1. Introduction

1.1. Background

The shadow of war has been nearly omnipresent ever since the end of the Second World War. But where the larger international scale wars have been few and relatively minor, civil wars have ravaged more than 73 countries (Regan, 2000), and at the end of the nineties over 16% of all countries were simultaneously involved in civil war (Hegre, 2004). The effects of civil wars may be even more devastating than those of international warfare, mainly because they last so long. Since 1950 the incidence of civil war has been explosive as new conflicts erupted faster than the old ones were resolved. This is clearly illustrated in figure 1, which also shows the transitory calming effect of the end of the cold war.

![figure 1](image-url)

Figure 1. The global incidence of civil warfare, 1950–2002. From Hegre (2004), fig. 1

During the cold war, many civil wars were ideological battles, one or both parties often being supported by «their» super-power. Since the cold war the emphasis in the study of civil conflict (and criminal activity as such) has shifted to include rational decision-making, where groups are viewed as profit-maximising units evaluating their options of peace, war and intensity as a function of what they believe can be gained from the different strategies (see for instance Regan (1998, 2000, 2002), Hirshleifer (1993), Azam (2000), Powell (2002) or Collier et al. (1999, 2003)). From this per-
pective, expected utility theories and traditional game theory are legitimate tools to describe the interaction in a civil war and in its possible negotiations about peace or cease-fire.

War is in this basic interpretation just another means of distributing resources. In the view of the parties, what is at stake is the control over some resource, be it land, minerals, oil or perhaps liberation from excessive taxation. Oppression against an excluded group might often take form of a high tax on their produce. In Burundi, the southern Tutsi elite in power distributed 98% of the capital to the areas surrounding the capital and to their home province Bururi, the remaining 14 provinces sharing the rest (Ngaruko and Nkurunziza, 2000). It seems clear that in such a situation, there may be immense gains for the excluded group if they are able to topple the government.

Of course, many of the stakes in a war cannot easily be quantified into a cost–benefit analysis like the ones we will use below. The right to practice your religion or to speak your mind can hardly be measured into a $Y$ in an equation, nor can the historical bearings of the oppression practiced by a ruling group necessarily be measured in material terms.

However, on the one hand the material aspects will often hold at least parts of the key to resolving a conflict, and is as such important to understand. And on the other hand, we might think that the material aspect of a conflict is the side that we as external conflict managers can most readily influence. If the historical and cultural sides of conflicts might need to be handled by the parties themselves and be allowed to heal over time and through dialogue, possibly by the help of international mediation, the material motivations can be dealt with and resolved in their own respect.

1.1.1. The effects of civil war

Resolving civil conflicts is firstly a question of reducing suffering and deprivation in the countries concerned, by ending violence and reducing the uncertainty that is relentlessly coupled with civil unrest. Civil wars create instability and fear; they hinder investment and reduce production, in many cases dramatically. The reallocation of resources from productive activities to fighting creates a double loss, first reducing the actual production in the economy and then destroying capital and parts of the realized production in the fight (Collier et al., 2003). Civil conflict also occurs disproportionally in countries with low income, particularly in Africa and the Middle-east
which alone have suffered 56% of all intra-state conflicts since 1945, 38% in sub-Saharan Africa alone (Regan, 2000). Thus, those that are most in need of economic and democratic development and of investments suffer the direst consequences of civil wars.

Using the definition employed by Sen (1999), civil war is also a dramatic reduction in the level of development, as freedoms are drastically restrained. The basic freedoms to survive or from starvation are weakened, the freedom of movement may be reduced and freedoms of education and going to work may be totally removed in some areas. Comparable countries drop from a 4.79 point average without conflict to 5.66 points in post conflict on the Freedom House indicator (Collier et al., 2003).†

Also more traditional measures of development are affected by civil war. As we saw above, GDP is reduced in a double manner leading to an average permanent loss of 2% only from the loss in productive activity (Op.cit.). At the same time, GDP growth is on average reduced by 2.2% every year of the conflict, generating incomes after the war that are about 15% lower than had there never been a war (Op.cit.). Collier et al. state further that an average developing country increases its military expenses from 2.8% to 5% of GDP during civil war. This will most likely lead to a reduction in the level of social expenditures, such as health, education or infrastructure. Coupled with the active destruction of infrastructure, by both sides in the conflict, and the looting of private and public structures, the country’s development indicators plummet.

Furthermore, refugees, capital flight, increases in mortality rates, reductions in life expectancy, deterioration in health levels and the persistence of these effects long after the end of violent hostilities all paint a glaring picture of the devastating effects of civil war.‡ It is therefore of paramount importance to search for solutions to civil wars.

1.1.2. International interventions

In response to the increasing number of intrastate conflicts, we have seen a surge in interventions since the Second World War. Regan (2002) accounts for 1400 interventions in 102 conflicts, where interventions among others can be economic, diplomatic

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† The Freedom House indicator goes from one to seven with one being the best.
‡ For a thorough and easily available presentation of the economic and social costs of civil war, see Collier et al. (2003).
or military, multilateral, unilateral or opposing. In a different approach (with slightly older data), Regan (2000) accounts for 190 interventions in 89 conflicts.

The topic of international interventions as conflict management has risen quickly on the international agenda. In the post-1990 situation, without a bipolar power struggle, the UN has markedly increased its involvement. Since 1990, the UN has been involved in 41 peacekeeping operations, out of a grand total of 59 missions in the organisation's history. The United Nations is currently involved in 16 peacekeeping operations, almost as much as in its entire history before 1990.³

During the same period, the collapse of the South-African and Rhodesian Apartheid regimes and the apparent success of the UN sanctions there, led to a surge in sanctions imposed by the international body. Pre-1991, the Security Council had voted for sanctions only in these two countries. Since then the UN has initiated twelve sanction programs, eight of them in Africa.⁴

The involvement of the UN in interventions in civil wars suggests that the focus of interventions has more markedly become conflict management on a neutral or quasi-neutral base, perhaps in sharp contrast to political or military strategic operations during the cold war.

1.2. What is a civil war?

To define properly a civil war seems nearly impossible. As Baev (2003:4) says it, «… the simple fact [is] that 50 casualties is a minor street riot in India and a major violent conflict in Georgia». And this is only the beginning of the problems. How do we separate civil wars from for instance (CSCW, 2003):

- interstate wars (how much intervention do we accept?),
- colonial conflict (how established must the state government be?),
- genocide and internal repression (how much opposition do we demand?),
- coups and internal unrest (how large must the ‘rebel’ group be?),
- banditry, crime and warlordism (how political must their aims be?) and
- terrorism (what are the aims, how long must they last?).

There may also be cases where the civilian population does not have the means to defend itself against government repression, and where other groups step in. Is this then a civil war or something else? In East Timor the international community stood up against the Indonesian oppression; in East Pakistan neighboring India has been intervening to protect Hindus; or in Corsica where criminal organizations have been leading the struggle for a secession from France (CSCW, 2003b).

We face two principal problems in this context. Firstly, we must find a good definition of 'war', excluding other forms of violence or power struggle. Secondly, we must separate civil wars from other wars. The first problem is classically answered by Clausewitz (1832, paraphrased from Clausewitz, 1976):

> War is merely a continuation of politics by other means

and

> War is thus an act of force to compel our enemy to do our will.

Jon Elster (CSCW, 2003b:5) proposes 'politics' in the clausewitzian context to involve one of the following aims:

- to force a change in government policy
- to replace the government without regime change
- to force regime change
- to achieve territorial secession
- to force incorporation of territory into another state

These broad, philosophical definitions may give a clear insight into what a civil war may be, but will prove very difficult to quantify. A quite classic definition applied to enable such exercises is adopted by Collier et al., where

> civil war occurs when an identifiable rebel organization challenges the government militarily and the resulting violence results in more than 1,000 combat-related deaths, with at least 5 percent on each side. (Collier et al., 2003:11)

This, of course, makes statistical exercises feasible, but excludes many conflicts that should intuitively and philosophically be included. In addition to the problem of cut-off points (conflicts of just a few deaths less or more than what is demanded), many
conflicts operate in a grey area that makes it problematic to demand a clear-cut challenge of the government (as exemplified earlier). On the other end of the scale, this definition might also face problems where banditry, terrorism and coups are involved, including more than is desirable.

The authors themselves use a more general definition further on, where

civil war occurs if a group of people forms a private military organization that attacks government forces and ordinary civilians on a large scale and with a degree of persistence. (ibid., p. 54)

The focus in this definition is also on the time-span of conflict, and it seems some measure of duration should probably be included in our definition (as is done by for instance Regan 1998, 2000, 2002). Finally, we should probably try to preserve our philosophical definitions and empirical judgments, be they hard or impossible to satisfactorily quantify.

For comparison, I include a dictionary definition of 'civil war'.

<table>
<thead>
<tr>
<th>civil war n.</th>
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<tbody>
<tr>
<td>• A war between factions or regions of the same country.</td>
</tr>
<tr>
<td>• A state of hostility or conflict between elements within an organization: «The broadcaster is in the midst of a civil war that has brought it to the brink of a complete management overhaul» (Bill Powell).</td>
</tr>
<tr>
<td>• Civil War The war in the United States between the Union and the Confederacy from 1861 to 1865. Also called War Between the States</td>
</tr>
<tr>
<td>• Civil War The war in England between the Parliamentarians and the Royalists from 1642 to 1648.</td>
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_The American Heritage Dictionary of the English Language, Fourth Edition_
1.3. Prerequisites for conflict – the three M’s of civil war

Why is it that in some countries, civil war seems to be more the rule than the exception while in others even thinking of such a scenario seems ridiculous? To look at this in a systematic way, I set up three analytically different (but overlapping) categories of premises for civil war, the three M’s, \textit{motivation, mobilization} and \textit{misperception}.

1.3.1. Motivation

An obvious prerequisite for a group to take to violent opposition against its government is that they have some form of political motivation. Literature provides us two main types of motivation (eg. Collier et al., 2003; Wood, 2003; Elbadawi and Sambadis, 2000; Regan 1998, 2002, 2003);

\begin{itemize}
  \item ethnic disputes and
  \item economic or social deprivation.
\end{itemize}

Where ethnic disputes focus on the demands of a distinguishable group within the state, often demanding secession (Chechnya, Ethiopia/Eritrea), conflicts based on economic or social deprivation seek to shorten the social or economic gap between the elite and the people, and are often fought over the control of the existing state (Angola, Vietnam). Regan (2000) and Collier et al. (1999) show that ethnic disputes are generally longer and that they respond differently to outside factors, such as interventions. The motivation of social conflicts can be described as the gap between aspirations and achievements. If the group feels it can do much better with a rearrangement of power or property structures, then it may be worth the cost to oppose violently (Regan 2002).

If we believe that there exist fundamental differences between ethnic and ideological conflicts, then our problem is how to distinguish the one from the other. How are we to distinguish a class struggle involving a suppressed group that is mainly homogeneous from an ethnic struggle that mobilizes around absolute or relative deprivation?
1.3.2. Mobilization

No matter how deep the deprivation or how fundamental the ethnic conflict; it will always take mobilization to establish a potent opposition. Differences in mobilization capabilities are one of the keys to why some countries seem to be locked in civil war, while unrest in comparable countries is quickly extinguished or never starts. Some main indicators that help understand the potential for mobilization in a country are (Regan, 1998);

- resources,
- size of area,
- centralization and
- ethno-cultural homogeneity.

Collier et al. (2003) consider the recruitment of soldiers as a question of labor recruitment. The rebel groups try to persuade the population to fight with them, whereas the government demands loyalty and obviously tries to dissuade rebel recruitment. In this process easily extractable resources like riverside diamonds or opiates can be a way of financing wages, bribes or other persuasion/dissuasion schemes (Regan, 2002). Thus, especially rebel groups in countries with such resources will find means to mobilize soldiers and support more readily available.

The size of the area and the level of centralization are key facilitators of mobilization. A small area provides ease for flows of information and soldiers, and a high degree of centralization often makes covert activity easier, even if at the same time reducing the cost of the government dissuasion. The full effect of a high or low level of centralization or area size is ambiguous.

Finally, ethnically homogeneous groups on both sides makes mobilization easier as members of such groups tend to stick together. Collier et al. (1999) further show that the relationship between the occurrence of civil war and homogeneity is non-linear. Both homogeneous and highly heterogeneous societies have a higher than normal level of civil wars. Regan (2002) explains this in two parts, stating that homogeneity «may influence the governments ability to divide loyalties within the opposition» and that this «is consistent with the idea that civil wars in homogeneous or highly heterogeneous societies tend to organize along ideological lines.» Collier et al.
(2003), on the other hand find no such relationship when studying the entire panoply of civil wars.

1.3.3. Misperception

In all civil wars, there is a fundamental problem of asymmetric information. It’s in the very nature of conflict that the parties do not share strategic information about fighting capabilities, popular support or resources. The parties might want to boast their capabilities at the negotiating table while talking it down when preparing for battle. This will normally cause both groups to misperceive their odds of winning, thus changing their expected payoff from going to war, all else given. Obviously, an upward misperception of the chances for victory will increase the expected gain from armed conflict, while the inverse is true when the parties make miscalculations downwards.

We will see in part 2 how peace agreements should always produce a surplus that can be divided between the two parties, both because of the destructions and uncertainties created and because of the allocation of resources away from production. We look at this in further detail, particularly in the discussion of the model of negotiations in part 3.
2. A model of conflict decision-making

The model in this section builds on insights and proposals from several articles, in particular Hirshleifer (1993), Azam (2003a) and Mehlum and Moene (2005). The variables applied in the model and their definitions are summarized in appendix 1.

2.1. Introduction

I assume that a war is already deployed. The parties choose either to continue the fight, to offer a peace agreement or to accept such if one is offered to them. If they continue the fight, they want to maximise production and their probability to win. As resources are taken from a common pool, there is a trade-off between these goals.

Two groups are involved in the fight, government \((G)\) and excluded \((E)\), and they are both centrally and effectively governed.\(^5\) I do not necessarily exclude the possibility of several conflicts in the same state, but assume that there is no collusion among the rebel groups, so that the government can effectively be said to fight two separate battles. All resources are utilised, either in production or in fighting (the unemployed might for instance intuitively be the first to struggle). The parties maximise their expected outcome, and choose simultaneously on all stages, thus deciding the outcome.

I will not include explicitly the damages and the detrimental effects of war in general in this discussion. Firstly, this is because I want to get to the core of my argument, and by focusing on the effects of disallocating resources from production I avoid the problems of measuring the social and human sufferings produced by fighting. Secondly, I am not certain that the parties will take these damages fully into account. At least partly, they might be considered as external effects in the sense that from the government's point of view, they are only aiming at inflicting such damages on the other. Thus excluding any altruism towards the other party, we might well argue that these effects do not enter in the calculations of neither of the governments. We might well include this side of the story in a later dip.

\(^5\) I stress the point of central governing, as among others risk-aversion, calculation capabilities, irrationality and lack of information might cause large problems in our discussion when the groups are anarchistic. All of these problems can and will, of course, be incorporated into the governing body itself, but then hopefully in a more systematic way, reducing the chaos.
2.2. The basic model

I will describe a three-stage dynamic game with full information. In the first stage of the game, the groups will decide whether to make a proposal for a peace agreement. In the second stage, a party, if any, that has been presented with an offer considers whether he will accept or reject the offer. The third stage of the game takes place if either no offer is presented or all offers are rejected, and consists of allocating resources to the fight.

The game can now be presented as in figure 3. To achieve peace, we must have that the outcomes in peace are expected to be larger for both groups than with any other outcome.

![Game Tree](image)

*Figure 2. The game tree of peace contract under full information.*

We demand of the solution that it be subgame perfect, meaning that the players take into account the choices that will be made in subsequent stages, and that «the players' strategies constitute a Nash equilibrium in every subgame» (Gibbons, 1992:124). Then they are in effect solving the game backwards, using their information about the other party to infer the expected outcome. We therefore start solving the game by seeing the allocation of resources in the last stage of the game, before considering the second stage of accepting a proposal and lastly the decision of offering one. For convenience, I will consider stage 1 and 2 together.
In the treatment below, \( i \) and \( j \) will always designate \( G(o\text{vernment}) \) or \( E(xcluded) \), where \( i \neq j \).

2.3. Stage 3: Preparing to fight

Production of the government, \( Y_G \), and the excluded group, \( Y_E \), are functions of the resources set aside for productive activities by that group, \( L_i \), and a group-specific external factor, \( \omega_i \). The effectiveness of resources increases in the external factor, so that for a higher \( \omega_i \), the production for a given level of input is larger, and the marginal returns on increasing the inputs are higher. Thus, when \( f_i(\cdot) \) is the production function,

\[
Y_G = f_G(L_G, \omega_G), \quad f'_G > 0, \quad f''_G < 0, \quad \frac{\partial^2 f_G}{\partial L_G \partial \omega_G} > 0
\]

\[
Y_E = f_E(L_E, \omega_E), \quad f'_E > 0, \quad f''_E < 0, \quad \frac{\partial^2 f_E}{\partial L_E \partial \omega_E} > 0
\]

There is a finite pool of resources initially distributed on each side, \( N_i \), of which the governing body can allocate one share to production, \( L_i \), and another to fighting, \( F_i \). We assume that all resources are utilized, so that the budget constraints in (3) and (4) hold by equality. Even if I'm in effect including all resources, human or not, in this constraint, it may be intuitively easier to think of them as human, thus assigning a number of workers and a number of soldiers.

\[
L_G + F_G \leq N_G
\]

\[
L_E + F_E \leq N_E
\]

The perceived probability of a group winning, \( \alpha_i \), is a function of their relative allocations to fighting and also of other factors (e.g., effectiveness in fighting), designated by \( \theta_i \). The relative allocations are measured by how many of the total fighters on the battlefield that are on your side. Obviously, the probability has to lie between zero and one.
(5) \[ 0 \leq \alpha_G = \alpha_G \left( \frac{F_G}{F_G + F_E}, \theta_G \right) \leq 1 \]

(6) \[ 0 \leq \alpha_E = \alpha_E \left( \frac{F_E}{F_G + F_E}, \theta_E \right) \leq 1 \]

Note that the probabilities in (5) and (6) are perceived and not actual, so that they not normally will sum to one. This is both because the parties have imperfect knowledge of the external factor of the other and because they may suffer from misperceptions, miscalculating their odds of victory in combat. At any point in a conflict, the parties will have to judge their chances according to various observed facts, eg. control of strategic strongholds, international support or popular foundations. In these calculations they will normally not be able to make precise and perfect judgments, meaning that their beliefs about their own chances are indeed beliefs, and as such inaccurate.

2.3.1. Solving the model

The two sides maximise expected utility for all future periods. They expect to win with a probability \( \alpha_i \). In the first period, the winning group will get its own production and a part of the other group’s production according to a fierceness factor \( \phi_i \), i.e. an expression of the intensity of the fight or the «level of hate». For all future periods, they can then tax the loosing group by a rate \( t \). This tax can also be taken to reflect militancy or ideological opposition, so that for instance a socialist group defeated by fascists indicates a positive \( t \) even before real term taxation. For all future periods, the parties produce some fixed level output, \( \tilde{Y}_i^L \) and \( \tilde{Y}_i^W \) for the loser and the winner respectively.

The expression for the expected utility of each of the groups is now given by,

(7) \[ U_i = \alpha_i \left[ Y_i + \phi_j Y_j + (\tilde{Y}_i^W + t \tilde{Y}_j^L) \sum_{k=1}^{T} \frac{1}{(1+r)^k} \right] + (1-\alpha_i) \left[ (1-\phi_j) Y_i + (1-t) \tilde{Y}_i^w \sum_{k=1}^{T} \frac{1}{(1+r)^k} \right] \]

The first part of the expression indicates the payoff to party \( i \) if he wins the battle, while the second part indicates its payoff if he is defeated. Both are taken for their respective probabilities. The two sums are exogenous and give the weight assigned to future output as a function of the discount rate \( r \) and the time horizon \( T \). For ease of notation they are replaced by \( \beta(r,T) \) in the discussions below. Notice immediately
that this parameter might vary heavily between different players and that it is highly
determinate on the outcome, seeing as it multiplies the future output. As usual, the
more myopic the parties are, the higher is \( r \) and/or the lower is \( T \). Then less weight is
given to revenues in the future, and relatively more to revenues today and in closer
periods. To give an order of magnitude, we might assign a value of \( \beta = 2.4 \) for an
impatient party, while we might assign a value of \( \beta = 8.5 \) for a patient one.\(^6\)

Now, inserting for (1) to (6) in (7), the expression for maximisation is given in its
entirety by (8) below.

\[
U_i = \max_{\theta_i} \left\{ \alpha_i \left( \frac{F_i}{F_i + F_j} \theta_i \right) \cdot \left[ f_i (N_i - F_i, \omega_i) + \phi Y_j + \beta (r, T) \left( \tilde{Y}_i^w + r \tilde{Y}_j^l \right) \right] \right\} \\
\quad + \left[ 1 - \alpha_i \left( \frac{F_i}{F_i + F_j} \theta_i \right) \right] \cdot \left[ (1 - \phi) f_i (N_i - F_i, \omega_i) + \beta (r, T) (1 - t) \tilde{Y}_i^l \right]
\]

where, as mentioned, \( \beta (r, T) = \sum_{k=0}^{T} \frac{1}{(1 + r)^k} \)

The optimisation yields the first-order condition in (9), deciding the allocation of re-
sources to fighting. The right-hand side represents the expected marginal return to
fighting, while the left-hand side is the marginal productivity of production. As usual
we demand equal effects of allocating one more unit to each of the two uses, as this
means we have saturated the expected output.

Notice that as the right-hand side increases, the optimality condition demands
higher marginal productivity in production. Because of the assumptions of concavity,
this means a lower proportional allocation to productive activities and a higher allo-
cation to fighting.

\[
f'_i = \frac{\alpha'_i}{\alpha_i + \phi_i (1 - \alpha_i) (F_i + F_j)^3} \left[ \phi Y_j + \phi Y_i + \beta (r, T) \left( \tilde{Y}_i^w + r \tilde{Y}_j^l - (1 - t) \tilde{Y}_i^l \right) \right]_{> 0}
\]

The second order-condition is treated in Appendix 2. It will normally be negative,
meaning that we can in fact maximise.

\(^6\) With a discount rate of 0.3 and a time horizon of 5 years \( \beta = 2.436 \), while a discount rate of 0.1 and
a time horizon of 20 years yields \( \beta = 8.514 \).
2.3.2. Analyzing the optimality condition

The effects of shocks to the exogenous factors are summarized below, parentheses indicating the variable affected in (9).

- **Intensifying fighting** \( \alpha', \phi', Y_j, \tilde{Y}_i^w, \tilde{Y}_i^L, t, T \)
- **Relaxing fighting** \( r, \tilde{Y}_i^L \)
- **Ambiguous** \( F_j, \phi_i, \theta_i(\alpha_i), \omega_i(Y_i,f') \)

Notice first that, as would be expected, all variables that increase the prize for a possible winner will intensify the fight. A higher production of our opponent during war, \( Y_j \), increases the bundle from which we can claim a share, and his post-war production after we have won, \( \tilde{Y}_i^L \), constitutes our potential tax base. Likewise, the tax rate, \( t \), gives us the winner’s share of future profits. All these variables thus measure the winnings that can be expected by the victorious party, and thereby increase the allocation of resources to fighting, augmenting the respective party’s chances to win.

Inversely, an increase in the discount rate, \( r \), or a decrease in the time horizon, \( T \), decreases the value assigned to our future tax benefits, reducing the expected prize. Then more resources are spent producing and less fighting.

Secondly, when our production after a lost fight, \( \tilde{Y}_i^L \), increases, the punishment if we lose is less harsh. That is, the alternative to winning the price becomes less discouraging, so that assigning resources to productive tasks becomes more appealing. Conversely, an exogenous increase in the marginal returns from fighting, \( \alpha'_i \), makes it more attractive to assign resources away from production, as our chances may be significantly enhanced.

The effects of an increase in our fierceness in conflict, \( \phi_i \), and of an increase in \( \theta_i \) (and thereby in the perceived probability, \( \alpha_i \)) are ambiguous and interdependent. If we are highly ferocious (ie. \( \phi_i \) is large), an increased perceived probability of winning increases the expected outcome and tempts us to fight harder. When we are less so, however, the effect is the opposite. Now the negative effect of allocating resources away from production dominates, and a higher \( \alpha_i \) in fact reduces fighting. This means that in a conflict with low fierceness, we would expect the weaker party to fight relatively harder and the stronger one less hard, prolonging the conflict.
When taking into account that the rebels might have lower productive efficiency and therefore lower marginal costs of fighting (Azam, 2002), then this effect is increased. This may also be a new take on the observed fact that many conflicts continue for a long time, often decades, without regime change or other determining battles, a question treated more extensively by Mehlum and Moene (2005).

Furthermore, when the function for the probability exhibits decreasing returns, ie. $\alpha'' < 0$, then the returns from the increased $\theta$, on expected outcome is always negative for the weaker party. All else equal, when the effect of assigning resources to the fight is lessened, the weaker party wants to allocate more of its total resources to fighting. We can think of this as the effect of the weaker party realizing that there is not much use producing when, at the end of the day, the enemy most likely will take it away in any case. So when their chances get smaller, they fight harder both to protect what they have and because the expected profitability of producing is decreased. Why waste your time working, when the produce probably will be stolen when you’re done?

In figure 3, I present the effect on the perceived expected benefits from fighting of an exogenous increase in the probability of winning, taken for different levels of ferocity. I use a specific function for the marginal returns from fighting (ie. the right side of (9)), simply setting all additive factors to zero and all multiplicatives to one. To get decreasing returns from allocation to fighting, I’ve set the function for the probability to square root, so the marginal effect is $1/2\sqrt{\alpha}$. The formula used in figure 2 is thus:

$$\frac{1}{2\sqrt{\alpha}} \frac{\phi}{\alpha - \phi(1 - \alpha)}$$

The actual numbers are not explicative, of course, and the actual expression of them is rather that of a factor on the optimality condition than expected outcome, but the effects come through a trade-off between expected outcome in a fight and actual loss from less production, so the interpretation is similar.
Figure 3. Expected returns from fighting for different levels of fierceness as a function of the perceived probability of winning when this is a decreasing function.

Notice how, in fights with low fierceness, an increase in your perceived probability of winning decreases your expected returns from fighting, whatever your strength. For higher levels of militancy the effect is reversed for the stronger party, but remains for the weaker. In this case, an exogenous increase in the perceived probability of the strong party winning increases fighting on both sides, assuming that the weaker party takes note of the increase. The reverse is true when the weaker party has its chances increased.

I stress that the probability in figure 2 above is changing because of the exogenous factor, as the effect through the number of fighters is accounted for in the condition for optimality. The optimal allocation of fighters as such is static and simply jumps from one level to another when $\theta_i$ changes.

An increase in the allocation of fighters of our opponent, $F_j$, also has ambiguous effects, again contingent on our relative military strength. See this simply by first noting that the direct effect in the expression is negative.

\begin{equation}
\frac{d}{dF_j} \frac{F_j}{(F_i + F_j)^2} = \frac{-1}{(F_i + F_j)^2}
\end{equation}
The second effect is through a reduction in our perceived probabilities of winning. We just studied this, and the same arguments still apply. However, now the effect is through a reduction in our chances, meaning that an increase in the fighting of the other increases our fighting when we are weak and decreases it when we are strong. Thus, under these assumptions we have a tendency towards escalation in the conflict when the government (if they are the stronger) increase their attacks.

Finally, an increase in $\omega$, increases both our production during war and the marginal productivity. A higher production gives us more to defend and incites us to fight harder, while higher efficiency in production makes the profits from an increased productive input higher and incites us to use more resources there. The total effect depends on the parameters of the production function.

2.4. Stage 1 and 2: Offering and accepting the peace

The parties can choose to offer a peace agreement instead of fighting. Both parties must accept a given contract of peace or cease-fire for it to be implemented. A contract must satisfy the participation constraint, meaning that it must provide the incentive for the agent to choose to participate (Laffont and Martimort, 2002). In our framework, this means that the parties must be offered a stake at least as high as what they could expect to get by fighting.

I exclude the possibility of sneak attacks, where a party signs the peace agreement on stage 2 and then assigns resources to fighting in stage 3. In this way, I assume that the parties are credible in the process of offering and accepting such an agreement. If we include sneak attacks, we will have to complicate the discussion by taking the outcomes as expected for the beliefs on how likely it is that the other party breaches the agreement. Then we have the problem that even if we believe that the other is credible, it may be dominating to commit a sneak attack ourselves. I leave the analytical aspects of this problem for another paper.

In these first two stages of the game, the groups will, as mentioned, decide whether to propose a peace agreement, and, if a party has been presented with one, he will consider whether he will accept or reject the offer.

In general, we will say that a group offers a peace agreement if its expected gain in case of war is smaller than what it gains with a peace agreement minus what it must offer the other group to get it to sign. We will say that the weak group then offers the
contract \( \{A, \tau\} \), promising to pay some fixed sum \( A \) once and then in all future periods a tax \( \tau \) on its production, and to refrain from further fighting.

I assume that what the parties produce after an agreement is the same as what they would have produced after a fight, the stronger party taking the place of the winner, assuming government, and the weaker taking the place of the loser. I have no intuitive explanation for this, but it seems reasonable that the production levels will be at least close. By this approach I am also assuming that it is always the weaker party that offers an agreement, ie. the likely loser of a fight. This process could be reversed, of course, and the stronger party could make the offer. This would not change the result, and only marginally the treatment.

A second simplification I use is that the parties are deciding explicitly (and credibly) which of the groups will be given government and taxation rights. In many conflicts, the agreement might more likely be to hold elections and to invite foreign observers to oversee that these are as democratic as possible. I don’t believe this simplification is very strong, as many conflicts are between groups that are clearly distinguishable. In these cases we might well expect both parties to know, at least approximately, the outcome of the elections. To include the uncertainty about this we could introduce the expected utility as a function of who wins, where we correct for the relative chances the respective parties have in the elections. I have not tried this path here.

The offering party’s utility discounted to present value by the discount rate \( r \), is now given by (11), giving its production in all future periods, minus the tax it has to pay in each period and the lump transfer of the first period.

\[
U_{j}^{pw} = [1 + \beta(r, T)](1 - \tau)\tilde{Y}_{j}^{L} - A
\]

If the stronger party \( j \) agrees to the contract \( \{A, \tau\} \), then its utility will be given by (12), where it must also commit to stopping attacks. (12) gives all of the stronger party’s future production and adds the tax transfer from the other party, as well as the lump transfer. Once again the terms are discounted to present value.

\[
U_{j}^{ps} = [1 + \beta(r, T)](\tilde{Y}_{j}^{w} + \tau\tilde{Y}_{i}^{L}) + A
\]

Constraints for participation in a peace agreement are thus given by the following set of equations.
Either, both (13) and (14) are satisfied, meaning that the government is admitted taxing rights, or this is the case with both (15) and (16), in which case the excluded group is given government and thus admitted taxing rights.

Using the information available to them, including their imperfect assessments of their probabilities in a fight, the parties prejudge the entire game. This means that the final decision of the groups is simply in stage 1, and gives the choice between the two actions; either offer a peace agreement or assign resources to the fight by maximising as in (9) above. We can represent this by the problem (17), where $j$ is the group considering to make an offer.

$$\max \{ U_j, U_j^{PW} \text{ subject to } U_i^{PS} \geq U_i \}$$

We have already seen the maximisation of $U_j$. There is no explicit maximisation in the second expression. To find the conditions for a successful peace accord we must therefore simply take the conditions into account and compare the utility that can be attained in a peace agreement to that which can be expected from fighting. Note that in the following the party that considers offering a peace agreement is group $j$, conditional on group $i$ accepting the offer, thus assuming or staying in government.

I use the superscript $\text{max}$ to note that the variable is given by the maximisation in (9) as it makes no sense for the parties to compare a possible peace agreement with anything but the best possible option. I have on purpose not cleaned up and rearranged the expressions in the early calculations, as I believe this will make it easier to follow the steps. Even if the expressions (18) and (19) therefore are unnecessarily long, it should be simple for the reader to recognize the origin of the different terms.

We start with the constraint and find a condition on the lump transfer satisfying the stronger party, so that it agrees to the contract, i.e. (14) or (16) is satisfied; $U_i \leq U_i^{PS}$. By inserting for $U_i$ from (8) and for $U_i^{PS}$ from (12), remembering to use the maximised values for the probabilities and the production, we get (18).
\[ A \geq \alpha_i^{\text{max}} \left( Y_i^{\text{max}} + \phi Y_j + \beta(r, T)(\tilde{Y}_i^W + t\tilde{Y}_j^L) \right) \\
+ \left(1 - \alpha_i^{\text{max}} \right) \left[ (1 - \phi_j)Y_j^{\text{max}} + \beta(r, T)(1 - t)\tilde{Y}_j^L \right] - \beta(r, T)(\tilde{Y}_i^W + \tau\tilde{Y}_j^L) \]

The condition says that the transfer must compensate the stronger party for the expected loss it suffers from not going to war. The first two expressions of (18) are the expected profits from fighting, while the last expression is the revenue gained by accepting the peace contract. Note that if we include risk aversion, then the transfer can be smaller, as the parties will be willing to buy themselves out of uncertainty, and that the condition in reality is on the set of \( A \) and \( \tau \), since the one can trade off the other.

There is no reason in our model for an offering party to offer more than what is strictly demanded by the other, thus by saturating condition (18) and inserting in (11) we get the rearranged expression for \( U_j^{\text{PW}} \) in (19).

\[ U_j^{\text{PW}} = \left[ 1 + \beta(r, T) \right] (1 - \tau)\tilde{Y}_j^L - \alpha_j^{\text{max}} \left( Y_j^{\text{max}} + \phi Y_j + \beta(r, T)(\tilde{Y}_i^W + t\tilde{Y}_j^L) \right) \\
- \left(1 - \alpha_j^{\text{max}} \right) \left[ (1 - \phi_j)Y_j^{\text{max}} + \beta(r, T)(1 - t)\tilde{Y}_j^L \right] + \beta(r, T)(\tilde{Y}_i^W + \tau\tilde{Y}_j^L) \]

The final step is to compare this constrained utility with the maximised expression for utility in the case of war, setting the conditions under which a peace agreement is preferred to war by the weaker party. That is where (13) or (15) is satisfied; \( U_j^{\text{PW}} \geq U_j \), inserting for (8) and (19). This gives the general condition (20).

\[ PD_j \equiv \left[ 1 + \beta(r, T) \right] (\tilde{Y}_i^L + \tilde{Y}_j^W) \geq Y_j^{\text{max}} + Y_i^{\text{max}} - \left(1 - \alpha_i^{\text{max}} - \alpha_j^{\text{max}} \right) \left( \phi Y_j^{\text{max}} + \phi Y_i^{\text{max}} \right) \\
+ \beta(r, T) \left[ \alpha_i^{\text{max}} (\tilde{Y}_i^W + t\tilde{Y}_j^L) + \left(1 - \alpha_i^{\text{max}} \right)(1 - t)\tilde{Y}_i^L + \alpha_j^{\text{max}} (\tilde{Y}_j^W + t\tilde{Y}_j^L) + \left(1 - \alpha_j^{\text{max}} \right)(1 - t)\tilde{Y}_j^L \right] \equiv WD_j \]

I define \( PD_j \) as the peace dividend when \( i \) is given government and \( WD_j \) as the total expected war dividend. Then (20) simply conditions the possibility of a peace agreement on the peace dividend being larger than the expected war dividend. Remember that these are in fact two conditions, as we would have one for the case where the incumbent is kept in government and another for the case where the excluded are given this position.

Several aspects about this condition are worth noting.

1. The possibilities for peace are independent of the agreed tax rate and payment, since these are just transfers from the one party to the other.
2. When fighting is more intense, then social waste during war is higher, ie. $Y_i^{max}$ and $Y_j^{max}$ is lower. Then the peace dividend is higher and a peace agreement is easier to establish, ie. the higher is the social waste from fighting, the larger are the possibilities for peace.

3. When the parties believe themselves stronger than they really are, then peace might become impossible to bring about, as the expected war dividend at some point will become larger than the peace dividend. This is due to the fact that the latter is restrained to the physical resource constraints of the country, whereas the expected war dividend might overbid this budget frontier when the parties have less than perfect information about their relative strengths (see further on page 45).

4. The war dividend relies almost entirely upon the perceived probabilities of winning. When these are low, the negotiation space for a peace agreement is large, whereas it gets smaller the stronger the parties believe they are. In fact, peace becomes impossible for high upward misperceptions of military strength, and even for modest misperceptions if the peace dividend is small.

Let’s consider more closely the particular case where there are no probability misperceptions. That is where $\alpha_l = 1 - \alpha_j$. Then we can reduce and rewrite (20) into condition (21), which shows clearly the significance of the relative economic size of the groups.

$$\tilde{Y}^w_i + \tilde{Y}^l_j - Y_i^{max} - Y_j^{max} \geq \beta(r,T)\alpha_j^{max}\left(\tilde{Y}^w_j - \tilde{Y}^w_i + t(\tilde{Y}^l_i - \tilde{Y}^l_j)\right)$$

(21)

First, notice that the left-hand side of (21) is always positive, since resources are not spent on fighting after the signing of a peace agreement. Fighting claims resources that can be used productively in the absence of war, so that peace creates a surplus that can be divided between the parties (this proposition is treated more fully on page 34).

Secondly, notice that in this situation, with common beliefs about the relative chances in a fight, the economic size of the two groups determines the sign of the first and second part of the right-hand side respectively. If we make the weak assumption that if $\tilde{Y}^w_i > \tilde{Y}^w_j$ then $\tilde{Y}^l_i > \tilde{Y}^l_j$, and we assume that the tax after a fight is not to steep,
then we can immediately see that the entire right-hand side is negative.\textsuperscript{7} This means that if group $i$ is the richer\textsuperscript{8}, then it should always be possible to establish a peace agreement where they remain or are installed in government. Further, when the chances of the poorer party increase, such an agreement is made easier, as the richer group has a stronger incentive to resolve the conflict without fighting, avoiding the possibility of being defeated in war.

Inversely, see that if group $i$ is the poorer, then under the same assumptions as above, the right-hand side is positive and a peace agreement giving $i$ government is harder to bring about, if it is feasible at all. Even so, we still have that when the chances of the poorer group increase, then the possibility space of such an agreement becomes larger. This last point seems intuitive, as it the economically stronger group has the highest stakes in a fight, and a militarily stronger poor party will up their chances of being defeated.

So in summary, when the richer group becomes stronger militarily, the chances for peace go down, whereas peace is more likely when this group becomes weaker militarily, even if the other becomes stronger.

Finally, I want to stress again that the perceived probabilities of victory are largely determinant of the possibility of establishing an agreement between the parties. If we can get them both to believe that their chances are quite small, then an accord should be easy to bring about. And, reversely, if they both think themselves stronger relative to the other party, then peace might be very tough to bring about. In part 3 we show that in this last case, with upward estimation errors, we will always require budget breaking to find an agreement that both parties can accept, paying the parties more in total than what they can in sum be expected to produce even in the absence of war.

\section*{2.5. International interventions as conflict management}

What are the ways by which we can influence the peace process and make a peace more easily attainable? I follow Regan and consider international intervention to be

\begin{footnotesize}
\begin{itemize}
\item[7] Since the government, ie. the winner, must maintain military and police, we might assume that they will be further from their maximum production than the opposition, ie. the loser. Then, if the tax rate is sufficiently high the right-hand side of (21) may become positive even when $i$ is larger.
\item[8] I take 'richer' to mean economically larger and 'poorer' to mean economically smaller in this discussion, even if the economic superiority may just as well come from a larger resource base as from a higher degree of wealth. In this sense, the 'richer' may well be more poor in a traditional sense measuring the income per capita.
\end{itemize}
\end{footnotesize}
any convention breaking action taken by a foreign state «targeted at the authority structures that determine the contours of the conflict» (Regan, 2000:10). This means that they do not enter into the normal interaction between the two states, so that for instance trade relations between two states that are continued do not constitute interventions, whereas trade relations set up or severed in the purpose of supporting a party in the conflict does. More to the point, military support from the USA to Israel is not necessarily intervention in this regard, as it must be viewed as a normal relationship between the two countries. But if the USA boosts their donations when there’s an intifada, on the other hand, then they are intervening.

Secondly, the international intervention targets authority structures in an attempt to shift the power balance between the government and the rebels (Regan, 2000). We presume that the intervener must have some interest in altering the path of the conflict, but what these interests are might be more difficult to establish. The intervener might well be attempting some form of conflict management, aiming at reducing the duration of the conflict, but might just as well be aiming at supporting one of the parties in a political or military strategy, not considering the path of the conflict explicitly. In a more cynical view the intervener might also have an interest in prolonging the conflict and avoid peace. It is however, more academically productive to treat intervention as conflict management, and to assume that the intervener does have some best interest in mind; either ending hostilities on both sides, helping one party to win or to alter the negotiation process in favor of the one or the other.

In general without an intervention the government will be more powerful relative to the opposition group, and therefore an intervention on behalf of the opposition should bolster their expectations for victory. That is, military interventions have a direct link to negotiation strategies and outcomes. (Regan, 2000:11)

There rests some problems with the definition of an intervention, as it does not indicate a clear difference between the actions of going to war and intervening other than a pre-existing conflict in the country. However, this presumably does not influence our discussion in a determining manner.

I assume third-party interventions to fall in under the following categories.

– economic (eg. sanctions, support, or trade arrangements; direct or indirect)
– military (e.g. sanctions, support, infiltration, intelligence, advisors, deployment of troops or strategic attacks)
– mediation

Let’s look at some examples of interventions (or groups of interventions) and how they might affect the allocation of resources and the possibilities of peace under the framework established above. I only look at positive interventions, i.e. an increase in variables, but the reader can easily read with the inverse function on, so for instance support becomes sanctions, and change the sign of the result.

2.5.1. Deployment of troops

functions as an increase in the resource base, $N$, but set aside for fighting. This means that the receiving party can allocate more resources to production, even if there may be conditions prohibiting diminishing beyond a certain level (though this may be hard to observe in practice...). There might be some conditions on the deployment or the intervener might bring weapons or strategies that were not present before (increasing $\theta_i$). In this case, the allocations of the receiving party may as we have seen increase or decrease depending on the initial military strength and their ferocity. But as we saw in (9), this changes the fighting allocation of the other group as well. I consider this effect further when studying military arms support.

Let’s assume that the deployment is conditioned on the receiving party fighting as hard as before, then when it is in favor of the stronger party, in our model the weaker party sees its probabilities of winning decrease. Above, particularly in figure 2, we show that this will increase their allocation to fighting. A deployment in favor of the weaker party, on the other hand, relaxes fighting as it reduces the chances of the strong party, leading it to assign fewer resources to fight.

The impact on the condition for peace depends on the affluence of the receiving group. Since fighting is fiercer, social waste is higher, meaning that the peace dividend is larger. Now, if the deployment is in favor of the poorer group, then the chances of this group winning are higher and the war dividend is reduced, further bettering the odds for peace. On the other hand, a deployment in favor of the richer group increases this dividend, opposing the effect of social waste. In this case, it is ambiguous whether the possibilities for peace are increased or decreased. All the
same, a sufficiently large intervention can, of course, force victory to the receiving party, and by such install peace.

The worst case here is an opposing intervention of remotely the same intensity. Then the actual fighting might increase dramatically without changing the odds. Even if peace becomes easier because of the increased peace dividend, the interveners may for political reasons in effect condition their support on an agreement not being signed. Think for instance of the interventions of the Soviet Union and the United States in Afghanistan in the early 80s. It seems unlikely that the US would have accepted a wish for a peace agreement, even in the hypothetical case where such a proposition was endorsed by a majority of their supported groups.

2.5.2. Military arms support

functions through $\theta$, increasing the perceived probability to win for a given input of fighters. The marginal revenue of fighting is increased, and the optimal assignment of fighters of the receiving group is affected, as we have seen in figure 2. If the receiver is the stronger group, then when their odds of winning are bettered, the fighting of the other party increases. Contrary to in the case of a direct military deployment, now both groups are taking any additional fighting resources from their finite pool of resources, thus reducing production and national income further. In the second case, where the receiver is the weaker party, the fighting of the other group diminishes. Whether the total fighting now increases, reducing national income, or if it goes down, increasing it, depends on the initial military strength of the receiving party and the parameters of the model.

Once again, whether the chances for peace are larger depends on the wealth of the receiving party. This effect is just as above, but if the final effect is to reduce fighting, then the intervention is less in favour of peace than it was in the case of a direct deployment of troops. This result comes directly from the fact that the parties now may reduce their fighting and thus decrease the potential gains from a peace agreement.

We could, however, see an increase in the misperceptions of fighting capabilities, increasing the beliefs of the receiving party disproportionally to the actual support given. When a small group gets vocal support or arms from, say, the USA, the group might feel much stronger than before, even if their actual fighting capacity is not significantly enhanced. At the same time, the other group might not realize the impor-
tance of the support (or notice it at all), thus overestimating their chances of victory. In this case, the effects on the intensity of the fight are stronger (positive or negative), but now the chances for achieving a peace accord are significantly decreased.

2.5.3. Economic support

is manifested in this model through $\omega$, increasing productive capacity for a given input of producers. This leads to more resources allocated to production for the implicated group, and thus increases the bundle to fight for, initially increasing the allocation of fighters from the other group. If this is the stronger, then as the weaker allocates resources away from fighting, they see their chances increased and up their fighting further.

In the other case, where the stronger party is the receiver of the support, the result is ambiguous because the weak party, as we have seen, will want to reduce its fighting when their chances increase (as they do when the stronger fights less hard), opposing the effect of an increased potential prize.

Receiving economic support increases wealth. If this support is given to the economically stronger group, then we have seen that they get more prone to signing a peace agreement, because their potential loss increases. Contrary, economic support to the poorer group might reduce the chances for an accord. Whether social waste increases again depends on the parameters.

Notice that the changes in the probabilities of winning may deepen the effects on the possibilities for peace. We said that the larger the differences in wealth and the stronger the poor party, the better the conditions for finding a peace agreement. If the richer party is also the stronger militarily, then this is exactly what we achieve by lending economic support to the richer group and exactly the opposite of what we get when supporting the poorer. When the poorer party is the stronger militarily, then these effects go in opposite directions.

If, however, the economic support is war dependent, meaning that it is (or expected to be) taken away when the war ends, then the war dividend is increased while the peace dividend is kept constant. Then peace is less likely. In fact, for significant contributions it seems unattainable in the absence of either budget breaking or downward estimation errors on the probabilities of winning.
2.5.4. Mediation

can reduce any potential information problems by adding credibility to one or both the parties. It can also sweeten the deal if a third party promises to contribute after the signing of a peace agreement. We noticed earlier the importance of the perceived probabilities of winning. In this model, influencing these downwards, if possible, will probably be both the most effective and the cheapest way to drive the parties towards a peaceful settlement.

The question of mediation and international interventions into them, in particular in relation to the problem of information problems and budget breaking is considered extensively in part three of this paper. Table 1 summarizes some results of different interventions in this model.

<table>
<thead>
<tr>
<th>Intervention type</th>
<th>Direct variable</th>
<th>National income(^9)</th>
<th>Fighting of receiving party</th>
<th>Fighting of other party</th>
<th>Possibility for peace</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployment of troops aiding the poorer party</td>
<td>N (+)</td>
<td>N/A</td>
<td>N/A</td>
<td>+</td>
<td>+/-</td>
</tr>
<tr>
<td>Deployment of troops aiding the richer party</td>
<td>N (+)</td>
<td>N/A</td>
<td>N/A</td>
<td>+</td>
<td>+/-</td>
</tr>
<tr>
<td>Military support to poorer party</td>
<td>(\theta) (+)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Military support to richer party</td>
<td>(\theta) (+)</td>
<td>–</td>
<td>+</td>
<td>+/-</td>
<td>+</td>
</tr>
<tr>
<td>Economic support to weaker and richer party</td>
<td>(\omega) (+)</td>
<td>+</td>
<td>–</td>
<td>+</td>
<td>+/-</td>
</tr>
<tr>
<td>Economic support to stronger and poorer party</td>
<td>(\omega) (+)</td>
<td>+</td>
<td>–</td>
<td>–</td>
<td>+/-</td>
</tr>
<tr>
<td>Economic support to weaker and richer party</td>
<td>(\omega) (+)</td>
<td>+</td>
<td>–</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td>Economic support to stronger and richer party</td>
<td>(\omega) (+)</td>
<td>+</td>
<td>–</td>
<td>–</td>
<td>+</td>
</tr>
<tr>
<td>Increase fierceness</td>
<td>(\phi) (+)</td>
<td>–</td>
<td>+</td>
<td>+</td>
<td>+/-</td>
</tr>
<tr>
<td>Credible promises of post-conflict investment/aid(^{10})</td>
<td>EXP.W, EXP.L (+)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>+</td>
</tr>
<tr>
<td>Promoting downward misperc. of winning odds (weak party)</td>
<td>(\theta) (-)</td>
<td>–</td>
<td>+</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td>Promoting downward misperc. of winning odds (strong party)</td>
<td>(\theta) (-)</td>
<td>+</td>
<td>–</td>
<td>–</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 1. Impact of different kinds of interventions in the model. Weak party designates a group with a small chance of winning (eg. less than 0.2), and vice versa for the strong party.

\(^9\) I use the sum of production as a measure of national income. Destruction and decreased investments are not included in case of increased fighting.

\(^{10}\) This only affects the revenue side of the condition for peace.
2.6. Concluding remarks

In this part, I have tried to give a framework for the material aspects of fighting, assuming that fighting resources are drawn from the same pool as productive resources. I hope to have shed some light on the forces at work, and to have contributed to more enlightened discussions on the effect of international interventions.

We have seen how the effect of such interventions varies significantly with the target. Both the initial military strength and the affluence of the target are determining factors on whether interventions improve on the conditions for establishing peace. It is obvious that interventions will often reduce the solvability of conflict rather than increasing it.

In the model established above, we have seen how the relative military strength of the receiving party determines the effect of an intervention on the intensity of conflict. When the receiver is the stronger group, then interventions that better their chances in war escalate the fighting on both sides. When the receiver is the weaker group, then such interventions eases fighting on both sides. We have also seen how higher intensity in fighting increases the peace dividend, and thereby the chances for peace.

Further, we have shown how the relative economic affluence of the two groups largely determines the effect that an intervention has on the possibility of establishing a peace agreement. When we increase the relative difference in wealth, we increase the potential loss of the richer party, increasing his willingness to go for peace. Similarly, increasing the military strength of the poorer makes a defeat more likely for the rich, increasing the chances for peace.

A major concern raised in this part is thus the non-linearity between the intensity of a conflict and the possibility of establishing a peace agreement. In fact, correctly applied international interventions in the sense that they increase the possibility of attaining a peace agreement, might intensify the conflict if such an agreement is not reached. Similarly, aiming to reduce the local sufferings induced by the fighting, and perhaps lessen the negative effects on the international economy, might in the process make the process of negotiating peace more difficult.

My premises for the discussions and the results above may of course be subject of controversy. Firstly, the use of a peace agreement as the ultimate goal for conflict management not unproblematic, and my analysis grows shallow from the fact that I
am not including the potential effects on the post-conflict society. If an international action first induces higher intensity fighting and then a peace agreement, the agreement might be more unreliable. Collier et al. (2003) among others, show that the post-conflict society has a higher chance of a relapse to fighting and speculates that this is due to social animosities and societal characteristics produced by war and violence. It seems reasonable to assume that such effects are deepened or expanded when the conflict grows more intense and suffering becomes harsher. Thus, the peace agreement attained by such an intervention might be short-lived.

Furthermore, a problem with the model itself is the assumption that the groups actually believe that the fight will be over at the end of the period. This means that they are not considering the obvious (and probably high) possibility that none of them, within the foreseeable future, will be able to inflict sufficient damage on the opponent to secure themselves from further attacks. A more reasonable assumption might be that they continuously update their beliefs on the fighting odds in retrospect, evaluating the progress made in the last fighting period and adjusting their allocations accordingly.

We should therefore probably include some perceived probability that none of the parties win – some probability of status quo in war. This would also remove the problem of disproportionately large marginal revenue of fighting in the absence of war (I leave this fact for the reader to calculate). Even if my aim is not to explicitly discuss the issues of how wars spur in initially peaceful societies, I would like to give insights to the post-conflict situation where this problem is as troubling. Alas, our jaws were not big enough in this paper.
3. A model of peace negotiations

In this section, I will step away from the macroeconomic approach considered above, and use a simple model to describe a game between two parties in a civil war during peace talks. Keeping the premise of rational, centrally organised players, I use standard microeconomic assumptions to show that with full information all conflicts can be settled. I further use the private, imperfect information about a party’s chances to win, to describe why we might not be able to reach such an agreement while staying on the country’s budget. I propose third-party interventions as a means of breaking the budget constraint, to create an incentive compatible sharing rule that is credible under the budget. Specific minimum contributions required to achieve truth telling are proposed as a portion of expected future revenue. Results should be naturally extendable to general problems of bargaining and settlement in civil courts.

3.1. Introduction

International players and third-party states have a long history in involving themselves in the negotiation process between the two sides in civil war. When a peace agreement was finally reached in 2002 between the Singalese government and the Tamil Tigers (the LTTE) in Sri Lanka, it was the result of a peace process lead by the Norwegian foreign ministry. It was also with Norwegian facilitating that the agreement between the Palestinians and the Israelis was first signed in 1993, while President Clinton and the Americans played this part in 1996. Similarly, The Economic Community of West African States (ECOWAS) and the French were strongly involved in the fragile peace established in Côte d’Ivoire in 2002, and the United Nations and other pan-national entities are regularly involved in facilitating mediation and settlement between fighting parties.

But what is the role of foreign mediators? Why do peace agreements so often come about with the help of foreign parties, and why, in so many conflicts, do one or both of the sides appeal to the international community to claim this role? A standard response to what international mediators do, is that they «install trust». They facilitate an environment in which the discussions can be «civilized» and they propose solu-
tions that the parties themselves could not have formulated. The political implications of mediation, the perils in dealing with cultural and historical animosities, are far beyond the grasp of this paper, and are discussed in the literature of political science. The aspect I wish to portray is one where mediation serves three distinct purposes;

- it can reduce information problems
- it can break the budget balance
- it can commit the parties

There are a whole range of information problems and asymmetries involved in the negotiation of a peace agreement, from the potential productivity of the country in the absence of war to the fighting capabilities and popular support of the respective groups. In particular, the relative strength of the parties is observed imperfectly, with each of them withholding information that might possibly make them vulnerable on the battlefield. Hegre (2004) assumes that war «provides a means of revealing information that is not available in the standard bargaining models». Obviously, mediation has the potential to replace war in this respect.

It seems clear that mediation can increase the possibility of establishing a peace agreement if 1) the parties are overestimating their own relative strength and/or if 2) there is negotiating room in which to establish a mutually beneficial peace accord, but one is not reached due to lack of communication.

Secondly, mediation can break the budget balance, making peace possible even in settings where the economic foundations of one is not present within the particular country. The international community holds capital that can potentially be used to sweeten the deal for one or both parties. Whether this is beneficial for the intervener(s) depends, but as we have seen, the effects of a civil war can be harsh and possibly even make such commitments directly profitable for the intervener(s) if they manage to establish peace. If the international community is in any way averse to conflict or to human suffering, even when it is not inflicted on themselves, then the profitability of acting as a budget breaker increases further.

Lastly, mediation can commit the parties and by such reduce the problems of trust. The third party, especially if it is a major player, may promise to sanction any deviation from a potential agreement, thus reducing or eliminating another of the major information problems of such negotiations.
An obvious problem the mediator has is how to induce the parties to reveal information that is only observed privately by them, and to which the mediator might actually be the least well informed. It is this problem I wish to study up close here, using expected utility theory and the concept of Nash-equilibria as a tool. The discussion will highlight the importance of the mediator as a budget breaker.

### 3.2. The basic model

We’ll consider a negotiation including two parties within a state that are already at war. We discussed the allocation of resources between production and fighting above, and will use some of the same notation. The general problem is the same, as outlined on page 10. Production in our economy is given by the production functions for each group, depending on the amount of resources spent on fighting, draining the finite pool of labor as to reduce output. To simplify in the following, I’ll ignore the fact that some resources will be spent on fighting (army, police, security etc.) even after a potential peace agreement, so that the production being distributed is simply that realized when all resources are used in productive activities. This assumption plays no central part in our discussion.

\[
F(N) \equiv \tilde{Y}_i^w + Y_j^L
\]

Each of the groups will, as part of any potential agreement, get entitlements to a share \(W_i\), hopefully inducing them to choose peace over war as the means to distribute the country's production. For simplicity, I denote that only one period’s production is being distributed, such that

\[
F(N) \geq W_E + W_G
\]

I will, however, refer to \(F(N)\) as *expected future revenue*, taking into account that what is being distributed is all future revenue, discounted to present value. If we wanted to include future periods explicitly, we could do this without changing the basic results in the following, by setting

\[
\tilde{F}(N) = \sum_{k=0}^{\infty} \frac{1}{(1+\delta)^k} \left[ \tilde{Y}_i^w + Y_j^L \right]
\]
As above, if the parties are to participate in the agreement, they must expect to make at least as much from signing, \( W_i \), as from going to war, \( U_i^W \). Thus the participation constraint is,

\[
W_i \geq U_i^W
\]

Depending on the nature of the conflict and the productive capabilities of the country, all conflicts will now in general have a possibility for peace, when we exclude the possibility of excessive costs of redistribution.

**Result 1.** With perfect information and no transaction costs, conflicts assuming resources can always be resolved by mutually beneficial agreements.

*Proof:* During a conflict, productive resources are taken from production and assigned to the conflict, thus a surplus can always be realized and divided between the parties in any fashion to reach an agreement where fighting stops. Where \( F_i \) are resources used in fighting, \( N_i \) the initial resource distribution and \( f_i(\cdot) \) is the production functions,

\[
F(N) - f_G(N_G - F_G) - f_E(N_E - F_E) > 0, \quad \forall F_i > 0, \quad i = E, G
\]

In figure 4, the expected revenue from fighting in point \( A \) lies below the budget line. The total production that can be produced and distributed lies below the production in peace. Now, if the parties expect to get a utility of \( U_i^W \) from fighting, then all distributions giving at least \( U_i^W \) to the excluded and \( U_i^W \) to the government will yield a pareto improvement. Then offering any share yielding such utilities as part of a peace agreement will be acceptable for both parties and the agreement will be realized. A problem might, however, be that the inefficiencies from taxation are very large, so that the realized distribution must lie in the interior of the budget line. However, even if it is true that many countries in civil war have poor infrastructure and surveillance mechanisms that may make the inefficiencies of taxation large, the inefficiencies of a distribution through war will be large as well. I therefore assume that (26) holds.

The entire line connecting \( B \) and \( C \) in figure 4 represents the bargaining space for mutually beneficial agreements between the two parties, while any point within the shaded area represents a pareto improvement from the status quo of war. If we include
any damages incurred during the fight, the expected profits from fighting will be reduced further, increasing the room for peace agreements.

![Diagram](image.png)

*Figure 4. Inefficiencies from fighting and possible pareto improvements from peace agreements. Adapted from Azam (2003a).*

### 3.3. Imperfect information

In most conflicts, we will expect both parties to know the strength of the other only approximately. Rather, they form their beliefs about their own relative strength on a multitude of imperfect signals ranging from physical battle to official and unofficial statements made by the other or third parties. None of the parties thus know the actual state of the other when going into the negotiations. Excluding the possibility of collusion between the two, we get a one-shot non-cooperative game where both parties try to maximise their own share, disregarding the effects on the other.

In these negotiations, the parties will compare any offer to what they could get through fighting. Therefore it seems logical that any sharing-rule should take the relative strength of the parties into account, distributing more to the stronger party and less to the weaker. I do not consider questions of justice or equity in this discussion. Their perceived chances in a fight in the following may also coherently be taken to signify the minimum share that a party will accept and still be willing to sign an
agreement of peace, given that the signal from the other is in accordance with our demands.\textsuperscript{11}

Assuming a sharing-rule that is linear in relative strength, so that a party receives a share equal to its probability of winning in battle, there will obviously be a strong temptation to exaggerate your strength, and thereby increase your share. But when one or both parties talk up their strength, the sharing-rule cannot work in general, as claims will overbid the budget frontier.

Our first aim is to find a general sharing-rule that induces the parties to reveal their \textit{actual} beliefs about their probabilities to win on the battlefield. To do this, we will look for a mechanism where sending your true beliefs is a dominant strategy.

\textbf{3.3.1. Incentive compatibility of revealing your true state}

Let $x_i = x_i(\alpha_i)$ be a signal from $i$ informing us of his beliefs (best guess) about his probability of winning the war $\alpha_i$, i.e., his relative strength in the conflict. Now, we want truth-telling to be dominating, such that

\begin{equation}
\text{arg max}_{x_i} W(x_i | \alpha_i) = \alpha_i, \forall \ 0 \leq \alpha_i \leq 1
\end{equation}

Where $W(x_i | \alpha_i)$ is a sharing-rule dividing the future revenue if a peace-agreement is attained. Since $i$ truly believes that $\alpha_i$ is his probability of winning, he is implicitly estimating the probability of $j$ winning as $\bar{\alpha}_j = 1 - \alpha_i$ (since he knows that $\alpha_i + \alpha_j$ should be one if his estimations are correct). In that case, if the distribution mechanism is truth revealing, then $i$’s expectation on $j$’s signal is obviously $\bar{x}_j = 1 - \alpha_i$.

It is then easy to see that any optimal revenue function, where truth telling is practiced so that $x^*_i(\alpha_i) = \alpha_i$ and thus expected, must yield the first-order condition

\begin{equation}
x^*_i = 1 - \bar{x}_j
\end{equation}

By this we know at least a factor of the derivative of the function. Let $q_i$ denote this factor, satisfying (28).

\textsuperscript{11}I stress the dependency on the other’s signal because it seems logical that the parties will update their beliefs according to the observed signals.
Then, using integration, we know that the sharing rule will be of the kind

\[ q_i = \int 1 - \bar{x}_j - x_i \, dx_i = x_i - x_i \bar{x}_j - \frac{1}{2} x_i^2 + C, \quad C \sim \mathbb{R} \]

Note that this function can be multiplied by any non-zero constant with the same maximum argument, since such constants will disappear when the derivative is set equal to zero.

Let \( 2(q_i - C) \) be the share of the production given to party \( i \), so that what they receive is simply the total production times \( 2(q_i - C) \). The reason for the factor 2 will become clear. We now have a candidate for a sharing-rule.

\[ W(x_i) = 2(q_i - C)F(N) = \left( 2x_i - 2x_i x_j - x_j^2 \right) F(N) + \tilde{C}_i, \quad \tilde{C}_i \sim \mathbb{R} \]

By definition, this revenue function will provide the correct incentives and ensure that the signal \( x_i \) given by \( i \) is indeed his best estimation of his chances in war. To see this, note that

\[ \frac{dW}{dx_i} = \frac{dq_i}{dx_i} 2F(N) \iff x_i^* = 1 - \bar{x}_j \quad \text{and} \quad x_i^* \left( \alpha_i \bar{x}_j = 1 - \alpha_i \right) = \alpha_i \]

To be certain that \( x_i^* \) describes a maximum, we can also check that the second-order condition of maximum is satisfied,

\[ \frac{d^2W}{d^2x_i} = -2F(N) < 0 \]

However, this function will normally not be on the budget, distributing more or less than is expected to be produced, which is our second main result.

**Result 2.** When two parties in conflict both have private information about their strength in battle, there exists no general continuous sharing rule that induces truth telling, satisfies incentive compatibility and is on the budget. There may exist par-
ticular sharing rules that satisfy both constraints in special cases, but then only by luck or by violating the assumption of private information.

**Proof:** To be on the budget, we must have that

\[ W_i \left( x_i(\alpha_i); \bar{x}_i \right) + W_j \left( x_j(\alpha_j); \bar{x}_j \right) = F(N). \]  

The parties maximise their share in expected terms, so that \( \bar{x}_j = 1 - x_j \). Now, the share \( q \) is a strictly convex function of \( x_j \), with a minimum for \( x_j = 1/2 \). Inserting for the borders \( x_j = 0 \) and \( x_j = 1 \), we find that \( q_i(1) = q_i(0) = 1/4 \) so that for all possible \( \alpha \), \( q_i(\alpha_i) + q_j(\alpha_j) \leq 1/2 \). Analytically,

\[ R \equiv 2q_iF(N) + \bar{C}_i + 2q_jF(N) + \bar{C}_j = (q_i + q_j)2F(N) + \bar{C}, \quad \bar{C} = \bar{C}_i + \bar{C}_j \]

Using the result for \( q \) above and imposing the budget constraint by equality yields a condition on \( \bar{C} \),

\[ R = F(N) \iff \bar{C} = (1 - 2q_i - 2q_j)F(N) \]

But this is contingent upon the signals \( x_i \) and \( x_j \), making the derivative of \( \bar{C} \) non-zero, violating the condition of truth telling. \( \square \)

### 3.3.2. Simulating claims as a function of the two signals

We can’t solve explicitly for \( R \), since there are two variables in only one equation. We can, however, simulate the individual and total claims for different combinations of signals. This yields figure 5 and 6 below, where \( \bar{C} = 0 \). Notice in particular how the individual claims are always maximised when the sum of the signals is one, and how total claims in the interior are always under the budget.

We can also now note from the proof above that the factor 2 introduced in our sharing-rule earlier is the maximum factor by which any incentive-compatible sharing-rule can sustain without breaching the budget.\(^{12}\) Finally, table 2 provides a more elaborate treatment of the claims by different sets of signals from the parties.

\(^{12}\) Provided we don't have a negative \( C \), of course.
Figure 5. Individual claim as a function of your signal for selected levels of the opponent’s signal (percent of expected future revenue).

Figure 6. Total claims as a function of i’s signal about his strength for selected levels of j’s signal (percent of expected future revenue).
3.3.3. The special case of common beliefs

We now know that our sharing-rule induces truth telling, so that \( x_i^* (\alpha_i) = \alpha_i \). In the particular case where beliefs are shared by both parties (as they would be if they were perfect), we have that if \( x_i = \alpha_i \) then \( x_j = \alpha_j = 1 - \alpha_i \). This reduces the function for total claims to (37) below.

\[
\hat{R} = \left( \alpha_i - \alpha_i (1 - \alpha_i) - \frac{1}{2} \alpha_i^2 + 1 - \alpha_i - \alpha_i (1 - \alpha_i) - \frac{1}{2} (1 - \alpha_i)^2 \right) 2F(N) + \tilde{C} \\
= \left( 2\alpha_i^2 - 2\alpha_i + 1 \right) F(N) + \tilde{C}
\]

When \( \tilde{C} = 0 \), this corresponds to the highlighted cells in table 2 above. We can draw the graph of \( \hat{R} \) in percent of \( F(N) \) for different exogenously given levels of \( \tilde{C} \). Note that as \( \tilde{C} \) becomes positive, there exist particular levels of \( \alpha_i \) such that we are on the budget, i.e. where the graphs for claims and budget cross, but that this will not be true in general.

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Table 2. Total claims (shares) for different sets of beliefs about relative strength. Highlighted cells indicate common beliefs.
Figure 7. The budget constraint and total claims for different levels of exogenous contributions and as a function of beliefs about relative strength when the parties have common beliefs (percent of expected future revenue).

3.4. Breaking the budget – a continuous rule

Since we don’t expect the parties to be willing to waste production, our sharing-rule, while yielding incentive compatibility, can hardly be deemed credible, leaving us with two options. Either we achieve some way to break the budget constraint, or we give up the first-best solution and search for a second-best (Laffont and Martimort, 2000). I will try to show how we can implement the first-best by using the breaking the budget.

A budget breaker is an outsider with no stakes in the game that can enter to implement a punishment that will otherwise not be credible under the budget. He can do this in two ways, either by confiscating surplus or by adding value to the distributed bundle (an example of this can be seen in Holmström (1982)). In our civil war, we can’t expect an outsider to be able to confiscate expected future output within the country, meaning that the only punishment an outsider can implement is to withhold

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13 I don't consider the possible inefficiencies created by collecting the resources needed to install budget-balance, so that our solution will be a true first-best only inside the country.
funds that would otherwise have been transferred. In this way, we can make credible the cost of signalling something other than your true belief.

Note how, in figure 7, the function for total claims as a percent of expected future revenue shifts upward when we increase the exogenous $\bar{C}$. It seems clear that at some limit, the entire function will lie above the budget, thus making the rule credible for all beliefs on $\alpha_i$.

**Result 3.** When parties are not averse to risk and an outsider credibly offers an increase in the available bundle by $D \geq 0.5F(N)$ distributing $D$ in any fashion not depending on the signals, then the sharing-rule in (37) is credible and signalling ones true beliefs is dominating.

**Proof.** To verify whether the sharing-rule is credible, the parties will check the properties of $R$, again using $\bar{x}_j = 1 - \alpha_i$. This yields a function similar to $\hat{R}$. If the sharing-rule never distributes less than the interior production of the country when I signal my true signal and the other signals what I expect him to, then we deem it credible. Minimising as above again yields (symmetrically for both parties),

$$\alpha_i^{\min} = \alpha_j^{\min} = \frac{1}{2}$$

To make the sharing-rule credible, we must increase the bundle so that total claims are always above budget. Setting the condition for the minimum total claims to be above budget obviously satisfies this.

$$\left(2\left(\frac{1}{2}\right)^2 - 2\frac{1}{2} + 1\right)F(N) + D \geq F(N)$$

$$\Leftrightarrow D \geq F(N) \left(1 - \frac{1}{2}\right) = 0.5F(N) \quad \square$$

It remains that our sharing-rule with $D = 0.5F(N)$ is still not on the budget for all possible sets of beliefs. See for instance that if $\left(\alpha_i, \alpha_j\right) = (0.9, 0.9)$, then total claims are in fact negative.

$$-1.26F(N) + D = -0.76F(N)$$
I don't consider this problem here, firstly because I intuitively assume that it will be very difficult to establish a peace agreement as long as both parties are 90% sure of winning a war. Secondly because it has no impact on the actions of the parties as long as they are risk-neutral. If they should be averse to risk, then they might formally shade down their signals, to avoid the chance of negative payoff. I leave the formal treatment for a later paper, but looking at table 2 again should at least give an idea about the risk involved, noting that claiming a high share involves the most risk.

The last possibility we need to consider is whether there exists some other sharing-rule that can induce truth telling, and whether this sharing-rule might have more appealing properties. It seems intuitive to assume that the third party contributing $D$ would want to make its contribution as small as possible, which yields result 4.

**Result 4.** Under the assumptions in result 3, and when the budget-breaker is cost minimizing, the sharing-rule $W_i^* = \left(2x_i - 2x_jx_j - x_i^2\right)F(N) + 0.5F(N)$ strategically dominates all other sharing-rules that induce truth telling.

*Proof:* See that any exogenous constant $D$ or $G$ that is to enter in the sharing-rule must be independent of the signals and can only enter as $D$ or $G$ in (41).

\begin{align}
(41) \quad & \tilde{W}_i = 2q_i\left(F(N) + G\right) + D, \quad D,G \sim \mathbb{R} \\
(42) \quad & R = \tilde{W}_i + \tilde{W}_j = 2\left(q_i + q_j\right)\left(F(N) + G\right) + D \\
\end{align}

We have already seen the condition on $D$ when $G = 0$, now with $D = 0$ the condition on $G$ is,

\begin{align}
(43) \quad & G \geq \frac{1 - 2q_i - 2q_j}{2q_i + 2q_j} F(N) \\
\end{align}

In expected terms, when $x_j = \alpha_i$ and $\bar{x}_j = 1 - \alpha_i$, we have seen that $2q_i + 2q_j \leq 1, \forall \alpha_j, \alpha_i$ so that

\begin{align}
(44) \quad & G \geq D \\
\end{align}

We must make sure that we are always above or on the budget, recalling also that
\[ \arg \min_{x_i} \tilde{R} = \frac{1}{2} \]

Then, when \( D = 0 \),

\[
2\left(\frac{1}{2}\right)^2 - 2 \frac{1}{2} + 1 \right) (F(N) + G) \geq F(N)
\]

\[
\iff G \geq F(N)\left(1 - \frac{1}{2}\right) = F(N)
\]

Now, it should be easy to see that minimising \( G + D \) under the constraints yields

\[
\left(G^*, D^*\right) = \left(0, F(N)/2\right). \quad \square
\]

A final comment is to the case where we have some information about the relative strength of the parties. Say that the weaker party considers itself no stronger than 0.3 and the stronger evaluates its chances at no less than 0.8. It seems that the only constraint we have to consider in this case is that of the weaker party. Recall that our sharing-rule is convex and symmetric around a minimum in \( x_i = 0.5 \). This means that the closer we get to 0.5, the more we must contribute to induce the parties to tell the truth. So the only constraint we must consider is that of the party closer to this minimum.

Without going into detail, even if getting information about the relative strengths (and the beliefs about them) is costly, it may well be possible to trade off revelation contributions, i.e., \( D \), and efforts to attain this information before or during the negotiations, thereby reducing the total resources spent by the third party.

### 3.5. The role of the participation constraint

The participation constraint has not been considered in the above, but we have already mentioned that it consists of attributing more to each of the parties than they expect to gain if they continue the fight. In other words, we need to offer the parties more if they accept to enter the peace agreement than they can expect to get from the war.

In most negotiations, the real objective is to reach an agreement that all parties can live with. To reveal perfectly the true state will normally not be necessary to achieve
this goal. Rather, we have seen that the bargaining room for beneficial agreements may be large, so that even with ample noise in the signals, peace might be within grasp. In general, the more resources the conflict consumes, the less the third party should have to contribute. And conversely, the more value the conflict creates, the higher the contribution that is demanded.

A second comment is on the third-party contribution. Recall that this must be distributed independently of the signals. This means that we must in effect contribute more than seems immediately necessary from the participation constraint. To offer the stronger party exactly what he demands, we must offer the weaker party a stake that is higher than what he would accept. The inverse is true if we want to keep the weaker party exactly on his participation constraint.

3.5.1. Misperceptions – more demanding

A problem might be that both parties consider themselves stronger than what they actually are. In this case, one or both might expect to gain more from fighting than what they can hope to get even in the best settlement possible, where they get the entire peace dividend. Now, the parties will not be able to reach a peace agreement without a contribution from a third party.

Such overestimations will also demand larger contributions from the third party, either to compensate for the higher expected war gains or to use resources on convincing the parties to reduce their estimations.

In figure 4, notice that when the expected profits from war are $U_E^m$ and $U_G^m$ respectively, then the point D lies outside the budget frontier even in the absence of war. When the parties overestimate their relative strengths, the minimum contribution to allow for peace is now the distance from D to the budget frontier. Note also that this contribution is necessary even if we know the beliefs of the parties perfectly, so that it will come in addition to the demands of inducing the parties to reveal their true state.
3.6. Concluding remarks

We have seen that when conflicts consume resources, then under full information, they should always be possible to solve. But when the parties have private information, then the obstacle is how to get them to reveal this without using more resources than is available. Because of the incredulity of distributing less than available within the country, I have proposed third-party budget breaking to offer more. We have then seen the optimal sharing-rule from both the interior and the exterior perspective.

Our discussion has shown that the private information of the parties provides the need for substantial third-party contributions. In general, we might conclude from this that the international community does well by involving itself in the process of peace negotiations, and that credible promises of post-war development aid might go a long way to establishing an agreement.

In the preceding discussion, we make two major assumptions that might be too strong. That the entire dividend is

1. quantifiable and
2. divisible

Figure 8. The budget frontier and the participation constraint when parties overestimate their strengths.
However, it is far from obvious that what is at stake can easily be measured in terms of money or resources, or that it can be shared in any coherent manner. Take the example of the Israeli–Palestinian conflict where three of the main problems are the return of the refugees, the status of Jerusalem and the repatriation of Israeli settlers. None of these issues can easily be quantified, if at all. In the case of the return of refugees, even if we could (or would) compensate either the Palestinians for the loss of their homes and belongings or the Israelis that might have to move, the affectionate ties are probably not properly accounted for. And the religious beliefs of either of the parties might not be readily traded, whatever the stakes.

«We know what Palestine needs from us,» said Reham. «Jihad. If Osama had chosen differently, he would have been living for himself, but failing Palestine. Everyone should choose sacrifice until we restore our rights. Israel is occupying our land and we have to get rid of it. Jihad is the only way.»14 (Jordan, 2002)

To divide these values is our second problem. Should half the settlers stay and half the refugees be allowed to return? The Israeli prime minister Ariel Sharon has for example stated again and again the indivisibility of Jerusalem, here from 1999, when he was foreign minister under Benjamin Netanyahu.15

Jerusalem has always been the national capital of the Jewish people, and of no other. […] There is wide national agreement, in Israel and in the Diaspora, that united Jerusalem under Israeli sovereignty is and will remain the eternal capital of Israel. (Sharon, 1999)

So, even if we are not able to tell the full story by our approach I hope to have presented some insights to be added to the larger mix.

In future research, it would be interesting to measure the effects of contributions empirically. One approach could be to study the actual contributions made by international players. These should have understood any such mechanism, and should as such already be making contributions in peace processes. To what extent are they doing this and can we see an effect?

14 Reham’s brother Osama was shot dead after killing an Israeli settler only a few days before this interview was made.
15 The proposal of dividing Jerusalem into ethnic enclaves was first proposed by then President Bill Clinton in 2000 on Camp David. For an interesting and amusing comment on the practicalities of such a scheme, see Benvenisti (2000).
4. Brief empirical analysis

In the preceding sections we have used a theoretical approach to analyse mechanisms in civil war, firstly seeing the allocation problem of the government and secondly the problem of private information and foreign involvement in negotiations. If our theories are correct, or rather if they hold significant strands of truth, they should leave traces within the data, allowing us to test the relevance of our theories.

In this fourth section of the paper, I wanted to conduct such tests, crediting or discrediting the presented hypotheses. Unfortunately, I could not find proper data, and having neither the time nor the resources to collect them myself, I have had to settle for an analysis of simple correlation between variables rather than the full econometrical regression.

4.1. Methodology

I ran a bivariate analysis on data provided by Regan (2000)\textsuperscript{16}, testing the Pearson correlation on dummy variables representing the type of intervention and the type of conflict, the potential success and the duration of conflict.

Table 2 shows the correlation between different types of interventions and 1) the success of the intervention and 2) the duration of the conflict. These results must serve only as reference points to our model, particularly because the data doesn’t differentiate between different kinds of military or economic interventions.

\textsuperscript{16} The data is available from http://bingweb.binghamton.edu/~pregan/.
4.2. Analysing the correlations

In table 2, four results stand out;

1. When the intervener is a major power, successful interventions are more frequent.
2. Targeting the opposition is positively correlated with longer conflict and negatively correlated with successful intervention.
3. Economic interventions are correlated with longer conflicts, in particular when targeted at the opposition.
4. When the government is the target of the intervention, in particular of one that is military, success is more frequent.

When the intervener is a major power, we might suspect that the intervention is larger, and perhaps that the experience of the intervention is more profound, both assigning higher impact of the actions on the parameters of the conflict. In this case, the first result harmonizes with our results.
Targeting the opposition means that their relative chances are decreased. If they are the weaker party in our model, then this means that they will increase their fighting effort. At the same time, their expected profits from fighting will be decreased as they see their chances worsened. If the opposition were the richer party, then we would in our framework expect that these interventions lead to increased probabilities of a peaceful solution, i.e. that it be successful. This is not supported in this simple test of correlations. If the opposition were the poorer party, however, we would expect the chances for peace to be smaller, a possible explanation for the correlation in our data.

At the same time, we would expect that if a peaceful solution is not attained, then fighting might prolong, as the rebels are fighting harder. This might be particularly present when the conflict has low fierceness, as the government then might fight less hard, as we have seen above. An example might be the Columbian conflict and the repeated and seemingly unfruitful American interventions targeted at the opposition group FARC.

Economic interventions increase the marginal productivity of the recipient. That is, the target, which I assume the intervention is opposing, sees a relative decrease in his marginal productivity, increasing the relative profitability of fighting. Then we would expect the target to fight harder and the recipient to fight less hard. Now, if the recipient is the stronger party, here probably the government, then the opposition is the target and fights harder. The odds are evened, so the conflict might drag out. This is in accordance with the third point above.

Our model suggests that when the government is targeted militarily, they see their chances reduced and decrease fighting, the opposite being true for the opposition. Depending on the kind of military intervention, they will change their fighting efforts, in all cases being better off. If the government is the stronger party, then the odds are evened and intensity is reduced, so that we should see longer conflicts when peace is not attained. The correlation in our data shows the opposite. That successful interventions are positively correlated with these interventions might be because of increased damage and social waste incurred on the government by any military attacks from the intervener. This increases the bargaining room in negotiations and makes a peace agreement more likely.
4.3. Qualifications

Our models above give foundations for running empirical tests. In particular, the model in section 2 implies causalities that should be present as correlations in data on the progressive intensity of fighting. Unfortunately, I have not been able to find sufficient data to run rigorous and proper econometrical tests. In the future, it would be very interesting to collect this data, using for instance number of war related deaths as a continuous measure of conflict intensity coupled with some measure of the scale of interventions to analyse how the intensity develops before, during and after an intervention of a particular type. In this analysis we would also need to include some measure of the relative economic strength of the parties. Sadly, this data is to my knowledge not yet available.

I also have several problems with the statistical data. Firstly, I have not managed to verify what ‘target’ means – the ‘target’ of a sanction being rather different than the ‘target’ of support in standard vocabulary – and I therefore suggest the reader to be careful while interpreting the data. I have assumed that the ‘target’ is the party that the intervener wishes to tip the scale in the disfavor of.

Regan (2000) himself does conduct some regressions on the data trying to endogenize the chance of successful intervention as a function of the type of conflict (ethnic, religious or ideological), the kind of intervention and the intensity of the conflict, ie. number of deaths per month. He states some rigorous results that in my view might be severely biased, and I have therefore opted not to do similar exercises or to make use of his results here. Even so, for the interested reader, his discussions are quite enlightening and highly readable.

There are two clear cases of selection bias. The first is that conflicts might have unobserved characteristics that determine both the kinds of interventions used and the responsiveness to foreign involvement. If larger interventions are overrepresented among those targeted at governments, then the correlation between successful intervention and military interventions targeted at governments might simply be due to this fact. Similarly, if either the opposition or the government more often were the economically stronger of the parties, then if our model in part 2 were correct, then this would influence the chances of success when using different kinds of interventions.

The second important selection bias, which is treated more extensively by Azam (2003b) for the case of aid and sanctions in a context of oppression, is the fact that
interventions might not actually be realized in the cases where they are, or would have been, the most effective. In these conflicts, the simple threat of, say, a military intervention might be enough to force the parties to an agreement. If a third party can make a credible commitment to use a harsh intervention against a government if it does not enter a peace agreement with the excluded group, then the government might well comply. In that case, the intervention is never realized, even if it was, in fact, the direct reason that a solution was reached. To show such effects, we would need to include mediation attempts in general and threats of sanctions or other types of interventions particularly. This might be difficult in practice, as such threats may well be shrouded in secrecy and thus hard to document or even discover.

Since mediation is not included in the data, I have not been able to test the results of my second model at all. We should, as mentioned, be able to recognize contributions by third parties in negotiation processes, and in future research we might collect this data and conduct the econometric tests.
5. Final comments

My aim with this paper has been to show the material driving forces of civil war, and suggest ways in which the international community could influence the intensity of conflict and the foundations for establishing a peace agreement. I have wanted to show the possibilities and perils of third party interventions, to promote efficient and effective actions carried out with the required prudence and humbleness.

We have seen that conflicts are fueled by the three M’s, motivation, mobilization and misperception, and that an international player can influence these by intervening in the conflict. These interventions can take forms that are economic, military or mediating, and applied correctly, can increase the chances of establishing a peace agreement between the parties.

In part 2, we saw that there is a fundamental non-linearity between reducing the sufferings of war and increasing the possibilities for peace. The dividing line between the two is the relative initial military strength of the parties and the economical differences between them.

In part 3, the focus was on the fact that parties have private information about their chances in a fight, causing problems of establishing credible sharing rules that are on the budget. We saw that sufficient third party contributions can solve this problem, at least in theory.

The material approach and the fundamental assumption that everything can be measured continuously and be divided in any fashion between the parties, of course puts limits to the application of my results and arguments. I hope nonetheless to have established a peace of the puzzle, albeit a small one.
Literature


Appendix 1 – Variables

$G$ – subscript indicating the government group
$E$ – subscript indicating the excluded group
$Y_i$ – production of group $i$
$f_i(\cdot)$ – group $i$’s production function
$L_i$ – resources set aside for production by group $i$
$\omega_i$ – external factor influencing group $i$’s production
$\alpha_i$ – perceived probability of winning the war for group $i$
$\theta_i$ – external factor influencing group $i$’s perceived probability of winning
$N_i$ – resource base of group $i$
$F_i$ – resources set aside for fighting by group $i$
$U_i^W$ – expected utility of group $i$ if fighting continues, $W$ – war
$\phi_i$ – militancy of group $i$ (fierceness if group $i$ wins)
$r$ – discount rate
$T$ – time horizon
$t$ – tax rate imposed by the winning group
$\tilde{Y}_i^W$ – group $i$’s production after winning the war, $W$ – winner
$\tilde{Y}_i^L$ – group $i$’s production after losing the war, $L$ – loser
$U_i^{PW}$ – expected utility of group $i$ if it offers a peace agreement, $P$ – peace, $W$ – weak
$U_i^{PS}$ – expected utility of group $i$ if it accepts the offer of peace, $P$ – peace, $S$ – strong
$W_i$ – share claimed by group $i$
$F(N)$ – expected future output of the two groups
$x_i$ – signal from $i$ informing us on his beliefs about his probabilities to win a war
$\bar{\alpha}_i$ – $i$’s beliefs about $j$’s signal before it is revealed to him

$i, j = G, E, \ i \neq j$
Appendix 2 – Second order-condition, model 1

The second-order derivative of (8) on page 14 must be negative to ensure that we can maximize the utility function. This is definitely true under two assumptions on probability and fierceness, and probably true in any case.

\[
\frac{\partial^2 U^W}{\partial^2 F_i} = \frac{F_j}{(F_i + F_j)^2} \left[ \varphi F_j \left( \frac{\alpha''}{F_j} - \frac{2}{F_j^2} (F_i + F_j) \right) + f_i \alpha' (\phi_i - \phi_j - 1) - f_i' (\alpha_i - \phi_i (1 - \alpha_i)) \right]
\]

\[
\varphi = \phi_j Y_j + \phi_i Y_i + \sum_{k=1}^{\infty} \frac{1}{(1 + r)^k} (\tilde{Y}_j^w + \tilde{Y}_j^L - (1 - t)\tilde{Y}_j^L) \gg 0
\]

This is negative either if both;

\[
\phi_j \begin{cases} \gg \frac{\alpha_i}{1 - \alpha_i} \\ \gg \phi_i - 1 \end{cases}
\]

or in any case if;

\[
\left[ \frac{\varphi F_j}{(F_i + F_j)} \left( \frac{\alpha''}{F_j} - \frac{2}{F_j^2} (F_i + F_j) \right) \right] \gg f_i \alpha' (\phi_i - \phi_j - 1) - f_i' (\alpha_i - \phi_i (1 - \alpha_i))
\]

which seems reasonable, due to the fact that \( \varphi \) will normally be very large.