_L]$ and $\delta \geq \bar{\bar{\bar{\delta}}}$ then there is a **Full pooling by battles** PBE in which P2 accepts x_2^V under V and x_2^D under D and hold beliefs $\mu(p = p_L \mid h_1 \neq B) = 1$.*

*(iv) If $Q \leq [p_H - p_L]$ there is a **Separating** PBE in which the H-type triggers A, P2 accepts x_1^L and holds beliefs $\mu(p = p_L \mid h_1 \neq x_1^L) = 1$.*

Proof. In order to prove this Theorem, let us first consider all the possible actions that both types of P1 can take at period $t = 1$.

a) L-type triggers A: It is easy to see that for the L-type, triggering A is always a dominated action. He could instead offer $\theta(1 - p_L)$ and end up better off since P2 will accept that offer.

b) L-type makes an offer: If the H-type makes an offer too, it is easy to see that it must be the same offer (the two-type assumption precludes the construction of a fully revealing schedule of offers). Hence, we are in the Pooling by offers scenario (case (*ii*)). This profile can be supported as an equilibrium when condition (3) holds because the optimistic beliefs ensure that if P1 deviates from this profile he will get at most $\delta(1 - \theta(1 - p_L)) < 1 - \theta(1 - \frac{p_L + p_H}{2}) = 1 - x_1^P$.

The second option is the separating profile in which the L-type makes an offer and the H-type triggers the Battle. This one cannot be sustained as a PBE. Notice first that it would require the L-type not to mimic and battle as well, i.e. $\delta \leq \frac{Q+p_L}{Q+p_H}$. But the H-type should not prefer to offer $\theta(1-p_L)$ because it is always accepted, and this requires exactly the opposite condition! Hence, a two-period separation of types cannot be a PBE.

It only remains to consider the case where the L-type makes an offer and the H-type triggers A (case (*iv*)). We must check that it is not in the interest of the H-type to trigger the Battle even if P2 holds optimistic beliefs; that is, we need to check that

$$\theta p_H \geq \delta(1 - \theta(1 - p_L)),$$

implying the condition $\delta \leq \frac{p_H}{Q+p_L}$.

But the existence of a Separating equilibrium does not only need this condition to hold true. This profile cannot be an equilibrium when $Q \geq p_H - p_L$ since the H-type would be better of by offering $\theta(1 - p_L)$ at $t = 1$ than by fighting A (P2 will always accept that offer). Notice however that $\frac{p_H}{Q+p_L} \geq 1$ when $Q < p_H - p_L$, implying that the restriction on δ has no bite in this region. Therefore, only the condition $Q < p_H - p_L$ must be met in order to support a Separating PBE.

c) L-type fights the Battle: First we show that if the Battle is fought both types must do so. Suppose the H-type makes an offer instead. Then the weak type would be better off by mimicking him. Suppose now that the H-type triggers A but the L-type fights the Battle; for this separation to be sustainable, the H-type should not prefer to fight the Battle as well. This implies that $\theta p_H \geq \delta(1-\theta(1-p_L))$ is needed, or in other words

$$\delta \leq \frac{p_H}{Q+p_L}.$$

We know that this restriction has bite only when $Q > p_H - p_L$, but in that case it is not optimal for the H-type to trigger A since he would prefer to offer $\theta(1-p_L)$. Therefore, both types must trigger the Battle. This is the Pooling by battles profile.

Now we obtain conditions that support Pooling by battles as a PBE of the game. Let us derive the pooling offers under both outcomes V and D. Given beliefs (5) and (6), one can compute the minimal acceptable offers for P2 under each outcome. Under V this offer is

$$x_2^V = \theta[1-(q^+p_H+(1-q^+)p_L)] = \theta(1-\frac{p_H^2+p_L^2}{p_H+p_L}),$$

whereas under D it is

$$x_2^D = \theta(1-p_Hq^- - p_L(1-q^-)) = \theta(1-\frac{p_H(1-p_H)+p_L(1-p_L)}{2-p_H-p_L}).$$

Note that $x_2^V < x_2^D$. It is immediate to see that for Pooling to be sustainable, both types must prefer to make the minimal acceptable offer x_2^j to A. The following auxiliary Lemma characterizes this necessary condition.

Lemma A1 *At the second period of the game* $G[\delta,\theta]$

(i) If $Q \geq (1-q^-)[p_H-p_L]$, *pooling can be supported under both outcomes V and D.*

(ii) If $(1-q^+)[p_H-p_L] \leq Q \leq (1-q^-)[p_H-p_L]$, *pooling can be supported under V only. Under D, separation prevails.*

(iii) If $Q < (1-q^+)[p_H-p_L]$ *pooling cannot be supported and separation occurs under both V and D.*

Proof. Let us consider the two possible outcomes of the Battle. Under V, both types will prefer to make the offer x_2^V if and only if

$$1-\theta(1-\frac{p_H^2+p_L^2}{p_H+p_L}) \geq \theta p_H,$$

that can be rewritten into

$$(1-q^+)[p_H-p_L] \leq \frac{1-\theta}{\theta} = Q.$$

This condition is equivalent to (2) under this outcome. Similarly, under outcome D we need

$$\begin{aligned} 1-\theta(1-\frac{p_H(1-p_H)+p_L(1-p_L)}{2-p_H-p_L}) &\geq \theta p_H \Leftrightarrow \\ \frac{1-p_L}{2-p_H-p_L}[p_H-p_L] &\leq \frac{1-\theta}{\theta}=Q, \end{aligned}$$

that note that again coincides with the condition on the feasibility of agreement under D. ■

We also need P1 not to be so impatient he prefers to trigger A. Formally,

$$\begin{aligned} \theta p_i &\leq \delta E[v_i]; \\ \delta &\geq \frac{\theta p_i}{E[v_i]} \qquad i=L,H, \end{aligned} \tag{11}$$

where $E[v_i]$ is the expected continuation value of the game for type i. The next auxiliary Lemma characterizes the set of parameters that satisfy these conditions.

Lemma A2 *There exist two threshold discount rates $\delta_1 \leq 1$ and $\delta_3 \leq 1$ such that*

(i) If pooling is only sustainable under V, condition (11) holds if and only if $\delta \geq \delta_1$.

(ii) If pooling is sustainable under both V and D condition (11) holds if and only if $\delta \geq \delta_3$.

Proof. We saw above that when $Q<(1-q^+)[p_H-p_L]$ there is separation under both outcomes of the Battle because the H-type prefers A to the pooling offer. Given this, H-type's optimal action is to trigger A at $t=1$. Hence, the first necessary condition for Pooling by battles to prevail is $Q \geq (1-q^+)[p_H-p_L]$.

Once in this region, if $Q \leq (1-q^-)[p_H-p_L]$, condition (11) reduces to

$$\delta \geq \frac{\theta p_H}{p_H(1-x_2^V)+(1-p_H)\theta p_H}=\frac{1}{1+Q-(1-q^+)[p_H-p_L]}=\delta_1,$$

because straightforward algebra shows that if condition (11) holds for type H so it does for the type L. Note that $\delta_1 \leq 1$ whenever $Q \geq (1-q^+)[p_H-p_L]$. This threshold is decreasing and convex in Q.

When there is pooling at both states ($Q \geq (1-q^-)[p_H-p_L]$) condition (11) boils down to

$$\delta \geq \frac{\theta p_H}{1-p_H x_2^V-(1-p_H)x_2^D}=\frac{p_H}{Q+p_H-\frac{p_H(1-p_H)+p_L(1-p_L)}{(p_H+p_L)(2-p_H-p_L)}[p_H-p_L]}=\delta_3,$$

because again, only the condition for the H-type needs to be checked. Note that $\delta_3 < 1$ in this area. This threshold is also decreasing and convex in Q. Tedious but easy computations show that $\delta_1 = \delta_3$ when $Q = (1 - q^-)[p_H - p_L]$. ■

There are two deviations from the Pooling by battles profile: (*i*) P1 triggers A in the first period; we already dealt with this possibility in Lemma A1. (*ii*) P1 makes an offer at that period. The following Lemma shows that if one uses optimistic out-of-equilibrium beliefs, a sufficiently high discount rate can avoid the latter deviation.

Lemma A3 *There exist two threshold discount rates $\delta_2 \leq 1$ and $\delta_4 \leq 1$ such that if P2's beliefs are $\mu(p = p_L \mid h_1 \neq B) = 1$ then Pooling with partial separation and Full pooling by battles constitute a PBE if and only if $\delta \geq \delta_2$ and $\delta \geq \delta_4$, respectively.*

Proof. When optimistic beliefs are used, the type with the most incentives to deviate is the L-type since the condition

$$\begin{aligned} 1 - \theta(1 - p_L) &\leq \delta E[v_i]; \\ \delta &\geq \frac{1 - \theta(1 - p_L)}{E[v_i]}, \qquad i = L, H, \end{aligned}$$

is required and $E[v_H] \geq E[v_L]$. Hence, new thresholds on the discount rate are needed. When there is separation under D the new condition is

$$\delta \geq \frac{1 - \theta(1 - p_L)}{1 - p_L x_2^V - (1 - p_L) x_2^L} = \frac{Q + p_L}{Q + p_L + q^+ p_L [p_H - p_L]} = \delta_2,$$

and

$$\delta \geq \frac{1 - \theta(1 - p_L)}{p_L(1 - x_2^V) + (1 - p_L)(1 - x_2^D)} = \frac{Q + p_L}{Q + p_L + \frac{p_H(1-p_H) + p_L(1-p_L)}{(p_H + p_L)(2 - p_H - p_L)}[p_H - p_L]} = \delta_4,$$

when there is pooling under both outcomes. Both thresholds are increasing and concave in Q. Easy algebra shows that $\delta_2 > \delta_4$ for any Q. ■

These conditions are summarized as follows:

$$\delta \geq \begin{cases} \overline{\delta} = \max\{\delta_1, \delta_2\} & \text{if } (1 - q^+)[p_H - p_L] \leq Q \leq (1 - q^-)[p_H - p_L]; \\ \overline{\overline{\delta}} = \max\{\delta_3, \delta_4\} & \text{if } (1 - q^-)[p_H - p_L] \leq Q, \end{cases}$$

so if the discount rate is high enough and P2's beliefs are optimistic, neither of the two possible deviations, either A or an offer, can beat the Pooling by battles profile. ■

B Appendix

The 3.0 COW Extra-systemic dataset contains 109 military disputes. We dropped 16 cases due to the lack of information about some covariates. The only main change we made on the composition of the sample, following the information obtained from Clodfelter (1992), Dupuy and Dupuy (1993) and Goldstein (1992), was to split the Franco-Dahomeyan war into two conflicts. Table 4 contains all the cases included in the analysis.

Substantial amounts o time and effort were required by the updates of the durations and number casualties in the original database. The original records were quite inaccurate probably because the interest of scholars has been almost exclusively centered in the Interstate wars database.

Table 4:
Extra-systemic wars in the sample, 1817-1988

War name	Participants	Start year	End year	Duration (months)
British-Mahrattan	United Kingdom vs. Mahrattas	1817	1818	7
British-Kandyan	United Kingdom vs. Kandyan rebels	1817	1818	13
Turko-Persian	Ottoman Empire vs. Persia	1821	1823	23
British-Burmese of 1824	United Kingdom vs. Burma	1824	1826	24
British-Ashanti of 1824	United Kingdom vs. Ashanti tribe	1824	1826	31
Dutch-Javanese	Netherlands vs. Java kingdom	1825	1830	57
British-Bharatpuran	United Kingdom vs. Bharatpur	1825	1826	1
Russo-Persian	Russia vs. Persia	1826	1828	20
British-Zulu of 1838	United Kingdom vs. Zulu tribe	1838	1840	25
British-Afghan of 1839	United Kingdom vs. Afghan tribes	1839	1842	42
First Opium	United Kingdom vs. China	1839	1842	36
Franco-Algerian of 1839	France vs. Algerian tribes	1839	1847	99
Peruvian-Bollivian	Peru vs. Bolivia	1841	1841	1
British-Baluchi	United Kingdom vs. Sind Army	1843	1843	6
Uruguyan Dispute	France & United Kingdom vs. Uruguay	1845	1852	86
Franco-Moroccan	France vs. Moroccan resistance	1844	1844	1
British-Sikh of 1845	United Kingdom vs. Sikhs	1845	1846	3
Cracow Revolt	Austria-Hungary vs. Polish rebels	1846	1846	1
British-Sikh of 1848	United Kingdom vs. Sikhs	1848	1849	5
British-Kaffir of 1850	United Kingdom vs. Kaffirs	1850	1853	37
British-Burmese of 1852	United Kingdom vs. Burma	1852	1853	10
British-Santal	United Kingdom vs. Santals	1855	1856	12
Second Opium	France & United Kingdom vs. China	1856	1860	49
Indian Mutiny	United Kingdom vs. Indian sepoys	1857	1859	23
Argentine-Buenos Aires	Argentina vs. Buenos Aires secessionists	1859	1859	5
British-Maorin	United Kingdom vs. Maori	1860	1870	122
Spanish-Santo Dominican	Spain vs. Santo Domingo	1863	1865	15
British-Bhutanese	United Kingdom vs. Bhutan	1865	1865	10
British-Ethiopian	United Kingdom vs. Ethiopia	1867	1868	4
Spanish-Cuban of 1868	Spain vs. Cuba	1868	1878	114
British-Ashanti of 1873	United Kingdom vs. Ashanti tribe	1873	1874	14
Franco-Tonkin	France vs. Vietnam	1873	1874	3
Dutch-Achinese	Netherlands vs. Aceh sultanate	1873	1878	66
Egypto-Ethiopian	Egypt vs. Ethiopia	1875	1876	5
British-Afghan of 1878	United Kingdom vs. Afghan tribes	1878	1880	22
Bosnian	Austria-Hungary vs. Bosnia	1878	1878	2
Russo-Turkoman	Russia vs. Turkomans	1879	1881	19
British-Zulu of 1879	United Kingdom vs. Zulu tribe	1879	1879	6
Gun War	United Kingdom vs. Basuto	1880	1881	8
Boer War of 1880	United Kingdom vs. Transvaal	1880	1881	3
Franco-Tunisian of 1881	France vs. Tunisia	1881	1882	14
Franco-Indochinese of 1882	France vs. Annam	1882	1883	16
British-Mahdi	United Kingdom vs. Mahdist	1882	1885	31
Franco-Madagascan of 1883	France vs. Madagascar	1883	1885	31
British-Burmese of 1885	United Kingdom vs. Burma	1885	1886	2
Mandigo	France vs. Mandinga	1885	1886	12
Serbo-Bulgarian	Serbia vs. Bulgaria	1885	1886	4
Italo-Ethiopian of 1887	Italy vs. Ethiopia	1887	1887	1
First Franco-Dahomeyan	France vs. Dahomey kingdom	1890	1890	8

Table 4 (cont.)

War name	Participants	Start year	End year	Duration (months)
Second Franco-Dahomeyan	France vs. Dahomey kingdom	1892	1892	5
Belgian-Congolese	Belgium vs. Congo	1892	1894	16
British-Ashanti of 1893	United Kingdom vs. Ashanti	1893	1894	12
Dutch-Balian	Netherlands vs. Bali-Lombok	1894	1894	3
Franco-Madagascan of 1894	France vs. Madagascar	1894	1895	10
Spanish-Cuban of 1895	Spain vs. Cuba	1895	1898	38
Japano-Taiwanese	Japan vs. Taiwan	1895	1895	5
Italo-Ethiopian of 1895	Italy vs. Ethiopia	1895	1896	11
Spanish-Philippino of 1896	Spain vs. Philippines	1896	1898	23
Mahdi Uprising	France & United Kingdom vs. Mahdist	1896	1899	42
British-Nigerian	United Kingdom vs. Nigeria	1897	1897	1
Indian Muslim	United Kingdom vs. Indian-Muslims	1897	1898	9
American-Philippino	United States vs. Philippines	1899	1902	42
Somali Rebellion	United Kingdom vs. Mad Mullah army	1899	1905	67
Boer War of 1899	United Kingdom vs. Boer	1899	1902	32
Conquest of Kano & Sokoto	United Kingdom vs. Kano & Sokoto sultanates	1903	1903	6
South West African Revolt	Germany vs. Herero & Nama tribes	1904	1905	22
Maji-Maji Revolt	Germany vs. Tanganyka	1905	1906	11
British-Zulu of 1906	United Kingdom vs. Zulu tribe	1906	1906	4
Moroccan of 1911	France & Spain vs. Morocco	1911	1912	13
Caco Revolt	United States vs. Haiti	1918	1920	19
British-Afghan of 1919	United Kingdom vs. afghan tribes	1919	1919	2
Iraqi-British	United Kingdom vs. Iraqi Arabs	1920	1921	14
Moplah Rebellion	United Kingdom vs. Moplah	1921	1922	4
Riff Rebellion	France & Spain vs. Morocco	1921	1926	64
Italo-Libyan	Italy vs. Libya	1923	1932	107
Franco-Druze	France vs. Druze	1925	1927	23
Saya San's Rebellion	United Kingdom vs. Burmese rebels	1930	1932	18
British-Palestinian	United Kingdom vs. Palestina	1936	1939	37
Indonesian	Netherlands & United Kingdom vs. Indonesia	1945	1949	49
Franco-Indochinese of 1945	France vs. Vietminh	1946	1954	93
Franco-Madagascan of 1947	France vs. Madagascar	1947	1948	20
Malayan Rebellion	United Kingdom vs. Malaysia	1948	1957	112
Sino-Tibetan of 1950	China vs. Tibet	1950	1951	8
Franco-Tunisian of 1952	France vs. Tunisia	1952	1955	39
British-Mau Mau	United Kingdom vs. Kenya	1952	1956	39
Moroccan Independence	France & Spain vs. Morocco	1953	1956	31
Franco-Algerian of 1954	France vs. Algeria	1954	1962	90
Cameroon	France & United Kingodm vs. Cameroon	1955	1960	55
Angolan-Portugese	Portugal vs. Angola	1961	1974	165
Guinean-Portugese	Portugal vs. Guinea-Bissau	1963	1974	140
Mozambique-Portugese	Portugal vs. Mozambique	1964	1974	121
East Timorese	Indonesia vs. Timor	1975	1977	19
Namibian	South Africa vs. Namibia	1975	1988	156
Western Saharan	Mauritania & Morocco vs. Polisario	1975	1983	98

Finally, we detail the sources of the independent variables.

Agreement: This historical data come from Clodfelter (1992), Dupuy and Dupuy (1993) and Goldstein (1992).

Average deaths: The COW database, Clodfelter (1992) and Lacina and Gleditsch (2004).

State's casualties ratio: The COW database, Clodfelter (1992) and Lacina and Gleditsch (2004).

Democracy: This score is contained in the Polity IV dataset compiled by Marshall and Jaggers (2000).

Repression: This measure is derived from the "Competitiveness of participation" variable of the Polity IV dataset.

The variables not mentioned above and the COW capability index were obtained from Bennett and Stam (2000)[26].

[26] These authors have developed a publicily available software called EUGENE that provides fast access to a comprehensive database on conflict related and political variables. This software is available at http://eugenesoftware.org/.