6

Explaining Conflict in Low-Income Countries: Incomplete Contracting in the Shadow of the Future

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6.1 Introduction

Since the end of World War II civil wars have taken place in at least 73 countries. The millions of casualties and economic costs have greatly contributed to these countries' slow, or negative, growth.[1] From a traditional economic perspective it is difficult to understand such a record of apparent inefficiency. Besides the cost of arming, the puzzle is why different parties don't just settle their differences peacefully under the threat of conflict. Given that war is destructive, breaks the various complementarities in production and trade, and has a number of other external and indirect effects both in space and time (see Collier et al. 2003), a peaceful settlement in the shadow of conflict would appear perfectly feasible. Such a peace would by no means necessitate disarmament. A cold war or the traditional balance of power that periodically takes place for decades at a time could conceivably take place within countries between contending ethnic, class, or religious groups. Of course, such settlements do occur, but the question, posed from an economic perspective, remains why don't settlements take place in every case?

One possible explanation involves asymmetric information. The contending parties within a country might not know one another's strengths and weaknesses, preferences, capabilities, or any other attributes of the environment within which they are operating. It has been known for some time in economics that asymmetric information in any one dimension can prevent parties from attaining mutually beneficial trades. Models specifically addressing the possibility of conflict in the presence of mutually beneficial settlement when there is asymmetric information include Brito and Intriligator (1985) and Bester and Wärneryd (1998). Especially when secrecy is important, as in the case of coups, asymmetric information appears to be a reason why peaceful settlements might not occur (although asymmetric information is not necessary for coups; see McBride 2004).[2] On the other hand, many civil wars and low-level conflicts last for many years, even decades. The contending parties involved in such conflicts seem to have learned over time the principal aspects of one another's capabilities and preferences, and therefore continuing conflict is difficult to explain by means of asymmetric information. For example, the inability of the FARC and the various Colombian governments over the long civil war not to settle, and likewise the government of Angola and UNITA, can hardly be considered an outcome of informational asymmetries.

In this chapter we argue for a possible explanation of conflict that has received much less attention than it deserves. There are two components in the explanation we discuss: (1) Adversaries are unable to enforce long-term contracts on arming, although short-term contracts, under the threat of conflict, can be written. (2) Open conflict changes the future strategic positions of the adversaries in different ways than does a peaceful contract under the threat of conflict.

The first component has become familiar to economists over the past two decades, especially for dynamic settings.[3] If there are difficulties in writing or enforcing long-term contracts on items like the job-specific training of an employee in a high-income country with a modern government and functioning institutions, it should not be surprising that enforcing long-term disarmament in a country with weak governance and institutions can be difficult. For arming is not just any item of job-specific training; in the presence of weak institutions it is the ultimate source that contending parties have at their disposal for enforcing other contracts. If contracts on arms cannot be written or enforced, arming can be expected to take place. Warfare, however, can be avoided since short-term contracts on everything else can be enforced given the arsenal possessed by each party. That is, condition (1) alone is not sufficient to generate open conflict.

What is also needed is time dependence as described in condition (2). Open conflict results in winners and losers not just in terms of immediate rewards but also in changing the strategic positions of the adversaries well into the future. Typically the winners have a higher chance of success and losers a lower one if they seek to continue their confrontations into the future. A peaceable short-term contract does not dramatically change the future relative positions of the adversaries the way open conflict does. There might be secular trends that favor one party over another, but such a trend would be different from the change in strategic positions that comes about through open conflict. As long as open conflict and short-term settlements have different implications for the parties' future strategic positions, one or more parties might decide to forgo the short-term advantages of peace for the uncertain but higher expected future benefits that can come from open conflict.

A discussion of the ideas that we explore in this chapter can be found in Fearon (1995). Skaperdas and Syropoulos (1996) showed how making the "shadow of the future" longer increases arming, but they did not distinguish between open conflict and settlement under the threat of conflict. Garfinkel and Skaperdas (2000) developed a finite-horizon model that actually demonstrates how open conflict occurs. Related in spirit is Acemoglu and Robinson's (2000) finding that there might not exist short-term transfers that can prevent a revolt. Powell (2006) also discusses the main issues and presents an illustrative model. Bester and Konrad (2004, 2005) examine the decisions of rivals on whether to attack or not to capture territory over finite or infinite horizons and show how large asymmetries in power or expectations of future equality can induce warfare. Mehlum and Moene (2006), although they do not distinguish between open conflict and settlement under the threat of conflict, concentrate on the role of the incumbency advantage that control of the state confers and how it stimulates arming.

In this chapter we examine an infinite-horizon model that shows how open conflict occurs within the context of low-income countries, where political institutions are weak and condition (1) above is more likely to be satisfied. Open conflict leads to destruction and therefore there is a short-run incentive to settle and peacefully divide the disputed output. War, though, eliminates one of the adversaries or increases the chance of winning a future war for the winner and increases the chance of future losses for the loser. Thus the possible current losses due to war are weighed against the possible future benefits of weakening or eliminating one's opponent. In our model, the benefits to the winner come from the reduction or elimination of future arming, but there are many other benefits that exist and we discuss them briefly.

The explanation for war that we advance is not meant to apply to the post–World War II period only. Organized warfare has been central to the experience of humanity since the agricultural revolution of prehistoric times. And, in particular, the place in which modern governance evolved—Western Europe—has had more than its share of civil and inter-state warfare. For example, most late medieval Italian cities were wracked by clan warfare for centuries before their governments developed ways of limiting arming through checks and balances, representative politics, or through autocracy. But what followed was inter-state warfare at a higher level in the whole Italian peninsula, between city-states, ecclesiastical states, and absolutist monarchs (that was the world that Machiavelli lived in; see McNeill 1982, ch. 3, or Tilly 1992, chs 2 and 3, for overviews). It was only in the second half of the nineteenth century that Italy was unified. It would be hard to argue that all this warfare was caused by asymmetric information, or to some systematic misperceptions and miscalculations. The combination of incomplete contracting and the fundamental nonstationarity or time-dependence of the future should be seriously considered as an explanation of open warfare that is complementary to existing ones.

6.2 The Basic Setting: War or Armed Peace

Consider two groups, A and B, that compete for power and interact over an indefinite horizon. They compete for output of value Y. Because the two groups cannot write contracts on the ultimate source of enforcement, arms, they have to expend resources r_A and r_B to maintain their positions. These expenditures are necessary regardless of whether War or "Armed Peace" ultimately prevails.[4] In the event of War, arms affect the probabilities of winning for each side; we denote these probabilities by p_A and p_B. (How these probabilities depend on arms is examined in the next section.) In the case of Peace, r_A and r_B—through their effect on the probabilities of winning in the event of War—influence each group's bargaining position in arriving at a particular settlement.

If War takes place, only a fraction $\phi \in (0,1)$ of Y can be consumed; the rest, $(1-\phi)Y$, is destroyed in the conflict. Because of lower production complementarities in low-income countries compared to high-income countries, we expect a lower level of destruction under War in low-income countries. In each period the expected single-period payoff of group $i = A, B$ in the event of War is

$$U_i^w = p_i \phi Y - r_i. \tag{6.1}$$

Since War is destructive, in each period both sides will prefer to divide Y in shares that equal their winning probabilities, with the resulting payoff of $p_i Y - r_i > p_i \phi Y - r_i = U_i^w$. The range of other possible divisions of Y is also Pareto superior to the payoffs under War. Under an indefinite repetition of such single-period simple interactions, there should never be an incentive to go to War provided that the two groups costlessly communicate and output Y is divisible.

However, if War does occur, we can reasonably expect interactions between the two groups to be different in the future. Given that the winner of the War will receive ϕY and the loser nothing, the resources that the winning side will command in the future can be expected to be higher than those of the loser. This outcome should bias future wars even further in favor of today's winner. The winner might even gain possession of the state, something that can provide greater resources than can be obtained otherwise, as well as greater ability to withstand challenges from the loser group in the future. Such induced asymmetries can well make War an attractive possibility, since a lower expected payoff for today can be traded off for more in the future.

For now we allow a stark and simple form of dependence of future power on today's war. We suppose that the loser of a war in any period is unable to raise the resources necessary to challenge the winner in future periods, and thus the winner is able to enjoy the output Y in all future periods while the loser receives nothing. (In section 6.4 we illustrate how our findings extend to the less well delineated setting whereby a group drops completely out of contention after a series of battles, and not just one, are lost.)

Consider then the negotiations that could result in either Peace or War in any particular period if no War has occurred in the past and each group has already invested its resources in guns (i.e., r_i is a sunk investment). Further, and without loss of generality, suppose that group A is the one that takes the initiative in making a proposal (e.g., by reining in a weaker government). In case of Peace, group A will receive the whole value of Y and will make an offer of subsidy S to group B, which can either accept or reject A's offer. If the offer is rejected, War will ensue. The resources that either party has invested in arms is considered sunk, so they abandon their current negotiations.

Assuming a discount factor $\delta \in (0,1)$, the discounted expected payoff for group i in the event of War is the following:

$$V_i^W = p_i \phi Y + p_i \sum_{t=1}^{\infty} \delta^t Y + (1 - p_i) \sum_{t=1}^{\infty} \delta^t 0 = p_i \left(\phi + \frac{\delta}{1 - \delta} \right) Y. \tag{6.2}$$

Note how in the event of war, because one group can be eliminated from contention, it will devote no future resources to arming. Group B can accept any offer S from group A that satisfies the following inequality:

$$S + \delta V_B(S) \geq V_B^W, \tag{6.3}$$

where $V_B(S)$ denotes the continuation payoff of group B when it is out of power given the subsidy S. As part of any Markov perfect equilibrium in which a positive subsidy is given, group A would offer a subsidy S^* that satisfies (6.3) as an equality. Assuming that S^* is accepted in this period, it will be acceptable in all future periods and therefore $V_B(S^*) = (S^* - r_B)/(1 - \delta)$. Then, from (6.3) and (6.2), the subsidy will be

$$S^* = p_B[\phi(1 - \delta) + \delta]Y + \delta r_B. \tag{6.4}$$

Note that this subsidy, which must be offered by group A to group B in order to prevent War, depends positively on the power of group B (as proxied by its probability of winning p_B), on the share of output that is not destroyed in the event of War, on the discount factor, as well as on the value of output Y. However, this minimally acceptable subsidy to group B might not be in group A's interest to offer. In particular, the resultant payoff of group A should be preferable to its expected payoff under War, or

$$Y - S^* + \delta V_A(S^*) \geq V_A^W, \tag{6.5}$$

where $V_A(S^*) = (Y - S^* - r_A)/(1 - \delta)$ is the continuation payoff of group A if Peace prevails forever.

Supposing the probabilities of winning for the two sides to sum to one (i.e., $p_A + p_B = 1$), it is straightforward to show that the condition for Armed Peace (so that equations 6.3 and 6.5 are both satisfied) is as follows:

$$Y \geq \frac{\delta(r_A + r_B)}{(1 - \phi)(1 - \delta)}. \tag{6.6}$$

When this inequality is reversed, there will not be a subsidy that is feasible, and War will ensue. Thus, based on (6.6), War is more likely and Armed Peace is less likely,

1. the lower is the contested output Y;
2. the higher are the resources devoted to arming $(r_A + r_B)$ by the two groups;
3. the higher is the discount factor δ; and
4. the less destructive War is (or, the higher is ϕ).

When contested output is low, as it presumably is in low-income countries, the current cost of going to War (controlling for ϕ) is low (as that cost equals $Y(1 - \phi)$), and therefore going to War becomes easier. On the one hand, greater arming increases the likelihood of War because War tilts the balance of power in favor of one side and reduces (and in our case, completely eliminates) the future costs of arming. Armed Peace, on the other hand, as its name suggests necessitates incurring the cost of arming forever.

Given the long conditioning of folk-theorem arguments, the effect of the discount factor on War appears to be counterintuitive. Note that folk-theorem arguments merely describe the possibility of cooperation by means of supergame strategies, typically in stationary settings. Nothing guarantees cooperation in such settings because the accompanying strategies and equilibria are rather fragile and not renegotiation proof. By contrast, we concentrate on regular strategies and equilibrium in a time-dependent setting. The more the future is valued, as indicated by a higher value of the discount factor δ, the greater the salience of the expected future rewards as compared to the current costs of War and therefore the higher is the likelihood of War.

Thus far the resources devoted to arms (r_A and r_B) have been treated as exogenous parameters. That might well be the case in many low-income countries if the groups involved face liquidity constraints and organizational disadvantages that prevent them from increasing their arming to levels that would be consistent with an unconstrained equilibrium. Arms embargoes and difficulties in accessing the international arms market can also play a role in restraining arming to levels that are considered as given. We next consider conditions where no such constraints exist.

6.3 Endogenous Arming

To allow for endogenous arming, we first need to specify how probabilities of winning depend on arming. We suppose that these probabilities depend on arming through the following additive contest success function (see Tullock 1980; Hirshleifer 1989):

$$p_i(r_A, r_B) = \frac{r_i^m}{r_A^m + r_B^m}, \tag{6.7}$$

where $i = A, B$ and $m \in (0, 1]$. The parameter m has been described as a measure of the effectiveness of conflict. A higher value of this parameter can be associated with more advanced forms of warfare that were traditionally less prevalent in many low-income countries but are now available there.

Assume that arming is available at constant marginal cost $\omega > 0$. Given that an integral part of the cost of arming is actually the cost of hiring soldiers, and since the cost of labor is lower in low-income countries, we expect a lower ω to be associated with lower incomes.

In each period the sequence of moves by the two sides is the following:

1. Levels of arming, r_A and r_B, are chosen simultaneously by the two groups.
2. The two groups bargain, with group A making an offer of dividing the period's surplus (denoted by the subsidy S to B). If the offer is accepted by B, group B receives S, group A receives $Y - S$, and the next period repeats the same two steps.[5] If the offer is not accepted by B, War takes place with the winning probabilities described in (6.7). The winner receives ϕY for the period and Y for every period thereafter, whereas the loser receives 0 for the period and thereafter.

Note that when group A contemplates whether to offer a subsidy to group B or go to War, the continuation payoff of group B is still the one described in (6.2). Conditional on Armed Peace, the subsidy that will just induce B not to go to War is the following variation of (6.4):

$$S^*(r_A, r_B) = p_B(r_A, r_B)[\phi(1-\delta) + \delta]Y + \delta\omega r_B. \tag{6.8}$$

This subsidy is derived under the condition that the same level of arming, (r_A, r_B), is chosen in every future period as well as in the current period. Note how this subsidy to group B depends on its probability of winning, which is increasing in the arming of the group, as well as directly on the arming of the group. The reason is that under Armed Peace the group will have to incur the cost of arming in every period.

The payoffs of the two groups under Armed Peace can now be calculated. Group A will receive in every period the total surplus minus the subsidy, $Y - S^* = Y - p_B(r_A, r_B)[\phi(1-\delta) + \delta]Y - \delta\omega r_B$, whereas in every period it will pay the cost of arming, ωr_A. We denote by (r_A^P, r_B^P) the future level of guns as part of a Markov perfect equilibrium, and denote the choices in the current period by (r_A, r_B). Then group A's payoff is as follows:

$$V_A^P(r_A, r_B) = \frac{1}{1-\delta}\{Y - p_B(r_A, r_B)[\phi(1-\delta) + \delta]Y - \delta\omega r_B^P - \delta\omega r_A^P\} - \omega r_A. \tag{6.9}$$

Group B receives the subsidy $S^* = p_B(r_A, r_B)[\phi(1-\delta) + \delta]Y + \delta\omega r_B$ in every period and pays the cost of arming (ωr_B) in every period as well. Then group B's payoff reduces to the following:

$$V_B^P(r_A^P, r_B^P) = \frac{1}{1-\delta}\{p_B(r_A, r_B)[\phi(1-\delta) + \delta]Y\} - \omega r_B. \tag{6.10}$$

The payoffs are not symmetric because group A is always the proposer and the subsidy offered is just the one that equates the Armed Peace payoff of B to B's expected payoff under War.

The Markov perfect equilibrium strategies under Armed Peace are such that r_A^P maximizes $V_A^P(r_A, r_B^P)$ whereas r_B^P maximizes $V_B^P(r_A^P, r_B)$. To solve for these equilibrium strategies, first differentiate to obtain the first-order conditions $\partial V_A^P/\partial r_A = 0$ and $\partial V_B^P/\partial r_B = 0$. Next use

$$\frac{\partial p_B}{\partial r_A} = \frac{-m r_A^{m-1} r_B^m}{(r_A^m + r_B^m)^2}, \tag{6.11}$$

$$\frac{\partial p_B}{\partial r_B} = \frac{-m r_A^m r_B^{m-1}}{(r_A^m + r_B^m)^2}, \tag{6.12}$$

obtained from (6.7). The first-order conditions show that

$$r_A^P = r_B^P = \frac{m}{4\omega}\frac{\phi(1-\delta) + \delta}{1-\delta}Y. \tag{6.13}$$

Both sides choose the same level of arming despite the asymmetry of payoffs in (6.9) and (6.10) because the cost of arming is the same. What becomes effectively contestable is the discounted total surplus under War: $[(\phi(1-\delta) + \delta)/(1-\delta)]Y$.

The positive influence on arming of the effectiveness of conflict (as represented by the parameter m) and the negative effect of the cost of arming (ω) are intuitively very plausible. The negative dependence of arming on the destruction that conflict brings about (as represented by the parameter ϕ) is also plausible and intuitive.

Perhaps of greater significance, however, is the strong positive dependence on arming of the discount factor, through the effect of the discounted total surplus under War, $[(\phi(1-\delta)+\delta)/(1-\delta)]Y$. For example, if $\phi = 0.5$, an increase in the discount factor from 0.9 to 0.95 more than doubles the term $(\phi(1-\delta)+\delta)/(1-\delta)$ from 9.5 to 19.5. As we saw in the previous section (see equation 6.6), a higher discount factor, as well as higher levels of (fixed) arming, increases the likelihood of War. Since with endogenous arming a higher discount factor increases the equilibrium arming, the set of parameters for which War becomes an equilibrium must increase compared to the case with exogenous arming.

Before deriving such a set of parameters, we consider the case of War. The payoffs under War are the following:

$$V_i^W(r_A, r_B) = p_i(r_A, r_B)\frac{\phi(1-\delta)+\delta}{1-\delta}Y - \omega r_i, \qquad i = A, B. \tag{6.14}$$

It is straightforward to show that equilibrium arming is not just symmetric but the same as under Armed Peace:

$$r_A^W = r_B^W = \frac{m}{4\omega}\frac{\phi(1-\delta)+\delta}{1-\delta}Y = r_i^P, \qquad i \in A, B. \tag{6.15}$$

The reason for the identical levels of arming under both Armed Peace and War is that even under Armed Peace, the determinant of equilibrium arming is the payoff under War, and the latter determines the disagreement point in bargaining for the two sides. Under both Armed Peace and War the relevant portion of B's payoff that can be influenced by its choice of arming is $p_B(r_A, r_B) \times [(\phi(1-\delta)+\delta)/(1-\delta)]Y$, whereas for A it is either $-p_B(r_A, r_B) \times [(\phi(1-\delta)+\delta)/(1-\delta)]Y$ (for the case of Armed Peace) or $p_A(r_A, r_B) \times [(\phi(1-\delta)+\delta)/(1-\delta)]Y$ (for the case of War), which equals $[1 - p_B(r_A, r_B)] \times [(\phi(1-\delta)+\delta)/(1-\delta)]Y$. Both cases lead to the same marginal incentives for arming.

The set of parameters under which either Armed Peace or War prevail can be derived by susbstituting the cost of arming into (6.6) or, equivalently, by determining whether or not, conditional on this period's arming, the total discounted surplus under Armed Peace is higher or lower than the total discounted surplus under War. By the latter approach, War will occur if and only if

$$\frac{Y}{1-\delta} - \delta\omega r_A^P - \delta\omega r_B^P = \frac{Y}{1-\delta} - \frac{2\delta\omega m}{4\omega}\frac{\phi(1-\delta)+\delta}{1-\delta}Y < \frac{\phi(1-\delta)+\delta}{1-\delta}Y, \tag{6.16}$$

where the left-hand side of the inequality represents the total discounted surplus under Armed Peace and the right-hand side the total surplus under War. Note that the left-hand side represents the present discounted value of all the surplus Y minus the discounted value of arming, whereas the right-hand side represents the reduces surplus from War today (ϕY) plus the discounted value that accrues to the winner of War from next period, $(\delta/(1-\delta))Y$. War occurs if and only if the current loss from War, $(1-\phi)Y$, is lower than the discounted sum of total arming under Armed Peace. Then inequality (6.16) reduces to

$$\frac{\delta m(\phi(1-\delta)+\delta)}{2(1-\delta)^2(1-\phi)} < 1. \tag{6.17}$$

Note that the level of income (Y) in (6.17) does not change whether there is Armed Peace or War. This finding is contrary to that in (6.6), where arming is exogenous. The endogenous cost of arms is proportional to Y and cancels out in (6.16). Furthermore the marginal cost of arming (ω) does not have an effect either because any change in that cost is met by a change in the equilibrium level of arming that exactly cancels out the change in the cost.[6]

From (6.17) we can conclude that War is more likely and Armed Peace less likely when

1. the effectiveness of conflict as represented by m is high;
2. the discount factor δ is higher; and
3. the War is less destructive (or, ϕ is high).

Items 2 and 3 were identified in the previous section where arming is exogenous. The effect of the discount factor is, if anything, stronger under endogenous arming, since the higher discount factor not only increases the value of the future cost of arming but also increases the equilibrium level of arming. For even small discount factors, if the cost of arming (in equation 6.13 or 6.15) is large enough, we might expect the adversaries to face serious liquidity constraints so that War is averted in some cases. However, as Collier et al. (2003) have found, recently some rebel groups have raised funds by selling the advance rights to the extraction of minerals that they currently do not control, and thus are able to at least partly circumvent the severe liquidity constraints that War entails. If the liquidity constraints were to be binding for both adversaries, we would then revert to the analysis of the previous section or continue with the more complex one in terms of states in the next section.

6.4 Multiple Victories for Winning the War

Our analysis thus far assumes that one War determines the victor. However, completely eliminating one's opponent is often only achieved after a series of smaller victories. We extend here the basic model of section 6.2 into a repeated game in which more than one War, more appropriately called a battle in this context, must be won in order to achieve total victory.

In any given period t, A and B will again make the same War-or-Armed Peace decision as before, yet now their interaction will depend on the existing state of relative power, which can differ over time. To keep the analysis as simple as possible, we will suppose there are five states, $x = 0, 1, \ldots, 4$. Let x denote the relative strength of A and B so that if they are in state x at time t, then A wins the next armed conflict with probability $p_A = x/4$. Should conflict occur in this state and A wins, then the setting moves to state $x+1$ in time $t+1$, whereas if B wins, then the setting moves to state $x-1$ in time $t+1$. A achieves total victory by winning enough battles to reach state 4, since $p_A = 4/4 = 1$ in that state. Conversely, B achieves total victory by reaching state 0.

Further suppose that the last winner of an open conflict has temporary control over the resources not destroyed by the fighting, and so is the player in position to make a settlement offer. Specifically, let A be the proposer in state 3, let B be the proposer in state 1, and let either A or B be the proposer in state 2 depending on who won the prior War. The idea here is that if we start in the even strength state 2, then states 1 and 3 are only ever reached by a victory of B or A in the prior period.

Notice how winning a War brings the victor closer to Total Victory in two ways. First, winning today brings the state closer to the Total Victory state, and second, winning today increases the chances of winning the future Wars that are needed to achieve that Total Victory. Also note that the basic setting presented earlier in section 6.2 is a three state, $x = 0, 1, 2$, version of this model in which $p_A = x/2$.

This type of competition has been termed "tug-of-war" by earlier researchers because of the potential for each side to move from a position of strength to weakness, and because the contest occurs over many periods. For example, Harris and Vickers (1987) use a multi-state race with contest success functions to study an R&D race in which each organization achieves victory only after separating itself from its rival, and Budd, Harris, and Vickers (1993) examine duopoly firms that in a similar race achieve market dominance. That said, the nature of the tug-of-war in our model differs in one key respect. In addition to one side's victory today bringing them closer to total victory, victory today also confers an additional advantage by increasing the victor's relative strength today. That is, victory today increases the likelihood that the same group will win again in the next period. This changing of relative power acts to increase the benefits of victory today while also increasing the cost of losing today. Our work also differs in that we apply the tug-of-war model to a new setting of War and Armed Peace.

To examine which is optimal for each group, War or Armed Peace, requires multiple steps in the logic. First, we must find the value functions for the situation in which War always occurs in each of the contention states $x = 1, 2, 3$. Next, we calculate what settlements must be offered to avert War and sustain Armed Peace in each period. This procedure, which is detailed in the appendix, yields the following four conditions for a Markov perfect equilibrium:[7]

- In state 3, A will offer an accepted subsidy only if

$$Y \geq 3\delta \frac{(\delta^2 + 8\delta - \delta^3) r_A + (8 - \delta^2 + \delta^3) r_B}{8(4 - 3\delta - \delta^2)(1 - \phi)}. \tag{6.18}$$

- In state 2, if A is the proposer, an accepted subsidy will be made only if

$$Y \geq 3\delta^2 \frac{2(1+\delta) r_A + (1+\delta) r_B}{3 + (13 - 12\phi)(1 - \delta^2)}. \tag{6.19}$$

- In state 2, if B is the proposer, an accepted subsidy will be made only if

$$Y \geq 3\delta^2 \frac{2(1+\delta) r_B + (1+\delta) r_A}{3 + (13 - 12\phi)(1 - \delta^2)}. \tag{6.20}$$

- In state 1, B will offer an accepted subsidy only if

$$Y \geq 3\delta \frac{(\delta^2 + 8\delta - \delta^3) r_B + (8 - \delta^2 + \delta^3) r_A}{8(4 - 3\delta - \delta^2)(1 - \phi)}. \tag{6.21}$$

Equations (6.18) through (6.21) are directly related to condition (6.6) for Armed Peace in the basic setting examined in section 6.2. Again, War is more likely in any period and any state when

1. the contested output Y is lower;
2. the two groups' resources devoted to arming $(r_A + r_B)$ are higher;
3. the discount factor δ is higher; and
4. the War is less destructive (or, ϕ is higher).

Notice that the conditions for War in multi-stage conflict are qualitatively identical to those found using the basic model in section 6.2. Thus the basic model captures the primary strategic elements at work in the choice between War and Armed Peace.

Nevertheless, the conditions for War are not identical quantitatively, and we can ask whether Armed Peace is more likely when total victory requires more War victories. To find out, we check whether equation (6.6) is less likely to be met than equations (6.18) through (6.21). To simplify this comparison, let us suppose that $r_A = r_B = r$. The symmetry implied by this assumption means that we need only compare (6.6) with (6.18) and (6.19), since (6.20) and (6.21) will now be identical to (6.18) and (6.19), respectively.

With this additional symmetry, (6.6) becomes

$$Y \geq \frac{2\delta r}{(1 - \phi)(1 - \delta)}, \tag{6.22}$$

and (6.18) and (6.19), respectively, become

$$Y \geq \frac{3\delta(\delta + 1) r}{(4 - 3\delta - \delta^2)(1 - \phi)} \tag{6.23}$$

and

$$Y \geq \frac{9\delta^2(1 + \delta) r}{3 + (13 - 12\phi)(1 - \delta^2)}. \tag{6.24}$$

A little bit more algebra reveals that the right-hand side terms of (6.23) and (6.24) are both less than (6.22) (since δ and ϕ are both less than 1).

Thus more victories do increase the likelihood of Armed Peace. Requiring more victories lengthens the time it takes to achieve total victory, thereby increasing the cost of defeating one's opponent.

Although Armed Peace is more likely in this setting, it is not guaranteed. In technical terms, Armed Peace never becomes the only equilibrium for all parameter settings. This is true even if the model were extended to a larger number of states, whereby a larger number of Wars must be won for total victory to be achieved. The reason is that there is always an incentive to achieve total victory, since it is the only way to avoid costly arming. As long as this total victory incentive exists, there is an incentive to fight, and the question is whether or not the benefits of Armed Peace outweigh those of fighting. As our analysis shows, many conditions present in low-income countries are those that make Armed Peace less likely even if total victory requires winning a series of battles.

6.5 Concluding Remarks

Why does conflict occur, and disproportionately so in low-income countries? Our analysis examines two key factors, that adversaries cannot make long-term contracts to enforce disarmament, and that open conflict changes the strategic nature of future interaction. Our analysis also considers two key features of low-income countries, that adversaries can make short-run (as distinguished from long-term) contracts, and that achieving total victory prevents one from having to spend resources on arming. Even though total victory, once achieved, is in some sense efficient because it no longer requires costly arms buildup, the only way to achieve it is through open conflict. However, open conflict is not only inefficient because it requires the costly buildup of arms, but it also leads to the destruction of resources. Armed Peace is thus a possible middle ground.

Yet our analysis shows that Armed Peace is not inevitable because the incentives to fight are strong. Our basic model shows that conflict is more likely than Armed Peace when large resources are devoted to arming, the future is not highly discounted, and war is not very destructive. When opponents choose their arming levels, we find that conflict is more likely when the effectiveness is conflict is high. Prolonging the length of time necessary to achieve total victory can increase the chances of Armed Peace, although the same conditions as those above will still lead to conflict. The lure of total victory and its impact on future strategic positioning remains a strong incentive to engage in open conflict.

In short, the combination of incomplete contracting and the expectation of complete victory are inducements to conflict. If parties can make long-term contracts, then the destructive nature of War leads to settlement that makes each side better off than fighting. Moreover, even if parties are unable to make long-term contracts, there still might be the possibility of short-term contracts that can be enforced by each side's threat to fight; that is, these short-term contracts might be enough to enable Armed Peace. However, if conflict today alters the future positions of the adversaries, then one or more parties might forgo the short-term relative safety of Armed Peace and by open conflict opt for the chance of total victory and its associated high benefits.

We conclude that the shadow of the future looms large in low-income countries that exhibit the conditions conducive to War described herein. Achieving lasting peace requires the development of institutions necessary to enforce and foster peaceful resolutions to competition over scarce resource. Since these institutions are costly to implement (Gradstein 2004) and take time to develop (Genicot and Skaperdas 2002),[8] our findings suggest that low-income countries will remain in a vicious cycle of poverty and violent civil or political violence for prolonged periods.

Appendix

Let $V_i^t(x)$ denote i's present discounted value of being in state x. The value functions for the total victory states are thus $V_A^t(0) = 0$, $V_A^t(4) = Y/(1-\delta)$, $V_B^t(0) = Y/(1-\delta)$, and $V_B^t(4) = 0$. Note that in the total victory states there is no need to arm by expending r_A or r_B, since the opponent has been eliminated.

To examine which is optimal for the groups, War or Armed Peace, in the other states requires two steps in the logic. First, we find the value functions for the situation where War always occurs in each of the contention states $x = 1, 2, 3$. Next, we calculate what settlements must be offered to avert War and sustain Armed Peace in each period. In this manner we obtain the conditions for a Markov perfect equilibrium.

Value Functions under War in Each Period

War in a contested state yields the following value functions:

$$V_A^{W,t}(1) = \frac{1}{4}(\phi Y + \delta V_A^{t+1}(2) - \delta r_A), \tag{6.25}$$

$$V_A^{W,t}(2) = \frac{1}{2}(\phi Y + \delta V_A^{t+1}(3) - \delta r_A) + \frac{1}{2}(\delta V_A^{t+1}(1) - \delta r_A), \tag{6.26}$$

$$V_A^{W,t}(3) = \frac{3}{4}\left(\phi Y + \delta \frac{Y}{1-\delta} - \delta r_A\right) + \frac{1}{4}(\delta V_A^{t+1}(2) - \delta r_A), \tag{6.27}$$

$$V_B^{W,t}(1) = \frac{3}{4}\left(\phi Y + \delta \frac{Y}{1-\delta} - \delta r_B\right) + \frac{1}{4}(\delta V_B^{t+1}(2) - \delta r_B), \tag{6.28}$$

$$V_B^{W,t}(2) = \frac{1}{2}(\phi Y + \delta V_B^{t+1}(1) - \delta r_B) + \frac{1}{2}(\delta V_B^{t+1}(3) - \delta r_B), \tag{6.29}$$

$$V_B^{W,t}(3) = \frac{1}{4}(\phi Y + \delta V_B^{t+1}(2) - \delta r_B). \tag{6.30}$$

To find the present discounted values for group A if War occurs in every contested period, plug (6.25) and (6.27) into (6.26) to solve for $V_A^W(2)$, and then plug that back into (6.25) and (6.27). Do a similar procedure for group B. The results are

$$V_A^W(1) = \frac{(8\phi - 2\delta^2\phi - 4\delta\phi - 2\delta^3\phi + 3\delta^3)Y + (3\delta^4 + 5\delta^3 - 8\delta)r_A}{8(1-\delta)(4-\delta^2)}, \tag{6.31}$$

$$V_A^W(2) = \frac{(3\delta^2 - 4\delta^2\phi + 4\phi)Y + (5\delta^3 + 3\delta^2 - 8\delta)r_A}{2(1-\delta)(4-\delta^2)}, \tag{6.32}$$

$$V_A^W(3) = \frac{(24\phi - 20\delta\phi - 6\delta^2\phi + 2\delta^3\phi + 24\delta - 3\delta^3)Y}{8(1-\delta)(4-\delta^2)} + \frac{(11\delta^3 - 3\delta^4 - 32\delta + 24\delta^2)r_A}{8(1-\delta)(4-\delta^2)}, \tag{6.33}$$

$$V_B^W(1) = \frac{(24\phi - 20\delta\phi - 6\delta^2\phi + 2\delta^3\phi + 24\delta - 3\delta^3)Y}{8(1-\delta)(4-\delta^2)} + \frac{(11\delta^3 - 3\delta^4 - 32\delta + 24\delta^2)r_B}{8(1-\delta)(4-\delta^2)}, \tag{6.34}$$

$$V_B^W(2) = \frac{(3\delta^2 - 4\delta^2\phi + 4\phi)Y + (5\delta^3 + 3\delta^2 - 8\delta)r_B}{2(1-\delta)(4-\delta^2)}, \tag{6.35}$$

$$V_B^W(3) = \frac{(8\phi - 2\delta^2\phi - 4\delta\phi - 2\delta^3\phi + 3\delta^3)Y + (3\delta^4 + 5\delta^3 - 8\delta)r_B}{8(1-\delta)(4-\delta^2)}. \tag{6.36}$$

We will use these equations in a moment, after we determine when Armed Peace or open conflict will result from optimizing behavior.

When Armed Peace Is Optimal

Let $S_i(x)$ be the offer made by i in state x. Note that if i's offer is accepted by j in state x in period t, then that same offer will be accepted in period $t+1$ because both parties are still in state x. Thus, to determine what $S_i(x)$ will be accepted by j, we compare the infinite stream of $S_i(x)$'s that j will get with what j will get going to War from period t on. For state 3, this comparison is

$$S_A(3) + \frac{\delta}{1-\delta}(S_A(3) - r_B)$$
$$\geq \frac{(8\phi - 2\delta^2\phi - 4\delta\phi - 2\delta^3\phi + 3\delta^3)Y + (3\delta^4 + 5\delta^3 - 8\delta)r_B}{8(1-\delta)(4-\delta^2)},$$

where the RHS is from equation (6.36). Since A will make the smallest such offer that satisfies the inequality, setting this to equal yields

$$S_A^*(3) = \frac{(8\phi - 2\delta^2\phi - 4\delta\phi - 2\delta^3\phi + 3\delta^3)Y + (24\delta - 3\delta^3 + 3\delta^4)r_B}{8(4-\delta^2)}.$$

Similar calculations for the other states yield

$$S_A^*(2) = \frac{1}{2}\frac{(3\delta^2 - 4\delta^2\phi + 4\phi)Y + (3\delta^3 + 3\delta^2)r_B}{2(4-\delta^2)},$$

$$S_B^*(2) = \frac{1}{2}\frac{(3\delta^2 - 4\delta^2\phi + 4\phi)Y + (3\delta^3 + 3\delta^2)r_A}{2(4-\delta^2)},$$

$$S_B^*(3) = \frac{(8\phi - 2\delta^2\phi - 4\delta\phi - 2\delta^3\phi + 3\delta^3)Y + (24\delta - 3\delta^3 + 3\delta^4)r_A}{8(4-\delta^2)}.$$

We next ask which one of these offers is optimal for the proposer.

Group A will offer $S_A^*(3)$ in state 3 if doing so now and forever is better than fighting forever:

$$Y - S_A^*(3) + \frac{\delta}{1-\delta}(Y - S_A^*(3) - r_A)$$
$$\geq \frac{(24\phi - 20\delta\phi - 6\delta^2\phi + 2\delta^3\phi + 24\delta - 3\delta^3)Y}{8(1-\delta)(4-\delta^2)}$$
$$+ \frac{(11\delta^3 - 3\delta^4 - 32\delta + 24\delta^2)r_A}{8(1-\delta)(4-\delta^2)},$$

where the RHS is from equation (6.33). Some algebra reduces this condition to

$$Y \geq 3\delta\frac{(\delta^2 + 8\delta - \delta^3)r_A + (8 - \delta^2 + \delta^3)r_B}{8(4 - 3\delta - \delta^2)(1-\phi)},$$

which is exactly equation (6.18). Doing the same comparison for an offer by group A in state 2 yields condition

$$Y \geq 3\delta^2\frac{2(1+\delta)r_A + (1+\delta)r_B}{3 + (13 - 12\phi)(1-\delta^2)},$$

which is equation (6.19).

Repeating the process for group B in states 2 and 1 yields

$$Y \geq 3\delta^2\frac{2(1+\delta)r_B + (1+\delta)r_A}{3 + (13 - 12\phi)(1-\delta^2)},$$

$$Y \geq 3\delta\frac{(\delta^2 + 8\delta - \delta^3)r_B + (8 - \delta^2 + \delta^3)r_A}{8(4 - 3\delta - \delta^2)(1-\phi)},$$

respectively, which are equations (6.20) and (6.21).

Notes

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1. An overview of the costs and other problems associated with conflict can be found in the World Bank report of Collier et al. (2003). The number of countries mentioned is quoted from Fearon and Laitin (2003). Hess (2003) provides estimates of the indirect costs of conflict in terms of reduced trading and welfare, which are about 8 percent of GDP on average for low-income countries and, of course, much higher for some countries while nonexistent for other countries. For an overview of the recent academic literature on civil wars, see Sambanis (2004).

2. McBride (2004) describes how coups can arise from incomplete contracting. When incumbent politicians cannot commit to efficient policies, they will resort to clientelist practices to gain popular support. If the incumbents are successful, political opponents' only way to gain political power is by attempting a coup.

3. Grossman and Hart (1986) introduced the main idea for the theory of the firm whereby parties cannot write long-term contracts on relationship-specific investments. Skaperdas (2003) discusses how incomplete contracting relates to civil wars.

4. The term "Armed Peace" is due to Jack Hirshleifer.

5. The results in this section on the level arming and the conditions under which War occurs do not depend on the particular sequence of moves. The same results will obtain with another bargaining protocol, an equal division of the surplus (which would correspond to any symmetric bargaining solution, including the Nash and Kalai-Somorodinsky solutions). The only difference is the payoffs obtained under Armed Peace, in which group A receives more than the War payoff.

6. We would like to thank Roger Myerson for discovering an error in an earlier version of our chapter in which ω was mistakenly shown to have a negative effect on the total cost of arming.

7. See Fudenberg and Tirole (1996) for a discussion of the Markov perfect equilibrium concept.

8. Of course, external shocks can help a country get started on a good path. McBride (2005), for example, shows how economic crises in low-income countries have led to economic reforms and declines in conflict.

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